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INNOVATING FOR A BETTER TOMORROW

SOUTHERN CALIFORNIA CLIMATE ADAPTATION PLANNING GUIDE

October 2020

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Glossary of Acronyms Used

ABAG / Association of Bay Area Governments

APG / Adaptation Planning Guide

CalBRACE / California Building Resilience Against Climate Effects

CalEPA / California Environmental Protection Agency

CNRA / California Natural Resources Agency

COG / Council of Governments

DWR / Department of Water Resources

FEMA / Federal Emergency Management Agency

ICARP / Integrated Climate Adaptation and Resiliency Program

IPCC / Intergovernmental Panel on Climate Change

LHMP / Local Hazard Mitigation Plan

MPO / Metropolitan Planning Organization

MTC / Metropolitan Transportation Commission

MWD / Municipal Water District

OEHHA / California Office of Environmental Health Hazard Assessment

OPR / Governor's Office of Planning and Research

RCP / Representative Concentration Pathway

RTPA / Regional Transportation Planning Agency

SANDAG / San Diego Association of Governments

SCAG / Southern California Association of Governments

US EPA / United States Environmental Protection Agency

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Salton Sea. Drought and increased temperatures have caused lake levels to recede, exposing heavy metals, agricultural chemicals and fine particulates connected to asthma and other diseases.

Chapter
1

Introduction and Background

CHAPTER 1

Introduction and Background

The Southern California Adaptation Planning Guide (SoCal APG) is the culmination of several efforts by the Southern California Association of Governments (SCAG) to help the region prepare for the negative impacts of climate change.

The SoCal APG was developed as part of SCAG's Regional Climate Adaptation Framework to help local governments in SCAG's 6-county region work together to plan and prepare for the impacts of sea-level rise, extreme heat, increasingly frequent and damaging wildfires, more frequent and severe rain events, and other climate-related issues. Recognizing that the SCAG region is already experiencing these impacts, there is an increasing need for adaptation planning to help individuals, communities, and natural systems cope with the unavoidable consequences of a changing climate.

Purpose and Scope of this Guide

The SoCal APG describes the range of climate change hazards the SCAG region is likely to face in the coming decades, describes adaptation principles geared to the region, and outlines a general process of adaptation planning that can be applied by any agency, no matter where they fall across the spectrums of funding, available resources, knowledge of vulnerabilities, and planning sophistication. It provides member agencies, including towns, cities, counties and subregional organizations with a compendium of tools, resources, and best practices to efficiently advance their adaptation planning using the best resources available.

SCAG member agencies have many reasons to engage in adaptation planning at the local level – from regulatory drivers like Senate Bill 379 (Jackson, 2015) and Senate Bill 1035 (Jackson, 2018), which requires General Plan Safety Elements to be updated to consider climate change impacts, to more tangible needs like protecting an eroding shoreline from sea-level rise. Whatever the reason for adaptation planning, this guide will provide resources, examples, and step-by-step guidance that will help advance the readiness of the local community to confront the challenges of climate change and increase resilience to its hazards.

The SoCal APG aligns with and leverages the extensive foundation of guidelines developed through other state climate programs. In particular, it aligns closely with the California Adaptation Planning Guide (California APG) developed by the Cal OES in much of its guidance, nomenclature, and its recommended 4-phase process for adaptation planning.[1] The SoCal APG differs from the California APG in that it focuses on the local communities of Southern California by identifying case studies and best practice examples from SCAG member jurisdictions to illustrate each phase in the adaptation planning process. It also references and provides guidance on the use of data and tools that have been specifically developed for adaptation planning in the SCAG region.

Intended Audience

The SoCal APG is intended for planning staff at SCAG member agencies involved in climate change adaptation planning at any stage or level of sophistication. Although SCAG does not include the 19 jurisdictions that are members of the neighboring San Diego Association of Governments (SANDAG), the vast majority of the information in the SoCal APG is applicable to those jurisdictions as well.

1 California Office of Emergency Services, 2020. California Adaptation Planning Guide. June 2020. Available online: https://www.caloes.ca.gov/cal-oes-divisions/hazard-mitigation/hazard-mitigation-planning/california-climate-adaptation

SCAG Adaptation Planning Framework

The SoCal APG was developed as a component of SCAG's Adaptation Planning Framework, which provides planning tools and resources, studies, scientific data, and mapping tools to SCAG's local and regional jurisdictions to help them plan for and manage the negative impacts of climate change. These tools and resources are available on the SCAG website, where a series of reference guides are available to quickly orient the user of the Framework to the range of available materials. These include:

- Public engagement workshop templates and materials
- Public engagement best practices based on literature review and interviews with community-based organizations
- Results of jurisdictional interviews regarding the state of local adaptation planning and regional coordination needs
- General Plan gap analysis of SCAG member agencies regarding the inclusion of adaptation goals, objectives and policies
- Gap analysis of county-level climate change vulnerability analyses in the SCAG region
- Interactive online map identifying climate change hazards in the SCAG region
- Scenario modeling of transportation and population displacement impacts due to extreme events related to climate change hazards in the SCAG region
- Matrix of adaptation strategies and actions for a variety of climate change hazards
- Model adaptation policy language for inclusion in general plans and local coastal programs
- Climate adaptation project prioritization tool
- Strategies for funding and financing climate-safe infrastructure
- Climate change adaptation project tracking tool
- Climate adaptation tracking metrics for cities and counties
- Climate change indicators and tracking metrics for metropolitan planning agencies
- Project checklist form for incorporating resilience features into the design and siting of new or existing development and infrastructure

CLIMATE CHANGE ADAPTATION AND COMMUNITY RESILIENCE

As described by the California APG, climate adaptation planning allows communities to identify ways that they might be harmed by future conditions, including those unique to their communities, and prepare for these conditions before they happen. The California APG notes the relationship between climate change adaptation and resilience, but refers to the following definitions to distinguish the two concepts:

According to the State's Planning and Investing for a Resilient California guidebook, adaptation is "an adjustment in natural or human systems to a new or changing environment" (such as the increased frequency and intensity of climate-related hazards or other climate-related conditions). An adaptation adjustment "moderates harm or exploits beneficial opportunities" brought about by the change.[2]

Resilience is "the capacity of any entity—an individual, a community, an organization, or a natural system—to prepare for disruptions, to recover from shocks and stresses, and to adapt and grow from a disruptive experience." A community's resilience is determined by its ability to survive, adapt, and thrive no matter what acute shock or chronic stressor it experiences.[3]

Overview of the Adaptation Planning Process

Available planning frameworks and guidance documents have many commonalities in how they describe the process of adaptation planning, but there are important differences and particulars amongst them when it comes to specific geographic regions, climate hazards, and recommended strategies for adaptation. The SoCal APG closely aligns with the California APG's 4-phase process for adaptation planning, illustrated in Figure 1, and described in more detail in Section 3. It also draws heavily from the **Regional Resilience Toolkit** developed jointly by the Governor's Office of Planning and Research (OPR), Federal Emergency Management Agency (FEMA), the United States Environmental Protection Agency (US EPA), Association of Bay Area Governments (ABAG), and the Metropolitan Transportation Commission (MTC).

Integral to the SoCal APG's four phases is public engagement, an essential component that applies to the entire process from inception to implementation.

2 Intergovernmental Panel on Climate Change (IPCC), "Annex II: Glossary," ed. K. J. Mach, S. Planton, and C. von Stechow, in Climate Change 2014: Synthesis Report, ed. Core Writing Team, R. K. Pachauri, and L. A. Meyer, IPCC, Geneva, Switzerland, 2014, p. 117–130, https://www.ipcc.ch/report/ar5/syr/

3 Rodin, Judith. 2014. The Resilience Dividend: Managing Disruption, Avoiding Disaster, and Growing Stronger in an Unpredictable World, New York: Public Affairs, 2014

Figure 1

California Adaptation Planning Guide's Four Phases of Adaptation Planning

Guiding Principles

SCAG's regional vision and principles for climate change adaptation align with the state's Integrated Climate Adaptation and Resiliency Program (ICARP), which was established by SB 246, signed into law by Governor Jerry Brown in 2015.[4] In 2017, the ICARP Technical Advisory Council developed a vision statement that expresses the characteristics of a resilient California, as well as principles that guide how adaptation actions should be implemented to achieve this vision. In 2018, the ICARP Technical Advisory Council adopted a definition for vulnerable communities (see inset), a term referenced throughout the Vision and Principles.

ICARP is administered by OPR and is charged with the development of tools and guidance, updating of the California APG, updating the State Clearinghouse for climate adaptation information, and coordinating climate adaptation efforts across relevant state agencies, offices, and councils.

VULNERABLE COMMUNITIES AS DEFINED BY THE ICARP TECHNICAL ADVISORY COUNCIL

Climate vulnerability describes the degree to which natural, built, and human systems are at risk of exposure to climate change impacts. Vulnerable communities experience heightened risk and increased sensitivity to climate change and have less capacity and fewer resources to cope with, adapt to, or recover from climate impacts. These disproportionate effects are caused by physical (built and environmental), social, political, and/or economic factor(s), which are exacerbated by climate impacts. These factors include, but are not limited to, race, class, sexual orientation and identification, national origin, and income inequality.[5]

4 For the full text of Senate Bill 246, see: https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB246

5 ICARP Technical Advisory Council, 2020. Technical Advisory Council. Available online: https://www.opr.ca.gov/planning/icarp/tac/

ICARP'S CLIMATE ADAPTATION VISION

All Californians thrive in the face of a changing climate. Leading with innovation, California meets the challenge of climate change by taking bold actions to protect our economy, our quality of life, and all people. The state's most vulnerable communities are prioritized in these actions. Working across all levels of government, the state is prepared for both gradual changes and extreme events. Climate change adaptation and mitigation is standard practice in government and business throughout the state. California meets these goals with urgency, while achieving the following long-term outcomes:

- **All people and communities** respond to changing average conditions, shocks, and stresses in a manner that minimizes risks to public health, safety, and economic disruption and maximizes equity and protection of the most vulnerable.
- **Natural systems** adjust and maintain functioning ecosystems in the face of change.
- **Infrastructure and built systems** withstand changing conditions and shocks, including changes in climate, while continuing to provide essential services.

ICARP'S CLIMATE ADAPTATION PRINCIPLES

- Prioritize **integrated** climate actions, those that both reduce greenhouse gas emissions and build resilience to climate impacts, as well as actions that provide **multiple benefits**.
- Prioritize actions that promote **equity**, foster community resilience, and protect the most vulnerable. Explicitly include communities that are disproportionately vulnerable to climate impacts.
- Prioritize **natural and green infrastructure** solutions to enhance and protect natural resources, as well as urban environments. Preserve and restore ecological systems (or engineered systems that use ecological processes) that enhance natural system functions, services, and quality and that reduce risk, including but not limited to actions that improve water and food security, habitat for fish and wildlife, coastal resources, human health, recreation and jobs.
- **Avoid maladaptation** by making decisions that do not worsen the situation or transfer the challenge from one area, sector, or social group to another. Identify and take all opportunities to prepare for climate change in all planning and investment decisions.
- Base all planning, policy, and investment decisions on the **best-available science**, including local and traditional knowledge, including consideration of future climate conditions out to 2050 and 2100, and beyond.
- Employ **adaptive and flexible governance** approaches by utilizing **collaborative partnership** across scales and between sectors to accelerate effective problem solving. Promote mitigation and adaptation actions at the regional and landscape scales.
- Take **immediate actions** to reduce present and near future (within 20 years) climate change risks for all Californians; do so while also **thinking in the long term** and responding to continual changes in climate, ecology, and economics using adaptive management that incorporates regular monitoring.

For vision statements and guiding principles that are more heavily focused on vulnerable communities, look to the Climate Justice Working Group and Asian Pacific Environmental Network (APEN), provided in the insets below.[6, 7]

The Climate Justice Working Group published the following vision and set of principles to guide adaptation planning efforts and advance more equitable planning outcomes.

CLIMATE JUSTICE WORKING GROUP'S VISION

By 2030, we envision a resilient California where our most vulnerable communities are ready to respond to the physical, environmental, economic and health impacts brought on by climate change, and thrive after climate events. California must proactively bring public and private investments into vulnerable communities to foster robust and thriving communities that are engaged, healthy, just, economically viable, and safe from environmental threats.

CLIMATE JUSTICE WORKING GROUP'S GUIDING PRINCIPLES

1. Actively engage frontline communities in research, planning, implementation, education, and decision making about potential climate change impacts and about the development, funding, implementation, and evaluation of adaptation and resilience policies. Create enabling conditions for frontline communities' early, continuous, and meaningful participation in the development of adaptation policy and funding decisions. Partner with local leaders and community-based organizations to enhance the effectiveness of adaptation research and innovation, education, decision making, and policy implementation. This overarching principle applies to all of the subsequent climate justice principles and recommendations.
2. Identify and reduce frontline communities' vulnerabilities to climate change, with a focus on physical, economic, and quality-of-life factors.
3. When planning for infrastructure investments, prioritize actions that increase the resilience of essential facilities and associated services that provide health care, food, drinking water, evacuation routes, and emergency shelter for frontline communities. Reduce community health and safety risks from potential damage to sensitive facilities such as water treatment plants, hazardous waste facilities, and power plants and transmission lines.
4. Promote adaptation policies, funding decisions, and implementation actions that increase training, employment and economic development opportunities among frontline communities. Where applicable, prioritize opportunities that advance a "just transition" from dependence on fossil fuels and further enhance community resilience to the impacts of climate change.
5. Promote and support regional and local adaptation efforts that generate multiple benefits across sectors.

6 Asian Pacific Environmental Network is an environmental justice organization that works closely with California's Asian immigrant and refugee communities.

7 The Climate Justice Working Group representing environmental justice, public health and climate equity organizations in California was convened to provide recommendations to the state as it prepared the 2018 Safeguarding California Plan.

CLIMATE JUSTICE WORKING GROUP'S GUIDING PRINCIPLES (CONT.)

6. During planning and implementation of land use and community development decisions, consider and avoid negative consequences of actions, including displacement, that could inadvertently increase frontline communities' and individuals' climate vulnerability.
7. Promote adaptation co-benefits of toxic chemical and greenhouse gas reduction policies by supporting those that also reduce frontline communities' climate vulnerability and enhance their resilience.
8. Ensure that adaptation policies, funding decisions, and implementation actions comply with relevant laws and policies that are designed to protect and advance civil rights and environmental justice.
9. Promote local, regional, and state agency transparency, accountability, and adaptive management by developing and applying easy-to understand climate justice metrics, data and information resources, and annual reporting protocols.
10. Identify needed funding, establish needed funding mechanisms, and allocate adequate funding to support adaptation policy development, implementation, and evaluation in frontline communities.

APEN developed the following principles that incorporate climate justice into resilience planning.

APEN'S COMMUNITY VULNERABILITY AND RESILIENCE TO CLIMATE CHANGE: KEY PRINCIPLES

- Ensure meaningful and active engagement with the most impacted communities.
- Practice both adaptation and mitigation simultaneously.
- Promote equity by prioritizing and protecting the most vulnerable populations.
- Encourage actions that provide multiple benefits.
- Consider unintended consequences and avoid maladaptive practices that cause harm.
- Maximize transparency and accountability.
- Drive decision making through strong scientific evidence and local knowledge.
- Create adaptive processes that provide flexibility and opportunity for revision.
- Advance a just transition toward a diversified and regenerative economy.

Regulatory Drivers for Climate Adaptation Planning

This section identifies state legislation that mandates the inclusion of climate adaptation in local planning processes.

Senate Bill 379

California SB 379 (2015) requires all cities and counties to address climate adaptation and resilience in the Safety Element of a General Plan and/or in the Local Hazard Mitigation Plan. The bill requires that the updated plan include a set of goals, policies, and objectives based on a vulnerability assessment that is specific to the local geography. Additionally, the bill requires that the updated plan include a set of feasible implementation measures designed to carry out the plan's goals, policies, and objectives and establishes minimum requirements that such implementation measures must include. These requirements include feasible methods to avoid or minimize the climate change impacts on new land uses; the location of essential public facilities outside of at-risk areas; the designation of adequate and feasible infrastructure located in an at-risk area; and the identification of natural infrastructure that could be used in adaptation projects. The update to the Safety Element must occur at the next update of a local hazard mitigation plan on or after January 1, 2017. Local jurisdictions without a local hazard mitigation plan must update their safety elements on or before January 1, 2022.

Senate Bill 1035 (2018)

California SB 1035 requires regular updates to the Safety Element chapter of the General Plan. New information regarding flood and fire hazards must be included and climate change adaptation and resilience must be addressed as part of the update. After 2022, Safety Elements must be updated upon each revision of the housing element or local hazard mitigation plan, but no less often than once every 8 years. Housing element revisions are typically on 4-8 year cycles and local hazard mitigation plans revisions are on 5-year cycles.

SB 1000

SB 1000 (2016), the Planning for Healthy Communities Act, stipulates that cities and counties with disadvantaged communities incorporate environmental justice policies in their General Plans through either a stand-alone element, or by integrating relevant goals, policies, and objectives throughout other elements. The bill requires cities and counties to identify disadvantaged communities (as defined in the bill), include policies and objectives to reduce unique or compounded health risks in disadvantaged communities, promote civil engagement in the public decision making process, and address the needs of disadvantaged communities. Compliance with SB 1000 is triggered when two or more elements in a general plan are revised after January 1, 2018. For example, an update to the safety and housing elements would trigger the need to comply with SB 1000 if the city or county has disadvantaged communities.

Balboa Pier, Newport Beach. Unusually high surf fueled by a storm in the southern hemisphere.

Chapter 2

Southern California Today

CHAPTER 2

Southern California Today

The six counties in the SCAG region are already experiencing the impacts of climate change. Some jurisdictions in the SCAG region are engaging in robust climate adaptation planning efforts whereas other jurisdictions have yet to begin the process.

The following section provides an overview of climate projections and anticipated climate impacts in the SCAG region, along with a high-level overview of the region's current adaptation planning initiatives.

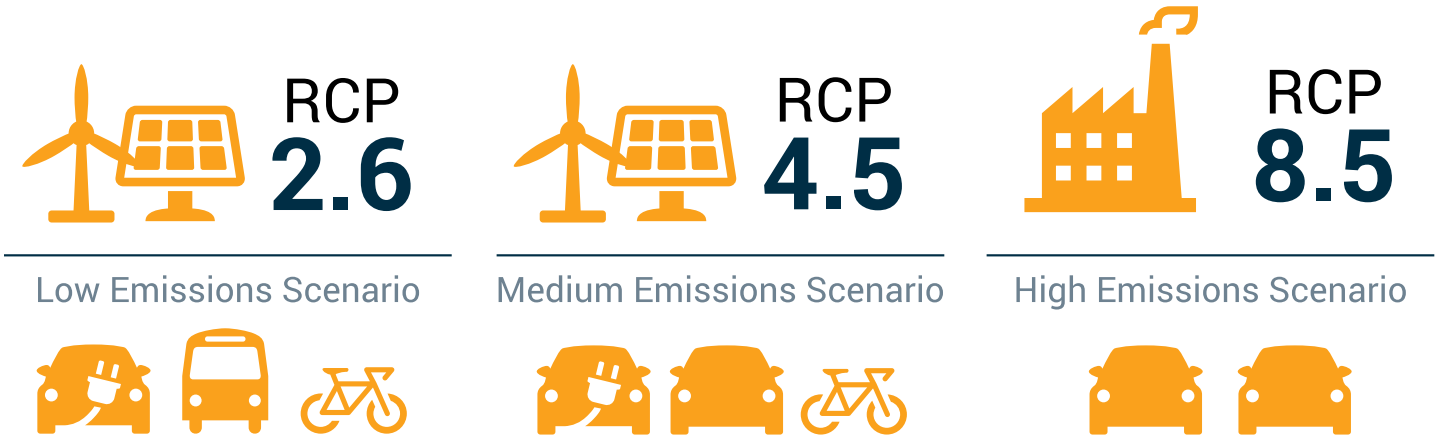
Climate Change Projections in the SCAG Region

State resources provide climate projections for a range of greenhouse gas emissions scenarios, climate models, and time frames. These scenarios inform different projections for how global emissions and atmospheric emissions concentrations may change locally over time. Forecasts in key state resources use representative concentration pathways (RCPs) based on future projections for the following three greenhouse gas emissions scenarios:

1. A low emissions scenario (RCP2.6) – this represents an aggressive emissions reduction scenario that assumes global greenhouse gas emissions will be significantly curtailed. RCP 2.6 most closely corresponds to the aspirational goals of the United Nations Framework Convention on Climate Change 2015 Paris Agreement.
2. A medium emissions scenario (RCP4.5) – this represents a mitigation scenario where global greenhouse gas emissions peak by 2040 and then decrease for the rest of the century.
3. A high emissions scenario (RCP8.5) – this represents a "business-as-usual" scenario where global greenhouse gas emissions continue to rise throughout the 21st century.

Figure 2

Representative Concentration Pathways (RCPs) Based on Future Emissions Scenarios



OPR recommends that agencies use RCP8.5, the high emissions scenario, when considering impacts through 2050 because there are minimal differences between the low and high emissions scenarios through the first half of the century.[1] When looking beyond 2050, warming scenarios should be considered on a case-by-case basis, with RCP8.5 projections providing a more conservative approach than using RCP4.5 or 2.6. The appropriate approach to selecting emissions scenarios depends on the community's consideration of risk.

For sea-level rise related climate hazards, climate change projections are documented in the State of California Sea-Level Rise Guidance prepared by the California Ocean Protection Council (OPC) (2018).[2] The OPC Guidance presents different sea-level rise values based on a low emissions scenario (RCP2.6) and a high emissions scenario (RCP8.5). OPC Guidance also provides a range of probabilistic projections of sea-level rise that correspond to different levels of risk tolerance. These levels are represented as risk aversion scenarios, including low, medium-high, and extreme risk aversions. Each risk aversion has a probability of occurrence (e.g., the low risk aversion has a 17% chance of being met or exceeded in the future). The California Coastal Commission recommends that agencies use, at a minimum, the medium-high risk aversion for long-term, community wide adaptation planning efforts.[3] Low risk aversion might be used for projects like an unpaved coastal trail while extreme risk aversion would be used for projects like a wastewater treatment plant or power plant.

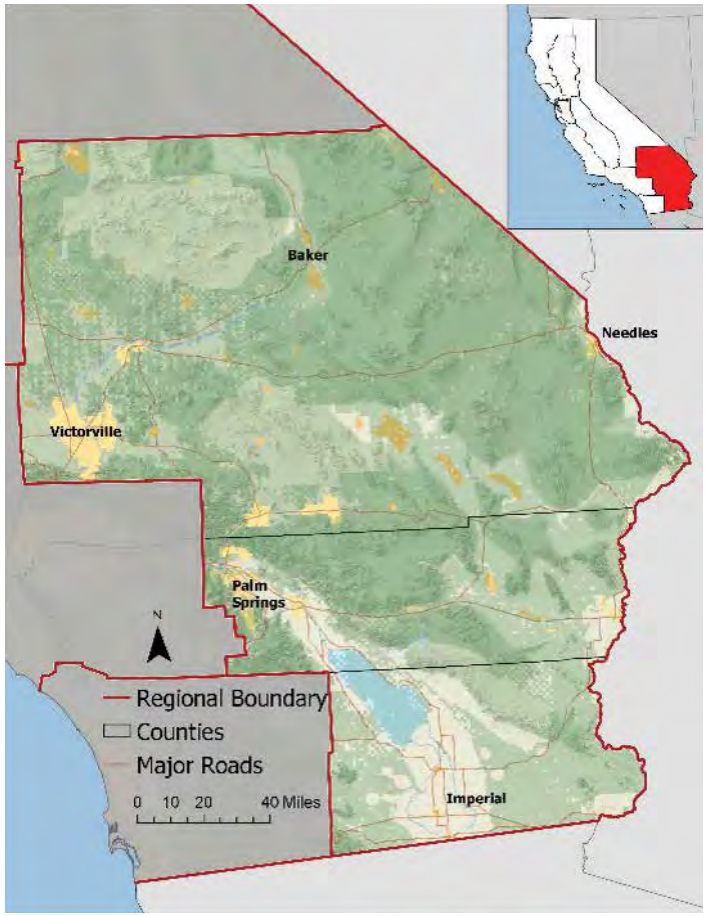
Climate Change Impacts in the SCAG Region

According to California's Fourth Climate Change Assessment, Southern California can expect extremes of precipitation and temperature, increased storm frequency and intensity, more wildfires, and rising seas.[4] These primary climate change impacts are expected to result in secondary effects such as more extreme droughts, new disease vectors, and an increase in landslides and debris flows. These impacts are described further under the nine climate-related hazards listed below, which cover a range of primary and secondary impacts.

The Fourth Assessment includes two regional reports comprising the SCAG region, as shown in Figure 3: one for the Los Angeles Region covering all of Ventura, Los Angeles, and Orange Counties, along with adjacent urbanized portions of San Bernardino and Riverside Counties, and another for the Inland Deserts Region covering all of Imperial County and the desert portions of Riverside and San Bernardino Counties.

1 Governor's Office of Planning and Research, Planning and Investing for a Resilient California, 2019, accessed August 2019, http://opr.ca.gov/planning/icarp/resilient-ca.html
2 California Ocean Protection Council, State of California Sea-Level Rise Guidance, 2018
3 California Coastal Commission, Sea-Level Rise Policy Guidance, 2018.
4 Bedsworth, Louise, Dan Cayan, Guido Franco, Leah Fisher, Sonya Ziaja. (California Governor's Office of Planning and Research, Scripps Institution of Oceanography, California Energy Commission, California Public Utilities Commission). 2018. Statewide Summary Report. California's Fourth Climate Change Assessment. Publication number: SUMCCCA4-2018-013.

Los Angeles Region



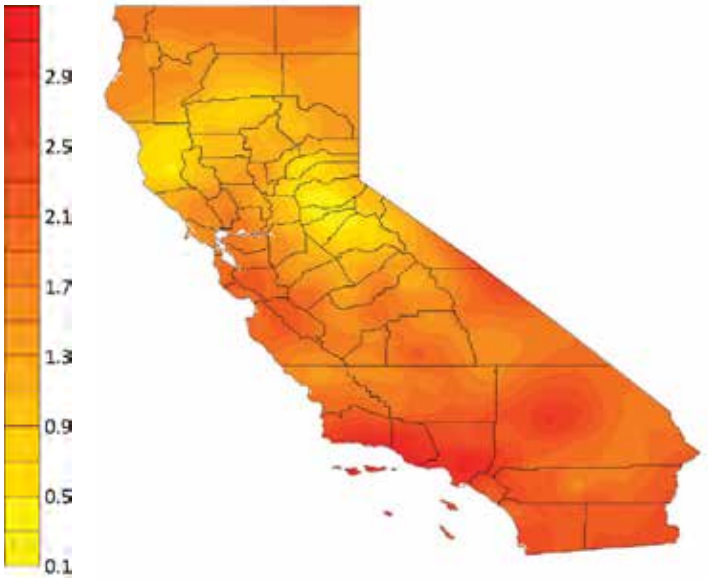
Inland Deserts Region

Figure 3

Regional Reports Included in California's Fourth Climate Change Assessment

Figure 4

Average Temperature Changes Across California



Extreme Heat – The Fourth Assessment indicates that the SCAG region can expect longer and hotter heat waves, with continued future warming over the region. In the Los Angeles region, average maximum temperatures are projected to increase around 4-5 degrees Fahrenheit by the mid-century, and 5-8 degrees Fahrenheit by the late-century, depending on future greenhouse gas emissions (i.e., RCP4.5 and RCP8.5). In the Inland Deserts region, the average maximum temperatures are projected to increase even more. According to an analysis conducted by Washington Post (documented in an article titled Fires, floods, and free parking: California's unending fight against climate change, by Scott Wilson, Michael Robinson, and John Muyskens), much of the SCAG region is heating up faster than the rest of the state, with Ventura and Los Angeles counties in particular being amongst the fastest warming in the lower 48 United States.

Extreme temperatures are also expected to increase in duration and intensity. For instance, downtown Los Angeles historically experiences fewer than 5 days per year with temperatures equal to or greater than 95°Fahrenheit. By the end of the century under a business-as-usual emissions scenario (RCP8.5), downtown Los Angeles is projected to experience about 23 such days per year (Cal-Adapt). Inland areas of the Los Angeles Region are projected to experience 60–90 additional extremely hot days (greater than or equal to 95°F) per year by the end of the century. In contrast, highest elevation areas and regions along the coast will only experience an increase of a few days. Extremely high maximum temperatures are expected to occur in the Inland Deserts region.

Extreme heat days and heat waves can negatively impact human health. Heat-related illness includes a spectrum of illnesses ranging from heat cramps to severe heat exhaustion and life-threatening heat stroke.[5]

An increase in urban heat islands also results in higher cooling demands. A continuation of current land use and development patterns that concentrates the region's new development at inland locations away from the coast will require increased energy for cooling.

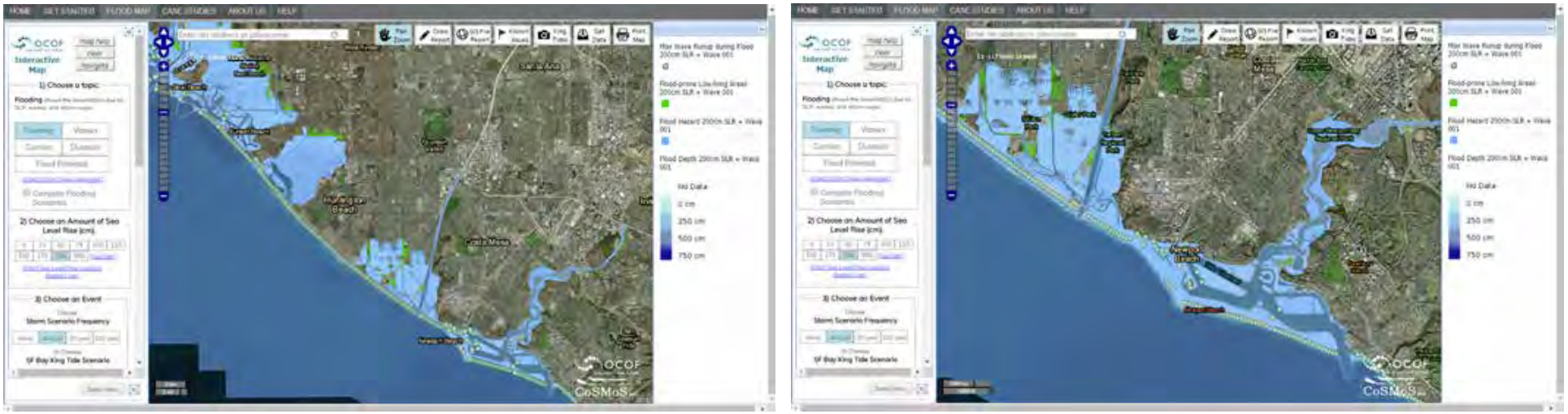
5 Union of Concerned Scientists (UCS), 2019.Killer Heat in the United States: Climate Choices and the Future of Dangerously Hot Days. July 2019.

Sea-level Rise/Coastal Flooding and Erosion – Sea-level rise is increasing the risk of coastal erosion and flooding along the California coast, and higher water levels due to sea-level rise will magnify the adverse impacts of storm surges and high waves. Estimates of future sea-level rise vary widely based on emissions scenario and uncertainty in feedbacks in the climate system.

Projections from the latest Ocean Protection Council 2018 guidance suggest roughly 1-2 feet of sea-level rise is likely (2 in 3 chance) by the end of century given the best-case low emissions (RCP 2.6) scenario. As much as 7 to 10 feet of sea-level rise could occur by the end of the century (1 in 200 chance) if the world continues "business as usual" and follows the high emissions (RCP 8.5) scenario.

Figure 5

Coastal Flood and Erosion Hazard Maps from Our Coast, Our Future.



Notes: Ballard, G., Barnard, P.L., Erikson, L., Fitzgibbon, M., Moody, D., Higgason, K., Psaros, M., Veloz, S., Wood, J. 2016. Our Coast Our Future (OCOF). Flood Map Web Application. Petaluma, California. www.ourcoastourfuture.org. (Accessed: Date July 2020).

A downed power line following a storm. In the fall of 2011, nearly a quarter of a million Southern California Edison customers were without power after a windstorm toppled utility poles.

Severe Storms/Wind – Severe storms can cause injuries or deaths, cause damage to buildings and structures, fell trees, block road and railway with debris, and spark fires with lightning strikes. Strong winds, such as the Santa Ana winds that Southern California typically experiences between October and April, are particularly dangerous in combination with dry conditions that are conducive to wildfire outbreaks. In recent years, electric utilities have shut down large portions of their power distribution systems during extremely windy conditions in an effort to prevent fires sparked by downed power lines, leading to hardships for those most dependent on the power grid. In October 2019, temporary blackouts affected more than half a million Southern California Edison customers, most of who had less than 48 hours' notice from the utility before power was shut off.[6] Multiple climactic factors contribute to extreme winds, including seasonal and inter-annual variability of sea surface temperatures that are represented by the occurrence of El Niño and La Niña events. Current climate models are inconsistent in their projections of future wind events, with some showing increases and some showing decreases.

