



City of
SACRAMENTO

Climate Action & Adaptation Plan



Public Review Draft

April, 2023





PREPARED FOR

City of Sacramento

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ACRONYMS, ABBREVIATIONS, AND GLOSSARY

A

AB – Assembly Bill

Actions – The implementable steps that together will achieve a Measure goal.

Active Transportation – Includes walking, biking, skating/rolling.

Adaptation – Improving the durability of community infrastructure and/or services to withstand climate change impacts (e.g., floods, extreme heat, etc.).

Adjusted Forecast – Adjusted version of a BAU forecast to account for State- and federal-level legislation and policies that are expected to reduce emissions for all jurisdictions in California.

ADU(s) – Accessory Dwelling Unit(s)

Affordable by Design – Describes a dwelling unit that is affordable to residents making less than 120% of the area’s median income by virtue of its design rather than government subsidy (include ADUs and small dwelling units).

Albedo – Reflectivity; the proportion of light or radiation that is reflected by a surface

AMBAG – Association of Monterey Bay Area Governments

ARI – Asian Resources, Inc.

B

BAU Forecast – Business-as-Usual Forecast; estimates how Sacramento’s emissions would change based on current activities and projected growth in population and jobs.

C

CAAP – Climate Action and Adaptation Plan

CAP – Climate Action Plan

CARB – California Air Resources Board

Carbon Neutrality – Carbon neutrality means balancing the emissions created within the City (e.g., through combustion of gasoline or usage of electricity) with the emissions sequestered (e.g., through carbon absorbed in trees or soils) within that boundary. For Sacramento to achieve carbon neutrality, all emissions will need to be offset by sequestered emissions.

Carbon Sequestration – The process of capturing, securing and storing carbon dioxide from the atmosphere.

CBO – Community-Based Organizations

CCA – Community Choice Aggregation

CEQA – California Environmental Quality Act

CH₄ – Methane

Climate Action Targets – Community-level GHG emissions reduction goals for 2030 and 2045.



Climate Equity – The City of Sacramento defines climate equity as the equitable protection from climate change impacts and environmental hazards (e.g., extreme heat, increased energy prices, etc.), as well as access to environmental benefits for all communities (e.g., programs, policies, and projects that mitigate climate change impacts). This means developing programs, policies, and projects that target historically under-resourced communities within Sacramento, according to the understanding that these communities have been historically disadvantaged by policies in the City, and in the United States more generally.

COPD – Chronic Obstructive Pulmonary Disease

CO₂ – Carbon dioxide

CRP – Community Resource Project

D

E

EF – Emissions Factor

EJ – Environmental Justice

EJCGC – Environmental Justice Collaborative Governance Committee

EJWG – Environmental Justice Working Group

Electrification – Conversion of fossil fuel equipment, such as a gas-fired furnace or gasoline-powered car to electric-powered equipment.

EO – Executive Order

EPA – United States Environmental Protection Agency

Equity or Just Transition – Refers to the transition from a consumption-based, extractive economy to a regenerative economy, with special consideration to address the past harm to frontline communities.

ESPC – Energy Savings Performance Contract

EV(s) – Electric Vehicles

F

Funding and Financing – Refers to the breadth of financial solutions available to fund projects or initiatives. Funding specifically refers to money provided or allocated for a particular purpose with no expectation of repayment. Financing specifically refers to money provided with the expectation of repayment over time, with interest (e.g., a loan).

Frontline Communities – Are those that experience continuing injustice—including people of color, immigrants, people with lower incomes, people experiencing homelessness or houselessness, differently-abled persons, seniors, and indigenous people—face a legacy of systemic, largely racialized, inequity that influences their living and working places, the quality of their air and water, and their economic opportunities.

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G

GHG(s) – Greenhouse Gas(es)

GHG Emissions Sector – A category of GHG emissions within a community that broadly describes where GHG emissions are coming from (e.g., transportation, buildings, etc.).

GWP(s) – Global Warming Potential(s)

H

HFC(s) – Hydrofluorocarbon(s)

HVAC – Heating, Ventilation, and Air Conditioning

I

ICLEI – Local Governments for Sustainability

Infill Growth – Rededication of land within an existing urban area to new construction to avoid expansion of the urban area.

Infiltration Capacity (of soil) – Maximum rate at which soils and rocks can absorb rainfall

IPCC – Intergovernmental Panel on Climate Change

J

K

Key Performance Indicator – A pre-defined and measurable success metric to concretely evaluate the success of an initiative.

L

LED – Light-emitting diodes; high-efficiency lightbulb technology.

Levee – An embankment built to prevent the overflow of a river.

LFLP – Local Food, Local Places

LHMP – Local Hazard Mitigation Plan

LID – Low Impact Development

M

Measure – Specific, data-driven opportunity for reducing GHG emissions in a specific sector.

Mobility – Movement of a person or people from place to place.

Mode share – Percentage of trips within a community attributable to a particular mode (or type) of transportation, such as car or bike.

MPOs – Metropolitan Planning Organizations

MT CO₂e – Metric Tons of Carbon Dioxide equivalent

N

NCDC – National Climatic Data Center

Net-energy Metering – A billing mechanism that credits solar energy system owners for the electricity they add to the grid.

N₂O – Nitrous oxide

O

OPR – Governor's Office of Planning and Research



P

PACE – Property-Assessed Clean Energy programs

PM_{2.5} – Particulate Matter

PPA – Power Purchase Agreement

Q

Qualified GHG Reduction Plan – A GHG reduction plan that meets the requirements of the California Environmental Quality Act (CEQA) Guidelines 15183.5(b) and acts as a tool for streamlining the CEQA process for new development that aligns with the plan.

R

Regional San – Sacramento Regional Sanitation District

RNG – Renewable Natural Gas

ROI – Return On Investment

RPS – Renewable Portfolio Standard

RWA – Sacramento Regional Water Authority

S

SacEV – Sacramento EV

SacRT – Sacramento Regional Transit

SB – Senate Bill

SB 1383 – A landmark waste mandate adopted by the State of California in 2016, which requires the State to reduce organic waste disposal 75% below 2014 levels by 2025 and increase edible food recovery 20%.

Small-lot Home – Equal to or less than 5,200 square feet for interior lots and 6,200 square feet for corner lots.

SMUD – Sacramento Municipal Utility District

T

TNC – Transportation Network Company (e.g., Uber, Lyft)

TSMP – Transportation System Management Plan

U

USDN – Urban Sustainability Directors Network

V

VMT – Vehicle Miles Traveled

W

Waste Diversion – Recycling or composting rather than sending waste to the landfill.

Weir – Low dam built across a river to regulate its flow.

X

Y

Z

ZEV(s) – Zero Emission Vehicle(s)



INTRODUCTION



Sacramento Climate Action & Adaptation Plan

The City of Sacramento's Climate Action and Adaptation Plan (CAAP) is a crucial step in the City's long-standing efforts to mitigate and adapt to climate change. The CAAP builds off the City's 2012 Climate Action Plan, the City's Climate Emergency Declaration, and incorporates recommendations from the Mayors' Commission on Climate Change. Recent events continue to emphasize the urgent need for

climate action. Developed over three years with extensive community engagement, the CAAP will position Sacramento to reduce greenhouse gas (GHG) emissions while adapting to the inevitable impacts that are already taking place.

In order to avoid the most destructive and costly impacts of climate change, the world must achieve carbon neutrality by the middle of this century.¹ With less than 30 years remaining to reach this goal, the CAAP sets new and ambitious targets for the City and identifies key strategies and actions that form the foundation of Sacramento's goal of achieving carbon neutrality by 2045.

1. International Panel on Climate Change (IPCC). (2022). *Special Report: Global Warming of 1.5°C*. Retrieved from: <https://www.ipcc.ch/sr15/>

CLIMATE ACTION & ADAPTATION PLAN

KEY CAAP TERMS

CARBON NEUTRALITY: Carbon neutrality means balancing the emissions created within the City (e.g., through combustion of gasoline or usage of electricity) with the emissions sequestered (e.g., through carbon absorbed in trees or soils) within that boundary.

CLIMATE EQUITY: The City of Sacramento defines climate equity as the equitable protection from climate change impacts and environmental hazards (e.g., extreme heat, increased energy prices, etc.), as well as access to environmental benefits for all communities (e.g., programs, policies, and projects that mitigate climate change impacts). This means developing programs, policies and projects that target historically under-resourced and low-income communities within Sacramento.

Coupled with the urgency to act, the City must center policies and actions around climate equity. Climate change is expected to most profoundly impact under-resourced communities. To ensure the equitable distribution of both short-term costs (through the targeted application of funding and financing) and long-term benefits (by prioritizing historically under-resourced communities during implementation) the CAAP was designed to help mitigate the upfront cost impacts to low-income communities that are associated with CAAP implementation and includes key actions and metrics to work towards a just and resilient future for Sacramento.



Sacramento Farmers Market



THE MAYORS' COMMISSION ON CLIMATE CHANGE

In 2019, the Mayors of Sacramento and West Sacramento convened a Commission on Climate Change to chart a path towards carbon neutrality by 2045. The Commission was made up of 19 representatives from major partners in the region. In addition, dozens of other leaders were engaged in technical working groups on the key topics of equity, mobility, the built environment, community health and resilience, and finance and funding. These technical reports fed into a final report (dated June 2020) from the Commission that outlines a high-level pathway towards carbon neutrality for Sacramento and West Sacramento.

These recommendations, which are summarized in *Figure 1-1* by topic area, became the foundation for CAAP development, providing the high-level guidance and leadership required to establish an aggressive yet implementable plan. From the high-level policy directions such as building electrification and increased mobility, the CAAP has developed specific actions that the City will take to make progress towards the carbon neutrality goal and the targets identified by the Commission. *Chapter 5 and Chapter 6* provide additional detail on the CAAP's consistency with the intent and direction of the Mayors' Commission on Climate Change recommendations.²

MAYORS COMMISSION ON CLIMATE CHANGE FOUNDATIONAL PRINCIPALS

URGENCY: Take significant action in the short term

ADVOCACY: Advocate for State and regional policies needed to achieve zero carbon

ACCOUNTABILITY: Assign dedicated senior level support to climate action

EDUCATION: Educate the public and stakeholders on addressing climate change

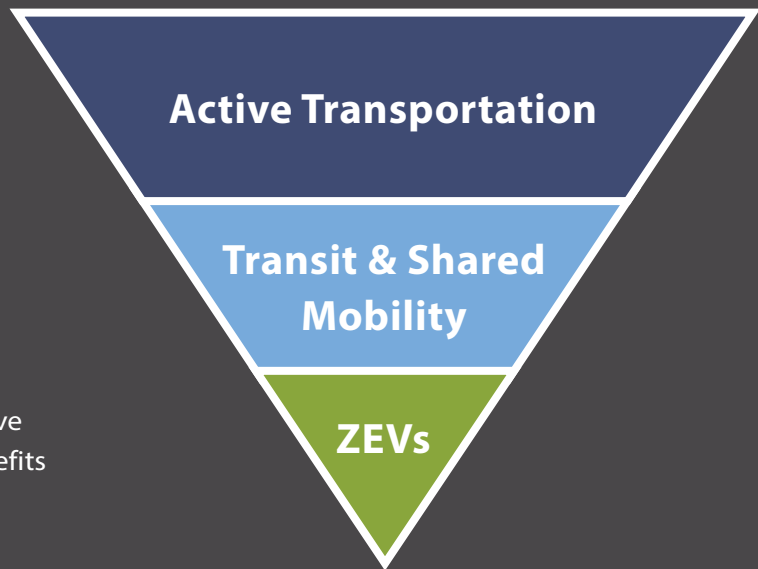
FINANCIAL AND ECONOMIC SUSTAINABILITY: Prioritize actions that spur innovation, economic development, and jobs growth.

2. The complete Mayors' Commission on Climate Change Report can be found here, along with more information on the Commission, meeting materials, and recorded meetings: <https://www.legacy.civicwell.org/climatecommission/>

Figure 1-1. Mayors Commission on Climate Change Recommendations

MOBILITY

Investments to reduce emissions stemming from the Mobility sector, the largest source of emissions for both Sacramento and West Sacramento, should follow a funding priority hierarchy that first prioritizes active transportation, followed by transit and shared mobility, and finally ZEVs. Following this hierarchy will enable the cities to achieve equitable outcomes and deliver multiple benefits to communities.



Active Transportation

Expand and enhance accessibility to low-stress, connected infrastructure for walking and rolling, prioritizing improvements that address specific community and neighborhood needs so that:

- 30% of all trips are by active transportation by 2030.
- 40% by active transportation by 2045.



Transit & Shared Mobility

Expand and improve transit and shared mobility services to be more accessible, affordable, timely and attractive than single-occupancy-vehicle use so that:

- 30% of all trips are by transit and pooled shared mobility by 2030.
- 50% by transit and pooled shared mobility by 2045.



Zero-Emission Vehicles

Develop a comprehensive package of incentives, disincentives and policies to encourage the adoption of zero-emission vehicles (ZEVs) so that:

- 70% of new vehicle registrations will be for ZEVs by 2030.
- All public, private and shared fleets fully electrified by 2045.

BUILT ENVIRONMENT

The built environment strategy focuses both on sustainable land use (how development is sited and organized) as well as the decarbonization of new and existing buildings. The Commission also points out the importance of sustainable land use patterns in decreasing car travel and increasing transit and active transportation.



Sustainable Land Use

Support infill growth consistent with the regional Sustainable Communities Strategy to ensure that:

- 90% of the cities' growth is in the established and center/corridor communities and is 90% small-lot and attached homes by 2040.
- Project level VMT is 15% below (or 85% of) the regional average.



Electrification of New Construction

Mandate all-electric construction to eliminate fossil-fuel use in new low-rise* buildings by 2023 and all buildings by 2026**

**Low-rise defined as under 4 stories.*

***Provided that the costs to go all-electric are cost-effective including the incremental costs of electrical infrastructure upgrades and the technology has shown to be feasible.*



Electrification of Existing Buildings

Transition 25% of existing residential and small commercial buildings to all electric by 2030.

COMMUNITY HEALTH AND RESILIENCY

The strategies included in this sector highlight opportunities to avoid or reduce carbon emissions while achieving important public health and climate resilience benefits.



Urban Greening and Forestry

Expand green infrastructure to ensure that all neighborhoods, starting with historically marginalized communities and tree-deficient neighborhoods, have:

- Access to green space within a quarter-mile by 2030.
- A baseline canopy of 25% by 2030, and 35% by 2045.