6 Shalby, Colleen, 2019. Power outages leave those with disabilities especially vulnerable. Help remains a work in a progress. Los Angeles Times, October 25, 2019. Available at: https://www.latimes.com/california/story/2019-10-25/problems-disabled-help-power-outages.

Inland Flooding – Despite small changes in average precipitation throughout the region, dry and wet extremes are both expected to increase with climate change. By the late-21st century, total rainfall on the wettest day of the year is expected to increase across most of the Los Angeles region, with some locations experiencing a 25-30 percent increase under the business-as-usual emissions scenario (RCP8.5).[7] Frequency and severity of atmospheric river events (narrow bands of concentrated moisture in the atmosphere that deliver intense precipitation over several days, and are responsible for a majority of extreme precipitation events in Southern California) are also projected to increase for this region.[8]

Within the Inland Desert region, precipitation is historically highly variable and occurs primarily in the summer and winter months. As the climate warms, projections show increases in winter precipitation and an approximately 40 percent decrease in the summer monsoonal precipitation. In most of the Inland Desert region, total rainfall on the wettest day of the year is projected to increase between 12 and 30 percent by the end of the century under a business-as-usual emissions scenario (RCP8.5). Additionally, higher temperatures may increase evaporative demand on water supplies in the region, resulting in decreased soil moisture. More intense rainfall combined with drier soils will increase the likelihood of flash floods.[9]

Flooded streets during a winter storm in Westminster, CA March, 2020.

More severe storm events are likely to result in greater river flooding and more intense storm damage, including mudslides and combined sewer overflows. As an example, the City of Palm Springs had unprecedented flooding in February 2019. The integrity of local infrastructure is left compromised as a result. For coastal communities, sea-level rise combined with increases in extreme precipitation has the potential to exacerbate flooding.

7 Pierce, David W., Julie F. Kalanksy, Daniel R. Cayan, Climate, Drought, and Sea-level Rise Scenarios for California's Fourth Climate Change Assessment, a Report for California's Fourth Climate Change Assessment. August 2018. Accessed online: https://www.energy.ca.gov/sites/default/files/2019-07/Projections_CCCA4-CEC-2018-006.pdf

8 CalAdapt. Data collected using the Extreme Precipitation Tool for selected geographies (Los Angeles, Oxnard, Riverside, Hesperia, Imperial).

9 Pierce, David W., Julie F. Kalanksy, Daniel R. Cayan, Climate, Drought, and Sea-level Rise Scenarios for California's Fourth Climate Change Assessment, a Report for California's Fourth Climate Change Assessment. August 2018. Accessed online: https://www.energy.ca.gov/sites/default/files/2019-07/Projections_CCCA4-CEC-2018-006.pdf

Drought – the SCAG region can expect more intense and extended duration of droughts, leading to longer water supply shortages. Increasing uncertainty in the timing and intensity of precipitation will challenge the operational flexibility of California's water management systems. The SCAG region imports approximately three-quarters of its potable water from outside the region relying primarily on deliveries from the following conveyance projects: The Department of Water Resource's State Water Project, the Metropolitan Water District's Colorado River Aqueduct, and Los Angeles Department of Water and Power's Los Angeles Aqueduct.[10] These agencies have created vast systems to deliver water from the Sierra Nevada Mountains, the Colorado River, and the Delta to meet the agricultural and urban water needs of the L.A. region. Changing environmental conditions, and legal and institutional arrangements determine the amount of water each of these Projects deliver to the SCAG region. Extended drought conditions in California and throughout the American southwest will create additional pressures on the system of imported water in the SCAG region.

Warmer, wetter winters would increase the amount of runoff available for groundwater recharge; however, this additional runoff would occur at a time when some basins are either being recharged at their maximum capacity or are already full. Conversely, reductions in spring runoff and higher evapotranspiration because of higher temperatures could reduce the amount of water available for recharge.

Increased drought and reduced water availability across the American Southwest will place increased pressure on the large scale infrastructure system which delivers imported water to the Los Angeles region.

Water temperature increases and decreased water flows can also result in increasing concentrations of pollutants and salinity, resulting in water quality degradation and possible habitat degradation.[11]

Higher temperatures are expected to exacerbate water stress in an already very water-limited region that faces demands from ecological and agricultural systems, as well as from residential and commercial development.

10 SCAG, 2008. Water: Final Regional Comprehensive Plan. 2008.

11 California Natural Resources Agency (CNRA), 2014. Safeguarding California: Reducing Climate Risk An update to the 2009 California Climate Adaptation Strategy. July 2014. Available online: https://resources.ca.gov/CNRALegacyFiles/docs/climate/Final_Safeguarding_CA_Plan_July_31_2014.pdf

Wildfire – Projections indicate that wildfire may increase over Southern California, but there remains uncertainty in quantifying future changes of burned area over the Los Angeles region. Wildfire in Southern California is influenced by environmental factors such as the dry and warm Mediterranean climate with periodic episodes of Santa Ana winds and droughts, shrub dominated vegetation, and rugged terrain as well as anthropogenic factors such as large wildland-urban interfaces, past fire suppression efforts, and human activity.[12] In addition to physical injury and property loss, wildfires can result in a number of impacts including respiratory impacts due to poor air quality and altered environmental conditions that can lead to post-fire landslides and flooding.[13, 14]

Fires in Southern California are often categorized in two ways: (1) fires that are driven by hot, dry Santa Ana winds in September to December, and (2) non-Santa Ana fires which coincide with hot dry summer weather. Future wildfire activity in Southern California will be driven by both anthropogenic factors as well as regional changes in temperature, precipitation, humidity, and wind events. Some models project that the overall burned area will increase by 60 percent for Santa Ana fires and over 75 percent for non-Santa Ana fires by the mid-21st century under a under a business-as-usual emissions scenario (RCP8.5).[15] Other models project a slightly smaller increase in burned area in the Los Angeles region by mid-century.[16] Within the Inland Desert region (Eastern Riverside, Imperial, and San Bernardino counties), changes in annual precipitation could impact the future amount and type of desert vegetation. For example, an increase in non-native grasses could result in an increase in wildfire activity. Wind also plays a key role in the spread of wildfire in the inland deserts. While significant uncertainty exists with regard to the influence of climate change on wind, it is possible that temperature changes could result in an increase in wind velocity in the Inland Desert region.[17] While there are uncertainties in existing models, most research indicates that the SCAG region could experience an increase in wildfire frequency and intensity by the mid-21st century.[18]

An airplane drops retardant on a wildfire in the Southern California foothills.

12 Yufang Jin et al. 2015. "Identification of two distinct fire regimes in Southern California: implications for economic impact and future change". Environ. Res. Lett. 10 (2015) 094005. September 8, 2015.
13 Finlay SE, Moffat A, Gazzard R, Baker D, Murray V. Health Impacts of Wildfires. PLOS Currents Disasters. 2012 Nov 2 . Edition 1. doi: 10.1371/4f959951cce2c.
14 United State Geological Survey (USGS), 2018. "Post Fire Flooding and Debris Flow". Accessed online: https://ca.water.usgs.gov/wildfires/wildfires-debris-flow.html Accessed: February 4, 2020.
15 Jin et al, 2015.
16 Westerling, Anthony Leroy. (University of California, Merced). 2018. Wildfire Simulations for California's Fourth Climate Change Assessment: Projecting Changes in Extreme Wildfire Events with a Warming Climate. California's Fourth Climate Change Assessment, California Energy Commission. Publication Number: CCCA4-CEC-2018- 014.
17 Hopkins, Francesca. (University of California, Riverside). 2018. Inland Deserts Summary Report. California's Fourth Climate Change Assessment. Publication number: SUM-CCCA4-2018-008.
18 Syphard, Alexandra, 2018. Session 12: Fire in Our Future. Conference Reference Materials, 2018 Environmental Law Conference at Yosemite, California Lawyers Association Environmental Law Section. October 20.

Air Quality and Vector Borne Diseases – As explained in the Fourth Climate Change Assessment, air quality in Southern California is expected to worsen with climate change due to higher ground-level ozone concentrations,[19] and increased particulate matter resulting from more frequent wildfires.[20] These conditions can exacerbate breathing problems, aggravate lung diseases such as asthma, emphysema, and chronic bronchitis, and cause chronic obstructive pulmonary disease.[21,22] Additionally, climate is one of many interacting factors that influences the distribution of diseases borne by animals such as rats, fleas, ticks, and mosquitoes, which spread pathogens that cause illness.

Southern California has achieved overall improvements in air quality in the past 50 years despite persistent population growth; however, the Los Angeles basin is still the smoggiest region in the nation, and climate change has the potential to make it worse resulting in negative consequences for human health. In the South Coast Air Basin, which covers Orange County and significant portions of Los Angeles, Riverside, and San Bernardino Counties, the number of days above the ozone standard has been steadily declining since the 1980's. However, in the summer of 2016, the Basin experienced its worst smog since 2008. By August of the same year, ozone had exceeded federal standards a total of 91 days since the beginning of the year, compared to 67 days over the same period during 2015.[23]

A heavy layer of smog blankets downtown LA. High temperatures, stagnant weather, and wildfire smoke impact the region's air quality.

As noted above, the increase in the frequency and intensity of wildfires has an impact on the region's air quality. As wildfires burn fuel, large amounts of carbon dioxide, black carbon, brown carbon, and ozone precursors are released into the atmosphere. Additionally, wildfires emit a substantial amount of volatile and semi-volatile organic materials and nitrogen oxides that form ozone and organic particulate matter. An investigation of air quality during and following the December 2017 fires in Southern California found that the fire event increased the 14-day averaged PM2.5 concentrations substantially above federal air quality standards.[24] A study of the impacts of wildfire smoke on respiratory illnesses found that during the 2007 wildfires in San Diego there were approximately 80 excess respiratory related hospital admissions, 26 excess acute cardiovascular-related hospital admissions, 760 excess

19 Fann, N., T. Brennan, P. Dolwick, J.L. Gamble, V. Ilacqua, L. Kolb, C.G. Nolte, T.L. Spero, and L. Ziska, 2016: Ch. 3: Air Quality Impacts. The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. U.S. Global Change Research Program, Washington, DC, 69–98. http://dx.doi.org/10.10.7930/J0GQ6VP6

20 National Oceanic and Atmospheric Administration (NOAA), 2018. The Impact of Wildfires on Climate and Air Quality. Available online at: https://www.esrl.noaa.gov/csd/factsheets/csdWildfiresFIREX.pdf. Accessed October 29, 2018.

21 California Environmental Protection Agency, 2013. Preparing California for Extreme Heat: Guidance and Recommendations. Available: https://toolkit.climate.gov/reports/preparing-california-extreme-heat-guidance-and-recommendations. Accessed: March 10, 2019. October 2013.

22 Kenward, Alyson, PhD, Dennis Adams-Smith, Urooj Raja, 2013. Wildfires and Air Pollution: The Hidden Health Hazards of Climate Change. Climate Central. Available at: http://assets.climatecentral.org/pdfs/WildfiresAndAirPollution.pdf. Accessed April 11, 2019.

23 Barboza, T. (2016). SoCal Hit with Worst Smog in Years as Hot, Stagnant Weather Brings Surge in Hospital Visits. Los Angeles Times. Retrieved from: http://www.latimes.com/local/lanow/la- me- ln-summer- smog- 20160805- snap- story.html

24 Shi, Hongrong, Zhe Jian Bin Zhao, Zhiji Li, Yang Chen, Yu Gu, Johnathan H. Jiag, Meemong Lee, Kuo-Nan Liou, Jessica L. Neu, Vivienne H. Payne, Hui Su, Yuan Wang, Marcin Witek, John Worden. Modeling Study of the Air Quality Impact of Record- Breaking Southern California Wildfires in December 2017. JGR Atmospheres, Published June 4, 2019.

respiratory related emergency department visits, and 38 excess acute cardiovascular-related emergency department visits. The estimated cost of these excess medical needs were estimated to be $3.4 million.[25]

Air quality in the Imperial and Coachella Valleys and the SCAG region generally, is tied to the fate of the Salton Sea. The Salton Sea is shrinking because of competing priorities for water supplies, and climate change is contributing to the evaporation of water which leads to dusty dry conditions. High winds blow the dust from the lakebed, which is contaminated from years of fertilizer and pesticide use in the area, around the Imperial Valley and eastern Coachella Valley contributing to air pollution.

Climate change will also impact the spread of vector-borne diseases in the SCAG region which may have serious consequences for human health. Unlike other climate-sensitive health risks, such as heat-stress, or exposure to storms and floods, the influence of temperature and precipitation changes on disease vectors are less direct and more dependent on a multitude of factors, including practices concerning agriculture, dams, irrigation, deforestation, population movements, and rapid unplanned urbanization. However, meteorological changes can clearly affect the rates of infection for various diseases by extending the seasons or geographic range across which disease-carrying animals are active.[26]

According to the California Office of Environmental Health Hazard Assessment (OEHHA), no clear climate-driven trends are currently evident in the number of vector-borne disease cases in California. However, warming temperatures may be creating favorable conditions for mosquito species native to the tropics that have recently been found in several California counties. These mosquitoes have the potential to transmit the Zika, dengue fever, and yellow fever viruses. The occurrence of West Nile Virus in California, first detected in 2003, may also have links to climate change, and health experts expect climate change to increase the transmission of Lyme Disease and other tick-borne illnesses. Health professionals are concerned that these and other invasive vector species may acclimate to California's warming climate and become widespread across the state.[27]

25 Ikuho Kochi, Patricia A. Champ, John B. Loomis, Geoffrey H. Donovan, Valuing morbidity effects of wildfire smoke exposure from the 2007 Southern California wildfires, Journal of Forest Economics, Volume 25, 2016, Pages 29-54, ISSN 1104-6899, https://doi.org/10.1016/j.jfe.2016.07.002. (http://www.sciencedirect.com/science/article/pii/S1104689916300174)

26 Campbell-Lendrum D, et al (2015). Climate change and vector-borne diseases: what are the implications for public health research and policy? Philosophical Transactions, Royal Society Publishing B370:20130552. http://dx.doi.org/10.1098/rstb.2013.0552

27 https://oehha.ca.gov/epic/impacts-biological-systems/vector-borne-diseases

A home west of Briar Wood Canyon is engulfed in post-fire debris flow from a rainstorm following the Station Fire. Photo credit: Susan Cannon, USGS.

Landslides – Typically, landslides are triggered by seismic activity or prolonged severe wet seasons. Climate change is not expected to affect the seismic risk, but it is expected to change winter storm patterns. In Southern California, regional models project a relatively steady annual average in precipitation totals, but the seasonal variability may increase, and storms could become more extreme.[28] The incidence of atmospheric rivers – narrow bands of concentrated moisture in the atmosphere that deliver intense precipitation over several days – is expected to increase, punctuated by dry periods.[29, 30, 31] Winters may be more compressed, with more rain falling over fewer months, and precipitation extremes in individual years may increase the occurrence of rainfall-induced landslides, particularly in areas where recent wildfire has burned landslide-vulnerable hillsides, removing vegetation and creating conditions for increased storm runoff.[32,33]

28 Swain, D.L., Langenbrunner, B., Neelin, J.D. et al. Increasing precipitation volatility in twenty-first-century California. Nature Clim Change 8, 427–433 (2018). https://doi.org/10.1038/s41558-018-0140-y

29 Warner, Michael & Mass, Clifford & Salathé, Eric. (2015). Changes in Winter Atmospheric Rivers along the North American West Coast in CMIP5 Climate Models. Journal of Hydrometeorology. 16. 118-128. 10.1175/JHM-D-14-0080.1.

30 Hagos, Samson M. L. Ruby Leung, Jin-Ho Yoon, Jian Lu, and Yang Gao. "A projection of changes in landfalling atmospheric river frequency and extreme precipitation over western North America from the Large Ensemble CESM simulations" Geophysical Research Letters / Volume 43, Issue 3. January 12, 2016.

31 Gao, Yang, Jian Lu, L. Ruby Leung, Qing Yang, Samson Hagos, and Yun Qian. 2015. "Dynamical and Thermodynamical Modulations on Future Changes of Landfalling Atmospheric Rivers over Western North America." Geophysical Research Letters 42 (17): 7179–86.

32 Oakley, N. Lancaster J.; Stock, J.D., Cerovski-Darriau, C.; Kaplan, M.; Ralph, F. M., 2016. "Atmospheric Rivers as a Trigger for Landslides and Post-Fire Debris Flows in Southern California". American Geophysical Union, Fall Meeting 2016, abstract #A44C-05. December 2016.

33 Oakley, Nina S. Jeremy T. Lancaster, Michael L. Kaplan, F. Martin Ralph. "Synoptic conditions associated with cool season post-fire debris flows in the Transverse Ranges of southern California". Nat Hazards (2017) 88:327–354 DOI 10.1007/s11069-017-2867-6. April 22, 2017.

Pests and Ecological Hazards – With climate change, ecosystems and wildlife will be challenged by the spread of invasive species, barriers to species migration or movement in response to changing climatic conditions, direct impacts to species health, and mismatches in timing between seasonal life-cycle events such as species migration and food availability.[34] In Southern California, even minor increases in summer temperatures could have adverse impacts on some important beneficial species while creating ideal conditions for other agricultural and urban pests. The differing responses of insects and agricultural diseases to changing climate conditions will create challenges in pest and agricultural management. Additionally, higher temperatures and extended drought can make forests more susceptible to attacks from pests which can in turn create larger wildfires due to increase fuel loads.[35]

Southern California is a region with high levels of biodiversity and home to many species endemic to the Mediterranean climate that are under pressure due to urbanization and agricultural expansion. These influences have caused natural areas to become smaller and more fragmented making them more vulnerable to the effects of climate change. Changes in temperature, precipitation, and wildfire regimes may result in species and ecosystem loss.[36] Additionally, sea-level rise and coastal flooding are likely to result in a significant loss of coastal wetlands. The loss of coastal wetlands in turn will result in smaller buffers against coastal storms and erosion, as well as a loss of habitat and source of long term carbon storage.[37]

Impacts to the Local Economy

The impacts of extreme heat, extreme weather, sea-level rise, wildfire, and drought will have direct impacts on the cost and loss of critical infrastructure, real estate, human health and productivity, stressed supply chains and shortages of critical resources, and increased economic inequality, especially in already vulnerable populations including lower-income and marginalized communities.[38]

Although the impacts of climate change on the local economy are as varied as climate projection models, there is consensus that increasing global temperatures will see a definite loss in U.S. GDP over the course of the next 80 years. Depending upon the severity of the temperature differential, this could be anywhere between 0.5 – 2 percent of GDP.[39] This equates to annual losses of up to $500 billion in wealth.[40] What is more important is that per capita GDP, the individual share of wealth, could decrease by over 10 percent during this same time period.[41] Finally, these estimates do not completely consider the international trade picture. As other countries are expected to experience similar or worse impacts on their economies, the ability for the economy to grow is inhibited. This additional loss is not considered, and economic growth is vital to expanding economic vitality and opportunity for all.

34 CNRA, 2014.
35 Trumble, John T. Casey, D. Butler. "Climate change will exacerbate California's insect pest problems" California Agriculture 63(2):73-78. https://doi.org/10.3733/ca.v063n02p73 Published April 01, 2009
36 Klausmeyer KR, Shaw MR (2009) Climate Change, Habitat Loss, Protected Areas and the Climate Adaptation Potential of Species in Mediterranean Ecosystems Worldwide. PLoS ONE 4(7): e6392. https://doi.org/10.1371/journal.pone.0006392
37 Doughty, Cheryl, Kyle Cavanaugh, Rich Ambrose, and Eric Stein, 2017. Sea-level Rise Impacts to Coastal Habitats in Southern California Estuaries. May 2017.
38 Fourth National Climate Change Assessment, US Global Change Research Program, 2018
39 Ten Facts About the Economics of Climate Change and Climate Policy, Ryan Nunn, et. Al., Brookings Institution, 2019.
40 Climate Damages and Adaptation Potential Across Diverse Sectors of the United States, Jeremy Martinish and Allison Crimmins, Nature Climate Change, 2019.
41 US Bureau of Economic Research, 2014

More specifically:

- Southern California will see increased costs to businesses and government in terms of healthcare costs and reduced productivity for heat and respiratory related illness due to high heat days and increased smog. The health impacts of increased extreme heat and reduced air quality include increased asthma, heart disease, respiratory illness, and death which will impact worker productivity, especially in agriculture and construction,[42] but will increase the costs of business and government across most sectors. Furthermore, it is expected that climate change related stressors will exacerbate mental illness which will further decrease productivity and increase health care costs.
- California is already facing a major housing crisis with California being the second most expensive state to live, behind Hawaii. California is also the most expensive place to purchase a home, only behind Hawaii and Washington, DC. Los Angeles is one of the top 10 US Cities with the highest rents.[43] California is expected to lose up to 100,000 housing units just due to sea-level rise by 2090. Furthermore, as financial institutions look to reduce risk, many areas in which homes are located may lose value or financing due to future threats of flooding, wildfire, and other natural disasters.[44] The cost burden has a direct effect on businesses finding and retaining a skilled workforce due to the cost burdens workers face to locate in California. Prior to 2020, the Los Angeles area saw two consecutive years of decreasing labor supply and net outward migration to other parts of the US.[45] Climate change is expected to increase migration to less vulnerable parts of the Country which will have an impact on local communities' ability to retain businesses and jobs.
- Energy and water costs are expected to rise as these resources become more costly. Although there is promise for renewable energy, California's water distribution system was based upon a system developed over 50 years ago; the system is neither equipped to deal with prolonged local drought nor drought throughout the entire Colorado River watershed, reducing valuable resources available for most of the US Southwest. Not only will increased energy and water costs negatively impact industrial hubs such as Los Angeles, but it will also have a tremendous impact on areas of the region where most of the US's winter fruits and vegetables are grown
- Southern California is highly reliant on tourism generated from its natural features. Climate change is expected to impact the health and biodiversity of a range of habitats including the forest and desert. Increased high heat and reduced snowpack may eliminate the viability of industries such as skiing, which already depend upon snowmaking in Southern California.[46]
- Local government will see fiscal impacts to revenue sources such as property tax and sales tax as businesses begin to relocate, infrastructure costs for replacement and hardening begin to take an increasing portion of local budgets, and property is lost to climate change impacts.[47]

42 The Economic Risks of Climate Change in the United States, Michael R. Bloomberg, Henry M. Paulson, Jr and Thomas F. Steyer, 2014.
43 California is Becoming Unlivable, According to Science, Aria Bendix, Business Insider, 2019.
44 Underwater: Rising Seas, Chronic Floods, and the Implications of US Coastal Real Estate, Union of Concerned Scientists, 2018
45 California Employment Development Department, 2020
46 Not the Golden State Anymore: Middle- and Low- Incoe People Leaving California, Kate Cimini, CalMatters, 2020
47 Surging Seas, Rising Fiscal Stress: Exploring Municipal Fiscal Vulnerability to Climate Change, Linda Shi and Andrew M. Varuzzo, Cities, 2020.

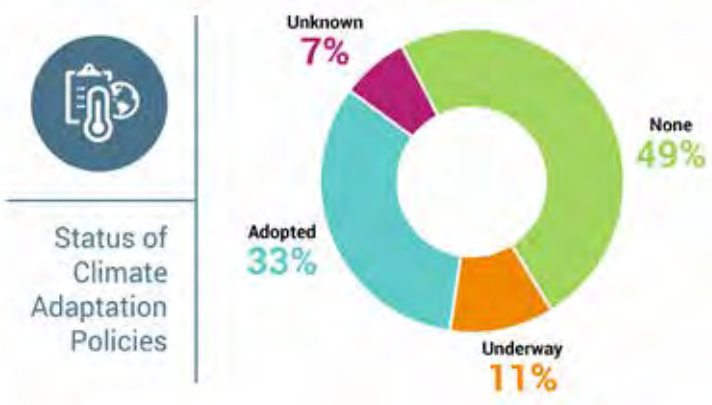
Status of Adaptation Planning Efforts in the SCAG Region

In recent years, the six counties in the SCAG region have engaged in a range of planning activities that include assessment of vulnerability to climate change hazards. A survey of these efforts is documented in the report titled Gap Analysis of Existing Countywide Climate Change Vulnerability Assessments in the SCAG Region, available on the SCAG website. The report reveals the following:

- Although all counties have a General Plan Safety Element (a required component of all General Plans), not all of them acknowledge or discuss climate change. However, they do analyze hazards that are related to or exacerbated by climate change, such as flooding, wildland fire, coastal erosion, and drought). Senate Bill 379 requires that Safety Elements be updated by January 1, 2022 to include consideration of climate change hazards, and strategies to improve adaptation and resilience to those hazards.
- For all six counties, a Climate Change and Health Profile Report has been prepared by the California Department of Public Health as part of the CalBRACE Project (California Building Resilience Against Climate Effects), which identifies high-level impacts of climate change and describes social vulnerabilities and climate-related health risks.
- Los Angeles and Ventura Counties have prepared vulnerability assessments specific to sea-level rise, while San Bernardino and Western Riverside County have prepared broader vulnerability assessments that address climate hazards relevant to their inland settings.

The gap analysis provides a summary of each county's efforts. In addition to Safety Elements and Health Profile reports, relevant documents reviewed include local hazard mitigation plans, integrated regional water management plans, sea-level rise assessments, sustainability plans, climate action plans, and agency-specific climate vulnerability assessments.

A survey was also conducted to identify the cities, counties, and tribal governments that have adopted or are in the process of adopting climate adaptation policies as part of their general plans or stand-alone plans (e.g., local hazard mitigation plans, climate action plans).



- Based on the research results, 84 cities and 4 counties in the SCAG region have adopted climate adaptation policies or are in the process of updating their policy documents. This corresponds to 44 percent of the total number of SCAG cities, counties and tribal governments. These cities and counties were ranked as platinum, gold, or silver based on the degree to which their policies addressed various climate change risks. Most were ranked silver (the lowest ranking) because climate change impacts were acknowledged in their planning documents as a risk but adaptation strategies or policies to address the risk were not identified.
- Only 14 cities and counties in the SCAG region have adopted or drafted an updated safety element that addresses climate change. This corresponds to 7 percent of the total number of SCAG cities, counties and tribal governments.

The policy gap analysis describes the criteria used to rank each city and county, and provides a summary of results by county. The results are summarized in a report titled Gap Analysis of Climate Adaptation Policies in the SCAG Region (available on the SCAG website) and in an interactive web map located **Here**.

Existing Resources for Adaptation Planning

There are a multitude of existing frameworks and guidance documents that are useful for climate change adaptation planning. **Appendix A** describes those that provide the most value to SCAG member agencies, selected based on their currency and their relevance to the region's geography, natural resources, and demographics. Many are resources developed by the State of California, which has made a concerted effort in recent years to provide planning assistance to state agencies and to local and regional governments that are faced with the challenge of adapting their communities to climate change impacts.

Many of these resources are referenced in the following section on The Adaptation Planning Process, which as a whole aligns closely with the phases and steps used by the California APG.

Ventura County. Smoke from a wildfire spreads along the coastline.

Chapter 3

The Adaptation Planning Process

CHAPTER 3

The Adaptation Planning Process

The SoCal APG recommends stepping through a four-phase process to comprehensively plan for climate adaptation at the local level, consistent with the California APG, and illustrated in Figure 6. This section describes a series of steps associated with each of the four phases, identifies tools and resources that can assist in completing each step, and portrays relevant examples that illustrate each step.

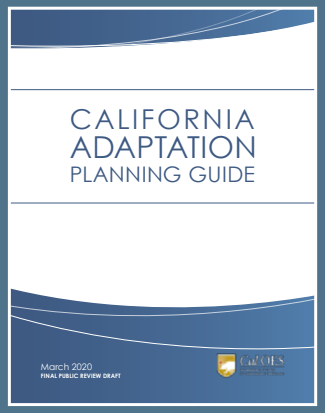
Integral to the SoCal APG's four phases is public engagement, an essential component that applies to the entire process from inception to implementation. The recommended approach for public engagement is described at the beginning of this section with specific engagement strategies identified at the end of each of the four phases.

The SoCal APG frequently references the California APG and the Regional Resilience Toolkit, described below.

Figure 6

Four Phases of Adaptation Planning

CALIFORNIA ADAPTATION PLANNING GUIDE



The State of California released the first APG in 2012, and it has been widely used by communities, government agencies, tribal governments, nongovernmental organizations, institutions, and others throughout California to help guide adaptation planning efforts. In 2020, the State updated the California APG to reflect the latest best practices; to integrate recent updates to State plans, policies, programs, and regulations; and to ensure that communities have guidance on using the best available science and information. The SoCal APG makes extensive references to the updated California APG.

The update to the California APG provides guidance to local governments on local adaptation and resiliency planning. It provides a four-phase, step-by-step process for climate vulnerability assessment and adaptation strategy development. It is designed to be flexible and guide communities in adaptation planning that best suits their needs.

REGIONAL RESILIENCE TOOLKIT (OPR, FEMA, USEPA, ABAG)

The SoCal APG makes extensive references to the Regional Resilience Toolkit, which lays out a process for adaptation planning using five steps to build community resilience, integrating climate change hazards with other natural disasters. The toolkit is intended to allow multiple jurisdictions and levels of government to work together toward creating regional adaptation solutions. Additionally, the toolkit is designed to engage non-governmental partners in community groups in the adaptation planning process. The Regional Resilience Toolkit focuses on creating multi-hazard resilience, providing jurisdictions across a region with the tools to address multiple hazards simultaneously within the context of federal, state, and local planning requirements and funding opportunities. The toolkit was created out of a partnership between Federal Emergency Management Agency, the United States Environmental Protection Agency, Office of Planning and Research, Association of Bay Area Governments, and the Metropolitan Transportation Commission. The toolkit can be applied in any region or community at any stage in the resilience planning process. The toolkit also includes guidance regarding communication and outreach guidance for engaging stakeholders across a region as well as worksheets that can be used to guide cross- jurisdictional resilience planning.[1]

1 Federal Emergency Management Agency (FEMA), United States Environmental Protection Agency (USEPA), Association of Bay Area Governments (ABAG), 2019. Regional Resilience Toolkit "5 Steps to Build Large Scale Resilience to Natural Disasters

Approach to Equitable Public Engagement

The goal for any successful adaptation planning process is a more prepared and resilient community. Engaging all voices of the community and stakeholders throughout the process, as well as ensuring that community members are engaged with the implementation of the plan itself is key to ensuring long-term success. This section describes essential principles for effective engagement, provides an overview of the public engagement process as it fits into the overall adaptation planning process, and describes a number of tools and resources that are available for SCAG member agencies to develop their engagement programs and activities.

The IAP2 model, described below, is an approach to tailoring public engagement to each step of the planning process.

EQUITY VERSUS EQUALITY IN PUBLIC ENGAGEMENT

The American system of democracy is based upon governance that is "...by the people, and for the people...". While all public engagement attempts to espouse this virtue, oftentimes engagement fails to engage all facets of the population, especially hard-to-reach and vulnerable populations such as low-income, people of color, non-English speaking, recent immigrants, elderly, youth, and those with disabilities.

Furthermore, there is also a difference between "equity" and "equality". Equality means everyone has the same right to participate in public engagement. It assumes that everyone has the same flexibilities, resources and access to communications to participate. This is often not the case. Equity means that the playing field is evened between groups of varying abilities and resources. This means extra effort to reduce barriers these populations may encounter in participation such as accommodating schedules, access to the internet, disconnect from traditional community communications media, language barrier, disability, etc. Equity is not just about allowing participation but going the extra mile to ensure hard-to-reach and vulnerable populations have the resources and opportunities to participate in a way that overcomes barriers.

Ensuring equity in the public engagement process means investing in the proper planning, tools, partnerships and resources to identify and remove barriers for meaningful participation for all facets of the community as part of the planning process. Ensuring adequate resources for public engagement in a project budget is important.

INTERNATIONAL ASSOCIATION OF PUBLIC PARTICIPATION SPECTRUM

The (IAP2) is a model for varying levels of participation. Local governments need to decide what level of engagement is appropriate for each set of engagement activities utilized throughout the climate adaptation planning process.

IAP2 Spectrum of Public Participation

IAP2's Spectrum of Public Participation was designed to assist with the selection of the level of participation that defines the public's role in any public participation process. The Spectrum is used internationally, and it is found in public participation plans around the world.