Sustainable Food Systems

Increase food security and access to healthy, affordable food for all communities, while supporting a regenerative food system by:

- Access to green space within a quarter-mile by 2030.



Electrification of Existing Buildings

Transition 25% of existing residential and small commercial buildings to all electric by 2030.

EQUITY

Equity was at the center of the Mayors Commission on Climate Change recommendations. They stated that “Accessibility, inclusivity, and shared decision-making lie at the heart of these strategies. All of the recommendations should be interpreted through a clear and focused equity lens. In their drive to carbon zero, the cities should take targeted measures to ensure that those who are least culpable and resourced are not burdened by climate-action measures. Rather, they should work to ensure that these communities benefit the first and most by the investments, improvements and new jobs generated through climate action.” The core recommendations of the Commission on Equity included:

1. Operationalize equity by providing education, ensuring shared decision-making, and allocating resources that address historical and current disparities.
2. Authentically and inclusively involve marginalized communities and populations that have been historically left out of the policymaking and governance process as co-creators in all planning and implementation phases to ensure fair, equitable outcomes.
3. Expand the capacities of cultural brokers and community-based organizations that have established relationships with marginalized communities, leveraging existing community engagement efforts when possible.

The City of Sacramento used these recommendations to inform the development of the CAAP. Specifically, the City worked with the Environmental Justice Working Group to develop a list of equity considerations to more specifically define equity in the CAAP, conducted equity focused outreach and engagement, and utilized the equity criteria during the development of the CAAP measures and actions.





Climate Action Plan and Sustainability in Sacramento

Sacramento is a growing City with a long history of climate action and sustainability. This history helped guide the framework for the CAAP. As of 2016, Sacramento had reduced GHG emissions 19% since 2005.

Mobility

Sacramento has taken major steps to improve transit and active transportation opportunities. The City installed miles of new parking protected bikeways, improved crosswalks, opened the city to electric bike and scooter share, and provided free transit passes for youth. All of these efforts can shift City travel away from single occupancy vehicles and towards healthier and more sustainable options.

Electric Vehicles

Sacramento has been a leader in increasing electric vehicle (EV) adoption by expanding public and workplace charging stations (now over 600 citywide), adopting forward-thinking charger requirements for new construction, building innovative partnerships, and planning for a future of emissions-free and even self-driving cars.

Energy and Buildings

Sacramento has unique opportunities to transition the built environment away from fossil fuels. Between Sacramento's newly adopted new building electrification ordinance and the leadership of the Sacramento Municipal Utility District (SMUD), a carbon-free built environment is closer than historically thought. Now is the right time to start electrifying due to the combination of SMUD's low rates (some of the lowest in California), excellent rebates, and Sacramento's climate.

City of Trees

Sacramento is well known as the City of Trees, with more than 19% of the city covered by tree canopy. These trees provide numerous benefits to Sacramento by cleaning the air, sequestering carbon, reducing water runoff, and keeping temperatures manageable during extreme heat events. By expanding the canopy, especially in neighborhoods with low tree coverage, the City can increase carbon sequestration, address climate injustice, and build resilience to a changing climate.



Street in Midtown, Sacramento

CLIMATE ACTION & ADAPTATION PLAN

A QUALIFIED GHG REDUCTION PLAN

This CAAP provides a pathway for the City of Sacramento to reduce GHG emissions consistent with state goals. In particular, the CAAP Update was developed to exceed the requirements of Senate Bill (SB) 32, which calls for a reduction in statewide GHG emissions 40% below 1990 levels by 2030. The CAAP also demonstrates the City's plan for substantial progress towards consistency with the State of California's statewide policy goals for GHG emission reductions, as enacted by AB1279 and the California Air Resource Board's 2022 Scoping Plan for Achieving Carbon Neutrality which sets a path to achieve carbon neutrality by 2045 with at least 85% reduction in GHG emissions from 1990 levels.³ In addition, this CAAP will fulfill the requirements of the California Environmental Quality Act (CEQA) Guidelines § 15183.5(b) to be a "qualified" GHG reduction plan. Under CEQA, local agencies must evaluate the environmental impacts of new development projects, including impacts from GHG emissions associated with their construction and operation. This process can be cumbersome for local agencies and developers alike and may result in project delays. The CEQA Guidelines recognize this and provide an option for new development projects to streamline the analysis of GHG emissions under CEQA, a process called "tiering." As a qualified GHG reduction plan, the CAAP addresses six criteria per CEQA Guidelines § 15183.5(b)⁴, as follows:

1. Quantify existing and projected GHG emissions within the plan area (CAAP [Chapter 2](#) and [Appendix A](#))
2. Establish a reduction target, consistent with statewide GHG reduction goals (such as those established by SB32), that is achievable based on substantial evidence, below which emissions would not be considered cumulatively considerable. (CAAP [Chapter 3](#) and [Appendix C](#))
3. Identify and analyze sector-specific GHG emissions from Plan activities (CAAP [Chapter 5](#) and [Chapter 6](#) and [Appendix C](#))
4. Specify policies and actions (measures) that local jurisdictions will enact and implement over time to achieve specified reduction target (CAAP [Chapter 5](#) and [Chapter 6](#))
5. Establish a tool to monitor progress and amend if necessary (CAAP [Chapter 8](#))
6. Adopt in a public process following environmental review (Associated EIR Resolution XX)

This CAAP meets CEQA requirements for qualified GHG reduction plans and will provide the City of Sacramento and its developers a critical tool for streamlining development through 2030 (i.e., the horizon year associated with SB 32). The CAAP is also consistent with the City's General Plan Update, using the same population, housing, and VMT growth projections. The City considers this especially important, given the current need for new affordable housing. By developing a qualified GHG reduction plan the City has provided new construction a viable pathway through CEQA and provides a pathway for development to meet the long-term goals of the City in a cost-effective manner.

3. The details of SB 32 and EO B-55-18, as well as other relevant legislation, is included in [Appendix B](#).

4. https://www.califaep.org/docs/CEQA_Handbook_2023_final.pdf (Page. 262)



The Science of Climate Change

GHG EMISSIONS AND CLIMATE CHANGE

GHG emissions are molecules in the Earth's atmosphere that trap energy from the sun. This is called the greenhouse effect (See [Figure 1-2](#)). Historically, the greenhouse effect has made Earth warm enough to sustain life. However, since the Industrial Revolution, anthropogenic (human-caused) activities have increased the concentration of GHGs in the atmosphere, amplifying the greenhouse effect and causing a global change in climate patterns. Over 97% of climate scientists agree that climate change is occurring and that human activities are the root cause.⁵

At the community level, carbon dioxide (CO₂), methane (CH₄), and nitrous oxide (N₂O) are the most common GHGs, making up 97% of the GHG emissions generated in the United States.⁶ GHGs are predominantly released into the atmosphere via the combustion of fossil fuels or as a result of other chemical reactions. In cities, GHG emissions come from four main sectors: buildings, transportation, waste, and water. Building emissions are associated

with electricity and natural gas used by commercial, residential, and municipal buildings. Transportation emissions are generated by fuels used to power cars, trucks, and off-road vehicles. Waste generates methane emissions from trash (especially organic materials) decomposing in the landfill. Water-related emissions are generated by the electricity used to transport water for residential, commercial, and agricultural use, as well as emissions from wastewater treatment processes.

The International Panel on Climate Change (IPCC) projects that a reduction in GHG emission to carbon neutrality by mid-century or earlier is required to limit warming trends from climate change to 2.7 degrees Fahrenheit and limit the worst impacts of climate change.⁷



I Street Bridge and Downtown Sacramento

5. NASA. (2022). Scientific Consensus: *Earth's Climate is Warming*. Retrieved from: <https://climate.nasa.gov/scientific-consensus/>
6. World Resources Institute. (2022). *4 Charts Explain Greenhouse Gas Emissions by Countries and Sectors*. Retrieved from: <https://www.wri.org/blog/2020/02/greenhouse-gas-emissions-by-country-sector>
7. International Panel on Climate Change (IPCC). (2021). *IPCC Sixth Assessment Report Working Group 1: The Physical Science Basis*. Retrieved from: <https://www.ipcc.ch/working-group/wg1/>

CLIMATE ACTION & ADAPTATION PLAN

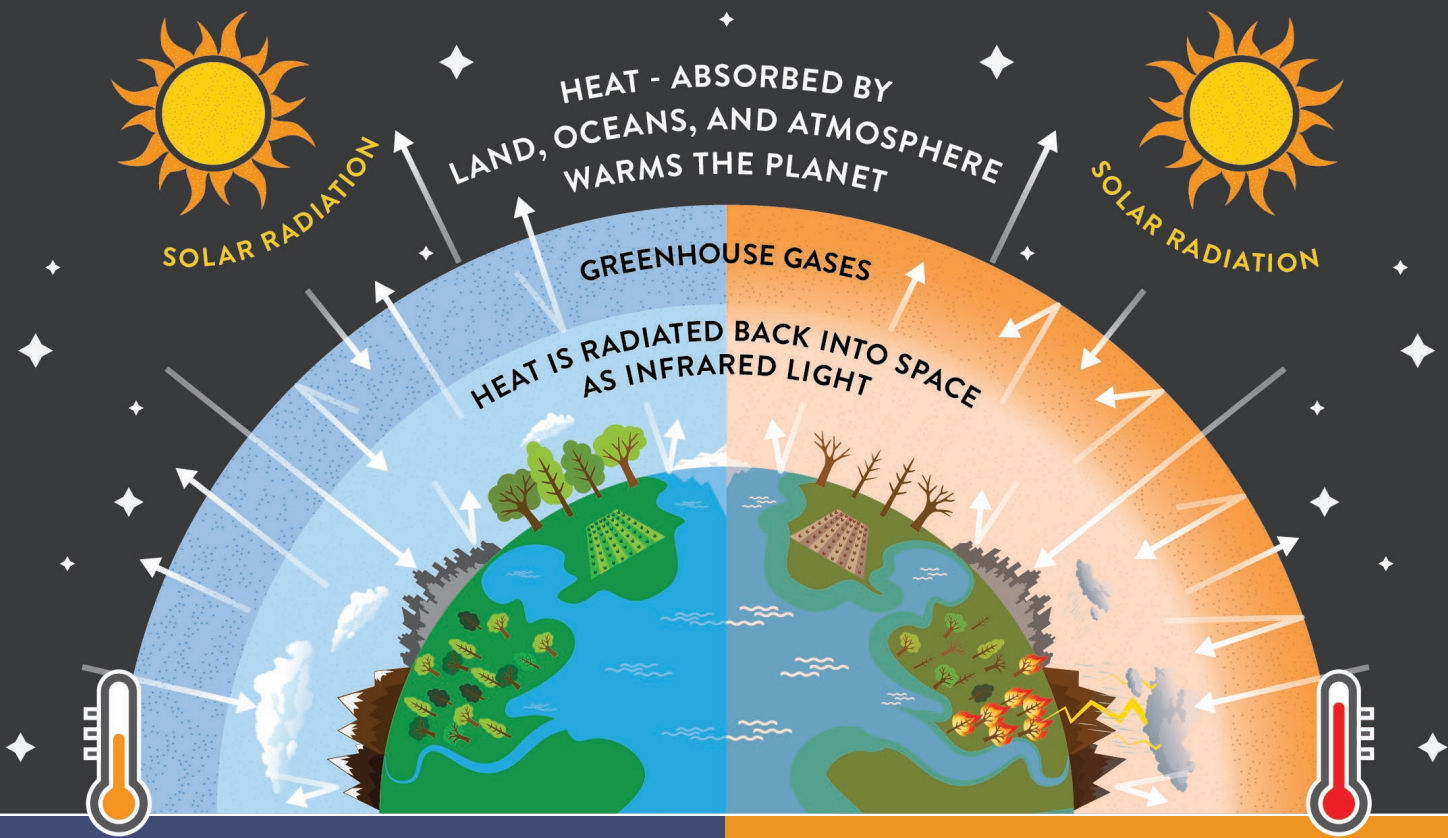
Figure 1-2. Greenhouse Effect

In the last century, human activities such as burning fossil fuels and deforestation have caused a jump in the concentration of greenhouse gases in the atmosphere.

THE RESULT: Extra trapped heat and higher global temperatures.

WITH NORMAL GREENHOUSE GASES

WITH INCREASED GREENHOUSE GASES



Some heat continues into space while the rest, trapped by greenhouse gases, help maintain the planet's relatively comfortable temperatures.

Increased greenhouse gases means less heat escapes to space. Between preindustrial times and now, the earth's average temperature has risen by 1.8°F (1.0°C).

**LESS GAS =
LESS HEAT TRAPPED IN THE ATMOSPHERE**

**MORE GAS =
MORE HEAT TRAPPED IN THE ATMOSPHERE**

Retaining more reliable:

- Weather
- Temperature
- Rainfall
- Sea Level

More intense:

- Storms
- Heat
- Drought
- Sea Level Rise



HOW WILL CLIMATE CHANGE AFFECT SACRAMENTO?

Climate change is projected to cause increasingly hazardous conditions for life on Earth, including increased heat waves, wildfires, drought, extreme storms, flooding, and sea level rise. In addition to these direct impacts, secondary impacts of climate change include adverse changes to biological resources and public health.⁸ The following section outlines the key climate risks expected in the Sacramento region, drawing on publicly available data produced by the Geospatial Innovation Facility at the University of California, Berkeley with funding and advisory oversight by the California Energy Commission and the California Strategic Growth Council, comparing the historical period to mid-century projections.

Temperature Increase

As GHG emissions increase, temperatures are also increasing globally, placing growing stress on human health, water resources, energy systems, and other assets. Sacramento's climate is no exception. Historically (i.e., pre-2005), the average annual maximum temperature in Sacramento has been 74.1°F.⁹ Temperatures are projected to increase by 4 to 5°F throughout Sacramento by mid-century (*Figure 1-3*). Under these conditions, Sacramento could experience hotter and significantly drier conditions. The effects of temperature increase are likely to be felt throughout Sacramento – especially in more densely developed areas with less green space – between May and October each year, with temperatures peaking in July and August. Therefore, these impacts are felt more acutely by under-resourced and lower income communities. Overall temperature increase can also lead to more frequent extreme heat days and heatwaves; the intensification of the urban heat island effect;¹⁰ greater heat-related illnesses such as heat stroke and heat exhaustion; and stress to infrastructure, as discussed below.

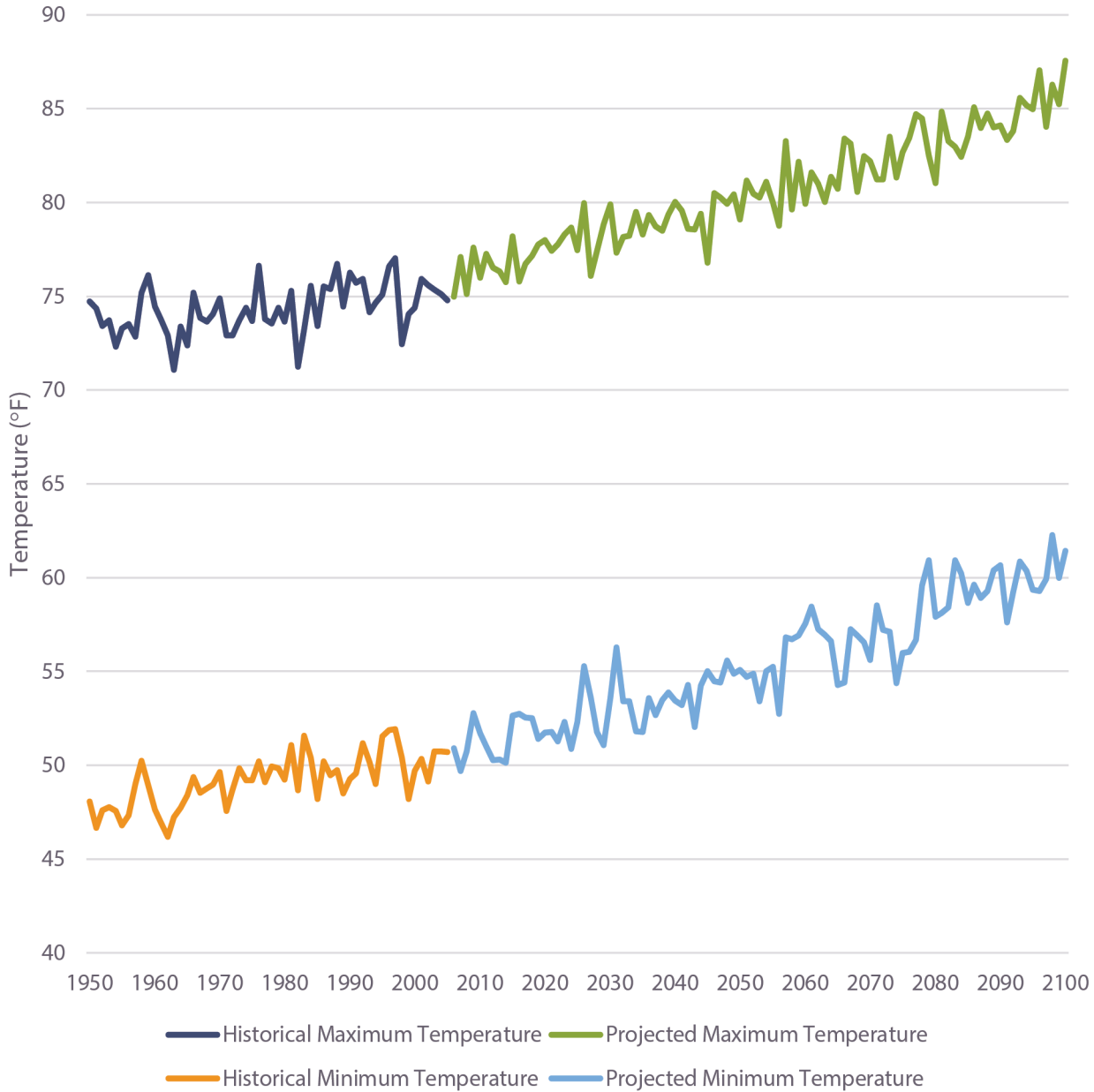
8. National Resources Defense Council (NRDC). (February 2019). *Climate Change and Health in California*. Retrieved from: <https://www.nrdc.org/sites/default/files/climate-change-health-impacts-california-ib.pdf>

9. Per Cal-Adapt, annual average maximum temperature is the average of the hottest (maximum) temperatures for every day in a year, calculated using each day's highest projected temperature and then averaging those daily highs across the entire year

10. Urban heat island effect occurs from higher levels of combustion and paved/built surfaces in urban areas, which retains heat in the urban area relative to less dense surrounding areas.

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Figure 1-3. Annual Average Temperature (°F) Changes in Sacramento



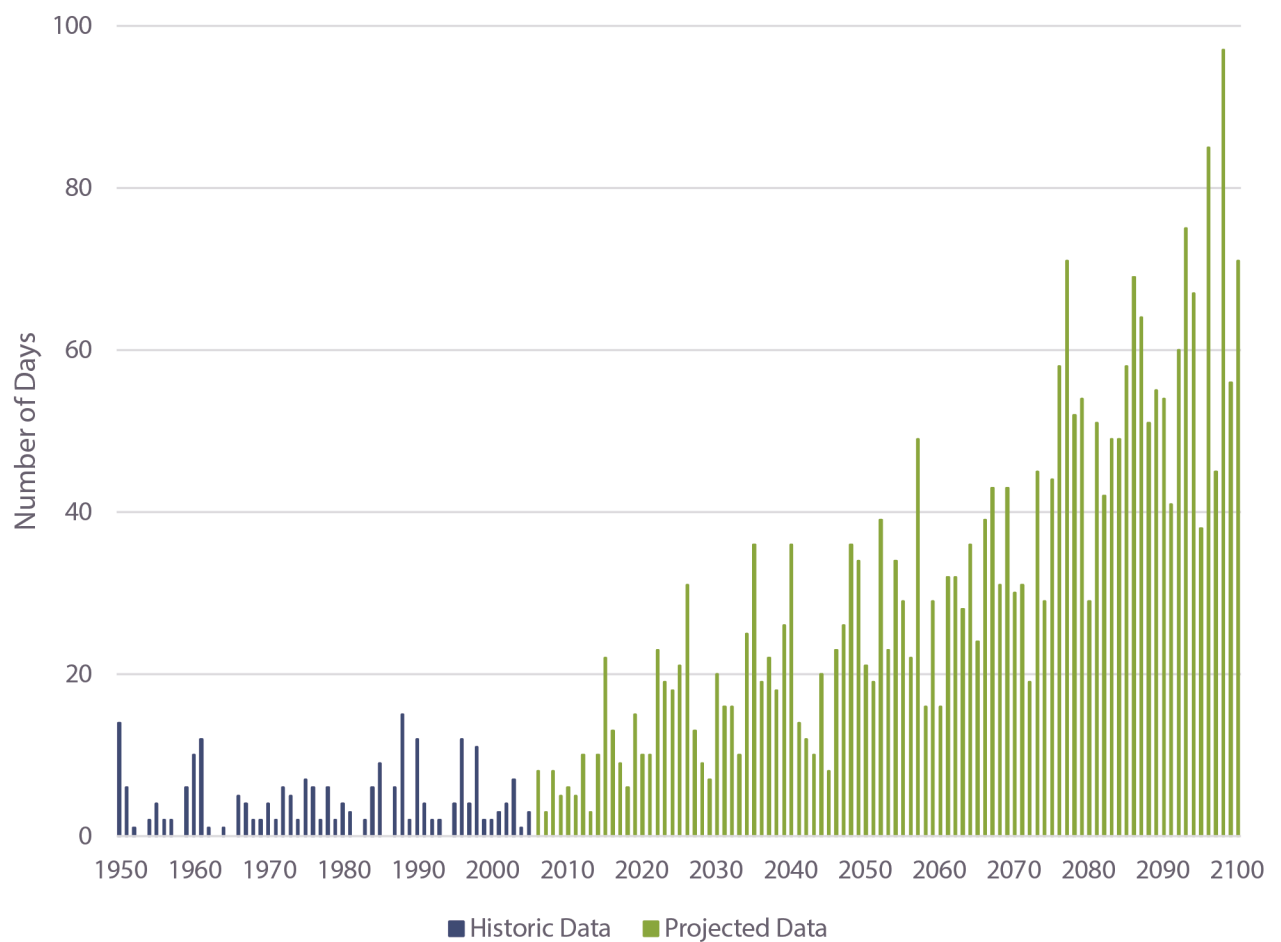


Extreme Heat Days

Historically (pre-2005), Sacramento has experienced about four extreme heat days per year, which are defined as days with maximum temperature over 103.9°F. By mid-century, Sacramento is projected to experience between 18 and 22 extreme heat days per year (*Figure 1-4*). July and August are likely to be the most critical months for increased temperature

effects, but the effects of high heat days will likely be felt throughout the spring and summer. The average temperature of a high heat day is also projected to increase to 108.4°F by the end of the century. Communities without access to air conditioning or cooling centers will be most at risk.

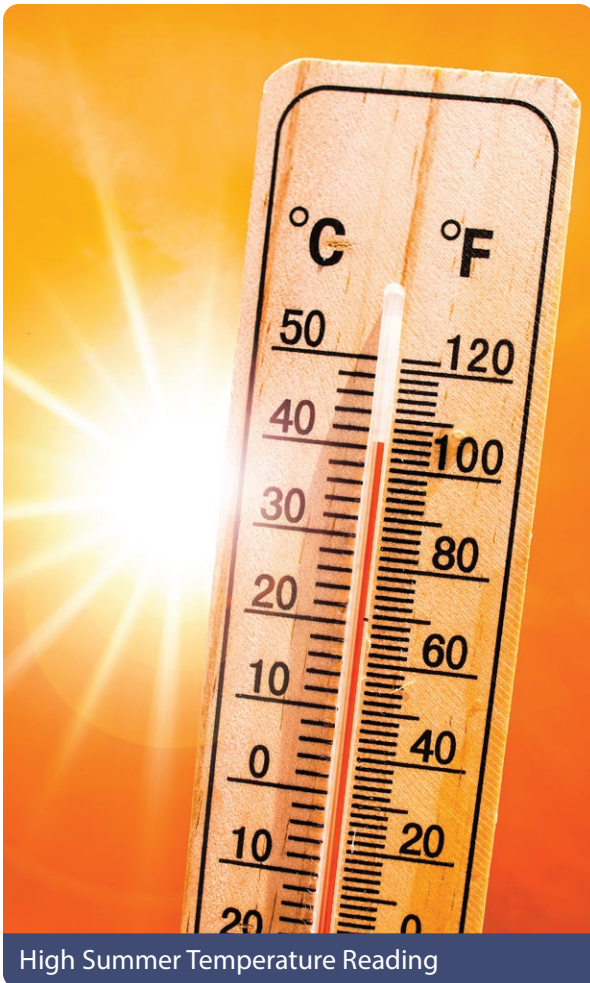
Figure 1-4. Annual Number of Extreme Heat Days



CLIMATE ACTION & ADAPTATION PLAN

Heat Waves

Heat waves are periods of four or more days of sustained, extreme heat. Historically, the Sacramento region experienced about one to two heatwaves per decade. By midcentury, Sacramento is projected to experience three multi-day heat waves per year, each projected to last between 7.6 to 9.1 days.



Heat-Related Illnesses

Heat waves and sustained high heat days are the nation's deadliest weather disaster and can cause heat-related illness such as heat exhaustion or heat stroke. Many people can take refuge in cooler environments to reduce their exposure to excessive heat; however, outdoor workers, unhoused residents, and people without air conditioning equipment or adequate ventilation, and people who may be unable to pay for increased energy use by using air conditioning are most vulnerable, making extreme heat a public health issue. Those who fear exposure to crime may hesitate to open windows, residents with limited transportation options may be unable to travel to cooler locations, while some may not be aware of the dangers posed by high heat or may not think of themselves as susceptible. Some individuals, including the elderly, those taking certain types of medication, and children, can also be more sensitive to the effects of heat. Extreme heat currently kills as many as 12,000 people a year in the United States, an issue that is expected to worsen due to climate change without a focus on adaptation.¹¹

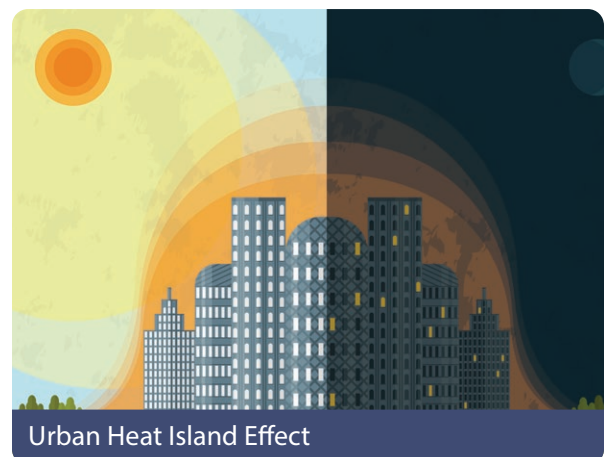
11. Shindell, Drew; Zhang, Yuqiang; Scott, Melissa; Ru, Muye; Stark, Krista; Ebi, Kristie L. (March 2020). *The Effects of Heat Exposure on Human Mortality Throughout the United States*. Retrieved from: [The Effects of Heat Exposure on Human Mortality Throughout the United States \(duke.edu\)](https://www.duke.edu/~shindell/pubs/20200301-heat-exposure-mortality-usa.pdf)



Urban Heat Islands

Heat islands are urbanized areas that experience higher temperatures than less developed outlying areas due to human activities. Structures such as buildings, roads, and other infrastructure absorb and re-emit the sun's heat more than features of the natural landscape such as forests and water bodies. Urban areas where these structures are highly concentrated and greenery is limited become "islands" of higher temperatures relative to outlying areas. Increased daytime temperatures, reduced nighttime cooling, and higher air pollution levels associated with urban heat islands can impact public health and lead to heat stroke, heat exhaustion, or even loss of life. In Sacramento, the urban heat island effect is most prevalent in or near industrial areas. Residents living near urban heat islands without access to heat relief and lacking air conditioning are most vulnerable to these health effects, and most often comprise low-income households and people of color. Over the course of the next several decades as average daily temperatures continue to increase, the urban heat island effect will become more pronounced in Sacramento. Increasing the number of trees and green space is one of the most effective ways to reduce the intensity of the urban heat island effect, but the use of high-albedo materials that lower heat absorption by buildings and roads can also help. Likewise, misters and drinking fountains can offer respite, especially in vulnerable areas.