INCREASING IMPACT ON THE DECISION

	INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
PUBLIC PARTICIPATION GOAL	To provide the public with balanced and objective information to assist them in understanding the problem, alternatives, opportunities and/or solutions.	To obtain public feedback on analysis, alternatives and/or decisions.	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered.	To partner with the public in each aspect of the decision including the development of alternatives and the identification of the preferred solution.	To place final decision making in the hands of the public.
PROMISE TO THE PUBLIC	We will keep you informed.	We will keep you informed, listen to and acknowledge concerns and aspirations, and provide feedback on how public input influenced the decision.	We will work with you to ensure that your concerns and aspirations are directly reflected in the alternatives developed and provide feedback on how public input influenced the decision.	We will look to you for advice and innovation in formulating solutions and incorporate your advice and recommendations into the decisions to the maximum extent possible.	We will implement what you decide.

The following excerpt describes ADA considerations relevant to public engagement in adaptation planning processes.

ACCOMMODATING DISABILITIES IN PUBLIC ENGAGEMENT

A typical American adult has better than a 1 in 4 chance of becoming disabled, even temporarily, at some point in their life. 2020 marks the 30th Anniversary of President George HW Bush's signing of one of the most extensive laws to grant equity to a portion of America's population that was often forgotten and ignored. This law covers urban planning and design, architecture, transportation, access to medical treatment, IT services, employment, and inclusion of those with disabilities in the deliberations of government, including public engagement.

The ADA gives rise to the term "Reasonable Accommodations." This means that in the planning process, local jurisdictions must go above and beyond to make someone with a disability able to participate in the same activities as their non-disabled colleagues. Here is a fact sheet from the Institute for Local Government providing some tips on how to provide reasonable accommodations during public engagement activities. It is important to remember that public engagement includes not only in-person event, but also digital engagement platforms and methods, including teleconferencing and webinars. Most local governments are subject to Section 508 of the Rehabilitation Act and Title III of the ADA.

In addition to case law under ADA Title III as well as the California Unruh Civil Rights Act, Section 508 requires websites and electronic content to be (Web Content Accessibility Guidelines) compliant. Examples of reasonable accommodation for digital engagement include that content can utilize verbal readers, magnification, uses captions or text alternatives, etc. For teleconferencing and webinars, there is the ability to use closed-captioning for those with hearing impairments and the ability for them to ask questions in a reasonable manner through chat or other means.

Essential Principles for Successful Engagement

The Regional Resilience Toolkit provides a good discussion of the following principles that underlie successful public engagement – whether it be for community planning in general or geared to resiliency and climate change adaptation planning in particular.

BUILD TRUST THROUGH PARTNERSHIPS & RELATIONSHIPS

Trust is the cornerstone of successful community engagement, particularly when it comes to issues surrounding climate change, where stakes can be high, yet information and data can be lacking or uncertain. Building effective stakeholder relationships take time, resources, ongoing care, and the allocation of resources to maintain and grow mutual trust and establish valuable, dynamic coalitions. The Regional Resilience Toolkit provides tips on getting to know your community's stakeholders and building trust through partnerships and relationships.

KNOW THE COMMUNITY'S STAKEHOLDERS

Understanding the concerns and motivations of community members, leaders, and decision-makers is key to building a coalition of stakeholders that is representative of all voices of the community and to effectively inform a plan or project. While hazard mitigation has traditionally been grouped with disaster preparedness and emergency response led by fire or police departments, climate change adaptation planning should be multi-disciplinary, spanning multiple city departments and involving many non-governmental stakeholders, such as community based organizations, property owners and managers, regulators, business interests, community members, and local institutions. It is also particularly important to identify the communities that that are disproportionately vulnerable to climate change hazards. These communities, often called frontline communities because they are susceptible to experiencing the impacts of climate change early and most severely as compared to other community groups, require careful identification, targeted outreach, and tailored engagement approaches. Identification of vulnerable population groups is a key step early in the planning process (see Phase 1) and will help to inform the approach to engagement. Additionally, communities that are disadvantaged, disenfranchised or otherwise typically underrepresented in planning processes warrant similar treatment as vulnerable communities (often these communities overlap).

The Regional Resilience Toolkit provides tips on how to identify stakeholders who should be involved, when and how to engage them throughout the planning process, and deciding which tools and/or methods will be effective in achieving your outreach objectives depending on your stage in the process. The SB 1000 Toolkit and the Urban Sustainability Directors Network's Guide to Equitable, Community-driven Climate Preparedness Planning provide tips on identifying and engaging communities to ensure a more inclusive an equitable planning process.

TELL THE STORY

When working with a diverse group of stakeholders, effective communication is essential to maintaining momentum and cohesion within the community. Storytelling is an effective approach for engaging stakeholders and making resilience relevant to their concerns and livelihoods. The Regional Resilience Toolkit explains the vital elements of storytelling through a range of communication channels (e.g., press conference, funding pitch, workshop, or one-on-one meeting) and provides a summary of best practices that apply to all storytelling situations.

STORYTELLING FOR RESILIENCE COMMUNICATIONS

Using a story framework for resilience communications is particularly useful as it allows for a more accessible and relatable approach that can transcend political issues and different views while making the communications personal and relevant to an audience. The information gained from "what we love and what we will protect" can be a productive starting point for crafting a strong communications story.

Source: Regional Resilience Toolkit page 113

Stakeholder Mapping

Identifying and understanding stakeholders, their needs, and their relationship to the planning process is essential to effective adaptation planning. Stakeholder mapping exercises can facilitate this process and can help to identify communities that have been historically underrepresented in planning and decision making. The Regional Resilience Toolkit explains the process of stakeholder mapping, gives example criteria that can help identify stakeholders that are connected to the planning process, and describes how to categorize stakeholder types. The Toolkit also provides worksheets to facilitate the stakeholder mapping process.

STAKEHOLDER MAPPING

Stakeholder mapping is the process of understanding perspectives and interests, visualizing relationships, and establishing which stakeholders are the highest priority for engagement. It may quickly become evident that many people could and should be involved in the planning effort. However, it is essential to differentiate the various audiences based on their level of interest and engagement, what level of technical understanding and input they have, and what level of resources are available to reach and engage the various groups.

The following are examples of criteria to consider in identifying technical and community audiences:

- The stakeholder owns an important asset.
- The stakeholder has the authority to regulate, make policy, or make decisions about an asset or asset class.
- The stakeholder will be affected by the assessment or potential strategies.
- The stakeholder has the potential to either help or hinder the political process.
- The stakeholder has specialized expertise that will help with technical questions.
- The stakeholder may be able to provide funding or otherwise assist in implementing strategies.
- The stakeholder represents typically underrepresented community members.
- The stakeholder may be able to make critical connections to other relevant topic areas and/or projects which the project team is unaware.
- The stakeholder has the time and ability to commit time and effort to the project.

Source: Regional Resilience Toolkit page 25

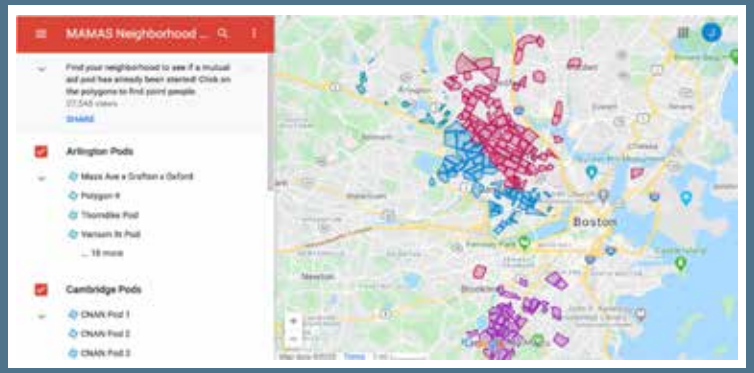
Engagement and Outreach Plan

Developing an engagement strategy should involve key team members and be considered a core part of the planning process. Developing an Engagement and Outreach Plan early in the planning process is effective in getting buy in from team members on how and when engagement should be happening. Maintaining consistent, relevant communication that is tailored to particular stakeholders and to each step in the planning process is key to maintaining momentum. Local non-profits and community leaders could be partners to assist in identifying vulnerable or underrepresented populations and brainstorming methods to reach these communities and bring them into the planning process. The Engagement and Outreach plan should dedicate resources to engaging these communities and amplifying their voices during the public participation process. Creating an equitable Engagement and Outreach Plan will help create public participation opportunities that are more productive for both the project team and the community. Keep in mind that public engagement is an iterative process and it is important to revisit and revise the Engagement and Outreach Plan throughout the planning process to incorporate lessons learned.

The California APG suggests a number of outreach methods to gather input from the community such as pop up booths, design charrettes, focus groups, interactive workshops, online and mobile engagement, open houses, surveys, and tours. It also includes a number of suggestions for how to plan outreach events that are engaging and inclusive.

LESSONS LEARNED FROM ENGAGEMENT APPROACHES UTILIZED DURING COVID-19 PANDEMIC

The Mutual Aid Medford and Somerville (MAMAS) network in Massachusetts was created during the coronavirus pandemic to build hyperlocal, virtual resilience hubs. The network mapped neighborhoods into "pods" or block areas with the goal of reaching neighbors that may not have access to internet. Each pod has a leader with the responsibility of reaching neighbors and creating phone trees and group chats. The MAMAS network created a virtual needs matching platform where neighbors may post either resources they can provide or needs that they have, allowing neighbors to connect resources virtually. Some of the resources that have been shared through the MAMAS network include childcare, car rides, cooking, translation, and financial resources. Outreach materials are provided in both English and Spanish and translation services are available for translation to Spanish, Portuguese, Haitian, and Creole. The MAMAS network has a how-to guide for establishing neighborhood pods and a mutual aid network in other areas and regions. These resources include outreach materials designed to reach residents that may not have internet access. SCAG member agencies could consider partnering with community organizations or providing technical resources to support creation of such resilience hubs to build a network of communication at the neighborhood level for support before, during and after emergency events. If well established and maintained overtime, it could also serve as a network to conduct outreach.



The Regional Resilience Toolkit describes the central components of an engagement and outreach plan such as establishing goals and outcomes, target audiences, and key messages. The Regional Resilience Toolkit includes a sample outline for an outreach and engagement plan and provides tools and worksheets to support public meetings and outreach activities. The toolkit identifies which outreach tools and tactics may be effective to reach target audiences at various stages in the outreach plan.

Regional Coordination

Addressing many of the critical issues and challenges presented by climate change requires going beyond the borders of a single city or county. Effective emergency response to large wildfires, for example, requires coordination amongst multiple agencies and local jurisdictions. Climate change's effects on quality, sea-level, transportation systems, and disease vectors are further examples of hazards that are best addressed through regional coordination in order to be addressed effectively.

In developing the Adaptation Planning Framework, SCAG interviewed several of its member agencies to better understand regional awareness of climate change issues and whether the existing regional coordination around planning issues could be harnessed for climate change adaptation, particularly at a regional scale. The results are summarized in the Regional Coordination Strategy Report, available on the Framework's web page **here**.

The findings reveal that there is general agreement on climate risks and the need for better planning, but less agreement on the actions necessary to address those risks. It is widely acknowledged that the region is experiencing negative effects from climate change, particularly as they relate to wildfires, drought, sea-level rise, and the social vulnerability related to those impacts. However, gaps persist in the information and data needed to support effective adaptation planning and decision-making.

Collaboration and knowledge sharing amongst local governments and regional agencies, particularly where assets and climate impacts are cross-jurisdictional, is essential to both long-term planning and short-term responses to climate emergencies.

Communication Strategies

Taking time to think about target audiences, key messages, and community values will pay dividends in the planning process. Communicating to stakeholders in a manner that is sensitive to community experiences and the stage in the planning process can help make conversations about climate change and adaptation more productive. Creating productive, authentic, and inclusive opportunities for public engagement requires significant investment, thought, and planning. Investment in this stage of the process will allow for meaningful input throughout the planning process to maximize influence by the community on the planning outcome.

SCAG has developed tools and guidance for public engagement, including tips on communication strategies that are most effective when it comes to talking about climate change adaptation and resiliency. A SCAG Community Workshop Template, provided on the SCAG Adaptation Planning Framework **web page** includes the following customizable components:

- A presentation slide deck tailored to SCAG jurisdictions who would like to engage constituents in a conversation about climate adaptation and/or mitigation.
- Materials for an interactive activity, in both group and individual formats.
- Corresponding meeting announcements and invites that you can change for your event

Figure 7

Excerpt from SCAG Community Workshop Template Guide

COMMUNICATION STRATEGIES

A good amount of research has been done about what communication strategies are most effective when it comes to talking about climate change, adaptation, and resiliency. SCAG gathered these best practices and tested them at a series of creative pop-ups in the Fall of 2019. This template is based on findings from this effort. Here are four different ways you can frame why your community needs adaptation strategies. Use one, or mix and match to find the right fit for your audience.

1) Make it personal

Use a personal "risk-based" messaging strategy that identifies the monetary costs and health impacts of climate change for your constituency.

- This strategy ranked as the most effective during SCAG's community outreach.
- Use facts that can apply to an individual's or family's life and phrase the risk so that the effects are tangible. A utility bill increasing by hundreds of dollars is an experience that is easy to grasp; it is much more difficult to grasp a change in millions of dollars to a government's budget.
- ***As an example, we have included four such facts in the "How the Climate Affects You" section of the slide deck.***

2) Localize and concretize

Use a before and after visualization of a familiar and beloved resource.

- In this strategy, you can direct your audience's feelings of attachment towards a place, into collective support. Use a visual (photographs, videos, renderings) to show the before and after effects of our changing climate. This allows attendees to see the effects for themselves.
- A good subject is nearby nature that has been affected by extreme weather events.
- As an additional note, the literature shows that conservative audiences respond more favorably to changes that are framed as the "past & present," whereas liberal audiences preferred a "present & future" framing.
- ***See the examples in the "How the Climate Affects California" section of the slide deck.***

3) Map the risk

Use a chronological map to show the proximity of risk and change over time.

- This strategy uses mapping visualization to help participants understand the future effects of climate change.
- It is important to keep in mind that map-reading is a special skill. Aid participant understanding by ensuring your visualizations are focused on your immediate locality, and that familiar landmarks are called out.
- Connecting the familiar (local places) to the hard-to-grasp (future climate effects) builds a kind of support grounded in personal affection.
- ***See the examples in the "How Climate Changes at Home" section of the slide deck.***

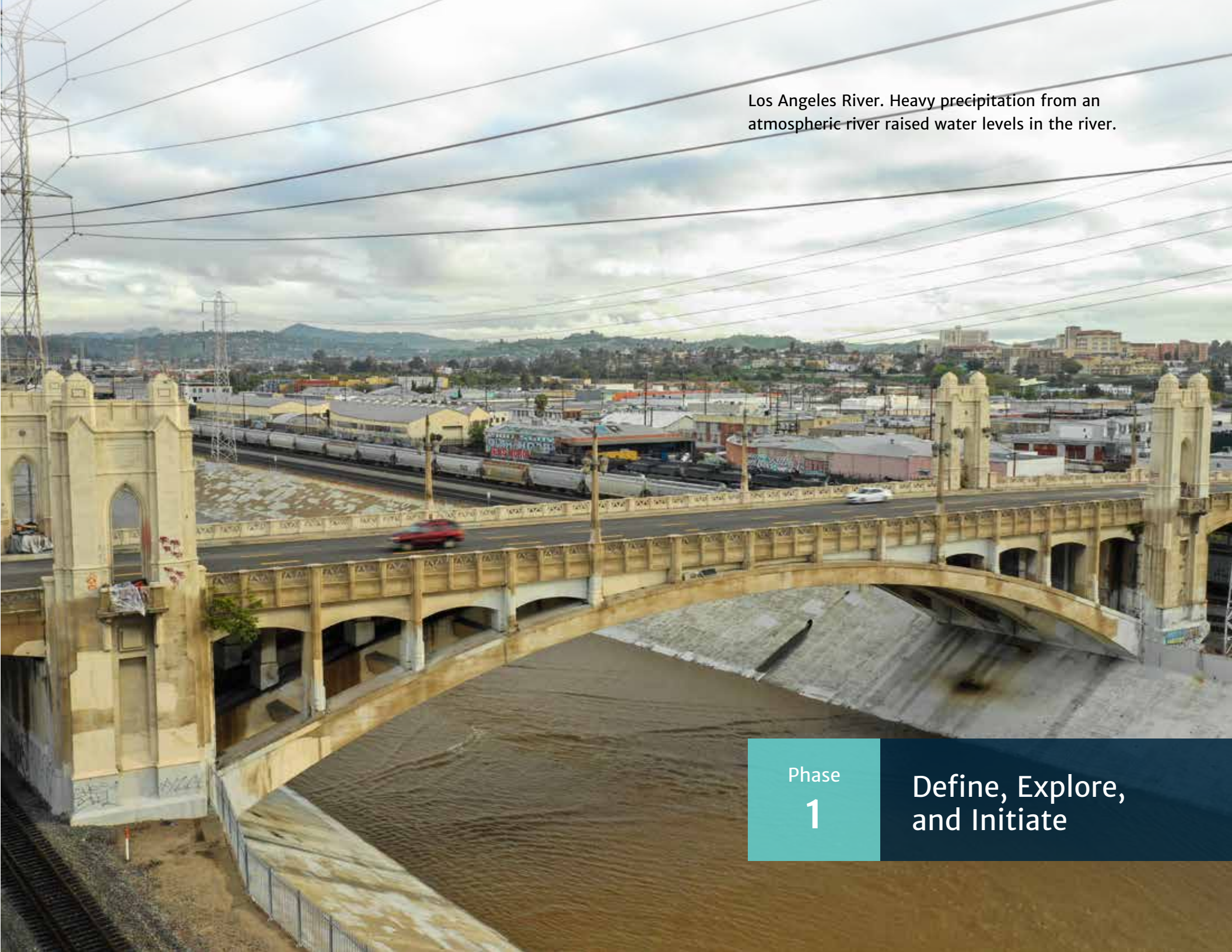
4) Bring in a trusted advisor:

Use the words and stature of someone your community already trusts.

- This strategy requires the identification of a leader or authority figure with whom your community has a rapport and finding a values-based message that will resonate with them.
- This can occur as quotes, a video message, or an in-person appearance. The literature says this strategy can work especially well with older, and more conservative constituencies.
- However, appropriate advisor selection can align this strategy with a wide range of ideologies. Notably, this strategy was reported as slightly less impactful than the other strategies explained here.
- ***See the examples in the "How the Climate Affects Us" section of the slide deck.***

Additional Tools and Resources for Public Engagement and Communication:

- The **Regional Resilience Toolkit** identifies best practices for planning and running workshops or meetings and provides planning worksheets and sample agendas. Appendices A of the Toolkit includes detailed guidance for stakeholder mapping, developing an Engagement and Outreach Plan, implementing storytelling communication techniques, and planning and running a successful meeting. Appendix A includes example meeting agendas and checklists for planning meeting logistics.
- The **SB 1000 Toolkit** provides resources for identifying disadvantaged communities and for integrating their needs into the community adaptation planning process. The SB 1000 Toolkit also identifies communication techniques and activities that may be useful when engaging environmental justice communities.
- The Urban Sustainability Directors Network's **Guide to Equitable, Community-driven Climate Preparedness Planning** is a guidance document for local governments to design and implement an inclusive and community centered planning process.
- The **Adapting to Rising Tides Program** has a Stakeholder Engagement Guide which provides information on stakeholder identification, building trust in relationships with stakeholders, and running effective meetings.
- The **Gateway Cities COG Climate Action Planning Framework** includes a Public Engagement Toolkit, developed by the Institute for Local Government, for incorporating public engagement into various climate related planning processes – including creating a climate action plan, hazard mitigation plan or any other resilience / adaptation related projects – using a framework that emphasizes intentionality and trust building.
- The **Government Alliance on Race and Equity** has resources available to local jurisdictions to help local jurisdictions communicate about issues such as race, equity, and justice
- The **Institute for Local Government** offers an Inclusive Public Engagement toolkit which provides tools for inclusive public engagement.
- The Local Government Commission's guidebook **Participation Tools for Better Community Planning** outlines key considerations when planning outreach events to engage a diverse group of participants and increase turnout. The guidebook also provides an overview of public engagement tools such as participatory budgeting, advisory committees, participatory mapping, tactile tools, walkability assessments, and virtual participation platforms.
- The **California Adaptation Clearinghouse** is an online resource that includes a database of communication and educational material.



Los Angeles River. Heavy precipitation from an atmospheric river raised water levels in the river.

Phase
1

Define, Explore, and Initiate

PHASE 1

Explore, Define, and Initiate

Establish a clear scope to inform and direct the climate adaptation planning process.

The adaptation planning process begins with a scoping phase that includes developing a community vision and supporting goals for adaptation and resilience, determining the study area, identifying the community assets to be protected, and articulating the resources needed to complete the planning process. The planning team should review existing plans and technical documents to become familiar with climate change-related analyses that may have already been completed or policy direction that may have already been adopted. As part of a visioning exercise, local agencies should establish draft adaptation goals and objectives to inform subsequent steps in the adaptation planning process.

Figure 8 adapted from the California APG, outlines the recommended steps for exploring, defining, and initiating the adaptation planning process. Each of these steps is described in more detail in the following sections. Note that Outreach and Engagement is not a step per se, but integral to the entire phase. However, developing a community engagement plan should occur prior to the implementation of outreach and engagement activities.

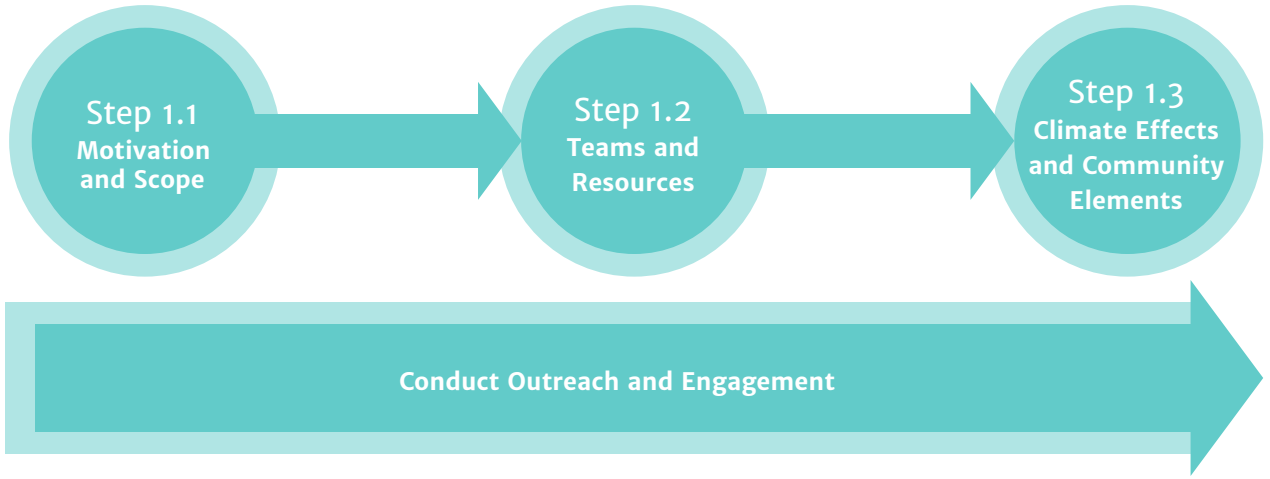


Figure 8

Steps in Phase 1

Step 1.1: Motivation and Scope

Goal: Consider the motivations and reasons behind the community's adaptation planning effort, define the desired outcomes, and outline the scope of the planning effort.

Materials to Prepare

- A brief description identifying the motivation of the climate adaptation planning process
- A preliminary vision statement with goals and objectives
- A map defining the geographic boundaries of the planning area
- Overall timeline for the climate adaptation planning process
- Identification of intended plan and associated Planning horizon

The California APG provides detailed guidance on identifying the motivation for initiating the climate adaptation planning process and defining the scope of the project. A brief summary of the guidance is provided here.

Confirm Motivations

Understanding the community's motivation behind adaptation planning is important to developing an effective planning process and determining the ultimate plan that will result from the process. As outlined in the California APG, some common motivators are:

- **Recent event or stressor.** The community has recently experienced a climate-related disaster or has concerns about a specific future disaster.
- **Community concern.** The community is aware of long-term changes in climate, such as rising sea-levels or temperatures. There is interest from residents, businesses, and other community members to address climate resiliency.
- **Regulatory requirement.** The community needs to comply with state law about adapting to a changing climate.
- **Opportunity.** Grants or other funding sources are available to support planning and implementation efforts.

Identifying the reasons and motivations behind the adaptation planning process helps to identify the interested stakeholders, clarify objectives, and determine measures of success. It will also inform the education, communications, and engagement strategies utilized to bring the community members into the planning process. A good understanding of these factors early in the planning process will help focus the effort and prevent scope creep as the community becomes more engaged and the awareness of climate vulnerabilities and risks become more widely disseminated.

DEFINING THE ADAPTATION PROCESS

The Regional Resilience Toolkit provides a helpful series of questions to help the community identify the reasons for adaptation planning, scope the effort for the project, and identify desired outcomes:

- What has triggered this process to begin? Is it an individual, or a regulation, or general pressure from the community, an agency, or neighboring jurisdictions?
- Who cares about this process and why?
- What are the motivations behind who cares and why they care?
- What is the "lens" through which the team is viewing this process? Is this rooted in climate change, sustainability, equity, etc.?
- Are there multiple lenses?
- How should the team measure a successful process?
- Is this project a stand-alone project or will there be multiple small assessments with different stakeholders as part of a larger project?
- How can this effort tie to the other planning efforts and amplify potential outcomes?

Source: Regional Resilience Toolkit page 36

Determine Community Vision, Goals and Objectives

For the planning area, it is important to develop a local adaptation vision that articulates what is important to the community and what should be prioritized. Review local plans (e.g., General Plan, local hazard mitigation plan) to determine if there are existing adopted vision statements or goals that can be used as a foundation to build from. This will help to align climate adaptation goals within the overall priorities of the community as reflected in already-adopted plans.

Engage with the community and community stakeholders to develop an understanding of local priorities to ensure that the climate change adaptation effort maintains momentum and community support. Also consider building from Integrated Climate Adaptation and Resiliency Program's vision and principles presented in Chapter 2. The community's vision and an initial set of local goals and objectives should reflect the community's unique physical, social, economic, and cultural conditions, which will in turn help inform the scope of the planning effort. Further

Note: It will be important to revisit the goals and objectives (as well as decision support criteria) following a vulnerability and/or risk analysis (see Step 3.2). This is because new information about community concerns may be revealed during the analysis and some of this new information may require urgent action or new considerations that weren't thought of previously. For example, a community may discover through a vulnerability analysis that sea-level rise will likely mobilize a subsurface toxic plume that has heretofore been immobilized and would have to prioritize protecting its water supply to reduce risk to human health and safety.

development of goals and objectives will be needed during the adaptation strategy development and prioritization process, as explained in Phase 3, Step 3.2 (Confirm or Further Develop Goals and Objectives). Sample goals and objectives are presented here for local agencies to choose from and refine as part of their local adaptation planning process. *See examples of vision, goal, and policy statements from the Cities of Laguna Woods, Los Angeles and Santa Monica at the end of this step.*

Sample Climate Adaptation Goals and Objectives for the SCAG Region

Goal 1: Resilient Communities. All people and communities respond to changing average conditions, shocks, and stresses resulting from climate change in a manner that minimizes risks to public health, safety, and economic disruption and maximizes equity and protection of the most vulnerable.

- Objective 1.1: Identify populations that will disproportionally experience the consequences of climate change.
- Objective 1.2: Deepen and focus engagement with disproportionally vulnerable communities.
- Objective 1.3: Address underlying health inequities for all residents, including those related to hazards such as localized air pollution, extreme heat, and flooding; access to basic health services; and access to affordable and nutritious foods.
- Objective 1.4: Improve emergency preparedness and planning with a particular focus on disproportionally vulnerable populations.
- Objective 1.5: Directly build and support grassroots capacity to adapt to climate impacts.
- Objective 1.6: Prioritize solutions towards reducing climate change risks for vulnerable populations and communities.
- Objective 1.7: Ensure that adaptation initiatives provide multiple co-benefits, including reduction in greenhouse gas emissions, support for the local economy, enhancements to the natural environment, or alleviating underlying health inequities.
- Objective 1.8: Incorporate inclusive decision- making in climate-adaptation planning efforts.
- Objective 1.9: Promote the integration of economic development and climate adaptation to provide sustainable benefits.
- Objective 1.10: Leverage land use planning to reduce exposure to climate hazards.

Goal 2: Resilient Natural Environment. Natural and managed systems adjust and maintain essential services for people and wildlife in the face of climate change.

- Objective 2.1: Design and implement nature-based projects and green infrastructure to protect and enhance the adaptive capacity of natural resources and urban environments.

- Objective 2.2: Develop and implement plans that allow habitat and species to move under changing climate conditions.
- Objective 2.3: Restore and enhance degraded habitats to increase capacity for species to adapt to climate change.
- Objective 2.4: Protect and maintain sensitive habitat, particularly in high- risk areas.
- Objective 2.5: Manage future flood risk by prioritizing the use of nature- based solutions.
- Objective 2.6: Protect agriculture and rangelands and other managed resources from the anticipated effects of climate change through land conservation practices and improved management practices.

Goal 3: Resilient Infrastructure and Built Environment. Infrastructure and built systems withstand changing conditions and shocks, including changes in climate, while continuing to provide essential services.

- Objective 3.1: Include short- and long-term actions in the capital improvement program which would promote resiliency of physical infrastructure to climate change impacts.
- Objective 3.2: Ensure residents have access to basic services such as electricity, gas, water, sewage treatment, public transportation, telephone lines, and wireless communication during and after climate hazard events.
- Objective 3.3: Upgrade existing buildings and design new buildings and development projects to withstand climate change impacts.
- Objective 3.4: Plan efficient and reliable transportation systems for emergencies.
- Objective 3.5: Implement successful adaptation strategies, designs, and building practices that can increase the transportation system's ability to address identified vulnerabilities

Goal 4: Resilient Processes. Each jurisdiction has the policies, institutional structures, and monitoring processes to implement adaptation strategies.

Objective 4.1: Monitor local changes in temperature, extreme heat days, heat waves, water supply, flood events, wildfire events, and sea-levels to inform policy and planning decisions. Regularly reassess climate vulnerabilities in response to changing conditions.

- Objective 4.2: On a regular basis, update and implement an action plan to address climate change-related risks consistent with changes in best available science and local monitoring reports.
- Objective 4.3: Monitor the effectiveness of adaptation strategies. Objective: Monitor the effectiveness of adaptation strategies.
- Objective 4.4: Align public infrastructure and investment decisions with the local government climate change action and/or adaptation plan.

- Objective 4.5: Promote near-term climate adaptation and mitigation strategies that do not preclude or prevent implementation of strategies that address longer-term hazards.
- Objective 4.6: Incorporate climate change considerations in existing planning documents and decision-making frameworks.
- Objective 4.7: Collaborate with local, regional, and tribal jurisdictions to maximize community resilience.
- Objective 4.8: Coordinate adaptation efforts across local, regional, and tribal jurisdictions and policy areas to maximize community resilience.
- Objective 4.9: Participate in regional planning efforts related to climate change adaptation.

Define the scope of the planning effort

Determining the scope of the planning effort means defining the geographic boundaries of the planning area, the time frame of the adaptation planning process and the planning horizon of the plan. Right-sizing the scope depends on where you are in the adaptation planning process and what you want to achieve with this particular effort.