Urban Heat Islands and Tree Canopy: Due to the urban heat island effect, heat can fluctuate by as much as 8 degrees between different areas of the City according to canopy cover. The distribution of heat is inequitable in the community. Some North Sacramento neighborhoods can be as much as 12.68 degrees Fahrenheit warmer than outside of City limits, and neighborhoods along south Franklin Boulevard can be as high as 15.15 degrees warmer than outside city limits. The City partnered with NASA for an analysis of urban heat impacts in the community. An interactive story map is available [online](#).



CLIMATE ACTION & ADAPTATION PLAN

Heat-Related Infrastructure Impacts

High temperatures can impact key infrastructure, including energy generation and distribution and transportation. High temperatures decrease the efficiency of power lines while increasing the demand for energy-intensive uses such as air conditioning and other cooling equipment. This results in a higher risk of blackouts and increases energy bills. These impacts can strain household budgets, increase exposure to heat, and disrupt medical and social services. Extremely high temperatures can also damage roadways, railways, and bridges, as well as reduce the comfort and feasibility of walking, biking, and taking public transit. Sacramento Regional Transit (SacRT) powers their light rail system with overhead catenary systems lines, which can stretch with heat and may lead to severing of the connection with the rail car.

Changes in Precipitation Patterns

Overall, annual precipitation is expected to increase in the Sacramento region to between 20.3 and 25.7 inches per year;¹² however, this increase will not occur at a uniform rate throughout the year. Rainfall will become more concentrated in the winter months and fall in fewer, higher-intensity events. These high intensity storms may produce higher volumes of runoff, contribute to increased flood risk, damage transportation infrastructure such as roads and bridges, and contribute to levee failure. Meanwhile, the spring and summer months are expected to see the largest reductions in rainfall compared to historical patterns. These changes could lead to drought, groundwater depletion, increased wildfire risk, changes in streamflow, decreased drinking water supply and availability, and strain to health, energy, and infrastructure systems.

12. Per Cal-Adapt Local Climate Change Snapshot Tool, projected Annual Average Precipitation at Mid-Century under a Medium Emissions (RCP 4.5) Scenario and a High Emissions (RCP 8.5) Scenario. <https://cal-adapt.org/tools/local-climate-change-snapshot/>



SacRT Rail Car in Motion



Sacramento River



Flooding

Historically, flooding has been the most frequent natural hazard in the Sacramento region. The extensive network of levees, dams, and weirs built for flood protection face a monumental task, which only looms larger as infrastructure ages and climate change induces larger storms and promotes sea level rise. Historic floods have damaged bridges and levees and resulted in significant numbers of people injured, killed, or forced to evacuate. Between 1996 and 2015, the National Climatic Data Center (NCDC) reported 32 flood events within Sacramento County, amounting to a total of \$13,326,000 in lost property damages. Large floods can result in damage to electric and transportation infrastructure, destruction of homes and businesses, increased rates of flood-borne disease, and loss of life. Flooding effects will be felt most strongly in low-lying areas, areas dependent on levee protection, and areas with inadequate stormwater infrastructure.



Flooded Sacramento Street

Storms

Storm runoff, particularly during high-intensity storms, can lead to erosion and localized flooding. This could result in significant impacts to local species and habitats and poses a risk to human health and structures. The strong winds that can occur during heavy storms can also damage structures and pose a threat to electricity infrastructure. Wooden crossbars and pole-mount transformers on distribution-voltage utility poles can be damaged by wind speeds as low as 60 miles per hour. Moderate winds can damage distribution-voltage utility poles and cause lines to sway and result in cross-phase shorting. Individuals living in mobile homes are especially vulnerable to the effects of high winds.



Fallen Power Pole

Changes in Winter Snowpack

Sacramento’s municipalities, industries, and ecosystems rely on the gradual melting of the Sierra snowmelt to provide a reliable supply of summertime freshwater and hydroelectric power. As temperatures increase, more precipitation will fall as rain instead of snow and snowmelt will occur earlier in the year, reducing the Sierra Nevada spring snowpack by as much as 70 to 90 percent.¹³ Disruption to the processes that ensure adequate snow supply will have a significant impact on energy generation, water availability, flood risk, and ecosystem health throughout California and in Sacramento. Earlier snowmelt will reduce the amount of water available for consumption during the summer, potentially leading to water scarcity. Reductions in winter snowpack are associated with declines in summer soil moisture content, which in turn increases wildfire risk and can impair water quality.

Drought

The combination of warmer temperatures, changing precipitation patterns, and decreased winter snowpack will likely cause longer and more intense droughts in California and the Sacramento region. Modeling of an extended late-Century drought scenario indicates that average annual precipitation between 2051 and 2070 could be as low as 78 percent of historical median annual precipitation averaged over the North Coast and Sierra California regions.¹⁴ While drought on this scale would have far reaching consequences, drought on a lesser scale can lead to reduced soil moisture, increased risk of wildfire, and reductions in streamflow. Drought conditions have profound impacts on water availability and increase demand for groundwater and compromise levee integrity. Other impacts of drought include dust storms, flash flooding, lower crop yields, and reduced water quality.

13. Data from Cal-Adapt, Local Climate Change Snapshot Tool: Snowpack, <https://cal-adapt.org/tools/snowpack>

14. Data from Cal-Adapt Local Climate Change Snapshot Tool: Extended Drought Scenarios, <https://cal-adapt.org/tools/extended-drought>



Reduced Sierra Nevada Snowpack



Lost Soil Moisture



Groundwater Supply

Streamflow declines and changes in precipitation patterns anticipated under continued global climate change will likely increase demand for groundwater. Groundwater currently comprises about one-third of the Sacramento region's water use, and studies have shown that regional rates of groundwater extraction increase under drought conditions. While the City's groundwater supplies are currently being managed sustainably, too much stress on the groundwater supply can lead to higher groundwater pumping costs, decreased streamflow, land surface subsidence, and loss of wetland ecosystems.



American River at the Auburn Recreation Area

Water and Soil Quality

Even after a fire is put out, it can continue to have detrimental effects on the environment and surrounding communities. The infiltration capacity of soil is reduced following wildfire, increasing the risk of landslides and waterbody contamination. Ash debris from wildfires may contain high levels of heavy metals and cause long-term effects on soil and water quality.



Grass Fire Ash Debris

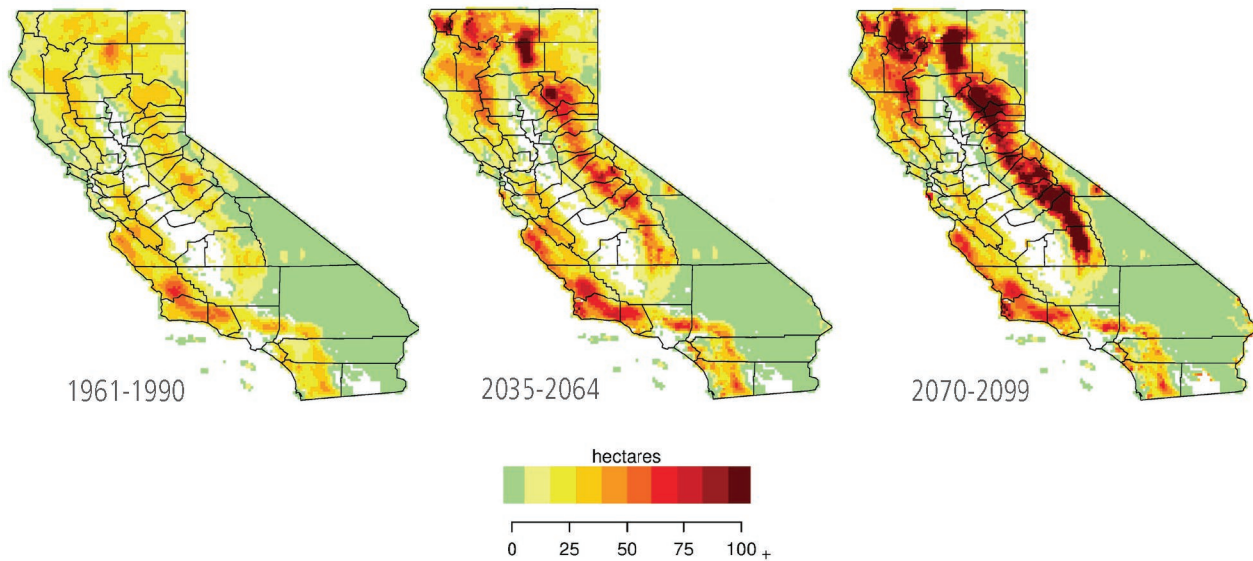
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Wildfire

Wildfire risk and intensity will continue to increase as climate change brings increased temperatures, a reduced snowpack, and altered precipitation patterns. California has an extensive history of wildfires, with large-scale, highly-destructive fires becoming increasingly common. Within Sacramento County itself, three major wildfires, causing a total of three million dollars in property damage, occurred between 2014 and 2021. While wildfire is unlikely within City limits, Sacramento the

smoke caused by wildfire creates impacts on air, and wildfires within the County can regionally affect water and soil quality, cause damage to energy infrastructure and roads, and create strain on local firefighting resources as the fire department is called to respond to fires across the region and state. Projections from California’s Fourth Climate Change Assessment predict that fires could burn up to 178% more acres per year by the end of the century compared to current averages (*Figure 1-5*).¹⁵

Figure 1-5. Wildfire in the 20th and 21st Centuries in California



15. California Natural Resources Agency. (2018). *California’s Changing Climate 2018*. Retrieved from: https://www.energy.ca.gov/sites/default/files/2019-11/20180827_Summary_Brochure_ADA.pdf



Air Quality

Wildfires are projected to increase in severity across Northern California, and their impacts on health will be felt in Sacramento. Particulate matter from wildfire dissipates throughout the Central Valley and degrades air quality for extended periods of time. During the 2018 Camp Fire, Sacramento's $PM_{2.5}$ (particulate matter) concentrations were among the highest in the world (over 300 micrograms per cubic meter of air).

Wildfire smoke can cause adverse health effects including restricted breathing; eye irritation; aggravation of respiratory and cardiovascular diseases including asthma, chronic obstructive pulmonary disease (COPD), bronchitis, and pneumonia; and increased cancer risk and impaired immune function. Vulnerable populations include young children; middle-aged and

older adults; pregnant women; those with hypertension, diabetes, and COPD; and smokers. Some studies have also found associations between low socioeconomic status and health effects related to wildfire smoke exposure. During wildfire events, Sacramento residents may avoid active transportation, spend less time outdoors, or avoid unventilated public transit facilities. These changes may have ripple effects on community health, energy use, and transportation-related emissions as residents may not be able to partake in daily exercise or may choose to prioritize the use of private vehicles. Poor air quality disproportionately affects low-income and disadvantaged communities, which experience higher exposure to pollution and lower access to healthy food, recreation, and healthcare.



Poor Air Quality in Sacramento

Sea Level Rise

Climate models anticipate some degree of sea level rise in all areas that are connected to ocean bodies. While Sacramento is not a coastal city, the Sacramento and American Rivers drain into the Sacramento-San Joaquin Delta, which in turn drains into the San Francisco Bay and the Pacific Ocean. Water levels in the Delta are not much higher than coastal sea levels and therefore, Sacramento will be effected by sea level rise. Further, the Delta and surrounding lands are low-lying and vulnerable to water level increases and storm surges that can compound the effects of flooding.¹⁶ As such, sea level rise will exacerbate flood risk in Sacramento and threaten the structural integrity of the levee system that protects the City. Depending on the nature of changes to the estuary's

shorelines in coming decades (hardened seawalls and levees vs. restored wetlands) the tidal regime could become more amplified or more dissipated, with varying effects on levee stability. Sea level rise will also increase saltwater intrusion in the Sacramento-San Joaquin Delta, impacting freshwater quality, agricultural production, the wellbeing of aquatic species, and the health of the health of aquatic ecosystems. Sea level rise is projected to progress gradually, affecting the areas immediately surrounding the Sacramento River and Sacramento River Deep Water Ship Channel. As the century progresses, the areas immediately around the American River and in agricultural areas south of Sacramento may also be affected.

16. Dettinger, M., J. Anderson, M. Anderson, L. Brown, D. Cayan and E. Maurer. (2016). *Climate change and the Delta, San Francisco Estuary and Watershed Science* 14(3): Article 5, doi: <http://dx.doi.org/10.15447/sfews.2016v14iss2art5>



Flooded Agricultural Fields

GHG EMISSIONS IN SACRAMENTO



Conducting a GHG Emissions Inventory

A community's GHG emissions can be quantified by conducting a GHG emissions inventory. An inventory provides information about where the largest sources of GHG emissions originate and opportunities for GHG emissions reductions. An inventory also establishes a baseline from which a GHG emissions forecast

and climate action targets can be established and progress tracked. Consistent with guidance from the Governor's Office of Planning and Research (OPR), Sacramento's community inventory uses the methods established in the U.S. Community Protocol for Accounting and Reporting Greenhouse Gas Emissions (Version 1.2).¹ For a full overview of methods used for developing Sacramento's inventory, including updates to previous inventories, see [Appendix A](#). The U.S. Community Protocol separates a jurisdiction's GHG-generating activities into categories known as emissions sectors. These emissions sectors broadly describe

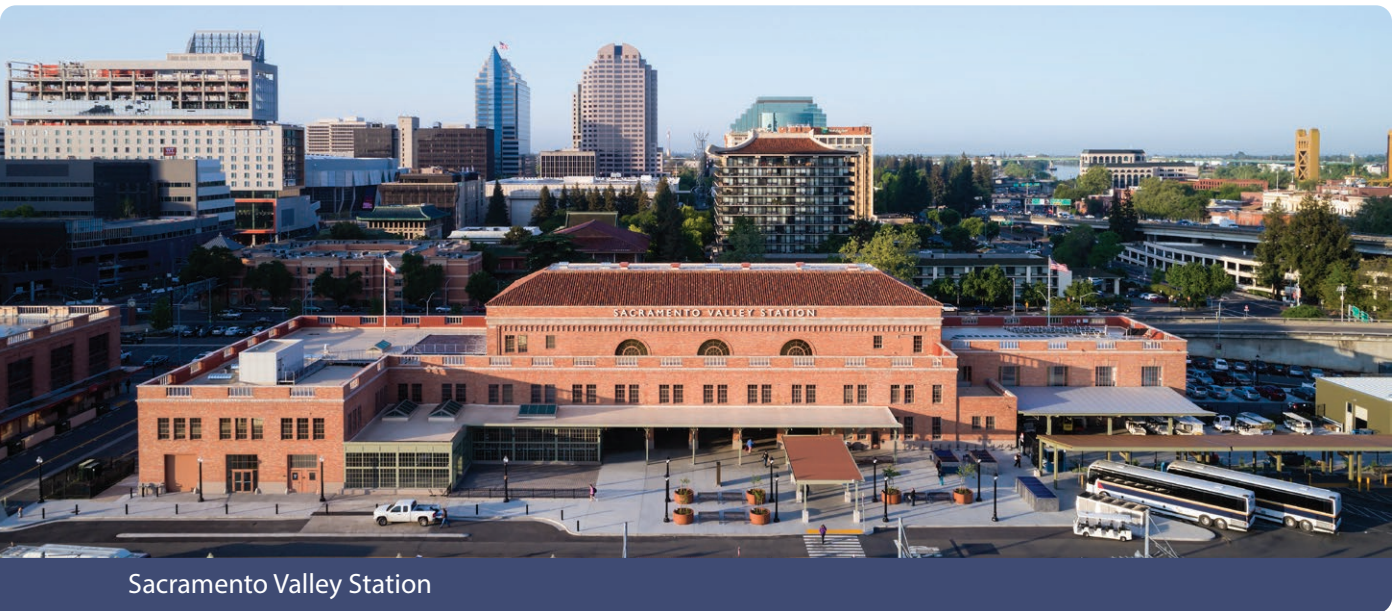
1. ICLEI – Local Government for Sustainability USA, U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. Retrieved September 20, 2021, from <https://icleiusa.org/us-community-protocol/>.