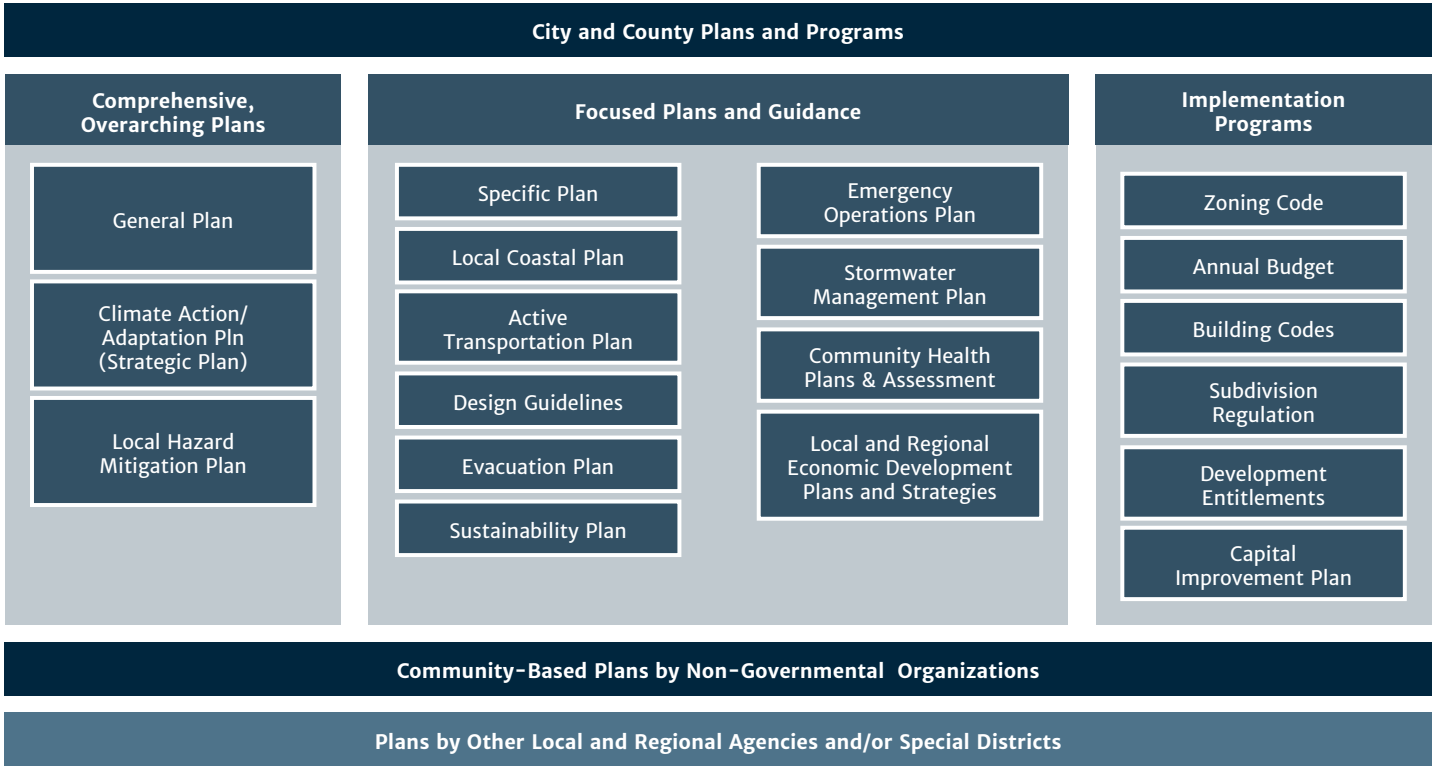
Considerations:

- **Geography and Scale:** Are you planning for a region, a city, or a neighborhood? Are you planning in coordination with neighboring cities? Do you need to work across political boundaries to effectively address certain climate risks and vulnerabilities?
- **Time Frame of the Planning Process:** Does your planning process have to comply with a grant deadline? How will community engagement impact your planning process timeline?
- **Time Frame for the Plan:** Are you planning far enough ahead to protect systems and assets over the course of their lifetimes? Are there near-term actions that can extend the long-term resilience of buildings and infrastructure systems?

Adaptation planning can take many forms, which vary in their relevance to these considerations. Typically, comprehensive local planning for climate change will manifest through one or more of the following: 1) the safety element and/or other elements of a general plan; 2) a stand-alone climate action or adaptation plan; or 3) a local hazard mitigation plan. More focused planning for climate change may also be needed. Figure 9, adapted from the California APG, provides a good summary of the types of local plans and programs that could potentially incorporate the adaptation planning process.

Figure 9

Types of Plans and Programs



CAPITAL IMPROVEMENT PLAN

Considering adaptation planning in the capital improvement plan planning process can be an effective approach to taking advantage of existing capital expenditure. Far more adaptation benefit is likely to come from smart programming of existing capital revenues than from new revenues. Combined, the cities and counties in the SCAG region spent $4.9 billion in one year alone (Fiscal Year 2017-2018) on capital expenditures.[1] Forty percent of this amount was for general government and transportation projects in the current year. An equal amount was spent on debt service (the amount of cash needed to pay interest and principal owed on a debt), highlighting the need to build climate adaptation into the capital planning process because of the extended time horizons associated with these expenditures.

Paying it Forward: The Path Toward Climate-Safe Infrastructure in California was created in response to Assembly Bill 2800 to evaluate how to integrate projected climate change impacts into engineering standards for buildings, water, transportation, and energy infrastructure projects.[2] Paying it Forward highlights the need for agencies at all levels of government to integrate climate science and adaptation into capital planning.

A key set of recommendation from Paying it Forward directly applicable to the climate adaptation planning process focus on staff development. Investing a relatively low amount in appropriate staff recruitment and training could generate substantial adaptation benefits through future climate-safe capital expenditures. Staff development efforts should focus on building capacity among engineering and planning staff to:

- Understand the impacts of climate change on the public services and infrastructure for which they are responsible.
- For the pre-development phase when capital projects are conceptualized, planned and designed, assess and account for the true benefits and costs of projects across their full life-cycle, including avoided costs that mitigate climate impacts.

Additional Tools and Resources for Scoping the Planning Effort:

- Appendix A of the **Regional Resilience Toolkit** include detailed guidance on how to incorporate hazards planning into different planning documents and how to establish resilience goals. Appendix B includes a worksheet for developing resilience goals (see Appendix A, Step 2 Assess, and Appendix B, Task 2.1 Develop Resilience Goals Exercise).
- The **Adapting to Rising Tides** Transparent Decision Making Document includes guidance on defining a project scope, establishing resilience goals, and defining an assessment approach. Additionally, the ART Functions and Values Mapping Exercise outlines how to run a workshop for the project team to create a shared understanding of which services, sectors, and assets are important within the community, and what the values and interests are important to the project team and stakeholders.

1 California State Controller's Office Local Government Financial Data. See https://bythenumbers.sco.ca.gov/.

2 Climate Safe Infrastructure Working Group, Paying It Forward: The Path Toward Climate-Safe Infrastructure in California, California State Legislature and Strategic Growth Council, September 2018.

Examples of Vision, Goal and Policy Statements

CITY OF LAGUNA WOODS

Climate Adaptation Plan (2014)

Table 6: Climate Adaptation Goals and Policy Objectives

Summary	
GOAL 1	**Increase resilience to climate change-related hazards.**
Policy Objective 1.1	Maintain low levels of heat-related illness and death.
Policy Objective 1.2	Reduce wildfire impacts.
GOAL 2	**Increase resource independence.**
Policy Objective 2.1	Maintain electricity reliability and affordability through energy conservation, efficiency, and independence.
Policy Objective 2.2	Maintain potable water reliability and affordability through water conservation, efficiency, and independence.
Policy Objective 2.3	Demonstrate sustainable resource leadership.
GOAL 3	**Sustain and advance climate adaptation efforts.**
Policy Objective 3.1	Institutionalize climate adaptation as a citywide priority.
Policy Objective 3.2	Develop regional, state, national, and private climate adaptation partnerships.
Policy Objective 3.3	Continually monitor and update this Climate Adaptation Plan.

Examples of Vision, Goal and Policy Statements

CITY OF LOS ANGELES

Resilient Los Angeles March (2018)

TURNING L.A. INTO THE STRONGEST AND SAFEST CITY IN THE WORLD

Resilient Los Angeles **focuses on the pressing challenges and opportunities that will shape our city today and for future generations. The City will address our preparedness for disasters, the economic security of all Angelenos, the threats of climate change, and our aging infrastructure. The City will advance this work through initiatives and measurable targets that include:**

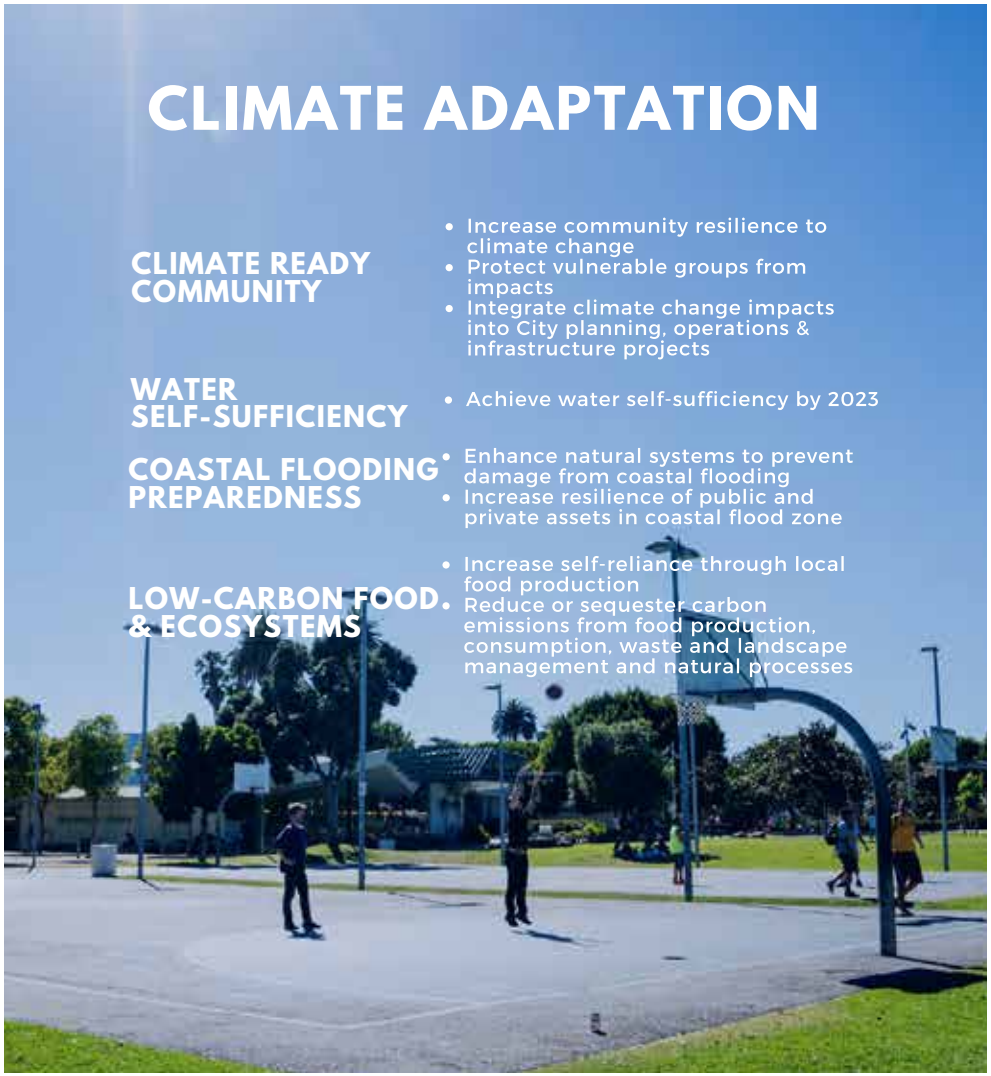
Climate Adaptation

- Prepare for the impacts of climate change by developing a comprehensive city-wide climate risk and vulnerability assessment by 2019.
- Accelerate reductions in greenhouse gas emissions and meet or exceed climate resilience outcomes consistent with the Paris Climate Agreement by 2020.
- Develop and implement urban heat island reduction plans and demonstration projects in our most vulnerable neighborhoods by 2022.
- Increase access to green space and open space through investments along the Los Angeles River system and in underserved neighborhoods by 2028.
- Increase equitable tree canopy coverage by 2028.

Examples of Vision, Goal and Policy Statements

CITY OF SANTA MONICA

Climate Action and Adaptation Plan May (2019)



Step 1.2: Assemble Project Team(s) and Resources

Goal: Set realistic expectations for the planning effort by identifying capacity for adaptation planning, estimating budget, and identifying availability of technical resources.

Materials to Prepare

- Identification of capacity for adaptation planning
- Project budget estimate
- List of core project team members, and members of advisory body
- List of technical resources

It is important to have reasonable expectations about what can be accomplished using available funding, technical and staff resources, and time. The body of data and technical resources available to adaptation planners grows bigger every day, but without the knowledge in how to effectively apply those resources, the capacity for effective adaptation planning is greatly diminished. The California APG identifies tools for evaluating the technical resources, knowledge, staffing, and financial resources necessary for the planning process. A brief summary of the guidance is provided here.

When developing a budget for the planning process, consider answering the following questions:

1) Do the existing staff have capacity to manage and complete the planning process? Would additional staff need to be hired?
2) Will technical experts, consultants, or academic partners need to be consulted?
3) How will the community engagement approach ensure an equitable and inclusive process? Do staff need training prior to engagement to understand how to effectively engage with vulnerable populations?
4) What are the costs associated with equipment, meeting supplies, design and production of meeting materials, facility rental, and other related expenses?

When assembling and organizing a project team, you should consider including a mix of people with varying responsibilities and expertise while still keeping it to a manageable size. Additionally, it is essential that the project team have a leader or primary point of contact to coordinate the process and facilitate meetings. The project team leader should have a relationship with or access to relevant decision makers.

The project team can be supported with an advisory body that includes representatives from departments that will have a key role in the planning or implementation process, local and regional agencies involved in hazard mitigation activities, agencies with regulatory authority, neighboring jurisdictions, business, academic partners, and other private and nonprofit interests. The advisory body should also include representatives from vulnerable communities as well. Depending on the key hazards and assets within a community, other community organizations and institutions such as hospitals and colleges or private entities such as utility companies may be included on the advisory board.

An advisory group can include multiple stakeholders with a variety of backgrounds, or multiple advisory boards can be set up such as a science advisory board, community advisory board, and business advisory board, allowing stakeholders to provide their specific local or sector specific input without being involved in every step of the planning process.

Consult the following to assist in identifying technical resources necessary to conduct the adaptation planning process:

1) State Adaptation Clearinghouse
2) California APG (Section 1.2 and Appendix C)
3) SCAG Adaptation Framework Tools Webpage
4) Neighboring jurisdictions vulnerability assessments and adaptation plans
5) Appendix A Helpful Tools and Resources for Adaptation Planning

Additional Tools, Data and Technical Resources for Assembling Resources

- The **Regional Resilience Toolkit Stakeholder Identification and Mapping Worksheets** in Appendix B will assist in identifying key project team members and essential advisory bodies and identifying gaps within the project team. Additionally, in Appendix B Worksheet 4.2, Local Funding Source Inventory, can assist in identifying available financial resources during the Project initiation phase.
- The **Adaptation Capability and Advancement Toolkit**, published by Alliance of Regional Collaboratives for Climate Adaptation, has a matrix approach that may be helpful for agencies to use when evaluating strengths and gaps in leadership and organizational culture, staffing and technical capability, stakeholder engagement, partnerships, and operations and institutionalized processes.

Step 1.3: Identify Community Climate Hazards and Critical Assets at Risk

Goal: Identify climate change hazards that could impact the community and populations and assets that are at-risk.

Materials to Prepare

- Identification of capacity for adaptation planning
- Project budget estimate
- List of core project team members, and members of advisory body
- List of technical resources

The California APG provides detailed guidance on identifying climate change hazards and community assets at-risk. A brief summary of the guidance is provided here.

As described in the California APG, the goal of Phase 1 is to gain a preliminary understanding of climate change effects on the community to help support project scoping. To inform the detailed vulnerability assessment in Phase 2, identify the climate-related hazards expected to impact the community, as well as the types of community assets potentially at risk from those hazards. These climate-related hazards and community assets will be refined during Phase 2 as a result of stakeholder and community outreach efforts. *See Jurupa Valley example.*

Identify Current and Future Climate-related Hazards

Climate-related hazards can be organized into the following categories, described in more detail in the Background and Setting chapter:

- Extreme Heat
- Sea-level RIse/Coastal Flooding and Erosion
- Severe Storms/Wind
- Inland Flooding
- Drought
- WIlfire
- Air Quality and Vector Borne Diseases
- Landslides
- Pest and Ecological Hazards

These climate-related hazards have profound implications for the SCAG region, representing a variety of risks to human health, built assets, natural and managed resources, and infrastructure. For your local planning area, use the tools and resources listed at the end of this section to identify the climate-related hazards that are anticipated for your community. A key resource is the regional summary reports issued as part of the most recent California Climate Change Assessment. The Los Angeles summary report covers Ventura, Los Angeles, Orange, and the western parts of Riverside and San Bernardino counties. The Inland Deserts summary report covers Imperial and the eastern parts of Riverside and San Bernardino counties. The **summary reports** describe projected climate changes and associated impacts on human, economic and natural systems across the regions.

In recent years, the six counties in the SCAG region have engaged in a range of planning activities that include assessment of vulnerability to climate change hazards. A survey of these efforts is included in **Appendix C** as the Gap Analyses of Existing Countywide Climate Change Vulnerability Assessments and Climate Adaptation Policies in the SCAG Region. These existing regional plans and studies, including local hazard mitigation plans, integrated regional water management plans, sea-level rise assessments, sustainability plans, climate action plans, and agency-specific climate vulnerability assessments, can provide a good starting point for local planning.

When identifying climate change hazards, consider those outside the planning area that may be harmful within the planning area. For examples, wildfires can impair regional air quality, impact major transportation routes, create refugees, and impact the local economy. Communities that do not have wildfire hazards in their planning area may want to consider including wildfire as a climate hazard of concern if it has the potential to occur in the region.

Additional Tools and Resources for identifying Climate-related Hazards:

- **CalAdapt** is an online resource for viewing and downloading data about projected changes in climate conditions and associated natural hazards, including extreme precipitation, extreme heat, wildfire, sea-level rise, inland flooding, and extended drought.
- The **Resilient IE** program from Western Riverside Council of Governments and San Bernardino County Transportation Authority includes regional vulnerability assessments and resilience strategies for Western Riverside County and San Bernardino County, Community Vulnerability Profiles for its member agencies, Hazard and Evacuation Maps, and other components for identifying hazards.
- **Local Hazard Mitigation Plans:** Local Hazard Mitigation Plans (LHMPs) are typically focused on natural and human caused disasters. They identify the threats posed by hazardous conditions in the local community, include strategies to mitigate hazardous events, and provide information about resources to

support hazard mitigation. Many existing LHMPs do not consider climate-related vulnerabilities, but since many of the hazards they do identify are expected to be exacerbated by climate change, they are a useful information source for vulnerability analysis.

- **General Hazards Assessment:** MyPlan is an online tool created by Cal Office of Emergency Services, the California Natural Resources Agency, and Federal Emergency Management Agency that consolidates GIS information about natural hazards in a single interface to aid planning efforts by cities, counties, tribes, and other jurisdictions in hazard mitigation planning.
- **General Hazards Assessment:** As described in Chapter 2, California's Fourth Climate Change Assessment includes reports regarding statewide and regional climate change impacts on human, economic and natural systems.
- **Sea-level Rise:** Our Coast Our Future is an interagency collaborative effort which creates user-driven modeling and mapping tools to help stakeholder and planners understand vulnerabilities to sea-level rise and storms.
- **Sea-level Rise and Other Ocean-related Hazards:** The Ocean Protection Council (OPC) has developed research regarding sea-level rise including Rising Seas in California: An Update on Sea-level Rise Science as well as policy and planning guidance document such as State of California Sea-Level Rise Guidance. Additionally, the OPC supports multiple grant funding opportunities for local coastal planning efforts. These resources are intended to provide communities with the tools they need to evaluate and adapt to the impacts of sea-level rise.
- **Public Health:** California Building Resilience Against Climate Effects (CalBRACE) is an online toolkit to assist local jurisdictions incorporate public health considerations into climate change adaptation planning. The tool includes vulnerability assessment tools, guides for how to evaluate projected climate change health impact, and, overarching climate change reports and health profiles.
- **Extreme Heat:** The California Heat Assessment Tool (CHAT) is an online tool that provides information about historical and projected heat impacts for planning areas across California. This tool is intended to help planners and members of the community plan for heat-related climate change impacts.

Identify Vulnerable Communities

There are many ways to define vulnerability of populations that are most negatively affected by climate change. In general, the most vulnerable populations in a community include:

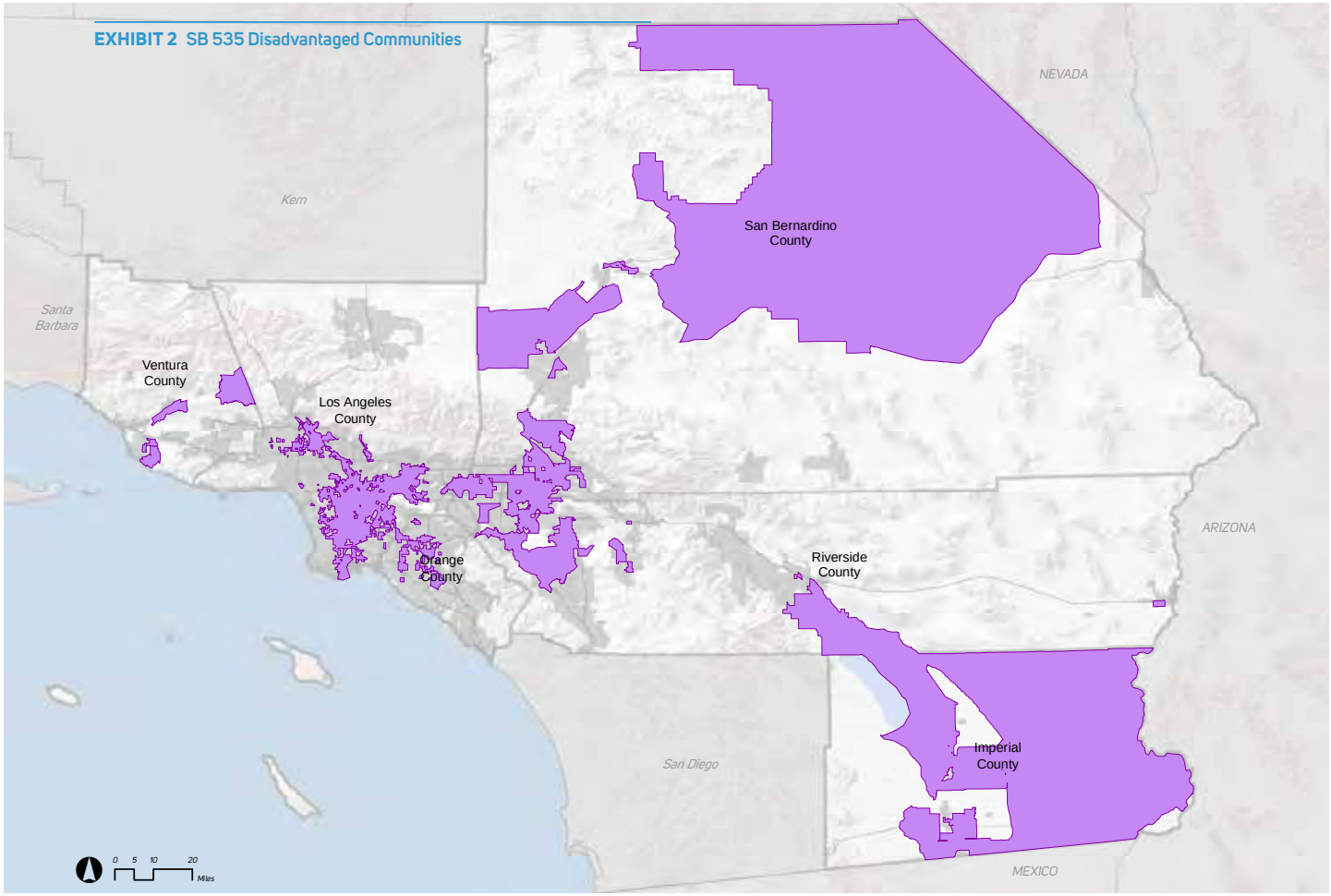
- low income,
- homeless,
- incarcerated,
- the unemployed or underemployed,
- seniors and young children,
- military veterans
- non-white communities,
- renters,
- students,
- visitors and seasonal residents,
- outdoor workers
- single female heads of households
- undocumented immigrants
- non-English speakers,
- tribal and indigenous communities,
- individuals with impaired health/disabilities,
- isolated individuals (e.g., no car or transit access)
- individuals with no health insurance
- individuals with educational attainment less than 4 years of college, and
- individuals who live in areas of high violent crime.

A majority of these population groups can be identified by relying on U.S. Census Bureau information or by accessing the California Health Places Index. Others will require outreach to community-based organizations to better understand the constituents they serve and whether they would be vulnerable to climate change hazards. There are also state resources. In an effort to equitably distribute its climate investments, the State of California uses the "disadvantaged community" criteria developed under SB 535 to ensure that at least 25 percent of funding from the state's Cap and Trade program benefits populations that are most vulnerable to climate change. Assigned the responsibility for identifying disadvantaged communities under SB 535, the California Environmental Protection Agency developed the CalEnviroScreen mapping tool for identifying areas disproportionately burdened by and vulnerable to multiple sources of pollution, based on a set of 20 indicators that includes exposure to air pollutants such as ozone, PM 2.5, and diesel particulate matter; drinking water contaminants, nearby hazardous waste generators and facilities, asthma, low birth weight infants, and poverty.

In the SCAG region, disadvantaged communities are distributed throughout the urban core of big cities like Los Angeles and Long Beach, as well as the lower-income areas of more rural counties in the eastern portion of the SCAG region. Figure 10, from SCAG's Connect SoCal, provides a regional overview of SB 535 Disadvantaged Communities. Consider including SB 535 Disadvantaged Communities as vulnerable communities susceptible to climate change hazards.

Figure 10

SB 535 Disadvantaged Communities in the SCAG Region



SB 535 Disadvantaged Communities in the SCAG Region

SB 535 Disadvantaged Areas

(Source: SCAG, 2015)

Additional Tools and Resources for identifying Vulnerable Communities:

- **Vulnerable Populations:** CalEnviroScreen 3.0 is an online screening tool that identifies communities that are disproportionately burdened by and vulnerable to various sources of pollution based on existing pollution burden and environmental effects as well as population-based disparities.
- **Disadvantaged Communities:** Locate disadvantaged communities as defined by CalEPA for the purposes of funding projects pursuant to SB 535 using the SB 535 Online Mapping Application of Disadvantaged Communities based on CalEnviroScreen criteria.
- The **SB 1000 Toolkit** includes guidance and resources for identifying disadvantaged communities.
- **Planning and Investing for a Resilient California:** The Vulnerable Populations Appendix identifies vulnerable populations and explains why these populations may be disproportionately impacted by climate change. The Equity Checklist includes a list of questions that can be used to guide a planning phase or decision-making process with the intent of ensuring equitable community engagement and more equitable outcomes for vulnerable populations.
- The **Regional Resilience Toolkit** offers guidance regarding identifying disadvantaged communities. Additionally, the Stakeholder Identification and Stakeholder Mapping Worksheets in Appendix B are intended to facilitate the identification of vulnerable communities and key stakeholders within the communities that should be included in the planning process.
- **California Heat Assessment Tool** is an online mapping tool that identifies population groups by census tracts that are particularly vulnerable to heat events.
- The **California Healthy Places Index** (HPI) is an online mapping tool that reports on community conditions related to health outcomes. Data can be displayed at the census tract level, city, county and other boundaries. The Healthy Places Index allows users to see how existing conditions for health intersect with areas of climate hazards. The HPI Policy Guide includes strategies designed to improve health while also building climate resilience.

Identify the Community's Vulnerable Assets

Across the vast SCAG region there are thousands of individual assets that are vulnerable to the effects of climate change. For adaptation planning it is useful to organize community assets under sectors, or groupings that represent existing management and governance structures. Consistent with Safeguarding California and the California Adaptation Clearinghouse, the California APG organizes community assets under the following 11 sectors:

1. Agriculture
2. Biodiversity and Habitat
3. Emergency services
4. Energy
5. Forestry
6. Land Use and Community Development
7. Ocean and Coast Resources
8. Parks and Recreation
9. Public Health
10. Transportation
11. Water

Adaptation planning tools developed by SCAG maintain consistency with these 11 sectors, but with a more detailed breakdown of sectors organized under the following four main categories (see Figure 11):

1. Natural and Managed Resources;
2. Buildings and Facilities;
3. Infrastructure Assets; and
4. People Assets.

For many resources, planning information and data is available for the SCAG region at a more refined level than is represented by the 11 sectors above, and is more closely aligned with the funding and decision-making authority of agencies and/or private sector interests that manage that resource. For example, the Land Use and Community Development sector includes both buildings and infrastructure, and includes assets that range from single family homes to large military installations. Similarly, under the Water sector there are different agencies managing drinking water supply, stormwater, and wastewater, and natural water bodies. Figure 11 provides a breakdown of important community assets under each main category, designed to represent sub-sectors that fall under the authority of local, regional, and state agencies dedicated to the management of that resource. Climate change is also anticipated to have impacts to more than just these industries and sectors through indirect effects that may be just as economically disadvantageous to a community (e.g., increasing costs of doing business). Community assets at risk from economic disruption associated with climate change should also be identified (e.g., small family-owned businesses, major employer).

TYPES OF ASSETS

The type of assets to be included in an assessment should be broad enough to ensure that the consequences of hazards on people where they live, work, access key services, and conduct other day-to-day activities will be fully considered. Assets can be grouped and assessed in three ways, which will influence the level of detail and effort required for the assessment:

Individual asset: A unique or critically important asset for which assessment findings would differ from other assets. For example, a power plant or major thoroughfare may be individual assets.

Representative asset: Assessment findings would be similar across a group of similar assets and would streamline the assessment process. For example, elementary schools may have very similar vulnerabilities across a jurisdiction. So instead of assessing each site, the assessment can be for the cross-section to reveal potential vulnerabilities inherent in all schools. Individual assets might have issues specific to their location, for example one elementary school might be near a flood plain while another might have only one road leading to it. Those issues should be considered when necessary.

Asset class: An asset class is a categorization of similar assets in one group. Figure 31 shows five classes: community and people; critical services; built environment; economy; and natural environment. Categorizing a class of assets allows jurisdictions to develop goals and strategies that may address the broad grouping. For instance, for community and people, a goal could be zero loss of life in disaster.

Source: Regional Resilience Toolkit pages 46-47

Figure 11

Community Asset Categories

NATURAL AND MANAGED RESOURCES

- Agriculture (crop, livestock, nurseries, aquaculture, grazing)
- Biodiversity and Habitat (preserves, critical species habitats, beaches, wetlands, deserts)
- Forests and Rangeland
- Ocean and Coastal Resources
- Parks and Recreation; Urban Forests
- Surface water (lakes, streams)

BUILDINGS AND FACILITIES

- Commercial buildings (includes retail, office, mixed use, overnight lodging)
- Industrial facilities
- Residential buildings (single-family, multi-family, mobile homes)
- Hospitals and healthcare facilities
- Public housing
- Public buildings and institutions (public schools, government offices, prisons, child care facilities, libraries, etc.)
- Private institutions (private schools, religious facilities, child care facilities, etc.)
- Military facilities
- Historic and cultural assets (historic-period built resources, native American cultural resources, paleontological resources, archaeological resources)

INFRASTRUCTURE ASSETS

- Airports
- Communication (communication towers, communication lines)
- Energy infrastructure (power generation and distribution facilities, natural gas pipelines and storage facilities, and oil and gas wells, pipelines, and refineries)
- Flood and erosion management (dikes, levees, floodwalls, dams, tide gates, shoreline protective devices, groins, jetties, breakwaters)
- Ports and marinas
- Public transit (transit stations, bus stops, bus routes, light rail)
- Railroads (heavy rail, yards)
- Roads and highways (includes public parking lots and other supporting car infrastructure)
- Solid and hazardous waste management (includes hazardous material storage sites and contaminated lands)
- Stormwater (pipes, detention basins, pumps, inlets, culverts)
- Wastewater treatment (sanitary sewer pipes, pump stations, treatment plants, outfalls, manholes)
- Water supply infrastructure (reservoirs, water towers, potable groundwater, snow pack, lift stations, treatment plants, wells, pipes)

PEOPLE ASSETS

- Public health
- Vulnerable populations
- Emergency services (police stations, fire stations and emergency water, emergency shelter sites)
- Food systems

Additional Tools and Resources for Identifying Critical Assets:

- Review the existing **Local Hazard Mitigation Plan** (LHMP) for a list of community assets identified by the local jurisdiction as vulnerable to seismic and flood hazards, which may include important community facilities as well as critical infrastructure for energy, transportation, water supply, stormwater management, wastewater treatment, and communications.
- The **Resilient IE** program from Western Riverside Council Of Governments and San Bernardino County Transportation Authority includes regional vulnerability assessments and resilience strategies for Western Riverside County and San Bernardino County, Community Vulnerability Profiles for its member agencies, Hazard and Evacuation Maps, and other components for identifying critical assets at risk.
- Appendix A of the **Regional Resilience Toolkit** offers guidance for considering scope and scale when selecting assets to include in the vulnerability assessment. Worksheet 2.3, Identify Important Community Assets, facilitates the identification and organization of community assets and their vulnerability. Worksheet 2.4, Community Asset Data Identification identifies potential data sources for assets in order to identify potential data sources and gaps.
- **Urban Footprint** is a web-based mapping software with a multitude of land use, environmental, hazard and resilience, demographic, and environmental justice data sets. The software can be used to identify vulnerable populations and assets and explore future climate risk scenarios. The Urban Footprint software does not require experience using GIS.