CLIMATE ACTION & ADAPTATION PLAN

where GHG emissions are coming from within a city. For example, Sacramento’s GHG emissions sectors include:

- The transportation sector (which captures combustion emissions from passenger and commercial vehicle trips that start and/or end in Sacramento)
- The building sector (which captures emissions from residential, commercial, and industrial electricity, natural gas, and other energy source usage within the city)
- The waste sector (which captures emissions from all solid waste generated within the city, as well as passive emissions from closed landfills within city limits)
- The water and wastewater sector (which captures emissions from delivering and treating water and wastewater for local residents and businesses)

In general, GHG emissions inventories used for local planning purposes, like Sacramento’s CAAP, include GHG emissions sectors that are under some level of the City’s jurisdictional control or influence. Emissions sectors that fall outside of the City’s jurisdictional control are typically excluded, as the City would not be able to enact policies or programs outside of its jurisdictional control. For example, combustion emissions from cars traveling through Sacramento, with origins and destinations outside of city limits, were excluded from Sacramento’s inventory because the local government cannot reasonably influence this pass-through travel activity. Additional sources of emissions not included in the inventory include agricultural emissions, which are limited within the city, and industrial sources,



Sacramento Valley Station



which are covered under the State’s Cap-and-Trade Program and for which data are not readily available.

To calculate the GHG emissions inventory, activity data are collected for each GHG emissions sector for a single calendar year. GHG emissions are calculated from activity data using GHG emission factors, which are science-based conversion factors that convert activity data to GHG emissions. Inventories

measure GHG emissions in units of metric tons of carbon dioxide equivalent (MT CO₂e).² One MT is equivalent to 2,205 pounds, roughly the same volume as a small two-story house and roughly the weight of a small sports car (Figure 2-1). The average car produces 5 MT of CO₂e in 1 year.³ Alternatively, planting 17 new trees removes about 1 MT CO₂e from the atmosphere over 10 years.⁴

Figure 2-1. Volume of 1 MT CO₂e



2. Carbon dioxide equivalent (CO₂e) is a unit of measure used to standardize the climate effects of various greenhouse gases. For example, 1 metric ton (MT) of carbon dioxide (CO₂) has equivalent climate effects (or global warming potential) as 1 MT of CO₂e; 1 MT of methane (CH₄) has approximately equivalent climate effects as 28 MT of CO₂e; and 1 MT of nitrous oxide (N₂O) has approximately equivalent climate effects as 265 MT of CO₂e. See [Appendix A](#) for more information on global warming potentials.
3. Environmental Protection Agency (EPA). March 2022. *Greenhouse Gas Equivalencies Calculator*. Accessed at: <https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>.
4. Ibid.

Current GHG Emissions in Sacramento

A GHG inventory was developed for Sacramento’s CAAP using data from 2016—the most recent year for which reliable community-wide data was available at the time this plan was developed. The Sacramento inventory includes community-wide GHG emissions from sources within sectors that are under some level of jurisdictional control or influence of the City, which include buildings, transportation, waste, water, and wastewater. [Figure 2-2](#) and [Table 2-1](#) show the results of

the GHG emissions inventory, with the buildings sector broken out by residential electricity use, commercial electricity use, residential gas use, and commercial gas use. The largest GHG emissions sector is transportation, followed by buildings, waste, wastewater, and water. Based on these results, the greatest opportunities for GHG emissions reductions are in the transportation and buildings sectors. Further details on the data, calculations, and results of the inventory are included in [Appendix A](#).

94%
**OF TOTAL GHG EMISSIONS
IN SACRAMENTO ARE
FROM BUILDINGS AND
TRANSPORTATION.**

Figure 2-2. Sacramento’s 2016 GHG Emissions by Sector

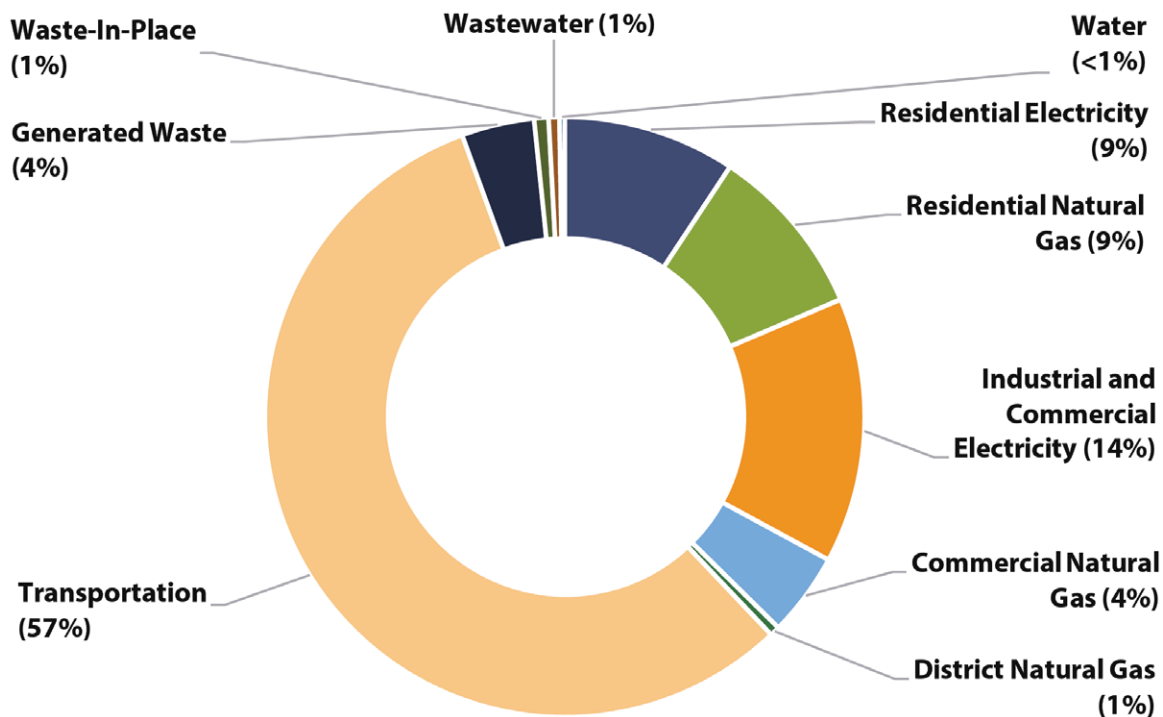




Table 2-1. Sacramento’s 2016 GHG Emissions by Sector

Sector	Activity Data	Emission Factors	MT CO₂e
Transportation	4,347,013,534 VMT	0.000445 MT CO ₂ e/mile	1,935,870
Industrial and Commercial Electricity	2,191,180,705 kWh	0.00022 MT CO ₂ e/kWh	489,945
Residential Natural Gas	59,977,656 therms	0.00531 MT CO ₂ e/therm	318,304
Residential Electricity	1,423,419,583 kWh	0.000224 MT CO ₂ e/kWh	318,275
Commercial Natural Gas	28,980,911 therms	0.00531 MT CO ₂ e/therm	153,803 ¹
Generated Waste	525,968 tons	0.255412 MT CO ₂ e/ton	134,339
Waste-in-Place	N/A ²	N/A ²	26,504
Wastewater	N/A ³	N/A ³	19,867
District Natural Gas	3,432,409 therms	0.00531 MT CO ₂ e/therm	18,216 ¹
Water	42,963,998 kWh	0.00022 MT CO ₂ e/kWh	9,607
Total Emissions			3,424,729

MWh: megawatt hours; kWh: kilowatt hours; CO₂e: carbon dioxide equivalent; MT: metric tons; VMT: vehicle miles traveled

1 No natural gas usage was reported for large industrial users due to California Public Utilities Commission privacy rules. The remaining industrial usage is from Pacific Gas & Electric “district” users.

2 Waste-in-place is a direct output of a landfill gas modeling system and does not have activity data.

3 Wastewater is a combination of stationary and process emissions, further detailed in Section 3.3.

Sacramento's GHG Emissions Over Time

Previously, the City completed a community GHG inventory for 2005 and an estimated GHG inventory for 2011. The City's three inventories demonstrate a steady reduction in GHG emissions over time, including achievement of the City's 2020 target to reduce GHG emissions 15 percent below 2005 levels by 2020. This corresponds to a return to 1990 levels (Figure 2-3 and Table 2-2). Since 2005, GHG emissions in Sacramento have decreased 20 percent, despite a 10 percent increase in

population, with reductions in every sector. Major reductions occurred in the waste and wastewater sectors, although these sectors make up a smaller portion of Sacramento's total GHG emissions. Increasing gas appliance efficiency helped reduce natural gas usage in buildings while increasing efficiency of fuels drove reductions in the transportation sector. Increased usage of renewables for electricity also decreased emissions from electricity usage in the buildings sector.

SACRAMENTO ACHIEVED A 20% REDUCTION BELOW 2005 LEVELS IN 2016, EXCEEDING THE 2020 TARGET.

Figure 2-3. Historic GHG Emissions by Year and Source (MT CO₂e)

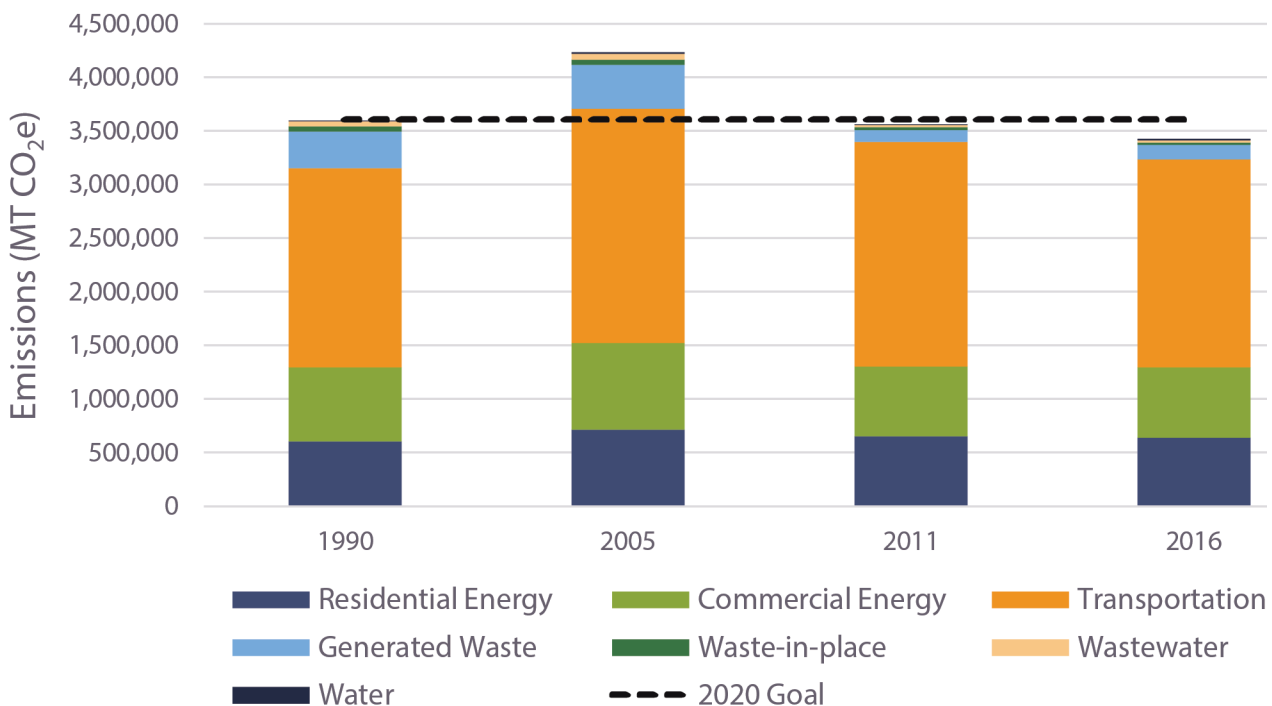




Table 2-2. Historic GHG Emissions by Year and Source (MT CO₂e)

Sector	1990 ¹	2005	2011	2016
Transportation	1,856,925	2,184,617	2,091,154	1,935,870
Commercial & Industrial Energy	689,637	811,337	650,627	661,964
Residential Energy	607,052	714,178	656,472	636,578
Generated Waste	344,506	405,301	113,192	134,339
Waste-in-place	42,432	49,921	25,773	26,504
Wastewater	48,773	57,380	18,719	19,867
Water	10,889	12,810	9,804	9,607
Total Emissions	3,600,213	4,235,545	3,565,741	3,424,729
Emissions per capita	9.75	9.57	7.58	7.25

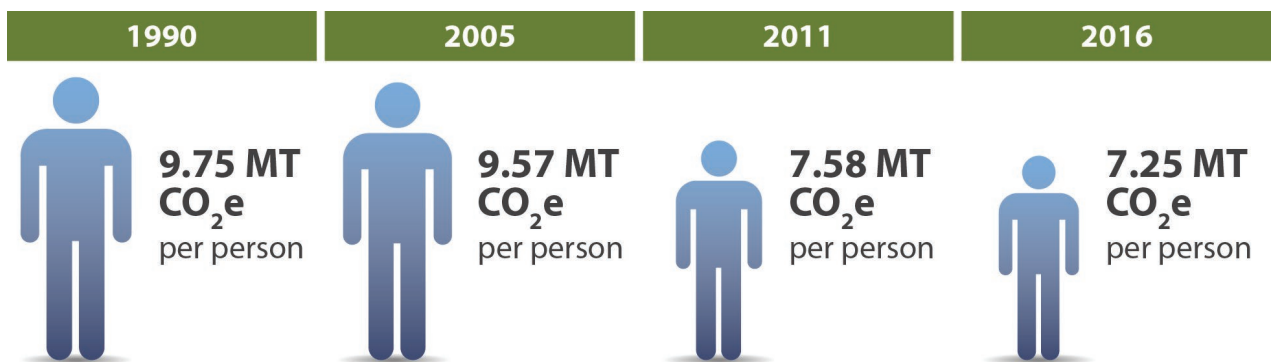
MT CO₂e: metric tons of carbon dioxide equivalent

¹ All 1990 inventory data calculated as a 15% reduction from 2005 inventory levels per California Air Resources Board guidelines.