Example of Preliminary List of Climate Change Hazards and Community Assets

WESTERN RIVERSIDE COUNCIL OF GOVERNMENTS, JURUPA VALLEY

Community Vulnerability Profiles (2020)

Key Vulnerabilities

Table 2 shows which hazards in Jurupa Valley's may pose the greatest harm to vulnerable groups or assets in the City. A full list of potential vulnerabilities is included in the Western Riverside County Vulnerability Assessment.

Table 2: Key Vulnerabilities in Jurupa Valley's by Applicable Hazard

Vulnerability	Hazards							
	Air Quality	Drought	Extreme Heat	Flooding	Human Health Hazards	Landslides and Mudslides	Severe Weather	Wildfire
Households in poverty	✓	✓	✓	✓	✓		✓	✓
Persons experiencing homelessness	✓		✓	✓	✓		✓	✓
Seniors	✓		✓	✓	✓		✓	✓
Chronically ill individuals	✓		✓		✓		✓	✓
Residential structures				✓		✓		
Airports				✓				
Dams						✓		
Energy delivery systems			✓				✓	✓
Railways			✓			✓		✓
Water delivery systems		✓						✓

Phase 1 Outreach and Engagement Considerations

The scoping phase is critical to the planning process. It presents an opportunity to shape and define how public engagement will be implemented for the remainder of the process. The following tools and resources can assist in creating an equitable engagement strategy that is inclusive, effective, and enduring. As discussed in the Asian Pacific Environmental Network Mapping Resilience document, there are limits to the capabilities of mapping, modeling, and planning tools especially when they are not vetted by local communities. Mapping Resilience emphasizes the importance of citizen and community engagement throughout the process to confirm findings and add a qualitative component and narrative to the climate science. Incorporating community knowledge throughout the planning process builds trust within the community and creates an opportunity to confirm findings.

Meaningful engagement with members from the most impacted communities early on in the planning process is essential to building a coalition of stakeholders who can be consulted throughout the planning process. Consider the additional time and resources that will likely be required to engage hard-to-reach populations, who may need focused outreach activities or interpretation services in order to participate.

The California APG provides the following tips for public outreach and outlines strategies for reaching all populations during public outreach efforts.

- Develop a community engagement plan that includes the following content: list of stakeholders, culturally-specific outreach needs and strategies, outreach messages, outreach goals for each stakeholder group, engagement objectives, engagement methods, integration with other planning activities, advisory group objectives and composition (if applicable), focus and purpose of each outreach activity, schedule of activities, and notification methods.
- Identify stakeholders that should be involved in the climate adaptation process, determine their role in the process, and how, when and how often they should be engaged (see Approach to Equitable Public Engagement at the beginning of Chapter 3 for more information on stakeholder mapping).
- Create a menu of outreach activities and strategies that provide opportunities for community education, input, and direct communication with the community throughout the climate adaptation planning process.
- Host a visioning activity that informs the development of goals and objectives for climate adaptation. See City of Long Beach example.

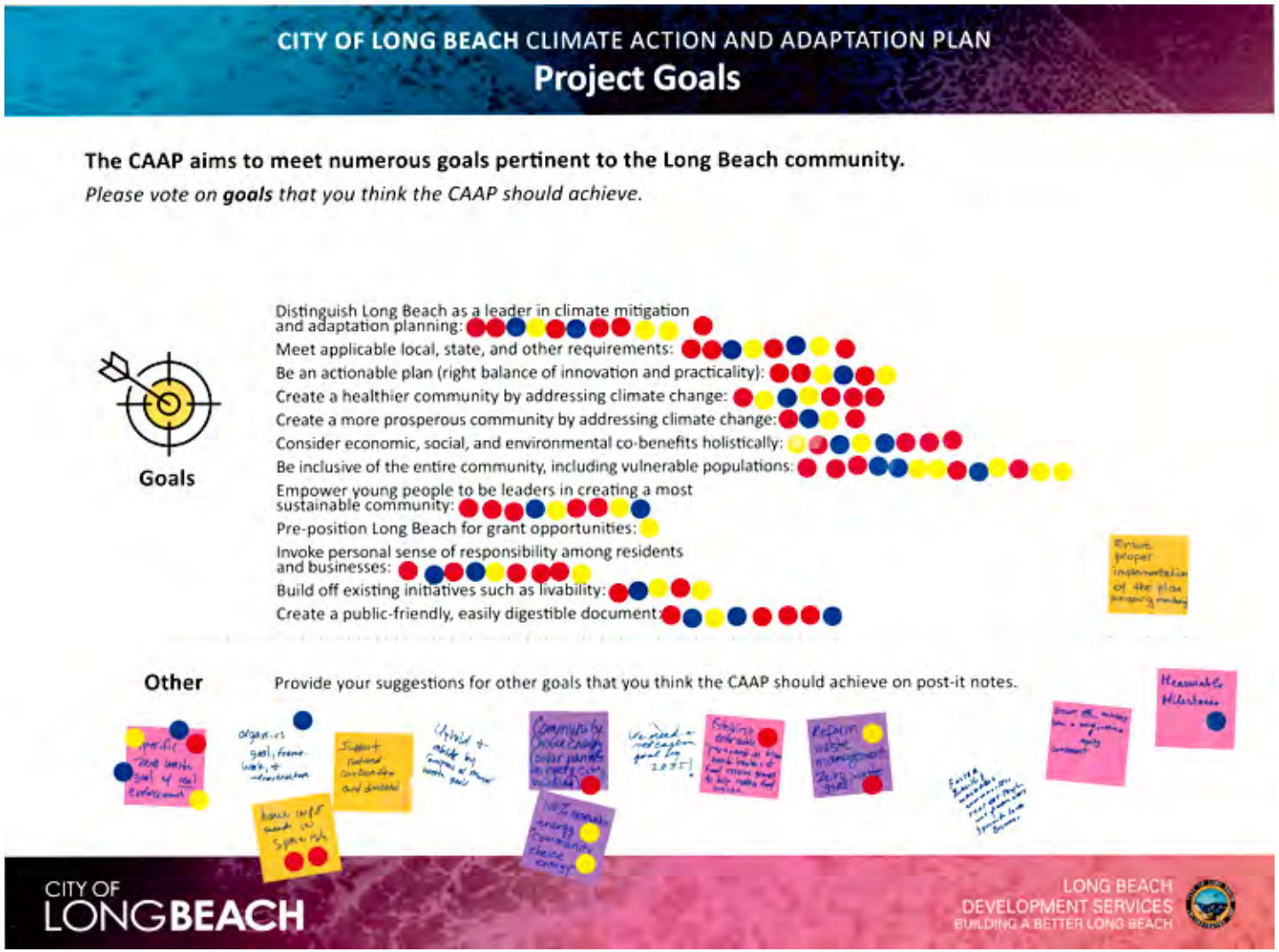
Tools and Resources for Phase 1 Public Engagement

- The **Regional Resilience Toolkit** includes a number of "Tactical Tools" for public engagement including Stakeholder Mapping worksheets, sample Outreach and Engagement Plans, and Sample Outreach tools and Materials, how-to guides for running meetings and workshops, and sample meeting agendas.
- The Gateway Cities COG includes a **Public Engagement Toolkit** focused on climate change that includes tip sheets and resources to effectively plan and implement inclusive engagement strategies. Based in the TIERS framework (Think, Initiate, Engage, Review and Shift) developed by the Institute for Local Government, the toolkit includes a list of questions to assist in defining the scope of the engagement plan and identifying resources to support the public engagement process. The toolkit also includes types of media and engagement activities to consider when building an engagement plan, as well as worksheets and questions to assist with brainstorming and drafting a public engagement plan.
- The **SB 1000 Toolkit** includes guidance and resources to incorporate equity and environmental justice considerations throughout the planning process. The toolkit emphasizes the importance of engaging disadvantaged communities and identifying equity concerns in the initial stages of the planning process. It provides guidance for identifying disadvantaged communities, explains community engagement techniques, and outlines principles for engaging environmental justice communities such as honoring local community knowledge.

Example of Visioning Exercise

CITY OF LONG BEACH

Climate Action and Adaptation Plan (2020)



Riverside County. The Apple Fire burned through the foothills in Riverside and San Bernardino counties, forcing thousands to evacuate.

Phase 2

Assess Vulnerability

PHASE 2

Assess Vulnerability

Evaluate the degree to which community assets are susceptible to the adverse effects of climate change.

While Phase I includes a step to develop a preliminary understanding of a community's vulnerability to climate change, Phase 2 is intended to better understand a community's major climate vulnerabilities, including critical assets at risk, and which vulnerabilities to identify adaptation strategies for in Phase 3. Phase 2 involves preparation of a vulnerability assessment that identifies the community assets that could be impacted by climate change, the severity of the impacts, and the ability of the community to prepare for and reduce the potential adverse impacts. Findings from the vulnerability assessment will help to identify and prioritize urgent matters and risks that require near-term action, as well as identify those that are longer term issues.

The detailed vulnerably assessment will be informed by the climate hazards and community assets identified in Phase 1, along with the community's vision, goals and objectives that have been articulated during that phase. **Figure 12** outlines the California APG's recommended steps for conducting a vulnerability assessment. In general, the vulnerability assessment should characterize the exposure, sensitivity and adaptive capacity of a community's assets as well as the consequences of assets being impacted. Each of these steps is described in more detail in the following sections. Note that Outreach and Engagement is not a step per se, but integral to the entire phase.

The approach recommended by the California APG is designed to ensure that the resulting vulnerability assessment meets Safety Element requirements in California Government Code § 65302(g)(4), as updated by SB 379 and SB 1035. It is also designed so that users can easily integrate the vulnerability assessment into a local hazard mitigation plan.

WHAT IS A VULNERABILITY ASSESSMENT?

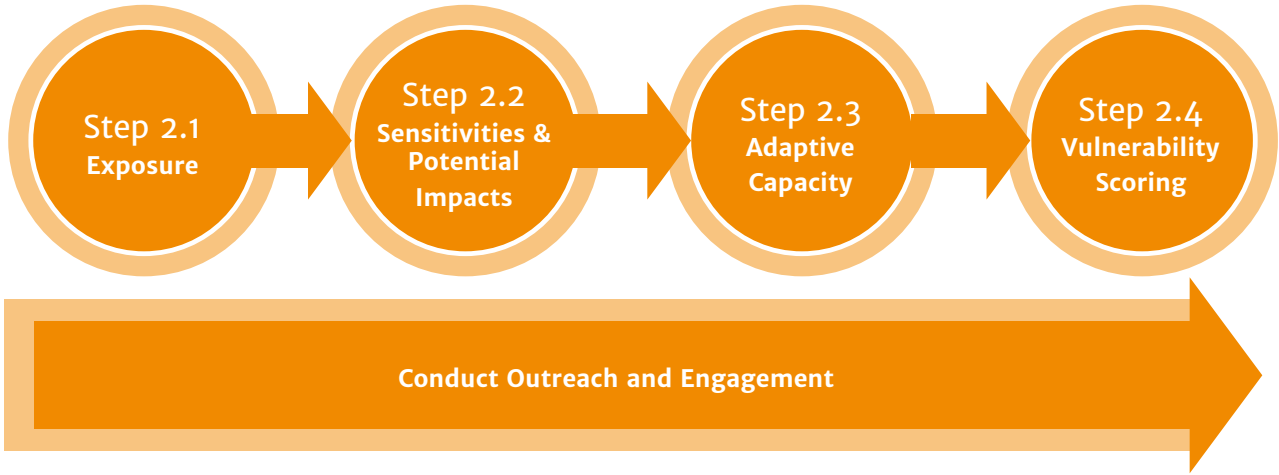
Vulnerability is the degree to which an asset or population group is susceptible to climate hazards. It is a function of an asset's exposure, sensitivity and capacity to adapt to climate change stressors. A vulnerability assessment is typically a screening level analysis to better understand the potential impacts and vulnerabilities to climate change hazards and to begin defining future adaptation responses. The vulnerability assessment incorporates the quantitative results regarding exposure of assets and facilities and utilizes qualitative data concerning sector or assets' sensitivity and adaptive capacity in order to understand their vulnerability to climate change. The assessment yields a relative ranking of vulnerability, within and across asset categories. Assets found to be vulnerable are candidates for inclusion in the risk assessment and adaptation planning phases, based on their criticality.

General Resources for Developing Vulnerability Assessments:

- **Regional Resilience Toolkit** – Appendix A and B include sample agendas, tips for arranging meetings and workshops, and worksheets that can support various steps involved in assessing vulnerabilities.
- **U.S. Climate Resilience Toolkit** – Worksheets, case studies, and tools are available online to help with assessing vulnerability.

Figure 12

Steps in Phase 2



Step 2.1: Exposure

Goal: Characterize the community's exposure to current and projected climate hazards.

Materials to Prepare (as suggested by the California APG)

- A final list of climate change hazards of concern.
- An overview of major historical hazard events and the consequences to the community.
- A description of how each identified climate change hazard is projected to change over the analysis period.
- Map of projected change in each identified climate change hazard.

The California APG provides detailed guidance on assessing how, where and when community assets will be exposed to climate hazards. A brief summary of the guidance is provided here.

For this step, use the same tools and resources identified in Phase 1 for identifying climate hazards to develop a more detailed understanding of climate change effects on the community, including a close look at critical assets and the most vulnerable populations.

Confirm the list of climate change hazards and their effects identified under Step 1.3 by engaging with community asset managers and key stakeholders, including emergency managers and municipal operations and maintenance staff who have knowledge of areas most frequently affected. See Phase 2 Outreach Considerations for different approaches to soliciting input.

Document major climate-related historical events, including when they occurred, where they occurred, and their magnitude. Understanding the historical record of hazards in the community provides context for public engagement concerning the impacts of climate change, and provides insights on how climate change might exacerbate existing hazards in the future. This step may also reveal important trends that can inform interpretation of current conditions and future projections. *See Barstow example.*

DIFFERENT LEVELS OF DETAIL FOR DIFFERENT PLANS

Exposure assessments have varying levels of detail. An Local Hazard Mitigation Plan effort should collect data for location, extent, and previous occurrences for each hazard. For other reporting efforts, such as a safety element, a qualitative description of the community's hazard history may be more appropriate.

Evaluate and describe how each climate hazard is projected to change over the time horizon identified under Step 1.1. The tools available for this task provide future projections of climate hazards at various scales. Some present a range of projection scenarios based on results of various climate models and global emissions scenarios.[1] Often, it is useful to look at a range of projections or multiple scenarios in order to get a full understanding of future climate effects on the community. *See South Bay COG example.*

For many climate change hazards, particularly wildfire, coastal flooding and erosion, and inland flooding, mapping is an important technique for visualizing the exposure of community assets to climate hazards. For large areas over which the effects of climate can vary substantially, mapping helps identify populations and areas of concern, and can help identify where vulnerabilities exist because of asset interdependencies. At a more localized scale,

1 For a discussion of different emissions scenarios and how they affect adaptation planning, see Climate Change Projections in Chapter 2: Southern California Today. Additional information can be found in the California APG and CalAdapt.

mapping can reveal overlapping hazards that could result in interconnected or cascading impacts, such as coastal flooding events making emergency access roads impassable in the event of an unrelated disaster such as a wildfire. *See Ventura County and Long Beach examples.*

Mapping may not be necessary if there is minimal variation in exposure of hazards across a community (e.g., extreme heat, drought). Other visualization tools can be used to characterize a climate change hazard, such as projecting the frequency of heat waves over the specified time horizon with the use of charts or line graphs. Regardless of whether a visualization tool is used, each climate hazard should be described in terms of how exposure varies across the community, and to what degree key community assets may be exposed.

As an example, a climate hazard impact statement from the San Bernardino County Vulnerability Assessment reads: "San Bernardino County is projected to experience major increases in extreme heat days, particularly in the southeastern and central portions of the County. The parts of the county near the Colorado River and sections of the Mountain region – including the area near Big Bear Lake – could experience as many as 50 additional extreme heat days per year by mid-century. Furthermore, all areas of the county are projected to experience at least 27 additional extreme heat days."[2]

EXPOSURE ANALYSIS USING GIS

The Regional Resilience Toolkit provides detailed steps on conducting an exposure analysis using Geographic Information System (GIS).

An exposure analysis involves combining the location and extent of the hazards with the location of assets. This is generally done through GIS mapping using pre-identified hazard scenario map layers and mapped community asset locations. There are five key steps to the exposure analysis:

1. Add relevant hazard layers into a new or existing map in ArcGIS (or similar tool).
2. Gather data and map the locations of key community assets.
3. Compare assets to the hazard layers.
4. Create maps showing the extent of hazards and the location of assets that intersect with those hazards.
5. Ask those with local knowledge and experience to help pinpoint locations that are not accurate and need further analysis.

2 San Bernardino County Transportation Authority and Western Riverside Council of Governments, 2019. San Bernardino County Vulnerability Assessment, at page 2.

Additional Tools and Resources for Determining Climate Change Exposure:

CLIMATE-RELATED HISTORICAL EVENTS

- Review your local hazard mitigation plan for a description of historical events.
- Step 2.1B in the California APG lists state and federal resources that provide information about historical trends and events related to coastal and storm hazards, temperature, precipitation and snowpack, drought, and wildfires.

CLIMATE HAZARD PROJECTIONS

- **CalAdapt** is an online resource for viewing and downloading data at the census tract scale about projected changes in climate conditions and associated natural hazards, including extreme precipitation, extreme heat, wildfire, sea-level rise, inland flooding, and extended drought. In addition to maps, Cal-Adapt includes a variety of visualizations to inform an exposure analysis and provides downloadable data to allow visualizations in other software (e.g., Excel charts).
- **California Heat Assessment Tool (CHAT)** is an online tool that provides detailed information about future extreme heat conditions across California.
- **Coastal hazards.** The U.S. Geological Survey's Coastal Storm Modeling System (CoSMoS) has detailed maps of coastal flooding under various sea-level rise scenarios, storm conditions, and erosion conditions. Use this resource to understand projected changes associated with sea-level rise.

EXPOSURE WORKSHEETS

- **Regional Resilience Toolkit Framework.** The framework has a worksheet to assist in crafting narrative descriptions of climate hazards. See Appendix B, Worksheet 2.2 Develop Hazard Impact Statements.

Example of Historical Hazard Events

CITY OF BARSTOW

Local Hazard Mitigation Plan (2018)

Table 4-5: Wildfire Occurrences 2011-2016

Year	Fire Name	Acres
6/1/2011	Roundup	144
6/9/2011	Bowen	295
7/3/2011	Deep	119
3/31/2015	River Bottom	185
8/7/2016	Pilot	8,110
8/16/2016	Blue Cut	36,274
Total		**45,127**

Source: Cal Fire

River Bottom Fire: On March 31, 2015 a fire erupted within Mojave Narrows Regional Park and quickly spread towards homes in Apple Valley, North of the Town of Apple Valley . A few outbuildings and vehicles were lost but no homes. The fire was contained by the next day. American Red Cross opened a shelter for those evacuated at Sitting Bull Academy.

Pilot Fire: The Pilot Fire started at about 12:10 pm on Sunday August 7, 2016 near the Miller Canyon OHV area off of Highway 138. The Pilot Fire burned 8110 acres and was declared controlled on August 16, 2016 as a result of significant rainfall. School Districts in the area were closed for a few days due to air quality.

Blue Cut: The Blue Cut Fire started on August 16, 2016 at 10:36 AM in the Cajon Pass along Old Cajon Blvd. north of Kenwood Avenue west of Interstate 15. The fire quickly spotted across Cajon Creek and grew into a large wildland fire. During the course of the fire fight, railroad lines, local roads, highway 138 and Interstate 15 were closed along with a large evacuation area that included Lytle Creek, Wrightwood, Summit Valley, Baldy Mesa, Phelan and Oak Hills.

At the peak of the battle to control this blaze there were 2,684 personnel actively involved in the fight to contain the Blue Cut Fire. These personnel have come from all over the nation to help with this firefight. The Blue Cut Fire burned 36,274 acres, destroying an estimated 105 single family residences and 216 outbuildings. In addition, 3 single family residences and 5 other structures were damaged.

Example of Future Projections of Climate Hazards

SOUTH BAY CITIES COUNCIL OF GOVERNMENTS

Sub-regional Climate Adaptation Plan (2019)

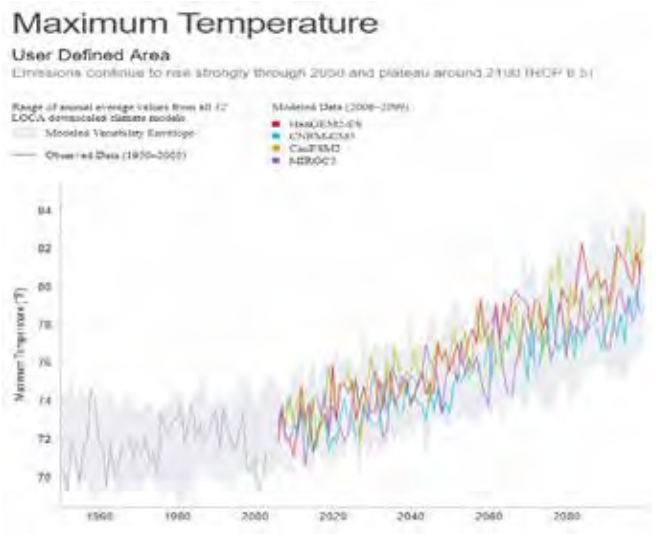
Figure 2.1 provides annual averages of observed and projected maximum temparature values for the South Bay under the business as usual (RCP 8.5) scenario. The gray line (1950-2005) is observed data. The colored lines (2006-2010) are projections from four downscaled climate model - called LOCA models. These models were selected by California's Climate Action

Team Research Working Group as the most relevant for the State of California and used in the California's Fourth Climate Change Assessment. Projected future climate from these four models can be described as producing:

- A *warm/dry* simulation (HadGEM2-ES)
- A *cooler/wetter* simulation (CNRM-CM5)
- An *average* simulation (CanESM2)
- A model simulation that couples the atmosphere and ocean general circulation models together with the land and sea ice modules (MIROC5)

While there is some variation, **Figure 2.1** depicts an upward trend that is consistent for all four LOCA models.

Figure 2.1: Annual Average of Observed and Projected Maximum Temperature in the South Bay



Source: cal-adapt.org

Example of Exposure Map of Multiple Climate Change Hazards

VENTURA COUNTY

Sea-level Rise Vulnerability Assessment (2018)

Figure 4-4 - Coastal Confluence Hazards Map

County of Ventura
VC Resilient Coastal Adaptation Project

4-10

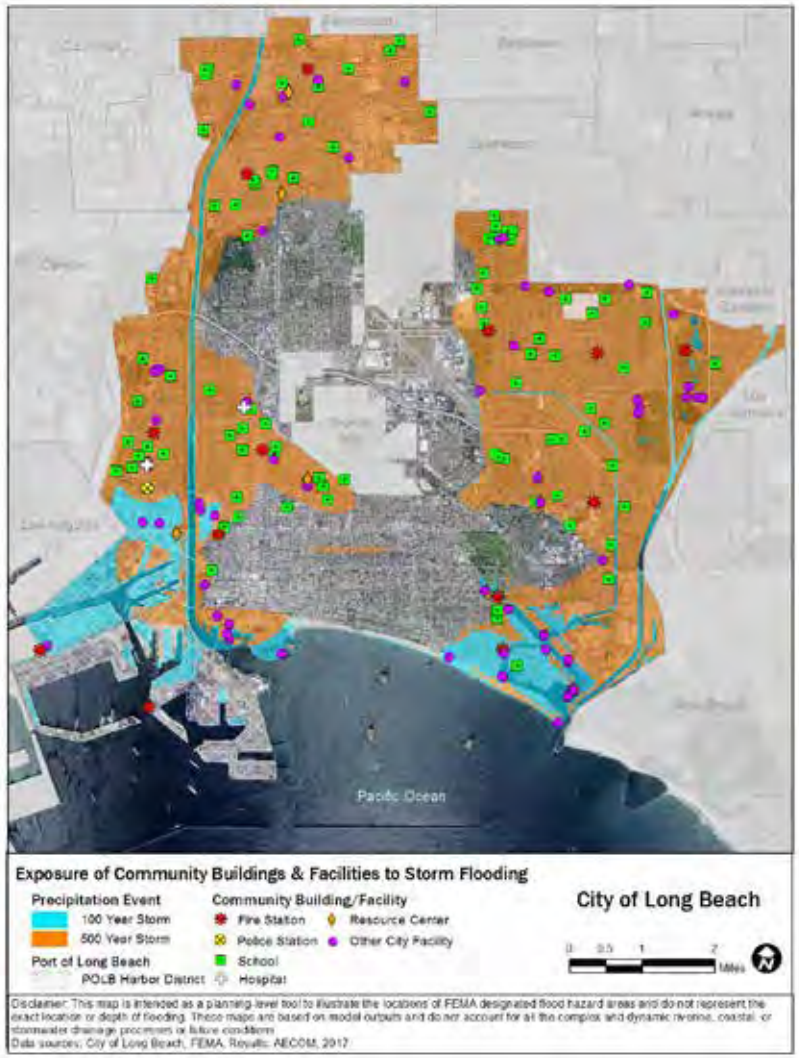
December 14, 2018

Example of Exposure Map overlain with Community Assets

CITY OF LONG BEACH

Climate Change Vulnerablity Assessment Results (2018)

Figure 10: Exposure of Buildings and Facilities to Riverine Flooding



Step 2.2: Sensitivities and Potential Impacts

Goal: Characterize the past and potential future climate impacts to community populations and assets.

Materials To Prepare (as suggested by California APG):

- A final list of community populations and assets that are sensitive to the community's climate change hazards.
- A list of historical and potential future climate impacts to community elements.
- A list of potential climate impacts of greatest concern.

This step examines how climate change exposures are expected to affect community populations and assets, and assesses the sensitivity of individual assets to particular hazards, based on various criteria such as age and condition, existing protections, and the importance or critical nature of the asset.

The California APG provides useful guidance on identifying critical assets, determining asset sensitivity, and identifying potential future climate impacts to the community. A brief summary of the guidance is provided here.

Review the community assets identified under Step 1.3 and create a final list of just the assets that would be exposed to the relevant climate hazards. Consider limiting the list of community assets to the most critical. Preparing a vulnerability assessment with an exhaustive list of assets has the potential to dilute the focus and lead to less actionable outcomes. Reviewing the vision, goals and objectives developed under Step 1.1 can help with identifying the most important community assets. *See San Bernardino County example.*

SENSITIVITY ANALYSIS

Sensitivity analysis examines how the performance of an asset may be affected by existing and future climate hazards.

How sensitive is the asset to hazard exposure? For example, is a particular facility affected by flooding? Extreme heat? Fire? If yes, by how much? Does it lose function completely? Is it water or wind proof? Can it maintain operations while exposed to the hazard?

Describe potential climate impacts based on examination of related historical impacts and reports discussing potential future climate impacts. The California APG identifies the following relevant reports to help inform the development of climate impact descriptions:

- Climate vulnerability assessments that the community has prepared in the past.
- Climate vulnerability assessments produced by local colleges or universities, the Alliance of Regional Collaboratives for Climate Adaptation (ARCCA), nonprofits, or other reputable organizations.
- The most recent California Climate Change Assessment reports, including the regional report (see Step 1.3).

Conduct interviews with asset and service managers and other stakeholders to increase understanding of past climate impacts. These interviews can also be useful in identifying the sensitivity of various assets at risk to future

climate impacts (consider also addressing adaptive capacity at these interviews per Step 2.3). The California APG identifies the following questions for use in the stakeholder interviews:

1. What services have been impacted by the climate hazard? Are these services disrupted? How might impacts to services change given projected changes in climate?
2. What facilities have been damaged, destroyed, or otherwise impacted by the climate hazard? How might impacts to facilities change given projected changes in climate?
3. Have populations been impacted physically or mentally by the climate hazards? How might impacts to populations change given projected changes in climate?
4. Have there been additional downstream disruptions that result from the loss of critical services (e.g., electrical disruptions impacting hospital service)? How might impacts arising from interdependencies change given projected changes in climate?
5. How have impacts varied across your community? Which populations have been most affected? Which populations might be most impacted in the future?
6. Did the climate hazard create economic losses? How might economic losses change given projected changes in climate?
7. Have community ecological or cultural resources been impacted? How might impacts to these resources change given projected changes in climate?

Prepare a summary of the potential future climate impacts. The summary could be a bulleted list of potential impacts and consequences to community assets or a more detailed report. The summary should acknowledge whether community assets have already been exposed to climate-related hazards. For some communities, a climate change hazards could impact them in the future that has not impacted them in the past. In this case, communities can look to others that have already experienced the climate hazard to better understand the types of impacts they could expect. *See Imperial County and Inglewood Examples.*

WHAT IS CLIMATE RISK?

Risk is quantified as the product of the probability of a hazard occurring multiplied by the consequences of that event. With respect to climate change, a risk assessment examines the consequences, likelihoods and responses to the impacts of climate change and how societal constraints shape adaptation options. A risk management planning framework is a decision-making framework based on evaluation and assessment of risk that allows communities to identify strategies to reduce those climate risks in an efficient and effective manner.

RISK = PROBABILITY X CONSEQUENCE

As a final step, identify potential climate hazards of greatest concern by determining which impacts pose the greatest risk. Feedback provided during engagement with community stakeholders and the goals and objectives developed under Step 1.1 can inform this step. The California APG suggests considering the following questions to help in identifying the priority climate impacts:

1. Which climate hazards might result in loss of life or significant human health impacts?
2. Which hazards might create disruptions or damages to essential facilities (see Phase 1, Step 1.3)?
3. Which hazards might generate significant losses for the local economy?
4. Which impacts may create significant environmental impacts, such as release of hazardous materials?
5. Are impacts of climate change effect short but acute, long term, or both?
6. Could two or more impacts interact to result in a more severe impact (e.g., wildfires followed by extreme precipitation creating landslides)?

Continued public engagement will be useful in identifying the impacts of greatest concern to the community and in prioritizing those concerns in the planning process. Gathering broad public input on the potential consequences of damaged assets through workshops, polls, or other means can often reveal previously unacknowledged vulnerabilities and help identify the greatest risks to the community or to specific populations.

CONSEQUENCES AND CASCADING IMPACTS

When considering the vulnerability of physical assets, it is usually the consequences of asset damage that are of primary concern, rather than the physical damage itself. Consider the type of harm or disruption that may result when an asset is exposed to a hazard. Would there be minimal damage, or complete destruction? Would damage cause delays or temporary disruption of service, or would there be longer term consequences? Would it cause injury or loss of life? At what scale would the consequences be felt? Would the loss of the asset affect the performance of other assets?

It is essential that planners consider interconnected and interdependent systems in assessing community vulnerability. In addition to the direct impact to a physical asset, such as inundation by flooding, there are compound or secondary impacts to consider that may represent an elevated risk to safety or human life. For example, California's latest extended drought, occurring from roughly 2012 to 2017, resulted in extremely dry conditions and fuel build up, which in turn increased the risk and incidence of wildfires. The resulting wildfires in steep-sloped areas subsequently resulted in high-risk areas for mudslides due to the loss of vegetation that normally stabilizes soils and soaks up precipitation during intense rainfall events.

Consideration should also be given to the cascading impacts that could occur when a climate-driven event results in the loss of service from critical facilities and infrastructure, such as water and wastewater systems, energy systems, essential facilities (e.g., hospitals), emergency response facilities, and local ecosystems. *See Manhattan Beach Example.*

Additional Tools and Resources for Assessing Sensitivity of Critical Assets:

Regional Resilience Toolkit Framework.

The framework has worksheets to assist in evaluating asset sensitivity. See Appendix B, Worksheet 2.7 Vulnerability Assessment Questions: Individual or Representative Assets and Appendix B, Worksheet 2.8 Vulnerability Assessment Questions: Asset Class.

Examples of Critical Community Assets

SAN BERNARDINO COUNTY
Vulnerability Assessment (2019)

PRIORITY VULNERABILITY SECTORS

San Bernardino County selected seven priority sectors based on their importance to the growth and success of the County and their potential vulnerability to climate change and the hazards discussed above. The County selected these sectors based on A) the precedent set by the 2014 West Riverside Council of Governments Adaptation Strategy, which is being used as a model for San Bernardino's vulnerability assessment, and B) the findings of the vulnerability assessment conducted for this report (for details, please refer to the Technical Appendix). The vulnerability assessment looked at specific sensitivities across population types, infrastructure types, services, and natural resources; using those results, the County then zeroed in on the most vulnerable and critical sectors to determine which should be priority sectors for focus.