Sacramento’s per capita emissions (in units of MT CO₂e per person) have experienced even larger reductions. Since 2005, per capita emissions have decreased 26 percent ([Figure 2-4](#)).

These reductions have positioned Sacramento well for adopting the even more ambitious climate action targets contained in this CAAP.

Figure 2-4. Per Capita GHG Emissions over Time



*1990 per capita emissions are estimated by dividing the 1990 emissions backcast (15% below 2005 levels) by the City’s 1990 population.

GHG Emissions Forecast

GHG emissions forecasts provide an estimate of future GHG emissions levels based on the projected growth and change in a community over time. Forecasts also account for current legislative actions from the State and federal governments that are expected to reduce future emissions. In order to clearly demonstrate how Sacramento's emissions will look in the future, two forecasts were developed—a business-as-usual (BAU) forecast and an adjusted forecast.

- The BAU forecast estimates how Sacramento's emissions would change based on current activities and projected growth in population and job growth.
- The adjusted forecast adjusts the BAU forecast to account for State- and federal-level legislation and policies that are expected to reduce emissions for all jurisdictions in California.

Sacramento developed the GHG emissions forecasts based on the 2016 inventory to project how GHG emissions in Sacramento will change over time. The forecasts extend from 2016 through 2045 and include milestone years 2025, 2030, and 2040. The BAU forecast was developed using growth projected trends in population, housing, employment, and transportation activity over time, consistent with city and regional projections.

The State legislation and policies included in the adjusted forecast are the Advanced Clean Cars Program, Title 24 Building Energy Efficiency Standards, and California Renewable Portfolio Standard (RPS). The Advanced Clean Cars Program is a comprehensive car emissions control program which regulates smog, soot-causing pollutants, and GHG emissions into a single coordinated package of requirements for passenger cars and light trucks sold in California with model years 2017 through 2025 to reduce California's GHG emissions by 34 percent in 2025.⁵ Title 24 Building Energy Efficiency Standards regulate new residential and commercial development in California by requiring increased efficiency related to space heating and cooling, lighting, and water heating, and are updated every three years. The California RPS program requires investor-owned utilities, publicly owned utilities, electric service providers, and community choice aggregators to increase procurement from renewable energy resources. For example, electricity service providers must procure electricity from 50 percent renewable resources by 2026, 60 percent by 2030, and 100 percent by 2045, leading to significant statewide decreases in electricity emissions. See [Appendix B](#) for more information on these and other programs and policies that are driving climate action in Sacramento and throughout California. The adjusted forecast is considered a more realistic picture of Sacramento's emissions in the future. The BAU and adjusted forecasts can be compared to show the extent to which State-level policies and programs will help to reduce GHG emissions in Sacramento ([Figure 2-5](#) and

5. California Air Resources Board (CARB). (2017). *Advanced Clean Cars Program*. Retrieved September 20, 2021, from <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/about>.



Table 2-3). The results of the forecasts show us that while State legislation will reduce GHG emissions in Sacramento through 2045, more work is needed at the local level to achieve Sacramento’s GHG reduction goals.

The adjusted forecast is the best estimate of how emissions will look over time in the city of Sacramento without additional actions at the municipal and community level. From the adjusted forecast and current State legislation, Sacramento established climate action targets

based on feedback from community engagement, adopted General Plan Vision & Guiding Principles, the Mayors’ Commission on Climate Change recommendations, and current State guidance and legislation. These considerations and the 2030 and 2045 climate action targets are outlined in [Chapter 3](#). For a complete explanation of the methods, data, and calculations used to create Sacramento’s forecasts, see [Appendix A](#).

Figure 2-5. Sacramento’s Business-as-Usual and Adjusted GHG Emissions Forecasts (MT CO₂e)

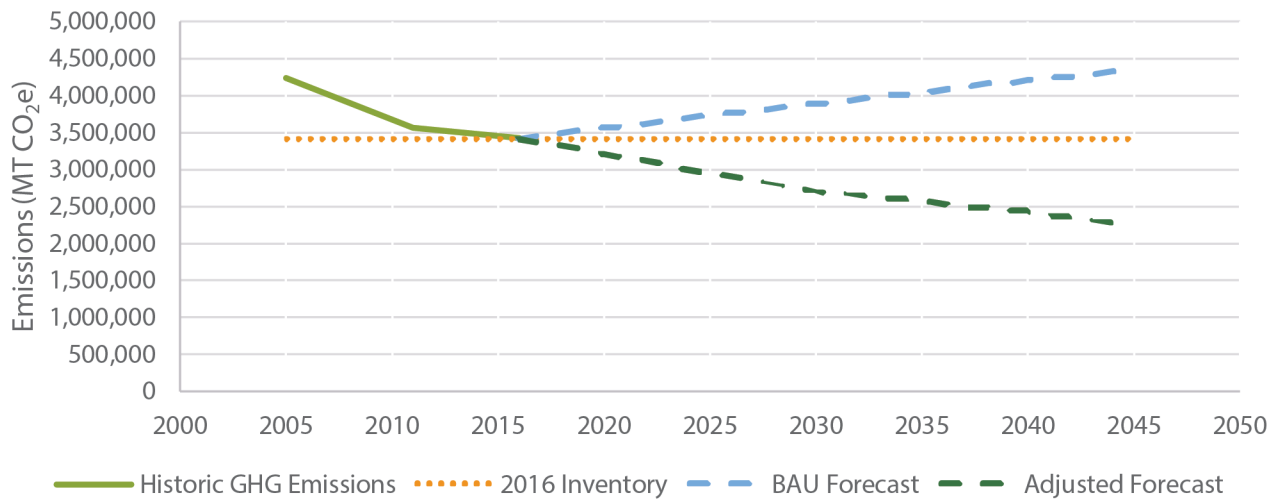


Table 2-3. Sacramento’s BAU and Adjusted Forecasts (MT CO₂e)

Emissions Forecast	2020	2025	2030	2040	2045
BAU Forecast	3,558,871	3,726,548	3,894,225	4,203,918	4,342,257
Reductions from State Legislation	344,615	780,096	1,190,660	1,775,373	2,114,935
Adjusted Forecast	3,214,256	2,946,452	2,703,565	2,428,545	2,227,322
Adjusted Forecast Percent Reduction from 2016	-6%	-14%	-21%	-29%	-35%

MT CO₂e: metric tons of carbon dioxide equivalent



CLIMATE ACTION TARGETS



Key State Legislation

As a leader in climate action, California has established extensive legislation, policies, and programs to reduce GHG emissions in the State. California's climate action goals are enshrined in Assembly Bill (AB) 32, SB 32, and EO B-55-18, which together set statewide GHG reduction targets for 2020, 2030, and 2045. Sacramento has historically aligned with state-level goals around climate change, as shown in [Figure 3-1](#). A full list of relevant state-level legislation is included in [Appendix B](#).



California State Capitol Building

CLIMATE ACTION & ADAPTATION PLAN

AB 32: AB 32 codified the statewide goal of reducing GHG emissions to 1990 levels by 2020 and required the California Air Resources Board (CARB) to prepare a Scoping Plan that outlines the main strategies California will employ to meet the 2020 target. The AB 32 Scoping Plan was first adopted in 2008, with subsequent updates in 2013, 2017 and 2022. The 2017 Scoping Plan¹ calls on cities throughout California to adopt GHG reduction targets in line with the State regulations that will provide their fair share of GHG reductions, support California in achieving the 2030 target (SB 32), and make substantial progress towards the 2045 goal of carbon neutrality (EO B-55-18).

SB 32: The successor legislation to AB 32 requires California to achieve a statewide reduction in GHG emissions of 40 percent below 1990 levels by 2030. The SB 32 Scoping Plan was adopted in 2017.

EO B-55-18: EO B-55-18 established a new statewide goal of achieving and maintaining carbon neutrality as soon as possible and no later than 2045. Executive orders have not been codified by California but are binding for State agencies; it is therefore considered best practice for qualified GHG reduction plans to address EO B-55-18. The 2022 CARB Scoping Plan assesses progress towards the State's 2030 GHG emissions reduction target and outlines a pathway to achieve carbon neutrality by 2045, including an Appendix with recommendations for local governments.

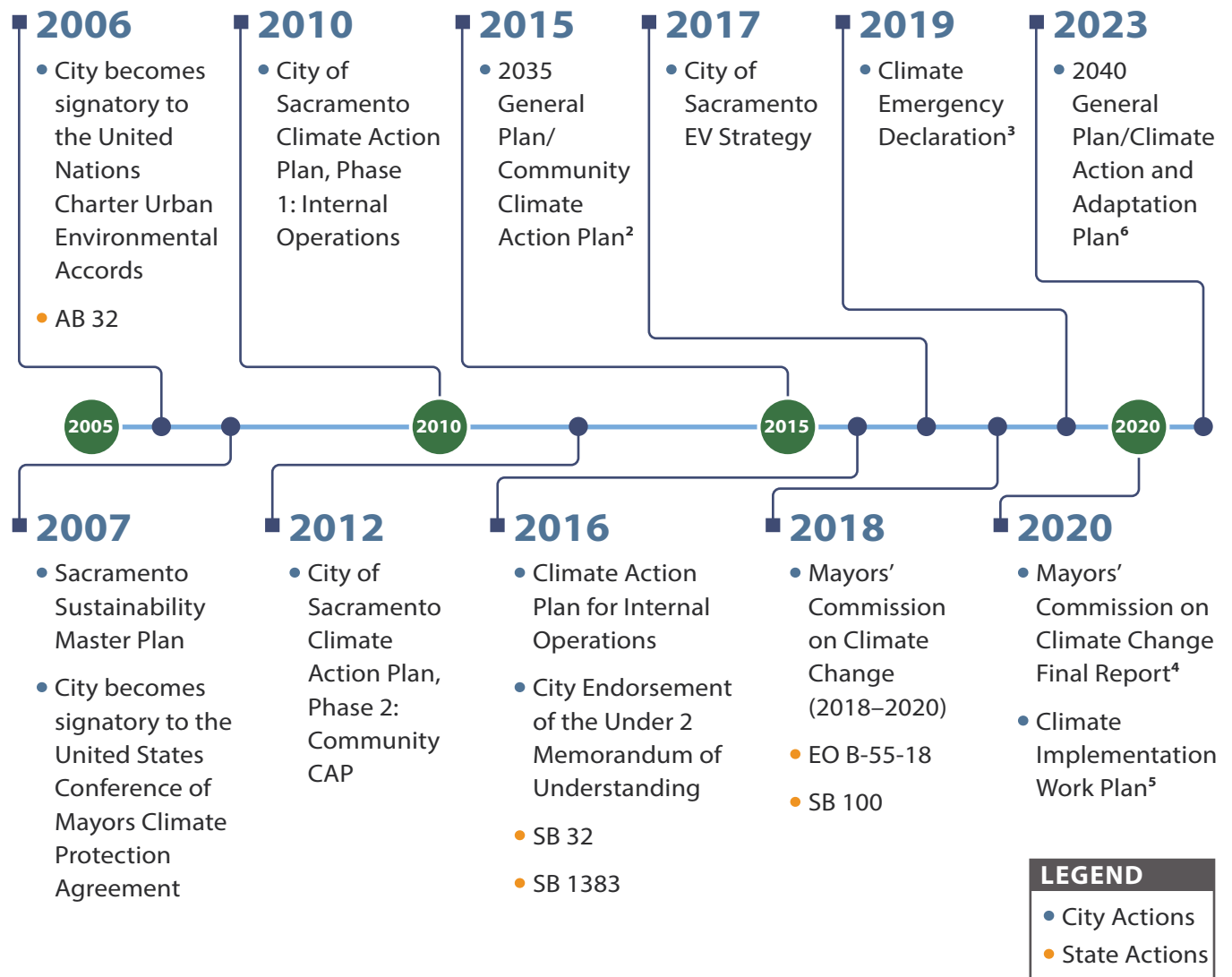
1. California Air Resources Board (CARB). (2017). *California's 2017 Climate Change Scoping Plan*. Retrieved September 20, 2021, from https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf



Sacramento River at Tower Bridge



Figure 3-1. Key State and City of Sacramento Legislation



2. The Sacramento [Community] Climate Action Plan was incorporated into the 2035 General Plan and adopted by City Council on March 3, 2015. Between March 2015 and the release of this document, the [Community] Climate Action Plan did not exist as a separate document.

3. Available online: <https://www.cityofsacramento.org/-/media/Corporate/Files/CMO/Climate-Change/R2019-0465-Declaring-a-Climate-Emergency-and-Proposing-Efforts-to-Restore-a-Safe-Climate-Background.pdf?la=en>

4. Available online: lcc.org/climatecommission/

5. Available online, with links to related City documents: <http://www.cityofsacramento.org/climateaction>

6. 2040 General Plan/Climate Action and Adaptation Plan Update: The Climate Action and Adaption Plan includes both community GHG emissions and GHG emissions from the City's internal operations.