The following sections detail potential climate impacts on these priority sectors (in no particular order):

1. Disadvantaged Communities and Social Vulnerability
2. Extreme Weather-Resilient Development
3. Transportation Infrastructure and Operations
4. Electricity Resources and Reliability
5. Water Sources and Reliability
6. Natural Resources (Biological Resources and Agriculture)
7. Plan Maintenance

Example of Community Populations that are Sensitive to Climate Change Effects

IMPERIAL COUNTY

Climate Change and Health Profile Report

CLIMATE CHANGE EXPOSURES	HEALTH IMPACTS	POPULATIONS MOST AFFECTED
Increased average temperature	• Cardiovascular disease • Increased number and range of: • Vector-borne disease, such as West Nile virus, malaria, Hantavirus, or plague • Water-borne disease, such as cholera and *E. coli* • Food-borne disease, such as *salmonella* poisoning • Harmful algal blooms causing skin disease and poisoning • Allergies caused by pollen, and rashes from plants such as poison ivy or stinging nettle • Vulnerability to wildfires and air pollution	• Children • Elderly • Agricultural workers • Those active outdoors • People with respiratory disease • People with acute allergies
Agricultural Changes	• Changing patterns and yields of crops, pests, and weed species, resulting in higher prices for food and food insecurity, hunger, and malnutrition • Changes in agriculture/forestry, leading to lost or displaced jobs and unemployment	• Agricultural workers • Rural communities • Low income • Elderly • Children

Example of potential impacts and consequences to community assets

CITY OF INGLEWOOD

Inglewood Energy and Climate Action Plan (2013)

TABLE 5: SUMMARY OF CLIMATE CHANGE PHENOMENA, IMPACTS, AND CONSEQUENCES BY SECTOR[30]

CLIMATE CHANGE PHENOMENA	SECTOR AFFECTED	ASSOCIATED IMPACTS	ASSOCIATED CONSEQUENCES
Temperature and extreme heat events	Public Health	Heat-related: heat waves and urban heat island Wildfires	Illnesses, injuries, and loss of life Decline in air quality
	Water Resources	Drought	Decline in quantity and quality of freshwater Increased water demand
	Economy	Drought Heat-related	Energy disruption Economic gains/losses
Precipitation and extreme precipitation events	Public Health	Flooding Drought	Illnesses, injuries, and loss of life
	Water Resources	Flooding Drought Nonpoint source pollution	Illnesses, injuries, and loss of life Decline in quality of freshwater Economic losses
	Economy	Flooding Drought	Loss of agricultural productivity Destruction and damage to property Economic gains/losses

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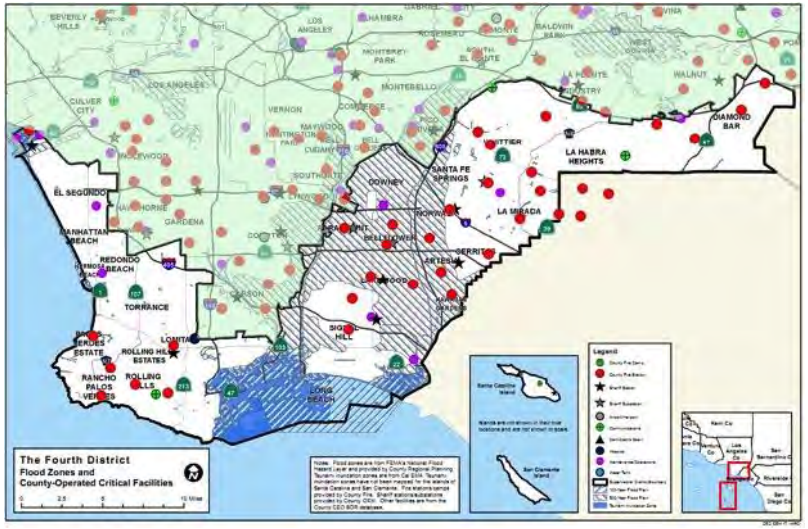
Example of Describing Cascading Impacts resulting from Flood Hazard

CITY OF MANHATTAN BEACH LOCAL HAZARDS MITIGATION PLAN

4.2.2.4 Cascading Events

Map 4-1 Local Coastal Flooding Areas



Floods can cause many cascading effects: fires can break out as a result of dysfunctional electrical equipment, hazardous materials can seep into floodways causing public health concerns and potential contamination of water, and in many cases polluted water supplies from debris and earth.

- **Effects on people and housing:** Direct impacts of flooding can include injuries and loss of life, damage to property and health hazards from ruptured sewage lines and damaged septic systems. Secondary impacts include the cost and commitment to resources for flood fighting services, cleanup operations, and the repair or replacement of damaged structures.
- **Effects on commercial and industrial structures:** Floods also result in economic losses through closure of businesses and government facilities; disrupt communications. Flood events impact businesses by damaging property and by interrupting business. Flood events can cut off customer access to a business as well as close a business for repairs. A quick response to the needs of businesses affected by flood events can help a community maintain economic vitality in the face of flood damage. Responses to business damages can include funding to assist owners in elevating or relocating flood-prone business structures.
- **Effects on infrastructure:** Flooding can cause damage to roads, communication facilities and other infrastructure.

:

Step 2.3: Adaptive Capacity

Goal: Characterize adaptive capacity of community populations and assets.

Materials to prepare (as suggested by California APG) :

- A matrix describing the community's existing capacity to adapt to each of the priority climate impacts based on existing policies, plans, and/or programs.
- An enhanced version of the same matrix describing factors that enhance local agencies' adaptive capacity.

Adaptive capacity refers to the ability of community populations and assets to adjust to climate change stressors and cope with the consequences. Adaptive capacity can be provided through physical design (e.g., back-up generator), or it can take the form of policies, plans, programs, governance, or institutions.

The California APG provides detailed guidance on identifying existing resources and assessing the community's ability to cope with potential climate impacts.

Review existing local plans, policies, and programs related to sustainability and climate change, as well as those that address hazard mitigation and emergency response. The California APG includes a comprehensive list of agencies and document types that are typically useful for this exercise.

Interview local agencies, such as public health departments or emergency responders, about their current practices, their future plans, and their ability to enhance adaptive capacity if called upon to do so. These interviews can be combined with interviews conducted under Step 2.2. The California APG identifies the following questions for use in the stakeholder interviews:

1. Are there existing programs and policies that help the community manage climate impacts?
2. How effective are they in managing present-day climate impacts?
3. Based on projected changes in climate, do you think they will be effective in managing future climate impacts?
4. Are there planned programs and policies that will help the community manage climate impacts?
5. How effective do you believe they will be in managing present-day climate impacts? Future climate impacts?
6. What are the barriers to managing climate impacts in the community? Are they related to institutional governance, attitudes and motivations, resources and funding, politics, leadership, expertise and technology, or other areas?

Adaptive capacity analysis examines the viability of plans to maintain system performance in the face of climate hazards. If the asset is damaged or destroyed, how quickly can it be repaired or brought back on line, or how quickly can functions be restored? Is there system redundancy? For example, if a major highway is shut down, are there other routes that can receive the traffic to avoid a back-up? If a substation goes down, are there other substations on the electricity grid that can pick up the load?

The objective is to determine the existence of polices, programs and strategies that can help manage climate impacts. These may include, for example, emergency response plans, evacuation plans, zoning requirements related to hazards and other effects of climate change, building code requirements related to hazards, asset engineering standards related to hazards, and water conservation policies.

Adaptive capacity can also be evaluated based on characteristics of the asset. For example, adaptive capacity can be tied to the ability of an asset to be physically repaired, modified, or relocated. For vulnerable populations, adaptive capacity can be tied to the ability of population groups to respond to climate stressors. *See City of Long Beach and WRCOG examples.*

FACTORS THAT INCREASE ADAPTIVE CAPACITY

The Hermosa Beach vulnerability assessment identified the following factors at being linked to increasing adaptive capacity: "economic resources, highly functional institutions, adequate infrastructure, availability of technological options and capacities, sufficient information and high levels of education and skill among decision-makers and stakeholders, significant social capital among community members, and equity in the access to these resources and capacities.

Additional Tools and Resources for Assessing Adaptive Capacity:

U.S. Climate Resilience Toolkit, Step 2 Worksheet

Example of Adaptive Capacity for Physical Assets based on ability to repair, modify or relocate (Rating Scale and Example Wetland Asset)

CITY OF LONG BEACH

Climate Change Vulnerability Assessment Results

Table 4: Adaptive Capacity Rating Scale for Physical Assets

High	Moderate	Low
Asset is easily repaired, modified, or relocated.	Asset may be repaired, modified or relocated, but with some challenges.	Asset may be repaired, modified, or relocated, but with significant challenges.

Table 14: Sensitivity and Adaptive Capacity Ratings for Wetlands

	Sea Level Rise (Permanent Inundation)*	← Rationale	Sea Level Rise (Temporary Flooding)*	← Rationale
Sensitivity	High	Vegetation would become regularly inundated. In a constrained urban environment, there is limited room for habitat migration.	Moderate	Erosion and debris can impair wetlands temporarily, but wetlands can tolerate occasional extreme storm flooding.
Adaptive Capacity	Low	In a constrained urban environment, there is limited room for habitat migration.	Moderate to High	Healthy wetlands can generally recover and regenerate following occasional extreme storm flooding.

*Note: Permanent inundation refers to inundation by the daily high tide (MHHW) and temporary flooding refers to flooding by the annual king tide or 100-year storm surge.

Example of Adaptive Capacity based on the ability to respond to impacts (Scores and Example Energy Infrastructure Asset)

WESTERN RIVERSIDE COUNCIL OF GOVERNMENTS

Western Riverside Adaptation and Resiliency Strategy: Part 1, Vulnerability Assessment

Table A-4: Adaptive Capacity Scores

Impact Score	Summary
AC4	Assets and populations can adapt with little or no effort. Overall quality of life may improve as a result.
AC3	Adaptive solutions are feasible for most or all sensitivities. Some sensitivities may face limited challenges.
AC2	Threats can be reduced or mitigated, but solutions are only feasible for some assets. Many assets are likely to face substantive difficulties in adapting.
AC1	Adaptive solutions are expensive and/or technologically difficult, but feasible. Approach may require politically unpopular actions or widespread lifestyle changes.
AC0	No method of adapting is currently feasible, although solutions may be possible in the future.

Buildings and Infrastructure						
V4	Energy transmission and delivery infrastructure		Extreme heat decreases the ability of the grid to transmit electricity; the Department of Energy estimates that for a 9-degree increase in temperatures, transmission line capacity falls by 7-8%, and substation capacity falls by 2-4%. These problems are compounded by the fact that electricity demand often spikes during a heat wave, primarily due to the increased AC load.	IM3	Retrofits and modifications to operating procedures can offset capacity losses, and improved efficiency can help to reduce demand during heat waves. However, implementation may be an expensive and lengthy process. The WRCOG communities have little or no operational control over the electricity grid.	AC1

Step 2.4: Vulnerability Scoring

Goal: Prioritize climate change vulnerabilities based on a systematic method of scoring that considers potential impacts and adaptive capacity.

Materials to prepare (as identified in California APG) :

- A table summarizing vulnerabilities and consequences.
- A table showing the vulnerability score for each of the major.

Vulnerability scoring can help clarify which climate change impacts pose the greatest threats and should be prioritized in adaptation planning.

The California APG provides detailed guidance on vulnerability scoring that involves ranking potential impacts and adaptive capacity.

- Begin by summarizing vulnerability for each climate change hazard in a table by describing exposure, sensitivity and potential impact, and adaptive capacity for priority population and community assets based on information gathered during steps 2.1 (Exposure), 2.2 ((Sensitivities and Potential Impacts), and 2.3 (Adaptive Capacity).

Establish a scoring rubric to begin the process of scoring for vulnerability. Scoring can help identify which climate change hazards pose the greatest threat to the community and should be prioritized for adaptation planning. The California APG recommends using the scoring rubric shown in Tables 2.1 and 2.2 as guides. The first table provides qualitative criteria for assigning a low, medium or high score to potential impacts and adaptive capacity. The second table displays the associated value for each score.

For each asset being considered, assign a potential impact rating that characterizes the degree of impact that would result from a given amount of exposure and the asset's sensitivity. Higher sensitivity indicates that the asset will have high vulnerability for a given amount of exposure, whereas a lower sensitivity indicates that the asset will incur limited damage or operational interruptions, and hence a lower vulnerability for the same amount of exposure. Similarly, the adaptive capacity is used to indicate the system's ability to cope with the impacts. Assets that have a higher capacity to manage for a climate change impact receive a lower vulnerability score, whereas assets with lower adaptive capacity receive a higher vulnerability score.

There are many potential approaches to scoring vulnerability, and the best approach for a given situation should be informed by community priorities. For instance, one community may place a high value on quantifiable metrics related to safety, while another may choose to incorporate metrics that also emphasize scoring related to lost revenue. In general, the combination of the degree of impact and adaptive capacity yields an asset's vulnerability.

Additional Tools and Resources for Vulnerability Scoring:

U.S. Climate Resilience Toolkit, Step 2 Worksheet

Table 2.1: Potential Impact and Adaptive Capacity Scoring Rubric

Score	Potential Impact	Adaptive Capacity
Low	Impact is unlikely based on projected exposure; would result in minor consequences to public health, safety, and/or other metrics of concern.	The population or asset lacks capacity to manage climate impact; major changes would be required.
Medium	Impact is somewhat likely based on projected exposure; would result in some consequences to public health, safety, and/or other metrics of concern.	The population or asset has some capacity to manage climate impact; some changes would be required.
High	Impact is highly likely based on projected exposure; would result in substantial consequences to public health, safety, and/or other metrics of concern.	The population or asset has high capacity to manage climate impact; minimal to no changes are required.

Table 2.2 – Vulnerability Score Metrix

Potential Impacts	High	Medium	Low
High	3	4	5
Medium	2	3	4
Low	1	2	3

Adaptive Capacity

Example of Vulnerability Scoring (Impact and Adaptive Capacity Scoring Criteria)

WESTERN RIVERSIDE COUNCIL OF GOVERNMENTS

Western Riverside Adaptation and Resiliency Strategy: Part 1, Vulnerability Assessment

Table A-3: Impact Scores

Impact Score	Summary (Buildings and Infrastructure, Economic Assets, Community Services)	Summary (Populations and Biological Resources)
IM0	Impacts are minimal. There are no service disruptions that community members are aware of.	All impacts are minimal. Community members may not notice effects.
IM1	Performance or services may be somewhat degraded on occasion.	Community members notice minor impacts. There may be mild disruptions to some behaviors or actions.
IM2	The asset is likely to experience chronic stress, limiting the ability to reliably function. Effectiveness may be entirely disrupted on occasion.	There is a marked decline in overall quality of life. Reductions to health, public safety, and/or community viability are likely.
IM3	The asset may only function in a limited way. It may frequently or always be unable to meet community needs.	There is a substantial drop in the well-being of the affected communities. Current lifestyles/habitat may no longer be viable.
IM4	The ability of the asset to provide beneficial service is destroyed.	There is a severe risk of injury or death in human populations and of major habitat shifts or degradation for biological communities.

Example of Vulnerability Scoring (Impact and Adaptive Capacity Scoring Criteria) continued

Table A-4: Adaptive Capacity Scores

Impact Score	Summary
AC4	Assets and populations can adapt with little or no effort. Overall quality of life may improve as a result.
AC3	Adaptive solutions are feasible for most or all sensitivities. Some sensitivities may face limited challenges.
AC2	Threats can be reduced or mitigated, but solutions are only feasible for some assets. Many assets are likely to face substantive difficulties in adapting.
AC1	Adaptive solutions are expensive and/or technologically difficult, but feasible. Approach may require politically unpopular actions or widespread lifestyle changes.
AC0	No method of adapting is currently feasible, although solutions may be possible in the future.

Example of Vulnerability Scoring (Results for Extreme Heat for Homeless Persons)

WESTERN RIVERSIDE COUNCIL OF GOVERNMENTS

Western Riverside Adaptation and Resiliency Strategy: Part 1, Vulnerability Assessment

EXTREME HEAT

Extreme heat refers to temperatures that are hotter than 98 percent of all observed historic high temperatures. When extreme heat occurs at least five days in a row, the event is known as a heat wave. Within Western Riverside County, extreme heat days are days in which the maximum temperature exceeds 103.6°F. Historically, the area has seen an average of four extreme heat days each year. Warmer air temperatures are a direct consequence of climate change and are likely to cause an increase in extreme heat. By mid-century, projections estimate an average of 15 to 30 extreme heat days each year, and potentially more in some parts of the subregion.

The greatest threat posed by extreme heat is health impacts caused by higher temperatures, which can be particularly problematic for children and older individuals, individuals who spend prolonged periods outside, individuals with existing chronic illnesses, and those who lack effective cooling in their homes or workplaces. Some types of infrastructure, particularly electricity transmission and delivery wires, may be less efficient and more vulnerable to disruptions as a result of very high temperatures. Extreme heat can also increase water loss in plants and animals, which may put stress on the subregion's biological communities and agricultural productivity.

Vulnerability Score	Sensitivity	Sensitivity Type	Impact Explanation	Impact Score	Adaptive Capacity Explanation	Adaptive Capacity Score
Populations						
V5	Homeless persons		Homeless persons lack permanent, and often temporary, shelter, which leaves them more exposed to extreme heat. Dehydration is common among persons experiencing homelessness, which can complicate existing medical conditions. Homeless persons are more likely to suffer from respiratory and other illnesses, which can be exacerbated during periods of extreme heat. Homeless persons often lack access to water, sunscreen, or protective clothing such as hats, further increasing their exposure to extreme heat events.	IM4	Persons experiencing homelessness do not have regular access to cool indoor locations. Riverside has various homeless shelter locations that can provide shelter from extreme heat conditions. However, homeless persons may not have adequate communication to know about them or may be unable to travel to those locations.	AC1

Phase 2 Outreach and Engagement Considerations

The primary goal of engagement and outreach in this phase is to develop an on-the-ground understanding of climate vulnerabilities by gathering information on neighborhood strengths, assets, and historical climate impacts. Engagement during this phase presents an opportunity for the community to shape the vulnerability assessment around community priorities and to share their expertise. The California APG recommends using the following strategies to collaborate with community members both within the organization and externally during Phase 2:

- **Targeted stakeholder interviews or focus groups:** Setup a series of interviews or focus group meetings with key stakeholders to inform Step 2.1 (Exposure), Step 2.2 (Sensitivities and Potential Impacts) and Step 2.3 (Adaptive Capacity).
- **Storytelling timelines:** Create a timeline of historic climate disasters with drawings, written stories, and photos as an outreach activity.
- **Participatory Asset Mapping:** Help the community understand the data informing the vulnerability assessment by providing different opportunities to interact with the data and provide input. These opportunities can be in the form of posters at workshops or GIS platforms that allow community members to map their own content.
- **Community-Based Participatory Research:** Partner with universities, educational non-profit organizations, or community-based organizations to create supplemental analysis or outreach materials.

Example of Virtual Reality

CITY OF SANTA MONICA

The Owls on the Pier

VISUALIZING SEA LEVEL RISE

In 2016, the City installed two telescopic viewers on the Santa Monica Pier, in partnership with USC Sea Grant, the US Geological Survey (USGS), and Owlized, Inc. "The Owls on the Pier" offered passersby an augmented reality experience into potential future scenarios of sea level rise impacts on Santa Monica's beach. The Owls surveyed participants on their views and concerns about climate change and sea level rise and their preference for climate adaptation approaches.

Over 10,000 people visited the Owls, and more than 2,500 of those participated in all or part of the Owl's survey. In addition about 1,000 people viewed the mobile version of the Owl and answered all or part of the survey.

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Example of Storytelling

VENTURA COUNTY

VC Resilient Coastal Adaptation Project Story Maps

https://rma.maps.arcgis.com/apps/MapJournal/index.html?appid=82ec17bb59094f46a37d4e21f1b4d33d

Ventura County created an online story map, an interactive series of maps, pictures, and narratives that describes the results of the vulnerability assessment.

Highland. Smoke from a nearby forest fire is driven by Santa Ana winds.

Phase
3

Develop and Prioritize Strategies

PHASE 3

Develop and Prioritize Strategies

Develop adaptation strategies to increase the resilience of community assets to climate change hazards.

This phase builds on Phases 1 and 2 by confirming the resilience goals and objectives identified in those earlier phases and addressing identified vulnerabilities with appropriate adaptation strategies. Strategy identification and prioritization should be informed by stakeholder engagement and prioritized based on local evaluation criteria.

The primary steps to Phase 3, as presented in the California APG, are summarized in Figure 13

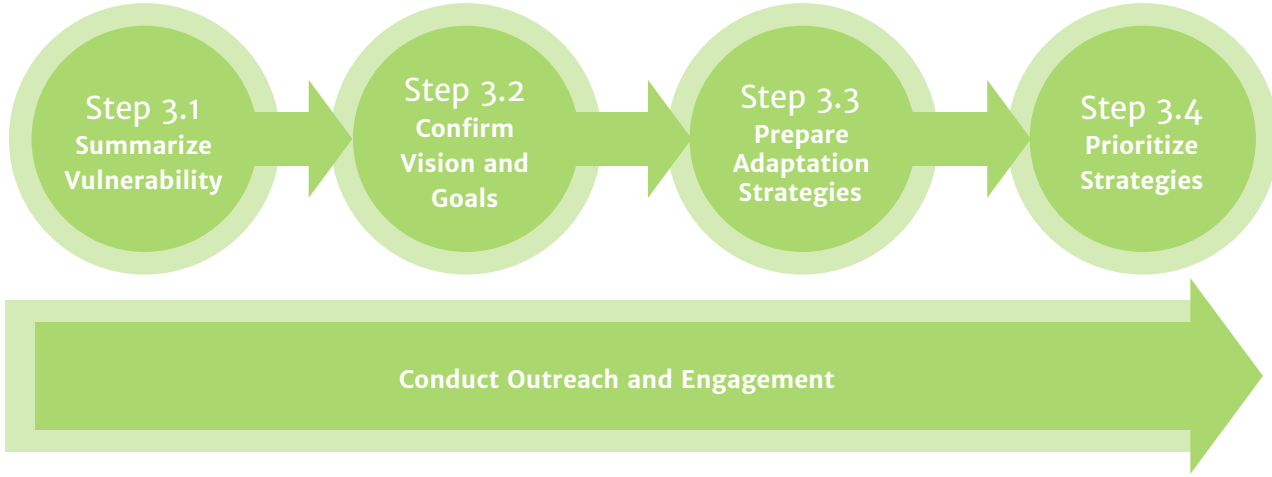


Figure 13

Steps in Phase 3

Step 3.1: Summarize Vulnerability

Goal: Prepare brief problem statements for community assets that describes vulnerabilities and consequences.

Materials to prepare

Craft problem statements for assets that received a high impact rating under Task 2.4.

Reviewing the results of the vulnerability assessment and scoring from Phase 2 will help ensure that the adaptation strategies developed during this phase are focused on the hazards and assets of most concern. The Regional Resilience Toolkit recommends developing "problem statements" for specific assets or asset categories that concisely describe vulnerabilities and consequences, in a way that is understandable to the planning team and to all stakeholders. This technique is also emphasized by Adapting to Rising Tides program, which uses the term "issue statement" to describe essentially the same thing. *See Gateway Council of Governments and Monterey Park for visually engaging graphic examples of problem statements.*

Both the Regional Resilience Toolkit and the Adapting to Rising Tides project provide helpful examples of problem statements. The example for the Western Riverside Council of Governments, from WRCOG Vulnerability Assessment, succinctly describes the vulnerabilities to agriculture from a pests and diseases. As described by the California APG, such problem statements help to:

- Communicate critical planning issues, for example, which critical assets are particularly vulnerable, what areas currently have repetitive losses, or how many high hazard areas are currently zoned for future development.
- Assist the community and stakeholders to prioritize and focus on the areas that have the greatest need for mitigation or adaptation based on the assessment of climate change–related effects.
- Create a clear and cogent "story" to help support decision-making by elected officials and other stakeholders.
- Provide a foundation for seeking funds to reduce the potential for harm and increase community resilience.

Additional Tools and Resources for Developing Problem Statements:

- The **Regional Resilience Toolkit** describes the role of problem statements in communicating key planning issues that emerge during the vulnerability assessment and includes a number of examples. Additionally, Appendix B of the Toolkit includes Worksheet 3.1, Develop Initial Problem Statements, to guide the development of problem statements.
- For additional **Problem Statement Examples**, see Ventura County Sea-level Rise Vulnerability Assessment (Chapter 5) and Western Riverside Adaptation and Resiliency Strategy: Part 1, Vulnerability Assessment.

EXAMPLE PROBLEM STATEMENT | WESTERN RIVERSIDE COUNCIL OF GOVERNMENTS VULNERABILITY ASSESSMENT

Agricultural Pests and Diseases

The Western Riverside subregion contains thousands of acres of agricultural land that contributes approximately $300 million to the $3.61 billion economy and 27,442 agricultural jobs in Riverside county (County of Riverside 2017, Halll 2018). The farms and ranches in the WRCOG subregion all face risk from assorted pests and diseases that may affect crops, vineyards, and livestock. These pests and diseases can cause plants and animals to grow slower, damage them so that their products are less appealing and harder to sell, or even die. While there are treatment options for a number of agriculture diseases, some have no cure.

Temperature increases play a key role in agricultural pests and diseases, as higher temperatures can increase the rate of reproduction for insects and mites (Hall 2018). High temperatures earlier and later into the year also create a wider window for pests and diseases to be active (IPCC 2013). Many crop plants, trees, and livestock may also be harmed and consequently weakened by warmer temperatures and changes in precipitation. The weaker plants and animals may not be able to fend off infestations or infections as well as stronger plants and animals, causing pests and diseases to affect more of the population.

Examples of Vulnerability Issue Statements in Graphic Form

GATEWAY CITIES COUNCIL OF GOVERNMENT

Climate Action Plan Framework Climate Hazards Infographic (2018

1. **Temperatures** and **extreme heat days** will continue to rise

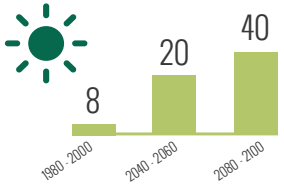
Higher temperatures may increase energy use for air conditioning, water use for irrigation, and the need for cooling centers.

Maximum Average Annual Temperatures

2080 - 2100 +5.3 F - 7.9 F

2040 - 2060 +3.8 F - 4.8 F

Extreme Heat Days Per Year



Lower income areas and communities of color are more likely to live in areas prone to suffer from urban heat island effect, which increases the magnitude of extreme heat events.

2. **Air quality** is expected to worsen

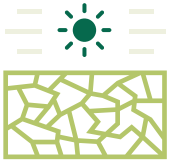
Increased regional wildfires, higher ozone concentrations, and worsening allergens may exacerbate:

3. **Stormwater runoff** volume in the Los Angeles Basin is projected to increase significantly

More precipitation will fall as rain instead of snow leading to an increase in stormwater runoff by as much as 50%. This will increase the likelihood of urban flooding and risk of property and infrastructure damage.

4. The State and region is expected to have more frequent, longer, and more **intense droughts**

Droughts may increase risk of wildfire in and adjacent to Whittier, La Habra Heights, and Santa Catalina Island, water restrictions, and energy use to transport imported water from other areas.



Examples of Vulnerability Issue Statements in Graphic Form

CITY OF MONTEREY PARK

Climate Action Plan (2012)

A **CLIMATE ACTION PLAN** *for Monterey Park*

Potential Climate Change Health Effects*

Climate Change Effect	Examples of Human Health Risk	Effects on Daily Lives of Monterey Park Residents
Increase in Extreme Heat Events	Heat Related Illness/Death Worsening of Chronic Health Conditions	Higher energy costs to cool homes & businesses Crowding at local malls/shopping centers with A/C
Increased Air Pollution	Increased Respiratory Illness and Seasonal Allergies	Increased discomfort due to asthma/allergies Increased medical costs Increased cost for medication
Floods, Droughts, Wildfires, Storms, Changes in Weather Patterns	Injury/Death Respiratory Illness Waterborne Illness Foodborne Illness Displacement Stress Related Disorders Mental Health Impacts Increase/Shift in Infectious Disease	Increased medical costs Poor health Exposure to prolonged heat or rain conditions
Higher Food Prices and Food Scarcity	Increased Hunger Decreased Nutrition	Higher grocery costs at the market Higher costs dining out Poor health
Sea Level Rise, Storm Surge, Longer Red Tides (toxic algae blooms in the ocean)	Injury/Death Wastewater System Impacts Displacement Stress Related Disorders Mental Health Impacts Poisoning from Contaminated Shellfish	Decreased access to local beaches Higher costs on seafood at grocery stores & restaurants Potential flooding due to overflow of storm water system

For additional information, contact the
Community Development Department
626-307-1315
planning@montereypark.ca.gov

Step 3.2: Confirm Vision and Goals

Goal: Refine the community's vision, goals and objectives prepared under Step 1.1 based on the results of the vulnerability assessment.

Materials to prepare

Revised vision, goal and objectives statements.

Revisit the vision statement and goals and objectives prepared during Step 1.1 to ensure they align with community needs and desires and establish a common foundation for stakeholders, the project team, and decision makers. Well-developed goals will also help in preparing appropriate adaptation strategies (Step 3.3).

The Regional Resilience Toolkit provides guidance on developing resilience goals that align with community needs and desires, and promote the selection and prioritization of maximally effective adaptation strategies. Goals should seek to protect assets, reduce impacts from hazards, and help stakeholders see how resilience fits in with existing community priorities. As outlined by the Regional Resilience Toolkit, adaptation goals may be driven by a desire to protect:

- Physical areas (e.g., new development along the shoreline, natural resource areas or assets)
- Asset classes (e.g., critical services)
- Social values (e.g., protecting parks because beauty and recreation are highly held values)
- Economic values (e.g., protecting major economic drivers like large businesses)
- Character, history, sense of place (e.g., protecting historic structures or neighborhoods)
- Existing functions/activities (e.g., preserving the function of an airport or seaport)
- Specific communities (e.g., vulnerable populations)

The Regional Resilience Toolkit provides the following questions intended to help refine adaptation goals and objectives.

- Does everyone understand the goal? Is it written in clear language? Are there multiple ways to interpret the goal?
- Who is responsible for implementation? Does the lead agency have influence or ability to achieve the goal? Are the resources, skill, and knowledge available to achieve the goal?
- How does the team know when a goal has been achieved? Is there a milestone that has been reached? An amount of money spent? An action achieved?
- Can the jurisdictions involved realistically achieve that goal? If not, what is more likely?
- Is it clear what the result or outcome is from achieving the goal?
- When should the goal be achieved? Is there a specific date or timeframe that can be established as a target? Should there be a mid-term timeframe?

Phase 1 in this guide presents adaptation goals and objectives for the SCAG region, informed by its unique geography and demographics, and consistent with the adaptation vision and principles developed by the state's Integrated Climate Adaptation and Resiliency Program (ICARP). Goals should be clear and accessible to all stakeholders. It is important for stakeholders to understand how resilience relates to community priorities. Goals and objectives that protect known vulnerabilities to critical assets and vulnerable communities are likely to align with public priorities.

As noted by the California APG, goals should be designed with consideration to how progress can be tracked or monitored. In some cases, it might make sense to prepare one or more "objective" statements for each goal that in some way can be measured to show progress toward the goal. For example, a goal to maximize equity and protection of the most vulnerable might have objectives for identifying populations that will disproportionally experience the consequences of climate change and increasing engagement with disproportionally vulnerable populations. In general, the goal and objective development process should strive to develop specific indicators of progress that can be monitored.

Additional Tools and Resources for Developing Goals and Objectives:

- The **Climate Justice Working Group** has developed a vision and guiding principles for increasing the resilience of those communities who are most vulnerable to the physical, environmental, economic and health impacts brought on by climate change.
- **Asian Pacific Environmental Network's "Mapping Resilience"** includes multiple principles highlighting equity and environmental justice considerations, which can be incorporated into policy and strategy development.
- Appendices A and B of the **Regional Resilience Toolkit** include useful guidance on establishing resilience goals. Worksheet 2.1, Develop Resilience Goals Exercise, in Appendix B includes a goal setting exercise that can be used within a community workshop or advisory group to identify community resilience goals.

Example of Goals and Policies

CITY OF INDIO

General Plan, Safety Element April (2019) (Interim Draft)

Climate Change and Community Resilience

Climate change is anticipated to amplify existing natural hazards. This goal aims to establish a framework for Indio to begin addressing the impacts of climate change.

Goal SE-5: Community Resilience. A community that is prepared for the potential impacts of climate change.

SE-5 Policies

SE-5.1 **Regional partnerships**. Establish partnerships with State, Federal, regional, and local agencies to collaborate and better understand the regional impacts of climate change, and to develop multijurisdictional solutions.

SE-5.2 **Climate change research**. Integrate climate change research and adaptation planning into City operations, services, and public infrastructure development, including capital improvements.

SE-5.3 **Cooling centers**. Establish cooling centers to reduce Indio resident's vulnerability to extreme heat events and severe storms.

SE-5.4 **Backup power.** Support critical facilities, such as schools, hospitals, and cooling centers to operate on micro-grids, which use various redundant backup systems including generator power, solar, and wind turbine power sources.

SE-5.5 **Neighborhood and building cooling**. Encourage new development and redevelopment to take steps to reduce the impacts of extreme heat events, including:

- Protect the City's healthy trees and plant new ones to provide shade, increase carbon sequestration and purify the air.
- Shade public parks and open spaces, including bus shelters.
- Support residential energy efficiency and weatherization programs.
- Design buildings to use less cooling through passive heat and cooling techniques.

SE-5.6 **Reduced water supplies**. When reviewing development proposals, consider the possibility of constrained future water supplies and require enhanced water conservation measures.

- Ensure compliance with the landscape conservation ordinance.
- Encourage the use of water conservation measures in new development beyond current requirements.
- Encourage the use of sustainable landscaping techniques.
- Support recycled water use.

SE-5.7 **Communications and outreach**. Continue to work with the Riverside County Public Health Department and County of Riverside Emergency Management Department to establish social networks and website updates to distribute information on climate change impacts to vulnerable populations including actions they can take to reduce exposure to unhealthy conditions.

SE-5.8 **Equitable distribution of resources**. Prioritize programs that ensure the benefits of climate action programs are fairly distributed and prioritized to those most in need, particularly populations most likely to be impacted by climate change.

SE-5.9 **Funding opportunities.** Pursue climate change grant funding opportunities when appropriate.

Step 3.3: Prepare Adaptation Strategies

Goal: Develop adaptation strategies to address the community's vulnerability to climate change hazards.

Materials to prepare

A list of adaptation strategies that address the problem statements developed in Step 3.1.

The problem statements or issue statements developed in Step 3.1 can be useful in identifying the key adaptation strategies needed to increase resilience of the community's most critical assets. The California APG provides guidance on how to draft a strategy to support the goals and objectives developed in Step 3.2, and directly address the vulnerabilities and problem statements developed in Step 3.1. As explained in the California APG, climate adaptation strategies should be developed within a policy framework appropriate to the planning context – to the plan or program being developed or updated (i.e., the general plan safety element, climate action or adaptation plan, local hazard mitigation plan, or other plan or project). The terminology used by the strategies should be consistent with the policy/planning document where the strategy will reside. *See Step 4.1 on creating an implementation program.*

In addition to the California APG there are many useful resources for identifying potential adaptation strategies, including Safeguarding California, Adapting to Rising Tides, and the Regional Resilience Toolkit. SCAG has compiled adaptation strategies from these and other resources into a Strategies Matrix (see Appendix B: Matrix of Adaptation Strategies and Actions, also available on the SCAG website) that can be sorted and filtered by climate hazard and asset type, to help identify strategies and actions that address community risks and vulnerabilities identified in Phase 1. The matrix includes over 275 strategies and implementing actions that are appropriate for the SCAG region. Many address multiple hazards or multiple asset types. Users can quickly identify their assets and hazards of concern and select from a range of strategies and actions that directly target that hazard. *See SCAG Strategies Matrix example.*

The Regional Resilience Toolkit provides helpful tips on developing strategies and specific actions and projects to address the vulnerabilities identified in Phase 2. It is important to ensure that the strategies are actionable, feasible, flexible, and that they are built on the community's long-term vision and values, and link to the plan's goals. Consider these best practices in developing strategies:

- Link strategies directly to problem statements: strategies offer the solutions to the problems identified in the risk assessment.
- Select fewer, more actionable strategies rather than a long laundry list of potential actions.

CONSIDER FUNDING OPTIONS WHEN DEVELOPING ADAPTATION STRATEGIES

SCAG prepared a report that serves as a guide for local agencies on climate adaptation funding and financing, with a focus on infrastructure. The report titled Funding and Financing Climate-safe Infrastructure is available in Appendix E. The report characterizes the climate adaptation infrastructure funding gap, provides over-arching strategies and policy guidance based on recent state publications, and summarizes challenges that local agencies face. It provides an adaptation finance toolkit for local agencies as they prepare and prioritize their adaptation strategies during Steps 3.3 and 3.4. The report also provides resources for funding climate adaptation infrastructure as local agencies seek to implement their strategies (as part of Step 4.1). Consider consulting this report when developing adaptation strategies to increase the likelihood of obtaining funding when strategies are implemented as part of Phase 4. The report is also available here: http://sustain.scag.ca.gov/Pages/Climate%20Change/Regional-Climate-Adaptation-Framework.aspx.

- Address multiple problems or vulnerabilities or link different sectors together (water, transportation, energy, etc.) with a single strategy to increase funding options.
- Ensure that there is someone who can be the lead on a strategy - someone who has the authority, political will, ability, time, and resources to make it happen.
    - Directly align strategies with resilience goals outlined at the beginning of the process.
- Ensure strategies can be integrated into existing programs, actions, and funding streams, such as existing capital improvement plans and projects.

When developing adaptation strategies that seek to increase the resilience of vulnerable population groups, considerations should be made to address the contributing causes of vulnerability, including unequal access to education, employment, and health care services, lack of political representation, social isolation, and institutional discrimination. According to the Urban Sustainability Directors Network's Guide to Equitable, Community-driven Climate Preparedness Planning, addressing the contributing causes of social inequities requires a continuum of actions that:

- Provide actions to reduce hazard risk, e.g., early warning systems and cooling centers;
- Improve assistance after a climate hazard, e.g., creation of shelters and preparedness hubs;
- Help communities adapt to changing climate conditions, e.g., conserve and use water and energy more efficiently; and

- Focus on reducing social inequities related to poverty, discriminatory institutional practices, and political representation.

The following series of questions included in the California APG and developed by Greenlining Institute are intended to help craft equitable adaptation strategies:

- Which vulnerable populations may be impacted by or could benefit from the strategy? How has the community identified these populations?
- Does the strategy have dedicated set-asides for vulnerable communities? Are the benefits of the proposed strategy broadly accessible to households throughout the community, particularly communities of color, low-income populations, housing-insecure households, people with disabilities, people experiencing homelessness, tribal and indigenous communities, and immigrant communities?
- Have you designed a process to collaborate with vulnerable populations that engages and empowers them in a meaningful, authentic and culturally appropriate manner? Which best practices for community engagement are you implementing?
- What mechanisms will you use to assure particular benefits to vulnerable populations? (e.g. provide technical assistance or capacity building, provide jobs, provide extra financial resources or investments)
- Does the strategy generate burdens (including displacement and increased costs), either directly or indirectly, on vulnerable populations? If yes, how will you address and mitigate them?
- How will the strategy provide for local capacity building? (e.g. through funding, expanded knowledge base or other resources?)
- Does the strategy help foster the building of effective, long-term relationships and trust between diverse communities and government? Does the strategy align with and support existing community priorities, creating an opportunity to leverage resources and build collaborative partnerships?

Develop adaptation strategies that could result in added beneficial results beyond just increasing resilience to climate change hazards. Consideration of co-benefits improves the chances of securing funding from regional, state and federal programs and aligns climate change resilience with a broader set of community goals. Examples of co-benefits to consider, as suggested in the California APG, include:

- Cost-savings
- Air quality improvement
- Water quality protection
- Stormwater management
- Increased public safety
- Recreation, open space, and tourism
- Greenhouse gas emissions reduction
- Public health improvement
- Economic continuity

Adaptation strategies should be developed according to the approach outlined above and as part of stakeholder and community outreach. *See adaptation strategies examples from the Cities of Laguna Woods, Pasadena and Santa Monica provided at the end of this step.*

ADAPTIVE PATHWAYS APPROACH

Climate change hazards will evolve and change over time, often increasing in their magnitude and extent (e.g., sea-level rise, extreme heat). Therefore, adaptations strategies will also need to change to reflect a change in conditions. One approach to accounting for dynamic climate change conditions is to identify thresholds that once reached would trigger the need to begin planning and implementing a particular adaptation strategy. For example, the number of extreme heat days anticipated to occur in the next ten years for one community may not warrant a strategy to setup cooling centers. However, it could be necessary in ten to twenty years when the number of heat days exponentially increase. Adaptive pathways allow communities to plan for the long-term while recognizing that implementation of some strategies do not need to occur immediately. Coastal communities are utilizing the adaptive pathways approach most extensively. The example below is provided for the City of Santa Barbara.

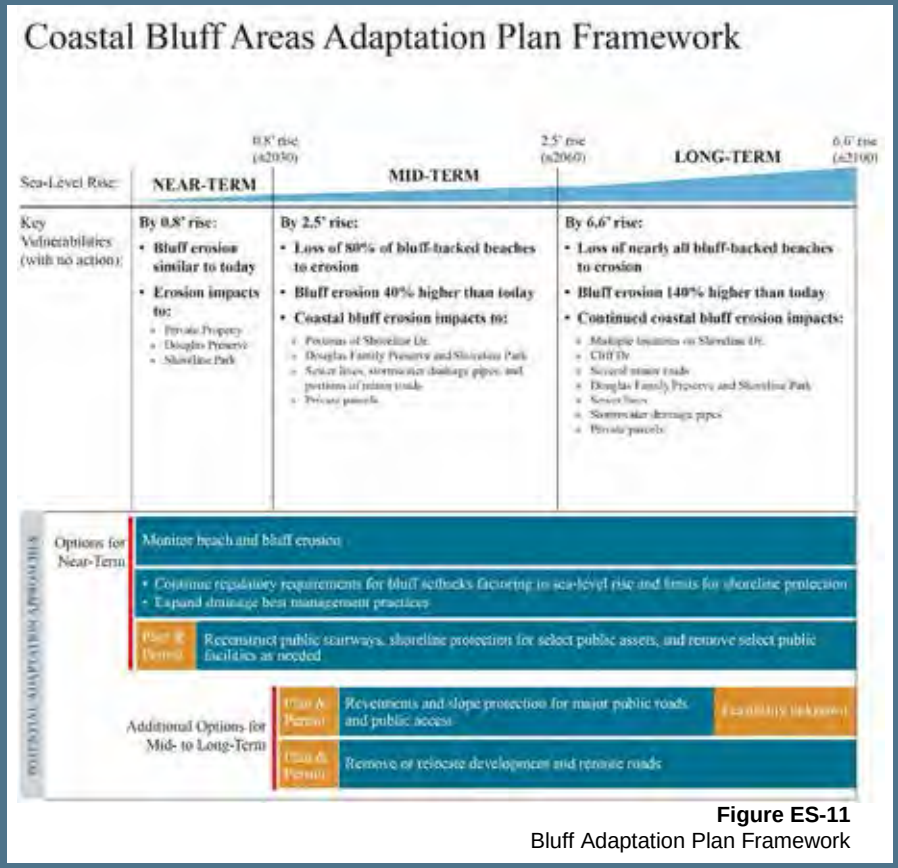


Figure ES-11
Bluff Adaptation Plan Framework

Regional Resilience Toolkit:

Example: Connecting Problem Statements to Strategies

Operational

Problem*:* The City has a lack of staff to enforce building codes and adherence to retrofit policies.

Strategy*:* Within the next year, build staffing capacity to implement and support plan implementation.

Plans, Regulations, and Policy

Problem: Electric power outages occur on a regular basis during winter storms, resulting in business in core commercial areas to lose customers.

Strategy: Within the next five years, require all new commercial solar installations to include energy storage with a minimum of 3 hours of downtime.

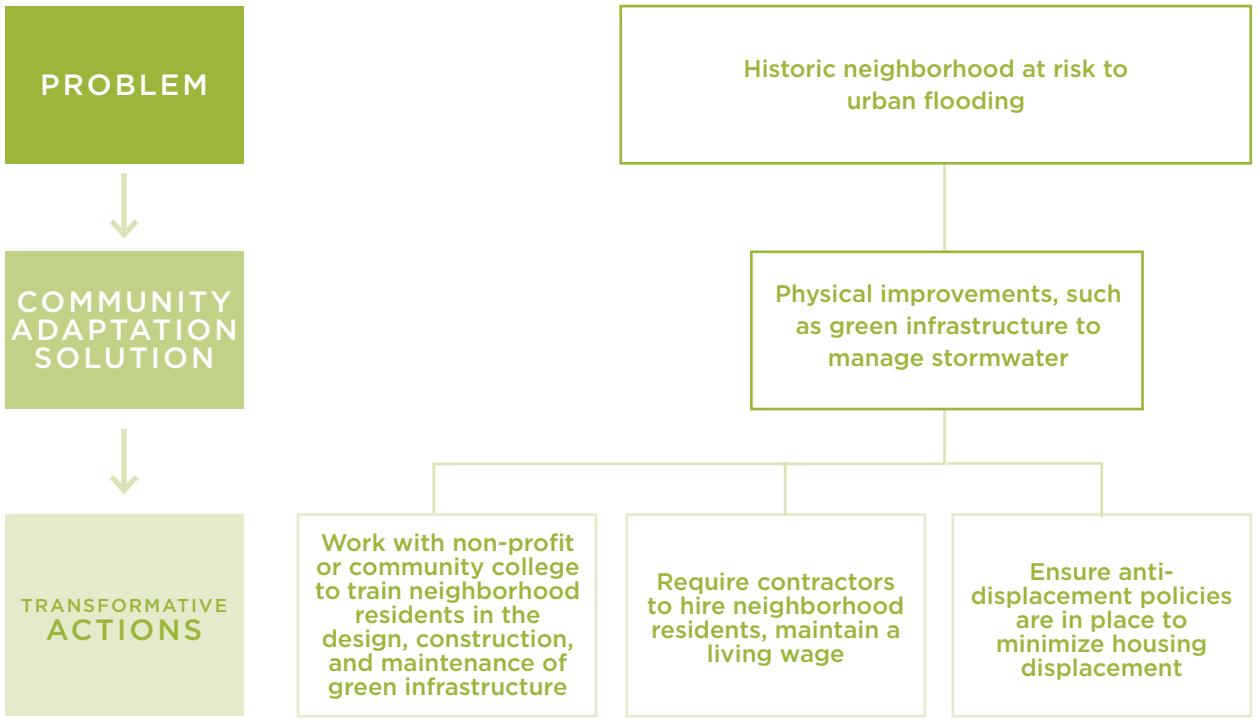
Education/Outreach/Coordination

Problem: There are over fifteen agencies and twelve non-profits involved in addressing sustainability and resilience in the city, resulting in substantial gaps, duplication, and increased competition for funding.

Strategy: Develop and convene a regional sustainability council to coordinate and align efforts of the agencies and non-profits.

Urban Sustainability Directors Network Guide to Equitable, Community-driven Climate Preparedness Planning:

Figure 8: An Example of Community Adaptation Solutions and Transformative Actions



HOW DO ADAPTATION STRATEGIES TRANSLATE TO POLICY?

An adaptation strategy can be a policy, program, project, or action that is intended to increase resilience to climate change hazards. Climate adaptation strategies should be crafted in a manner that fits within the framework appropriate to the plan or program being developed (e.g., the general plan safety element, climate action or adaptation plan). Typically, for general plans, the framework includes goal statements with multiple objectives and/or policies associated with each goal. General plans can also include implementation programs that specify actions necessary to achieve the objectives and policies (e.g., updating the municipal code to include design standards). The level of detail of the objectives and policies can vary but is typically less specific than other planning documents. Note that to be in compliance with SB 379, the safety element update should include a set of goals, policies, and objectives along with implementation strategies that address climate adaptation. Climate action or climate adaptation plans typically include adaptation strategies that are more detailed and include an implementation program that assign specific actions to local departments and community partners.

As part of the SoCal Climate Adaptation Planning Framework, SCAG prepared sample goals and objectives (see Phase 1), model policies for general plans and local coastal programs (see Phase 4), and a matrix of adaptation strategies and actions (included under this step). Depending on the framework associated with the plan or program being developed, a community can utilize some or all of these materials as a starting point from which to refine and adapt to their local circumstances. The goals and objectives can be combined with the general plan model policies to inform a safety element update, for example, along with the adaptation actions from the matrix included as the implementation strategies. If a community prefers to have detailed and more actionable objectives and policies, the adaptation strategies and actions can be used instead of, or in addition to, the general plan model policies. The adaptation strategies and actions are well-suited for including in a climate action or climate adaptation plan.

Lastly, SCAG also prepared a sample set of metrics for each objective provided in Phase 1. These metrics (once refined by the local community) can also be integrated into a planning document to facilitate monitoring and tracking of progress towards climate adaptation goals. Metrics are often found in both general plans and climate action and climate adaptation plans.

Additional Tools and Resources for Identifying Adaptation Strategies

- **SCAG's Adaptation Strategies Matrix**, available on the SCAG web site
- The **Resilient IE** program from Western Riverside Council of Governments and San Bernardino County Transportation Authority identifies adaptation strategies appropriate for communities in Western Riverside County and San Bernardino County.
- Appendix B of the **Regional Resilience Toolkit** includes Worksheet 3.2, Strategy Idea Sources, a handout that identifies and links to existing reports and plans that can be used to generate ideas for strategies. The handout identifies which asset classes and hazards are addressed by each document. Worksheet 3.4 Strategy Development and Implementation Handout provides two tools that can be used by the project team to outline key components of each strategy including the purpose, hazard addressed, type, process, and relevant partners. The strategy implementation tool identifies the staff lead for a given strategy, cost estimate, benefits, funding sources, timeline, and related policies.
- The Adapting to Rising Tides (ART) program includes a guide for **Developing Adaptation Responses** which explains the different types of adaptation responses and outlines a step by step approach to developing them. The ART program includes an example agenda for an adaptation strategies development meeting, as well as guides to hosting engagement exercises during the strategy development process to create agreement among the project team, stakeholders, and decision makers.
- **California Adaptation Clearinghouse.** The Adaptation Clearinghouse is an online resource that includes a database of case studies of effective resilience and adaptation planning available throughout California. The database is easily searchable and provides background information regarding the resource and a link to any associated materials or websites.
- Urban Sustainability Directors Network's **Guide to Equitable, Community-Driven Climate Preparedness Planning** is a guidance document for local governments to design and implement an inclusive and community centered planning process.
- The **California Coastal Commission Sea-level Rise Policy** Guidance provides over 100 adaptation strategies organized by coastal resource.

Example of Adaptation Strategies

CITY OF LAGUNA WOODS

Climate Adaptation Plan (2014)

Implementation Action 1.1.2: Adopt development standards to mitigate urban heat island effects. The urban heat island effect is a phenomenon in which temperatures in the local climate increase due to certain aspects of the built environment that retain or emit heat to a greater extent than would ordinarily exist in lesser developed areas (e.g., large areas of asphalt and impervious surfaces). The City will consider adopting development standards intended to reduce the solar reflectance and thermal properties of new and significant redevelopment projects. The City will specifically consider the adoption of standards requiring greater use of cool roofs, pervious surfaces, high albedo pavement, and shade over asphalt areas.

- ISSUE: Average temperatures may increase over time, and extreme heat is Laguna Woods' most likely and impactful near-term climate change exposure.
- BENEFIT: Reduction of factors contributing to temperature increases in the local climate.
- COST: *One-time*: Low (staff time to prepare development standards and seek City Council adoption). *On-going*: Low (staff time to ensure compliance with standards as a part of the development review process).
- COORDINATION: Low (review of development standards and best practices from outside organizations).
- DELIVERABLE: Development standards to mitigate urban heat island effects.
- SUCCESS: Enforcement of development standards to mitigate urban heat island effects.

Example of Adaptation Strategies

CITY OF PASADENA

Climate Action Plan (2017)

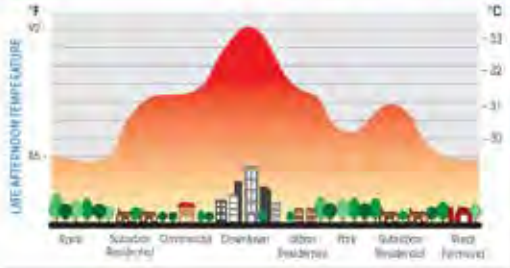
Measure 2 – Promote healthy, safe, and resilient communities

	Implementation Actions	Primary Responsibility
A	**Present the Community Health Needs Assessment:** Share available environmental health data when conducting community presentations	Public Health
B	**Promote Food Waste Prevention:** Continue to promote the "Be Better Pasadena" program where health educators provide free community nutrition classes that encourage food waste prevention by teaching topics such as proper food storage, repurposing leftovers, reading expiration date labels, participating in community garden projects, and composting	Public Health

Measure 3 – Support strategies to reduce the urban heat island effect.

	Implementation Actions	Primary Responsibility
A	**Analyze Cool Pavement Strategies:** Study the feasibility of implementing cool pavement strategies - materials and/or technologies that reflect more solar energy - in an effort to reduce the urban heat island effect	Planning
B	**Plant Shade Trees:** Continue to increase tree planting and urban green space by implementing the urban greening measures identified in the CAP, with emphasis on shading home, critical infrastructure, and bicycle and pedestrian routes	Public Works

What is the urban heat island effect?



An urban area creates a heat island when its temperatures are higher than those of the surrounding non-urban area. As urban areas develop, buildings, roads, and other infrastructure they replace open land and vegetation. Developed surfaces absorb more solar energy, and can create higher temperatures in urban areas.

Example of Adaptation Strategies

CITY OF SANTA MONICA

Climate Action and Adaptation Plan (2019)

ACTIONS

	Carbon Reduction Potential	Cost to City	Community Benefits	Lead	Partners	Status or Timeframe
WATER CONSERVATION						
H201: Commercial Sector Retrofits Develop incentives and direct install programs to retrofit inefficient water fixtures in commercial properties.	●●○○	$$	$ G R	OSE	MWD	Ongoing
H202: Coin Operated Laundry Program Develop incentives targeted at multiunit dwelling property owners and laundry service vendors to replace inefficient laundry systems with new systems.	●●○○	$$	$ G R	OSE	MWD	Near Term
H203: Increase Direct Install Program Expand annual replacement of inefficient toilets in multiunit dwellings and single-family homes.	●○○○	$$	$ G R	OSE	MWD	Ongoing
ALTERNATIVE WATER SUPPLY						
H204: Arcadia Water Treatment Plant Improvements Increase in production efficiencies at the Arcadia Water Treatment Plant by recovering brine concentrate.	●●○○	$$$	$ G R	WRD	ED	Mid Term
H205: Clean Beaches Initiative & SMURRF Repurposing Upgrade the Santa Monica Urban Runoff Recycling Facility (SMURRF), that provides a drought resilient, local water supply, to increase the amount of recycled water production. Connect SMURRF to the newly constructed (2018) Clean Beaches Initiative 1.6 million gallon tank, to supply SMURRF with rain and brackish ground water when urban runoff is not available.	●●○○	$$$	$ G R	WRD	ED	Mid Term
LOCAL GROUND WATER PRODUCTION						
H206: Expand Local Water Resources Expand capacity at Arcadia Water Treatment Plant to accommodate more water. Restore the Olympic wellfield and develop a new well to enhance drought resilience.	●●○○	$$$	$ G R	WRD	ED	Long Term

Carbon Reduction Potential

Cost to City
$ Low
$$ Medium
$$$ High

Supports Paris Agreement
Potential for Cost Savings, Local investment and Jobs
Potential to Address Equity
Government Leadership
Advances Smart City Concepts
Enhances Environmental Quality
Enhances Community Resilience
Improves Public Health & Safety

Step 3.4: Prioritize Adaptation Strategies

Goal: Prioritize adaptation strategies based on goals and objectives and other criteria.

Materials to prepare

A prioritized list of adaptation strategies.

Once a list of appropriate strategies has been compiled for each relevant hazard and asset category, they should be prioritized based on local evaluation criteria. General criteria for strategy prioritization include effectiveness in reducing risk, cost, and level of effort to implement. Members of the community and stakeholders should be engaged to also provide input on prioritizing adaptation strategies. As outlined in the California APG, prioritization of strategies should consider a multitude of factors:

- **Vulnerability Score** (from Step 2.4). Which strategies will be effective at addressing assets or systems with the highest vulnerability?
- **Administrative Operability.** Who will implement the strategy and what is their organizational capacity?
- **Cost.** How much will the strategy cost to implement?
- **Funding.** What resources are available to pay for implementation? Is there bond funding available? (see Phase 4 for a list of potential funding sources including bonds, tax programs, public-private partnerships, and others.)
- **Effectiveness/Benefit.** How effective is the strategy at addressing the problem and/or what is the benefit? What future losses might be avoided?
- **Efficiency.** How do the costs compare to the effectiveness/benefit? (What is the benefit-cost ratio?) What are direct and additional indirect benefits of the strategy?
- **Environmental Impact.** What are the potential environmental impacts or considerations of implementing the strategy?
- **Co-benefits.** Does the strategy offer co-benefits, such as economic development, habitat improvements?
- **Equity.** Who pays the cost and who receives the benefit? Does the strategy address underlying institutional and social inequalities, remove barriers and provide resources needed to provide opportunity for all?
- **Consistency with goals and objectives.** Is the strategy aligned with the goals and objectives established as a result of the engagement process?
- **Legality.** Is the strategy consistent with applicable laws? Is there any legal risk in implementing the strategy?
- **Permitability.** How complex is the permit process? Is it likely that permits can be obtained?
- **Responsiveness/Appropriateness.** How responsive or appropriate is the strategy to the needs and conditions of everyone in the community, especially those on the frontline?

- **Timing.** When will implementation begin and how long will it take?
- **Monitoring.** How will the strategy be tracked and monitored for effectiveness? Is there a key performance indicator?

An effective means of narrowing down potential adaptation strategies is to prioritize those that that reduce risk to life. Some communities may want to start a conversation about tolerable risk, defined as risk that society is willing to live with so as to secure certain benefits, or that society is confident is being properly managed. Using life safety as a primary criterion helps prioritize certain adaptation strategies over others that may be politically popular or achieve other desired co-benefits, but are not addressing a critical risk.

Another approach to strategy selection, outlined in both the Regional Resilience Toolkit and the Adapting to Rising Tides (ART) program, is to develop prioritization criteria by viewing potential strategies through "frames" that provide a way to view the strategy in terms of its community benefits, and help to identify the factors that affect its ability to be implemented. Evaluating strategies through frames can identify and highlight the benefits and tradeoffs of strategies, which can be very useful when garnering political, community, and financial support for implementation. ART and the Regional Resilience Toolkit suggest consideration of the following four frames when prioritizing strategies:

- **Society and equity:** Effects on communities and the services on which they rely, with specific attention to disproportionate impacts due to social, political, or economic inequality, removing barriers and providing necessary resources and opportunities to provide true equity.
- **Economy:** Economic values that may be affected such as costs of physical infrastructure damages, threats to established markets or industries, or lost community wealth and public revenues during recovery periods.
- **Environment:** Environmental values that may be affected, including ecosystem functions and services and species diversity.
- **Governance:** Factors such as organizational structure, ownership of assets, management responsibilities of assets, jurisdictional mandates, regulations, or funding options that impact how a community can respond to a hazard.

This framing process can be done by anyone involved in the process, though it is particularly effective in the context of engaging stakeholder groups. A diverse set of stakeholders can help share community values and identify valued assets within each frame that may be affected by a particular strategy.

Additional Tools and Resources for Prioritizing Adaptation Strategies

- The **Regional Resilience Toolkit** offers a detailed approach to evaluating strategies according to their impact on society and equity, economy, environment, and governance. Appendix A provides a sample agenda for a project team meeting regarding strategy prioritization. In Appendix B, Worksheet 3.3, Evaluation Criteria is a tool for evaluating and prioritizing which strategies to implement based on the feasibility, social benefits, economic benefits, environmental improvement, and community objectives.

Phase 3 Outreach and Engagement Considerations

At this stage in the process, the goal of public engagement is to involve stakeholders in identifying solutions to the problems and hazards identified in Phase 2 and to create a cohesive summary or story of vulnerabilities that can be communicated to decision makers and stakeholders. Continued stakeholder engagement is key during this phase in order to influence the direction that the community chooses to take towards resilience. While developing strategies, stakeholder and community input will aid in "ground-truthing" the feasibility of strategies. Additionally, input from the community and stakeholders will be critical while prioritizing strategies to meet the greatest vulnerabilities or needs of the community.

During the process of prioritizing strategies, the project team should create communication materials that help the community understand various aspects of each strategy. These materials could include information about the cost and feasibility of alternatives, lists of potential challenges and benefits of strategies, case studies, and other information. Graphic representations of this information can be helpful when facilitating a prioritization meeting with a large group.

As noted by the California APG, it is critical to maintain a collaborative relationship with community members and stakeholders during the strategy development and prioritization process. To that end, it is important that the project team prepare to receive feedback on strategies, have a method to track feedback, and make materials from workshops and meetings accessible to the public in order to maintain a transparent decision making process. Inclusive facilitation skills are critical.

Additional Tools and Resources:

- The Local Government Commission's guidebook titled **Participation Tools for Better Community Planning** highlights a number of public engagement tools including ways to help the public visualize alternatives.
- **Are You a Climate Change Survivor** is a workbook prepared by the Pacific Institute and Climate Action Coalition with engagement activities and related materials, including games to identify resilience strategies.

Example of Phase 3 Engagement Activities

CITY OF HERMOSA BEACH

Look Ahead Hermosa Beach (2019)

Above is a current view the beach at the northern edge of Hermosa. Below is a visualization of the area with the return of coastal dunes and beach grass to block some of the effects of sea level rise.

Look Ahead Hermosa Beach

Virtual reality brings climate impacts and action to life

Imagine some of your favorite places in Hermosa Beach underwater. Hard to picture? An innovative new initiative, *Look Ahead Hermosa Beach* is using virtual reality to raise awareness about the risks of sea-level rise and help community members envision and weigh in on available solutions.

Through a partnership with the City of Hermosa Beach, United States Geological Survey (USGS), Climate Access, and WhiteSpace VR *Look Ahead Hermosa Beach* offers an immersive VR experience that illustrates the risks of sea-level rise in three familiar locations – the Hermosa Beach Pier, Pier Plaza and The Strand– as well as steps that can be taken to address risks from climate impacts and reduce carbon emissions. *Look Ahead Hermosa Beach* includes interesting facts about climate change in the region and an opportunity for community members to share their concerns and opinions with the City of Hermosa Beach via survey questions embedded in the VR and sign up to receive more information about climate action underway and how to get involved.