IPCC-Informed Targets

In addition to California’s own regulatory environment, the goal of carbon neutrality is backed by global research on climate change and the targets necessary to avoid the most serious climate change impacts. The IPCC has found that in order to limit global warming to 1.5 degrees Celsius above pre-industrial levels, the world must reach carbon neutrality by mid-century (~2050).⁷ Warming above this level is linked to catastrophic heat, drought, and impacts to ecosystems and global food production.



Sacramento’s Climate Action Targets

This CAAP establishes Sacramento’s GHG reduction target for 2030, as required by CEQA for a “qualified” GHG reduction plan and a long-term GHG reduction goal for 2045. The 2030 target and long-term 2045 goal (referred to collectively as Sacramento’s climate action targets) provide the impetus for implementation of the CAAP and its associated GHG emissions reductions. As Sacramento tracks its GHG emissions and implements the CAAP over the next 10 years, the climate action targets will provide an important point of comparison by which to measure progress and re-evaluate long-term strategies to achieve 2045 goals. Based on the current science and California’s GHG reduction legislation, Sacramento’s climate action targets are as follows:

2030 CLIMATE ACTION TARGET: Reduce Sacramento’s per capita GHG emissions to 3.63 MT CO₂e per person by 2030, equal to 63 percent below 1990 levels. In mass emissions, this equates to achieving emissions less than 2,160,128 MT CO₂e in 2030.⁸

7. Intergovernmental Panel on Climate Change. (2021). *Sixth Assessment Report*. AR6 Climate Change 2021: The Physical Science Basis. Retrieved September 20, 2021, from <https://www.ipcc.ch/report/ar6/wg1/>

8. Based on current population projections, changes to population would change the mass emissions threshold since Sacramento’s GHG reductions are based on per capita emissions. This equates to a 61 percent reduction compared to 2005 on a per capita basis.



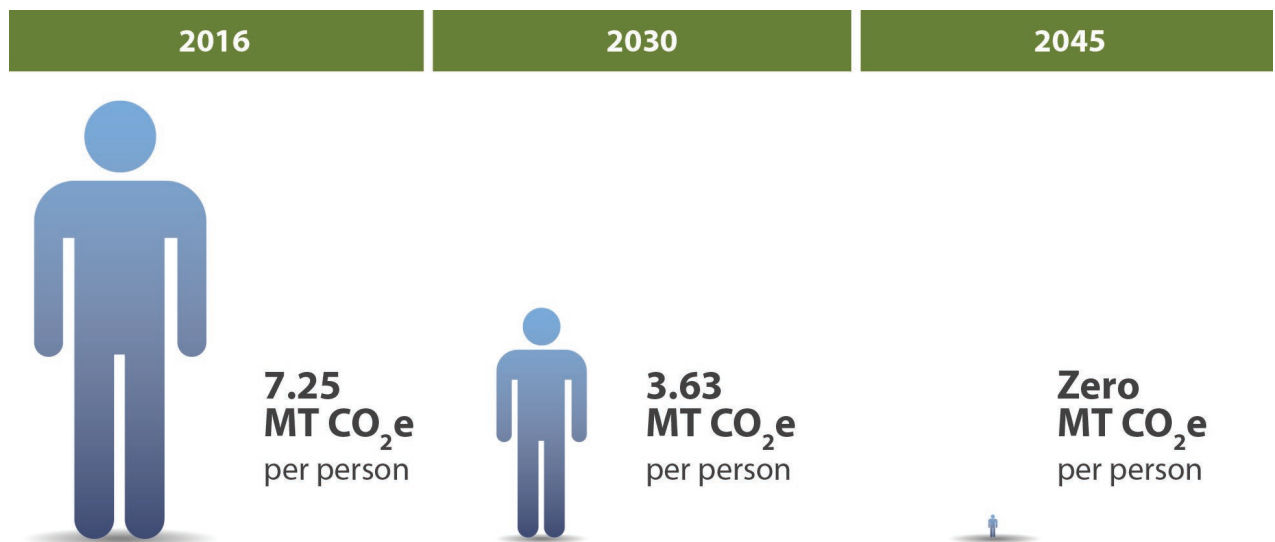
2045 CLIMATE ACTION GOAL: Reduce Sacramento’s per capita GHG emissions to net zero MT CO₂e per person by 2045, equal to 100 percent below 1990 levels.

The City of Sacramento has established a per capita target for 2030 and 2045 based on guidance provided by California’s 2017 Scoping Plan. Using a per capita emissions target means that regardless of unforeseen population changes, the City’s targets of 3.63 MT CO₂e per person and net zero MT CO₂e per person will remain unchanged. This approach allows

the City to continue to grow, while focusing on decarbonizing systems rather than limiting growth that could compromise new housing and job opportunities and potentially increase regional emissions.

Figure 3-2 shows how per capita emissions will decrease to zero by 2045. This means that even while population increases, average emissions per person will decrease due to more efficient buildings, transportation and land use, and waste management within the city.

Figure 3-2. Sacramento’s Climate Action Targets Through 2045 (per capita)

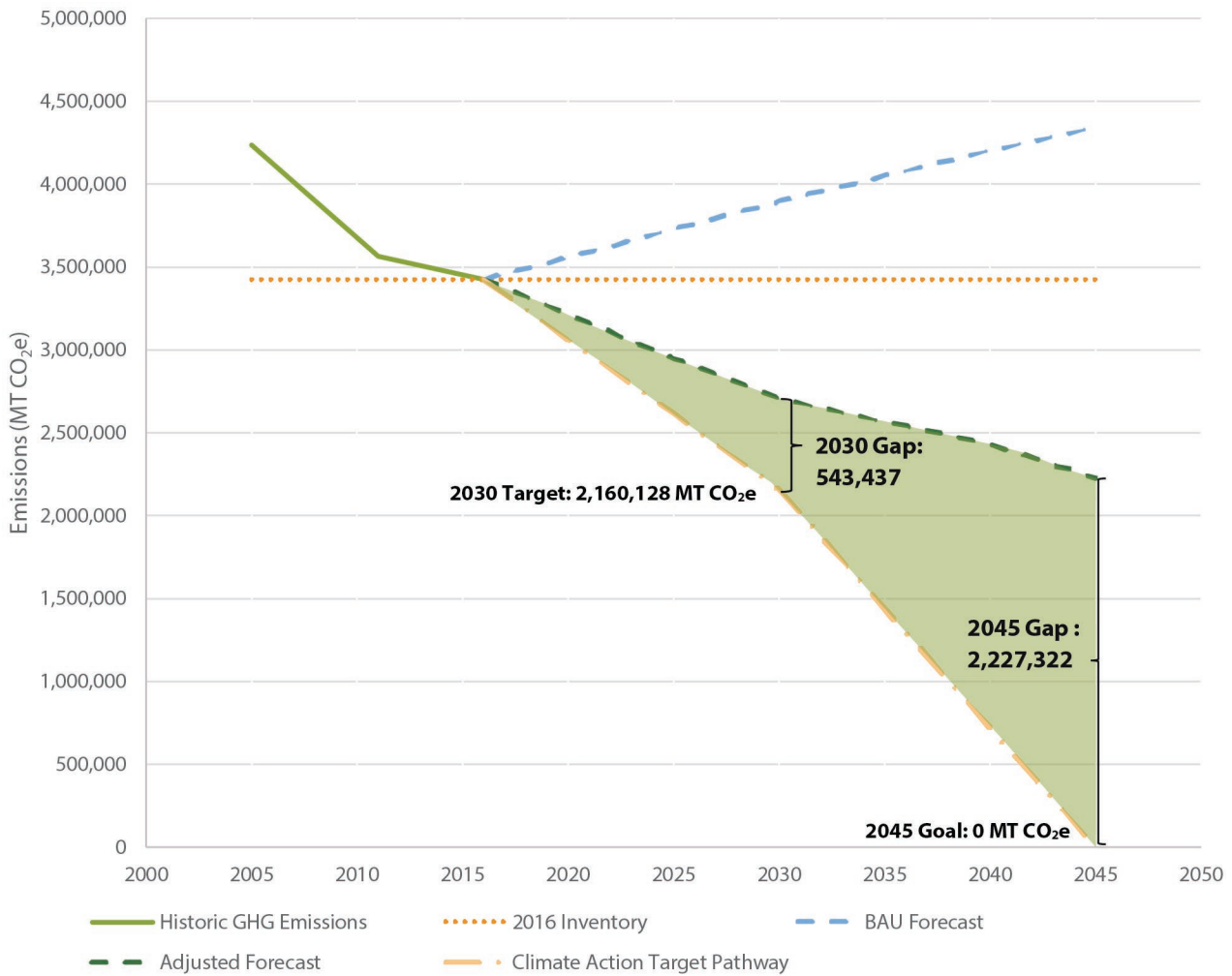


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Figure 3-3 shows Sacramento’s BAU forecast, adjusted forecast, and 2016 GHG emissions inventory, relative to the climate action targets. This figure demonstrates the estimated mass

emissions (in units of MT CO₂e) over time based on the current population projections. This trajectory may change depending on the actual growth of the city.

Figure 3-3. Sacramento’s GHG Forecast and Climate Action Targets (MT CO₂e)





As shown in [Figure 3-3](#), a gap remains between Sacramento’s projected GHG emissions in the adjusted forecast (green line) and Sacramento’s climate action targets (yellow line). The gap represents the GHG emissions to be reduced by the measures and actions contained in this CAAP, as detailed in [Chapter 6](#). Based on these projections, the City of Sacramento must close a gap of 543,437 MT CO₂e by 2030 in order to achieve its GHG reduction targets. The CAAP

is focused on achieving the 2030 target of 3.63 MT CO₂e per person (50% below 2016 per capita emissions levels) and making substantial progress toward achieving the 2045 carbon neutrality goal. While this CAAP provides a pathway to achieve the 2030 target, as presented in [Chapter 5](#), additional State legislation, new technologies, and innovative approaches will be needed to achieve carbon neutrality city-wide by 2045.



Second Saturday Dancing



COMMUNITY ENGAGEMENT



Community Informed Plan

This CAAP was driven by community input through multiple years of outreach and engagement conducted as part of the 2040 General Plan Update (2040 General Plan)/CAAP. Community engagement by the Mayors' Commission on Climate Change was conducted in a parallel process, which also helped to shape the CAAP. Community support and collaboration are key to developing a successful CAAP, as well as implementing the plan over time. Furthermore, the CAAP development process generated a large amount of community interest, because climate change is a global issue that will have direct impacts on the local

community. To help guide community input through the planning process, the goals associated with outreach and engagement were broken into four phases.

PHASE 1 - ISSUES/OPPORTUNITIES: The focus of the first phase of community outreach was on identifying and understanding the issues and opportunities that needed to be addressed in the 2040 General Plan/CAAP.

PHASE 2 - OPTIONS AND ALTERNATIVES: During the second phase of outreach, the project team engaged (mostly virtually) with the community to develop GHG reduction measures, a Draft Land Use Map, Proposed Roadway Changes, and Key Strategies that are responsive to challenges in the coming years and to implement the adopted 2040 Vision and Guiding Principles.

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PHASE 3 - DRAFT PLAN PREPARATION:

Release for public review of the Draft CAAP and Draft 2040 General Plan.

PHASE 4 - FINAL PLAN ADOPTION:

Gain decision-maker support and approval for the 2040 General Plan/CAAP.

In order to reach a wide audience from all parts of Sacramento’s diverse community, the City employed a suite of outreach and engagement strategies. These included multiple iterations of in-person workshops, pop-up events, working groups, virtual workshops (available in English, Spanish, and Chinese), and a scientific survey. The graphic below shows key engagement events which fed directly into the CAAP and General Plan.¹ Out of these many and varied events, the primary outreach events that provided feedback specific to the CAAP were the citywide workshops, youth engagement and workshops, Environmental Justice Working

Group (EJWG), interest-based focus groups, and scientific surveys. The following sections highlights the results of each of the primary outreach events and discusses how this feedback was directly reflected in the CAAP’s goals and strategies.

ESTIMATED COMMUNITY PARTICIPANTS

- **CITYWIDE WORKSHOPS:**
1,139 households
- **SCIENTIFIC SURVEY:**
504 participants
- **COMMUNITY PLAN AREA WORKSHOPS:**
236 households
- **OTHER OUTREACH:**
approximately 300 participants

Figure 4-1. Key Engagement Events for the CAAP and General Plan



1. A calendar of all outreach events can be found on the City’s website: <http://www.cityofsacramento.org/-/media/Corporate/Files/CDD/Planning/General-Plan/2040-General-Plan/Outreach-TimelineWorking-Document-PHASE-II-081120.pdf?la=en>



Citywide Workshops

Each of the four citywide workshops completed as part of Phase 1 had seven staffed stations where community members could learn about the 2040 General Plan/CAAP and provide input to guide Sacramento’s future. Several of these stations covered topics related to climate action and adaptation and provided the community with an initial opportunity to influence the direction of the plan and provide suggestions for the measures and actions that should be included by noting their interest and ideas around key GHG reduction strategies such as building electrification and EVs. Throughout the workshop, community members were able to move between the stations, ask questions, and provide feedback to the City and consultant team related to each of the station topics for review and integration into the plan.

At the climate change station, one display board introduced the concept of climate change with infographics and graphs to display information, including the city’s GHG emissions trends over time compared to the State’s GHG emission reduction goals, a graph depicting Sacramento’s GHG emissions by sector, and details about rebate programs and incentives currently available from SMUD for electrification of vehicles and homes. A second board included a map of climate change hazard risk areas, such as flooding, wildfire, drought, and extreme heat, with a brief summary of the various impacts.

Table 4-1. Citywide Workshop Demographics

Ethnicity	
Hispanic or Latino	38
Not Hispanic or Latino	81
Race	
American Indian or Alaskan Native	9
Asian	31
Black or African American	107
Native Hawaiian or Other Pacific Islander	2
White	175
Other	3
Disability	
Yes	9
No	103
Age	
Under 40	75
Over 40	97

Out of 344 total responses. Not all questions were answered by every community member.