Example of Phase 3 Engagement Activities

CITY OF LONG BEACH

Climate Action and Adaptation Plan

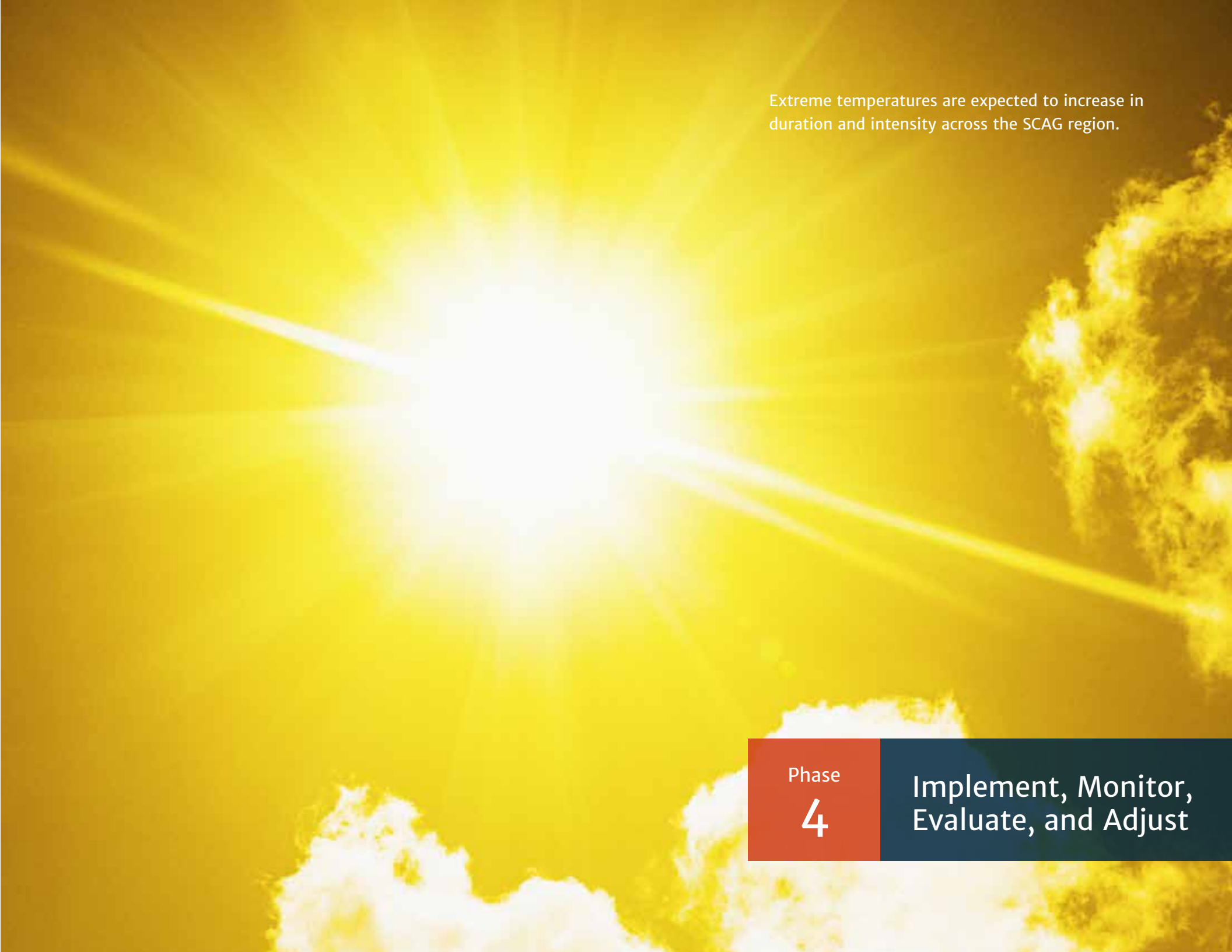
Flooding Actions (Coastal + Inland)

Long-Term (2050-2100)

Long -Term Actions 2050 - 2100 *Physical (see map at right)*	
13. Continue to nourish beaches	Based on findings from beach characterization, public beaches identified as suitable could be nourished so that they are expanded and preserved.
14. Construct living shoreline/berm	The shoreline could be elevated to be in with the landscape and park facilities to prevent flooding of inland areas while continuing to provide beach access.
15. Elevate/extend curb	The curb could be elevated and extended to eliminate gaps that could become flood pathways.
16. Elevate streets/pathways	Elevate waterfront streets and paths to provide protected transportation routes and flood protection for infrastructure behind the roadway.
17. Retrofit/extend walls	The existing wall may currently provide some flood protection, but it is segmented and not designed for flood protection. It could be retrofitted or rebuilt to provide adequate protection against Sea Level Rise (SLR).
18. Retreat / realign parking lots	Relocate, reduce size, or realign parking lots to create buffers.
19. Extend/upgrade existing seawalls	Sheet pile seawalls could be expanded to other areas of the Naples community that are not being addressed by the current upgrade.
Long -Term Actions 2050 - 2100 *Informational*	**What it does**
20. Investigate feasibility of managed retreat	Explore managed retreat options for vulnerable shoreline infrastructure through land acquisition and relocation programs.
21. Evaluate feasibility of storm surge barrier at Alamitos Bay	Conduct a feasibility study to evaluate construction of a storm surge / tidal gate barrier at entrance to Alamitos Bay.

DEVELOPMENT SERVICES

CITY OF LONG BEACH



Extreme temperatures are expected to increase in duration and intensity across the SCAG region.

Phase 4

Implement, Monitor, Evaluate, and Adjust

PHASE 4

Implement, Monitor, Evaluate, and Adjust

Successful adaptation planning is an ongoing process that requires implementation, monitoring, reevaluation and adjustments. Implementation of adaptation actions will require continuous tracking to measure effectiveness. Changing conditions, the resources of partner stakeholders, changes in best available science, new technologies, new funding sources, and changes in community priorities will necessitate regular reevaluation of appropriate adaptation strategies and, potentially, identification of new strategies.

The final phase in the adaptation planning process focuses on implementation. Following the Phase 3 steps of determining goals and objectives, and identifying priority adaptation strategies, the project team should develop an implementation program that ensures the effectiveness of each strategy. The primary steps to Phase 4, as outlined in the California APG, are summarized in Figure 14 below. These four steps help keep the priority strategies on track, and allow for adjustments based on observations, changes in funding, new science, or changes in local governance and planning priorities.

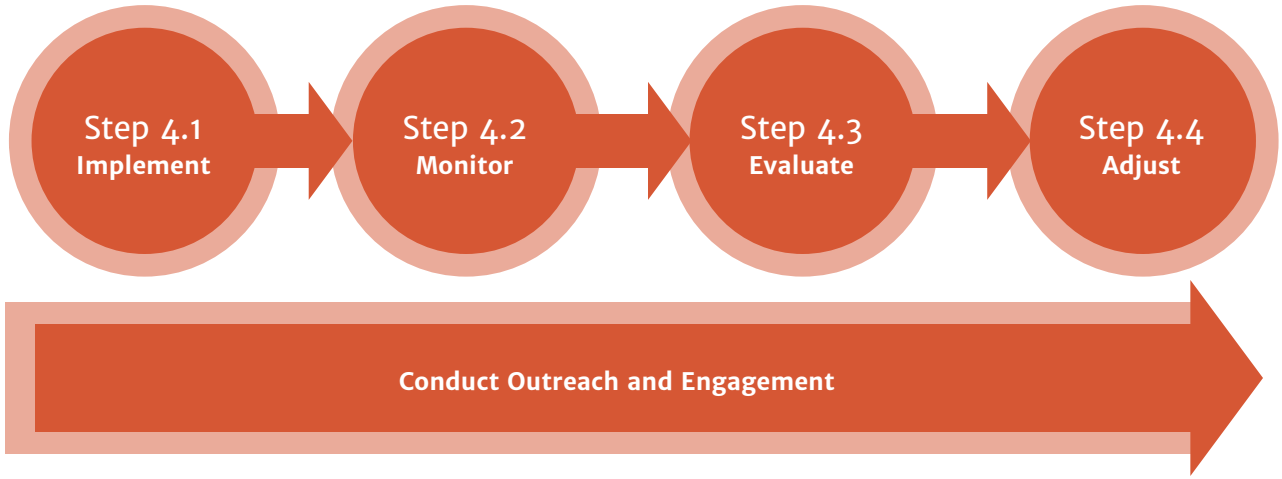


Figure 14

Steps in Phase 4

Step 4.1: Implement

Goal: Prepare an implementation program that identifies the actions that should be taken to facilitate implementation of adaptation strategies.

Materials to Prepare

- Prepare an Implementation program that identifies timeline, responsible entity, staff lead, funding, public engagement and other mechanisms to carry out each adaptation strategy
- Update or adopt the plan identified under Task 1.1

Phase 4 begins with preparation of an implementation program, which at its core should identify the timeline and the agency, department, or entity responsible for implementation, along with the mechanisms needed to carry out each adaptation strategy. This involves assigning staff, developing programs or other measures, identifying partner agencies and stakeholders, securing funding, and engaging the public. In addition, this step typically involves review of existing planning documents or other mechanisms that are best suited for implementation of each strategy, as well as any documents that would need to be amended to ensure consistency.

The Regional Resilience Toolkit provides a good discussion of best practices to adhere to when developing implementation programs, including tips on building political support, finding funding, leveraging existing projects and processes, and synergizing efforts with stakeholders and partners. The Toolkit offers the following best practices to adhere to when developing implementation programs:

1. **Foster political buy in** by building a supportive political climate and addressing the concerns of elected officials or other decision makers.
2. **Seek sustained commitment** from elected officials, department heads, city administrators, and city managers.
3. **Focus actions where the money is** and select actions that align with funding priorities.
4. **Piggyback on successful local projects** that align with existing community priorities, which should have been identified early on in the project.
5. **Use existing processes, groups, or sources of funding** that can be adapted to include actions that advance resilience.
6. **Consider the city's partners**, including the owners, regulators, partner agencies and stakeholders, and users of assets that need retrofitting, moving, or rebuilding. Create more realistic solutions by identifying and engaging with all involved stakeholders from the beginning.
7. **Do not be afraid to build something new**, as it sometimes makes more of a statement and political splash to create an entirely new effort, especially if the effort can garner a lot of excitement and involvement from a wide variety of stakeholders.

See the City of Laguna Woods example of an implementation plan.

The following list, adapted from the California APG, identifies local plans that may be relevant to establishing the policy, regulatory or procedural framework to facilitate implementation of adaptation strategies:

- **General Plan.** The general plan's primary location for addressing climate hazards and adaptation is the safety element, but adaptation goals and policies are also relevant to include in elements focused on land use, circulation, conservation, open space, housing, air quality, and environmental justice.
- **Local Hazard Mitigation Plan.** LHMPs include both long-term and short-term hazard mitigation planning. They should be consistent with the general plan's safety element.
- **Climate Action/Adaptation Plan.** The local agency may have a dedicated climate adaptation plan or it may have a climate action plan focused on greenhouse gas reduction, with a section or chapter devoted to climate change adaptation that includes strategies for increasing community resilience. Some agencies, such as the City of Long Beach, fully integrate greenhouse gas emissions reduction and climate change adaptation into a single planning document. These types of documents typically discuss implementation issues, including assigning responsible entities, funding, and indicators for monitoring.
- **Sustainability Plan.** Like climate action plans, sustainability plans tend to be broad strategic plans where climate change adaptation is often a component, covering strategies and implementation issues.
- **Local Coastal Program.** A local coastal program is a policy and regulatory document that is intended to protect coastal resources and maximize public access to the shoreline. Coastal communities can incorporate climate change adaptation policies and regulations to address climate change hazards, particularly impacts associated with sea-level rise.
- **Capital Improvement Plan.** A local government's capital improvement plan (CIP) is a short-range plan that identifies and forecasts funding for capital improvement projects, prioritizes improvements based on funding available, and estimates a timeline for completion of individual improvements. The CIP typically links capital expenditures to other long-range plans, such as the general plan or hazard mitigation plan, and connects community goals to priorities for public spending. With its emphasis on project implementation, a CIP can help facilitate the inclusion of climate hazard mitigation into project identification, prioritization, and design.

- **Integrated Regional Water Management Plan.** Integrated regional water management (IRWM) plans, required by Senate Bill 1672 (2002), address water demand and supply, water quality, flood protection, and other water-related matters at a regional level. The California Department of Water Resources' IRWM planning guidelines require the inclusion of climate change considerations in IRWM planning analyses. This is particularly relevant for areas like the Salton Sea where watershed issues fall under several local, regional and state agencies.

In addition, a local government's administrative policies, procedures, and initiatives can be amended to direct local agency staff efforts toward implementation of certain adaptation strategies, such as participating in regional coordination efforts, engaging with state and federal agencies in planning and funding strategies, monitoring climate change indicators and tracking implementation, and facilitating public outreach and education programs.

MODEL POLICIES FOR THE GENERAL PLAN AND LOCAL COASTAL PROGRAM

SCAG has developed a large suite of model policy language to address climate adaptation in general plans. The model language has been organized to fit within the following elements, but the local agency can use its discretion for choosing the appropriate element: Safety, Circulation, Land Use, and Environmental Justice. Model policies have been crafted to address the climate hazards anticipated in the SCAG region. SCAG has also collected policy language from local coastal programs that address sea-level rise hazards. The general plan and local coastal program model policies were derived to be consistent with the adaptation strategies and actions included in the Adaptation Strategies Matrix introduced in Step 3.3. The model policies are meant to be used as a starting point and should be refined to suite the unique context of each local community.

EXAMPLES OF CLIMATE ADAPTATION POLICIES BY CITIES AND COUNTIES IN THE SCAG REGION

SCAG conducted a survey to identify the cities, counties, and tribal governments that have adopted or are in the process of adopting climate adaptation policies as part of their general plans or stand-alone plans. The report titled Gap Analyses of Existing Countywide Climate Change Vulnerability Assessments and Climate Adaptation Policies in the SCAG Region is available in Appendix C. The results are also available in map form here: https://www.arcgis.com/apps/webappviewer/index.html?id=c2cf117ec7c047b29273f9b82c0b678f

Consider consulting these resources when refining your goals and objectives to review example policy language drafted or adopted by communities in the SCAG region.

PROJECT CHECKLISTS FOR INCORPORATING CLIMATE CHANGE ADAPTATION ELEMENTS INTO LOCAL PROJECT APPROVAL PROCESSES

To assist with implementation of climate adaptation as part of project siting, design and operation, SCAG prepared a set of checklists for the following hazards:

- Drought
- Inland Flooding
- Sea-level Rise/Coastal Flooding
- Extreme Heat
- Landslide
- Wilidlife

These checklists are intended to help project proponents and city planning staff consider climate change hazards and vulnerabilities during the permit review and approval process, and incorporate elements or design changes to ensure projects are resilient to the anticipated impacts of climate change.

Funding

Finding adequate funding to implement adaptation strategies is an ongoing challenge. As mentioned at the end of Chapter 1, the most significant source of funding is from integrating climate adaptation into existing local agency expenditures. In terms of new funding, there are state and federal grant programs currently available to support both adaptation planning and strategy implementation.

Additional funding programs are likely to emerge in coming years as more and more communities experience the impacts of climate change. Over time, communities should develop a layered funding strategy that uses local investments to leverage regional, state, and federal grants, and loans, as well as private sector investments. The variety of tools that local agencies can utilize to generate adequate funds are summarized in the table below.

Table 4.1: Local Revenue Sources for Climate Adaptation

Revenue Source	Applicability to Climate Adaptation	Revenue Potential	Ease of Authorization
Financing Districts[1]			
Benefit Assessments[2]	NARROW: Must provide direct benefit to assessed parcels	LIMITED: But critical to leverage funding from directly benefitting property owners	MODEST: Majority district property owner approval weighted by assessment[3]
Community Facilities District Special Tax (Mello Roos)	MODEST: Wide range of facilities & services; but must benefit taxed parcels		MODEST: 2/3 district property owners[3], or 2/3 voter approval if more than 12 voters in district
Property Tax Increment[4]	BROAD: Facilities (no services), environ-menttal mitigation	LIMITED in the short run; INCREASING over time with new development	SIMPLE: Governing board approval subject to majority protest by property owners
Local/Regional Public Enterprises			
Water, Sewer & Refuse Charges	NARROW: Must support enterprise operations	MODERATE to SIGNIFICANT: Depends on climate adaptation priorities relative to other enterprise needs	SIMPLE: Governing board approval subject to majority protest by ratepayers
Sea & Airport Revenues			SIMPLE: Governing board approval

Table 4.1: Local Revenue Sources for Climate Adaptation

Revenue Source	Applicability to Climate Adaptation	Revenue Potential	Ease of Authorization
Jurisdiction-wide (Cities, Counties & Special Districts)			
Ad Valorem Property Tax (G.O. Bond)	MODEST: Limited to capital projects	MODERATE to SIGNIFICANT: Depends on tax rate and size of tax base	DIFFICULT: 2/3 voter approval, except school bonds require 55 percent
General Tax[5]	BROAD: Any government purpose		MODEST to DIFFICULT: Majority voter approval[6]
Special Tax[5]	BROAD: Restricted to approved uses		DIFFICULT: 2/3 voter approval[6]
Property-Related Charges	NARROW: Must directly benefit property (includes storm water management)	LIMITED to MODERATE: Services must direct benefit property	MODEST: Majority property owner approval
Gas Tax, Highway Tolls & Bridge Tolls	NARROW: Transportation Facilities & Services	MODERATE to SIGNIFICANT: Depends on tax rate and size of tax base	DIFFICULT: Gas tax = 2/3 voter approval by county / Highway tolls = state legislation / Bridge tolls for SF Bay area = majority voter approval in 9 counties
Development Exactions[7]	MODEST: Wide range of facilities; but must benefit new development	LIMITED: Dependent on new development	SIMPLE: Governing board approval
User Fees	NARROW: Limited to cost of service used by payer	LIMITED: Only for use of a public service such as permit inspection fees, park & rec. fees, etc.	SIMPLE: Governing board approval

Note regarding debt financing: all revenue sources can be used for debt financing except (1) business-owner based business improvement districts (BIDs), (2) development exactions, and (3) user fees. General taxes cannot be used to service debt but can support an installment sale or lease agreement to fund capital facilities over multiple years, essentially equivalent to debt financing.

1 Financing districts are funding vehicles created by a local agency (city or county) for a defined geographic subarea within the agency's jurisdiction.
2 California law includes a wide variety of enabling statutes for local agencies to levy special assessment for services and facilities such as: business area improvement, geological hazard abatement, landscape and lighting, municipal improvement, open space maintenance, parking, and tree planting.
3 Vote is weighted by amount of each voter's assessment or special tax. Business improvement districts (BIDs) are an exception in that the levy is assessed on business owners (building tenants), not property owners, unless the district is a property-based BID (PBID).
4 California law includes several enabling statutes for local agencies to use property tax increment such as Enhanced Infrastructure Financing Districts (EIFD) and Community Revitalization and Investment Authorities (CRIA).
5 Restricting expenditures makes a tax a special tax, otherwise it's a general tax. Taxes include the parcel tax, sales tax, utility user tax, transient occupancy (hotel) tax, real property transfer tax, and business license tax,
6 For a general tax, some agencies have used a companion ballot measure specifying a non-binding expenditure plan, similar to a special tax but without the two-thirds voter approval requirement. Recent appellate case law suggests that special tax measures require only a majority vote if placed on the ballot by citizen petition, rather than the elected governing body.
7 Includes any payment of funds or dedication of public facilities required as a condition of development, such as development impact fees, development agreements, and community benefit agreements.

Identifying the avoided costs and other fiscal benefits of implementing adaptation strategies, particularly for those adaptation strategies that are costly, may facilitate public acceptance to secure support for new revenue sources. Addressing climate change hazards ahead of time is typically more cost-effective than responding after the impacts have occurred. See the Financing & Funding Climate-Safe Infrastructure developed as part of SCAG's Regional Climate Adaptation Framework for a detailed list of funding sources, available **here**:

Additional Tools and Resources for Implementing Adaptation Strategies

- The **Regional Resilience Toolkit** describes the usefulness of both short and long-term implementation plans and includes examples of both types of plans. Additionally, Appendix A includes a sample agenda for an advisory group meeting to discuss implementation plans, funding, and determine roles for implementation. Worksheet 3.5, Strategy Development and Implementation, provides a tool for the project team to identify and discuss key implementation considerations such as funding, timeline, staff leads etc.
- The **Gateway Cities Climate Action Planning Framework** includes Climate Adaptation Model General Plan Language, along with sample implementation actions and programs, to help cities integrate climate change adaptation into their climate action plan, general plan, and/or LHMP, and meet the requirement of State legislation (i.e., SB 379).
- **OPR's Climate Adaptation Finance and Investment in California** includes a chapter on funding and financing implementation with guidance for local governments regarding options for bonds and taxes. It also includes grant programs by asset type from state and federal agencies. It is intended to provide a survey of issues, considerations and sources of funding that can help guide strategies and tactics for investing in adaptation and resilience in California.
- AECOM partnered with Resources Legacy Fund to produce **Paying for Climate Adaptation in California: A Primer for Practitioners**, a report that synthesizes information local decision-makers need when thinking about funding and financing climate adaptation. The report offers a foundational understanding of existing constraints and opportunities and recommends ways cities, counties, water districts, utilities, state agencies, private companies, and other entities can make adaptation and resilience investments.17 The AECOM report categorizes funding opportunities into Grants and Assessments, Taxes, Fees, and Private involvement.
- The Adaptation Clearinghouse's **"Investing in Adaptation"** web page lists funding opportunities by adaptation sector.
- **The California State Library** lists funding opportunities resulting from recent legislation.

Example of Climate Adaptation Implementation Plan

CITY OF LAGUNA WOODS

Climate Adaptation Plan (2014)

Table 7: Work Plan Key

Cost				Coordination		
$	$$	$$$	$$$$			
Low (less than $25,000)	Medium-low ($25,000–$49,999)	Medium-high ($50,000–$99,999)	High ($100,000 or more)	Low	Medium	High

Table 8: Work Plan

Implementation Action	Costs and Coordination		Potential Funding Sources	Other Local Actions Implemented	Status/Effectiveness
1.1.1: Amend the Emergency Operations Plan to include an Extreme Heat Annex.	One-time costs	$	General Fund; grants for disaster preparedness, climate adaptation, public health, etc.	**LHMP**: Projects M, U, W, Y and Z **Safety Element:** Goals S-4 and S-5	
	Ongoing costs	$			
	Coordination	🧍🧍			
1.1.2: Adopt development standards to mitigate urban heat island effects.	One-time costs	$	General Fund	**LHMP**: Projects A, B, and M **Safety Element:** Goals S-4 and S-5	
	Ongoing costs	$			

Step 4.2: Monitor

Goal: Monitor changing climate and community conditions and track effectiveness of adaptation strategies.

Materials to Prepare

- Select indicators and adaptation metrics to track
- Establish a process to track and collect metrics

Due to the inherent uncertainty represented by climate change, monitoring the effectiveness of adaptation strategies and actions is essential to ensure that they adequately address community vulnerability and continue to be as effective as planned. In addition, as new information is available or conditions change (e.g., infrastructure degrades), cities and counties may need to revisit their risks and priorities, and possibly change course. Regular monitoring enables effective adaptive management of changing conditions and priorities.

Metrics and Indicators

The following types of indicators and metrics are useful in monitoring a community's adaptation to climate change:

- **Climate Change Indicators:** These indicators track changes to the climate and the associated impacts of climate events. There are multiple state, regional and academic entities that track these indicators.
- **Vulnerability Indicators:** These indicators track the community's exposure to climate threats, the sensitivity of the community to those events, and how suited a community is to adapt to climate threats.
- **Climate Adaptation Metrics:** These metrics track the community's progress towards planning for and mitigating climate threats.

The Regional Resilience Toolkit dedicates one of its five major adaptation planning steps to metrics and monitoring the success of implementation. This includes detailed guidance on how to develop good metrics that connect to goals, community values, and desired outcomes, while being feasible to track and provide truly useful information for those implementing a plan and making necessary adjustments over time to ensure effectiveness. It is important to consider that identifying too many metrics could lead to administrative burden that may outpace the city or county's ability to monitor the plan. According to the Toolkit, good metrics should be designed to do the following:

- Connect to goals, community values, and desired outcomes.
- Feasibly track information required to measure the metric. If the data is too difficult or expensive to track and gather, it does not help.
- Mean something and not simply a count. For example, a metric that indicates a number of people who receive training does not necessarily correlate to knowledge.
- Offer fewer, more meaningful metrics rather than a laundry list that will not be tracked.
- Provide data for accountability, guiding action, telling a story, and measuring success.
- Be adaptable and scale with the effort and do not become unwieldy.

CLIMATE ADAPTATION PERFORMANCE MONITORING FRAMEWORK

SCAG has developed a Climate Adaptation Performance Monitoring Framework based on the Adaptation Goals and Objectives presented in Phase 1, with suggested Climate Adaptation Metrics applicable to the SCAG region (see Appendix G). The suggested metrics are sample performance measures to help cities and counties measure progress towards each climate adaptation objective they pursue. The majority of the metrics provided are process-oriented metrics, which tracks what a local municipality does (e.g., update the General Plan Safety Element or dollars invested in climate adaptation programs). There are also outcome-oriented metrics which measure the progress towards a desired outcome (e.g., % of city with tree canopy).

Table 1. Climate Adaptation Performance Monitoring Framework

	Sample Adaptation Objectives	Sample Adaptation Outcome Metrics
Goal 1: Resilient Communities. All people and communities respond to changing average conditions, shocks, and stresses resulting from climate change in a manner that minimizes risks to public health, safety, and economic disruption and maximizes equity and protection of the most vulnerable.		
1	Identify populations that will disproportionally experience the consequences of climate change.	• Report prepared identifying disproportionally vulnerable populations to climate change • Report updated at every decennial census • Report updated subsequent to major update to CalEnviroScreen
2	Deepen and focus engagement with disproportionally vulnerable communities.	• $ invested in climate adaptation education • % of outreach budget targeting disproportionally vulnerable communities • % of materials translated into multiple languages • # of people engaged at community events in vulnerable communities • # of touch points / impressions • % of people aware of potential risks (based on targeted surveys)
3	Address underlying health inequities for all residents, including those related to hazards such as localized air pollution, extreme heat, and flooding; access to basic health services; and access to affordable and nutritious foods.	• # of partnerships established with local public health department, health providers and academic institutions • % of climate change educational materials that address public health • Population within 15 minutes of healthcare facility • # of hospital beds per 1000 residents • # of grocery stores with fresh produce per 1000 residents • # of farmer markets per 1000 residents • # of acres of farmland conserved • % reduction in food desert area

Ideally, these factors should be considered during the goals and strategy development process outlined in Step 3.3, when one should start thinking about metrics and indicators that can be used to monitor implementation progress. In developing goals and objectives, using a S.M.A.R.T. approach (ensuring they are Specific, Measurable, Achievable, Relevant, and Time-based) is easier to identify and align useful metrics. Broader goals may require more discussion about specific and useful metrics and may require multiple, phased metrics (i.e., a measurement that changes over time) to help measure progress.

Once indicators and metrics have been selected, the entity responsible for collecting and tracking the data should be assigned. This can be a local agency department, regional entity, or community group. One department should be designated for collecting information from the monitoring entities in order to conduct an overall assessment of effectiveness at regular intervals.

Additional Tools and Resources for Monitoring Adaptation Strategies

- **Appendix A of the Regional Resilience Toolkit** describes the role of monitoring metrics in building support for projects and programs, attracting funding, and tracking progress of resilience measures. The "Measure" chapter of Appendix A identifies considerations for developing metrics such as identifying available data to track progress.
- The **Gateway COG Climate Adaptation Model General Plan Language** document includes example equity focused metrics to monitor the extent to which strategies and actions account for and serve disadvantaged communities.

Step 4.3: Evaluate

Goal: Prepare a monitoring report that collects data being tracked and evaluates progress in achieving intended adaptation outcomes.

Materials to Prepare

Monitoring report that compiles the results of data collected and tracked under Step 4.2 and identifies any major changes in climate science, best practices, community characteristics, and community priorities

Data collected and tracked under Step 4.2 should be regularly evaluated to determine if adjustments are needed to the adaptation strategies. In addition to tracking the metrics from Step 4.2 and evaluating their effectiveness in achieving intended outcomes, current climate science, best practices, community characteristics, and community priorities should be regularly evaluated to determine if adjustments to the adaptation strategies and vulnerability assessment are needed. *See County of Los Angeles example.*

Climate science is constantly evolving. The Intergovernmental Panel on Climate Change updates climate science and global adaptive needs every five to seven years. The state updates the Safeguarding California Plan and Climate Change Assessment every few years. Best practices may alter as science and technology changes, and as we learn more after each climate-exacerbated hazard event. Changes in community characteristics can be evaluated to determine if there are changes in exposure or adaptive capacity that increase the vulnerability of populations or assets, or expose new community populations or assets to hazards. If there are adaptation strategies that are meant to be implemented once a specified threshold is reached (see Adaptive Pathways approach under Phase 3), evaluation will be necessary to determine if the threshold has been reached and the strategy is triggered.

Example of Annual Worksheet Evaluating Changes in Conditions

LOS ANGELES COUNTY

Local Hazard Mitigation Plan

2019 AHMP - Annual Review Worksheet				
HMP Section	**Questions**	**Yes**	**No**	**Comments**
PLANNING PROCESS	Has your County department/agency (or other type of organization) done any public outreach activities regarding the AHMP or a mitigation project? If yes, please describe.			
	Has your County department/agency (or other type of organization) integrated any of the AHMP's elements into other plans or policies? If yes, please describe.			
HAZARD IDENTIFICATION	Has a disaster occurred in this reporting period that affected your department/agency (or other type of organization)?			
	Do you know of new hazard studies, reports and/or mapping available for Los Angeles County? If so, what are they?			
RISK ASSESSMENT	Does your County department/agency have any new critical assets that should be included in the 2024 AHMP risk assessment?			
	Have there been changes in development trends that could create additional risks?			
MITIGATION STRATEGY	Are there different or additional resources (financial, technical, and human) that are now available for mitigation planning?			
	Should new mitigation actions be added?			

Step 4.4: Adjust

Goal: Determine if adjustments are needed to improve the effectiveness of adaptation strategies.

Materials to Prepare

Revised adaptation strategies, vulnerability assessment, or related implementation tools

Based on the results of the evaluation process under Step 4.3, it may be appropriate to make adjustments to the adaptation strategies, vulnerability assessment, or the related implementation tools that facilitate progress towards adopted goals. The Regional Resilience Toolkit identifies the following reasons for adjusting course:

- The strategies were successfully implemented and new priorities are needed.
- Implementation is not achieving the results expected.
- The strategy has an unintended consequence.
- Funding has changed.
- Political and/or public priorities have changed.
- New climate science data is available.
- Other significant changes in the environment or circumstances.

Adjustments do not necessarily need to be extensive, requiring a full rewrite of an adopted plan. It is more practical to focus the adjustments to be as narrow as possible.

Phase 4 Outreach and Engagement Considerations

Outreach and engagement during the implementation phase will bolster community support and understanding for climate adaptation. It will also provide opportunity for the community to influence the timing and approach to adjustments in order to improve the effectiveness of the adaptation strategies. Maintaining partnerships with community members and stakeholders established during Phases 1 through 3 will facilitate communication and transparency during Phase 4. Outreach and engagement opportunities are identified below for each step:

Step 4.1 Implement: As outlined in the California APG, the community and stakeholders can be sought in the following roles:

- Collaborators in education.
- Participants and facilitators of tours of adaptation projects as they are implemented.
- Recipients of surveys to assess effectiveness and social acceptance.
- Receptors or generators of online updates of adaptation progress.
- Participants or leaders of pop-up booths at locations illustrating adaptive action or community events.

Step 4.2 Monitor: Publish and share reports of the results of monitoring efforts to maintain awareness of the effectiveness of adaptation strategies and local adaptation needs. This data should be communicated to members who are expected to be the most vulnerable to climate-related hazards. As outlined in the California APG, some sample actions are:

- Document lessons learned during the planning process and ensure that future planning processes take the lessons into consideration.
- Have a community advisory board lead monitoring and review of the plan, or partner with a university or college program to do this.
- Identify mechanisms for holding agencies and departments accountable.
- Use "open data" online platform approaches to sharing climate, project implementation, and equity information with community members.
- Define and regularly measure a series of equity-related indicators.
- Develop a reporting system (e.g., online) to communicate results for the equity-related indicators through time.

See Los Angeles County example.

Step 4.3 Evaluate: Directly engage community members in evaluating monitoring data through committees or engagement with community organizations, particularly representatives of vulnerable populations. This will foster a better understanding of the progress made in climate adaptation and issues that remain to be resolved. California APG recommends establishing clear avenues for recourse and accountability of project implementation to increase transparency and the ability for the community to influence the outcome.

Step 4.4 Adjust: Engaging with the community throughout Phase 4 tasks, including the tracking and reporting of data in a transparent fashion and engaging community members in evaluating the effectiveness of adaptation strategies, will be critical to sustaining ongoing adaptation. Sustained engagement will also help to avoid any surprises when adjustments are made. The California APG outlines the following engagement and outreach actions:

- Ensure that lessons learned and outcomes from review and monitoring of implementation are publicly available.
- Use data to inform plan updates and/or make any needed course corrections.
- Develop materials allowing for pop-up events to solicit feedback and ideas for strategy adjustment when needed.
- Collaborate with the community to update strategies and program implementation based on lessons learned from monitoring.

Example of Engagement with Vulnerable Populations

LOS ANGELES COUNTY

Climate Action Plan and Safety Element Update (2020)

If you are a senior or electricity dependent resident living in the following communities and have experienced or started to prepare for future wildfires, please join our focus group!

Los Angeles County Dept. of Regional Planning (DRP) is holding focus groups to learn how seniors and electricity dependent residents (for medical or disability reasons) are adapting to climate induced wildfires. Vulnerable populations, like seniors and electricity dependent residents, living in wildfire hazard areas are more at risk. We would like to hear about your experience about the changes you've made to your life to prepare for future wildfire events.

Seniors Focus Group – Online Zoom Meeting
Date: Tuesday May 12, 2020
Time: 5:00 – 6:30 pm
Sign up here: https://bit.ly/3fpDHQk (https://bit.ly/3fpDHQk)

Electricity Dependent Residents Focus Group – Online Zoom Meeting
Date: Tuesday May 26, 2020
Time: 5:00 – 6:30 pm
Sign up here: https://bit.ly/2L3Grou (https://bit.ly/2L3Grou)

For more information email: climate@planning.lacounty.gov (mailto:climate@planning.lacounty.gov)

Figure 15

California Adaptation Planning Guide's Four Phases of Adaptation Planning

Conclusion

The process to prepare for climate change outlined in this guide is intentionally designed to be cyclical, with implementation of Phase 4 eventually triggering the need to begin anew with Phase 1. Climate conditions, best practices, funding programs, and community values are expected to change over time, necessitating substantive updates to vulnerability assessments and adaptation strategies. State legislation also mandates regular updates to make sure planning documents reflect current and projected future conditions.

Access the Climate Adaptation Framework **website** for additional tools and resources.

SOUTHERN CALIFORNIA CLIMATE ADAPTATION PLANNING GUIDE

October 2020

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