Respondents provided answers to the climate change questions using sticky notes. Based on the results of the community input, most respondents (84 percent) support electrification if it does not increase costs and the functionality that respondents currently have is maintained ([Figure 4-2](#)). For EVs, 64 percent of respondents noted a lack of charging infrastructure as a major hurdle to ownership ([Figure 4-3](#)). This concern was recognized, and the EV strategy discussed in [Chapter 6](#) aims to increase charging infrastructure to alleviate

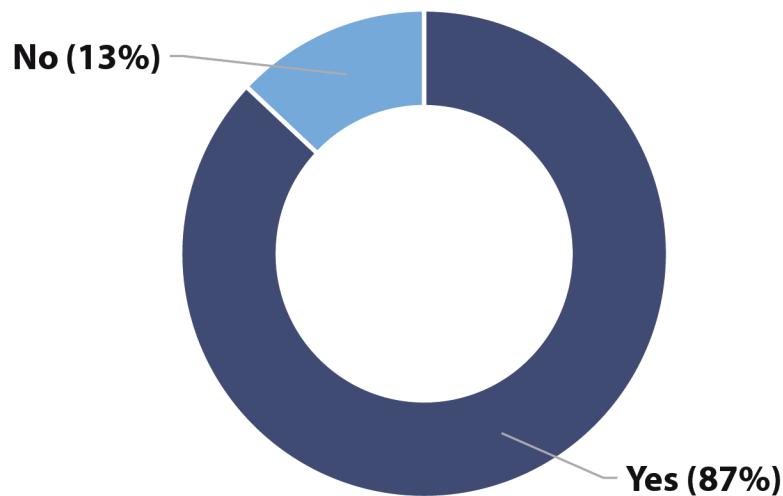
CLIMATE ACTION & ADAPTATION PLAN

this hurdle. The community also provided ideas for how to protect the most vulnerable citizens in Sacramento from the climate vulnerabilities discussed in *Chapter 1* of the CAAP. Ideas such as weatherization programs for low-income and rental properties, tree planting to

adapt to extreme heat events, and rebates for improving home air filtration were provided by the community and impacted the development of the CAAP strategies, measures, and actions. The results are summarized in *Figure 4-4*.

Figure 4-2. Community Feedback on Home Electrification²

Would you consider converting your home to all-electric appliances if they don't cost you more and function as well as gas appliances?



2. This figure represents the results of a survey and is not statistically representative of the Sacramento community at-large.



Figure 4-3. Community Feedback on EVs³

What, if anything, prevents you from converting to a plug-in EV? Please select all that apply.

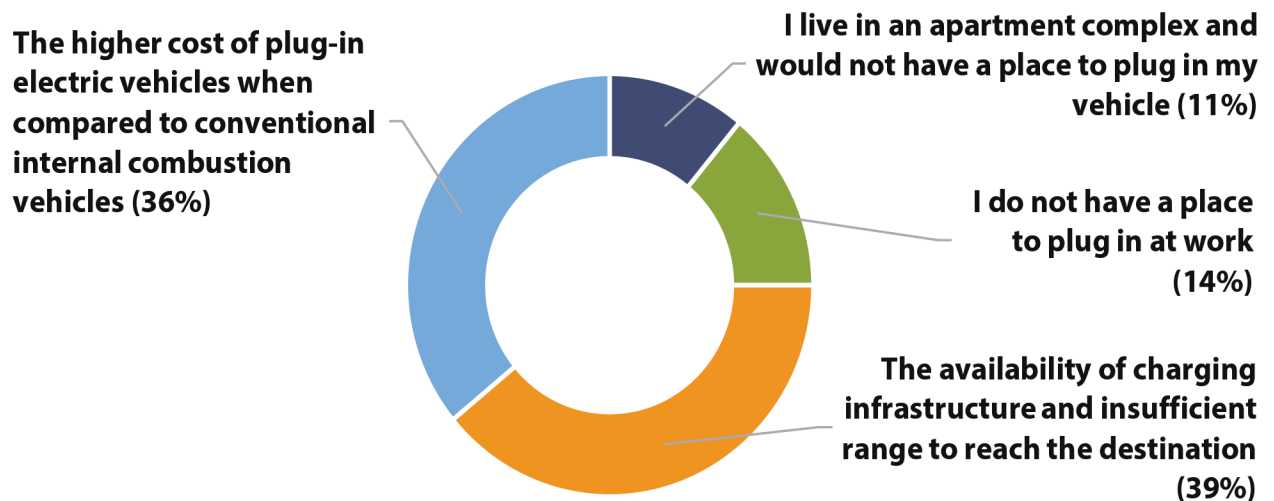
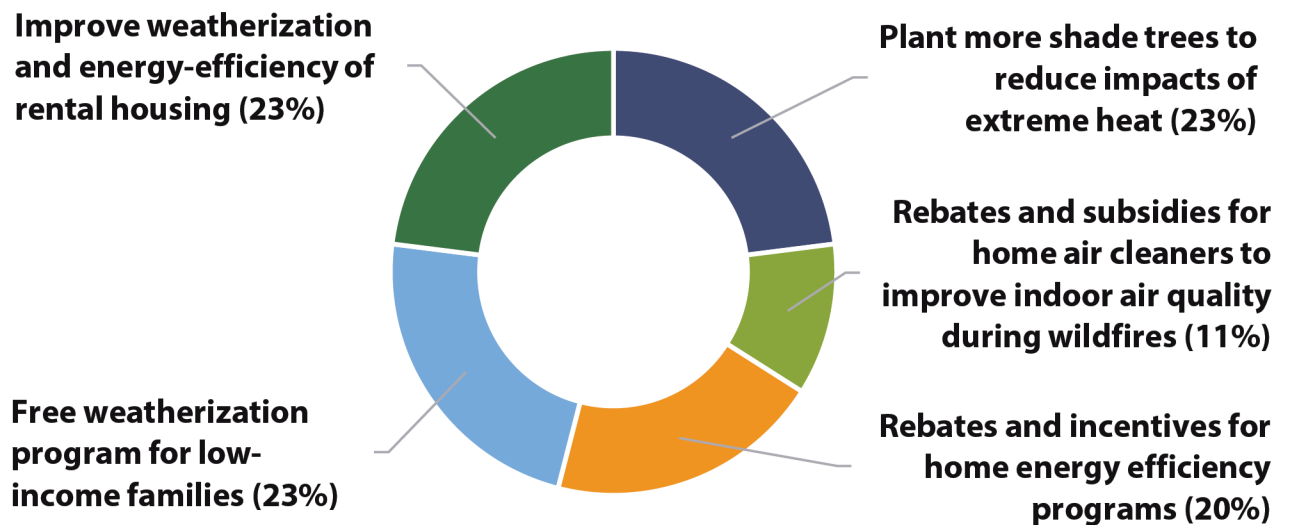


Figure 4-4. Community Feedback on Climate Change Impacts⁴

How should we respond as a community to reduce impacts of climate change on our most vulnerable citizens (elderly, disabled, children, and low-income families)?



3. This figure represents the results of a survey and is not statistically representative of the Sacramento community at-large.

4. This figure represents the results of a survey and is not statistically representative of the Sacramento community at-large.

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Climate change and sustainability-related ideas were also provided in other sections of the workshops and integrated into the CAAP development. For example, when asked what makes a community truly livable, 33 percent of participants said, “an environment that feels healthy, with clean air, clean water, and ample access to parks, trees, and other green space.” Another 31 percent said, a “community that is well-connected; walking and biking are easy because almost all key stores and services can be found within walking distance.” A word cloud developed by community members from the Pocket Community Plan Area during a plan area meeting echoes these themes. Key concepts depicting their vision for the future of their community include a more accessible (e.g.,

walkable, bikeable), sustainable (e.g., clean air, green), environmentally and socially just (e.g., diverse, cohesive, affordable), and adaptable (e.g., resilient, protected, safe, secure, and connected) neighborhood.

33%

of workshop participants indicated that “An environment that feels healthy, with clean air, clean water, and ample access to parks, trees, and other green spaces” is the key to a truly livable city.





Youth Engagement and Outreach

Through pop-up workshops, summer programs, and classroom presentations, the City encouraged the younger generation to be active members of their community by providing equitable opportunities, while also collecting valuable input that helped shape the 2040 General Plan and CAAP. To gain feedback from the youth representatives and their communities, the Sacramento 2040 General Plan Team developed and implemented a 3-month-long Summer Youth Engagement Program consisting of five youth representatives from the following Sacramento organizations:

- La Familia Counseling Center
- Green Tech Education and Employment
- Asian Resources, Inc. (ARI)

The youth representatives embarked on a mission to engage their peers in a discussion around what Sacramento can do and what

the City's CAAP can incorporate to address the evolving issues around climate change. Through development of an informational video⁵ and online questionnaire, the youth representatives helped to inform the early planning process of the 2040 General Plan and CAAP. The video was produced, shot, and edited by the youth representatives, and features seven Sacramento-elected officials and subject matter experts including:

- Mayor Darrell Steinberg | City of Sacramento
- Councilmember Jay Schenirer | City of Sacramento, District 5
- Jose Bodipo-Memba | Director of Sustainable Communities, SMUD
- Ryan Moore | Interim Director, City of Sacramento Public Works
- Jennifer Donlon Wyant | Transportation Planning Manager, City of Sacramento Public Works
- Ryan Gardener | Environmental Project Manager, Rincon Consultants
- Paul Trudeau | Program Manager, Green Tech Education and Employment

⁵ Video viewable at: <https://www.youtube.com/watch?v=Xlo-cFufM1U&t=1s>



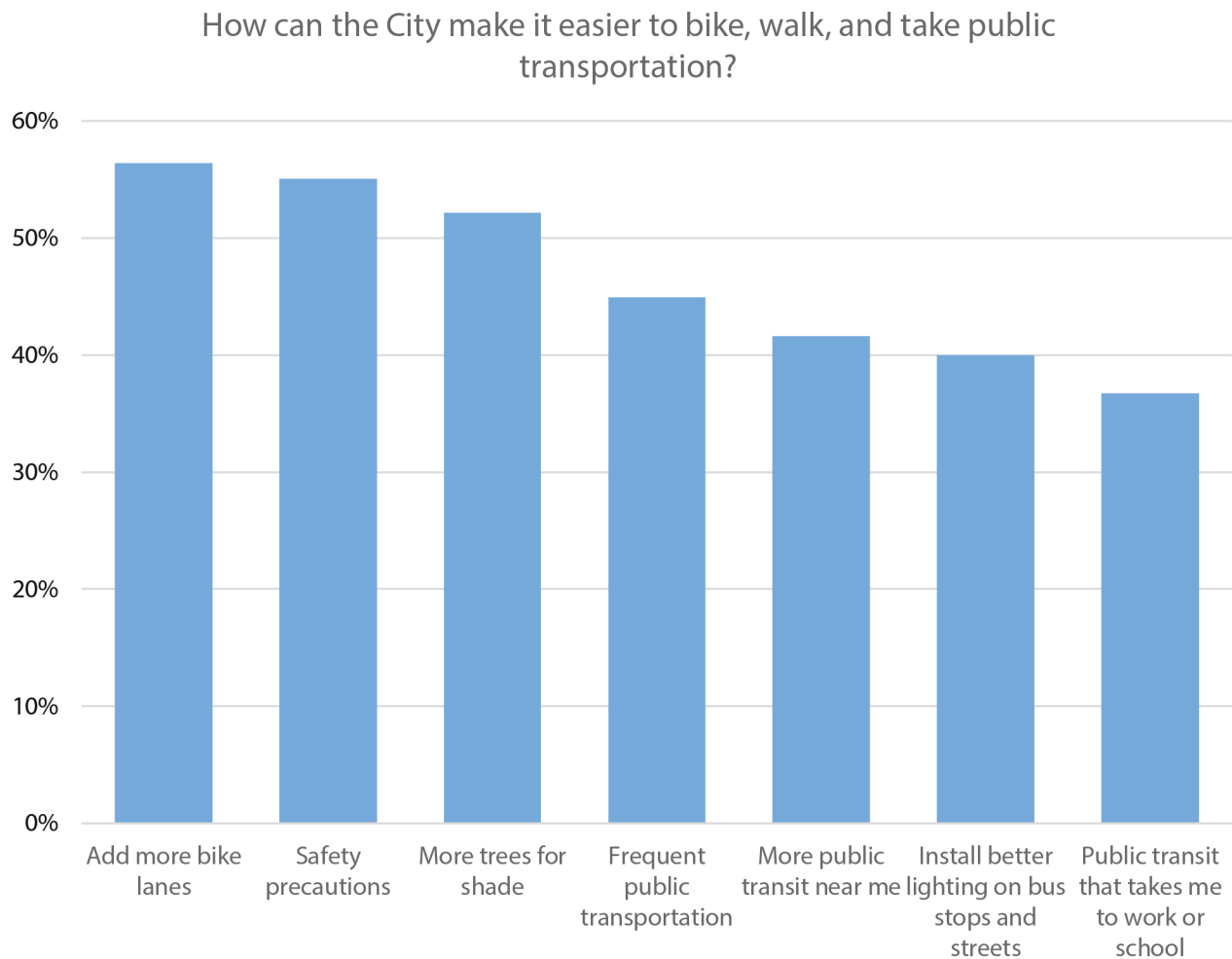
Hot Spot, South Natomas

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In addition to the video, students conducted their own surveys of family and friends to better understand the opportunities and hurdles around climate action and adaptation in the city. All together, they collected feedback from more than 300 Sacramento residents. The students provided grass-roots feedback on

topics like renewable energy, transportation, and overall sustainability. These responses were considered when developing the strategies, measures, and actions in the CAAP. The results of one of the youth survey questions on active transportation are shown in [Figure 4-5](#).

Figure 4-5. Youth Feedback on Active Transportation and Transit⁶



6. This figure represents the results of a survey and is not statistically representative of the Sacramento community at-large.



Equitable Engagement

The City of Sacramento understands that no community should be left behind nor bear a disproportionate burden as new climate action policies and programs are instituted. This applies specifically to communities in Sacramento that have been historically marginalized. These communities are not only the most vulnerable to the impacts of climate change due to below-average housing options, previous land use decisions, and other resource limitations, but also unfairly impacted by the policies and programs put in place to address climate change. The City will have equity protections in place to avoid unintended impacts from policies and programs to address climate change.

ENVIRONMENTAL JUSTICE WORKING GROUP

As part of the 2040 General Plan, the City adopted a new Environmental Justice (EJ) element to help Sacramento address community issues in equity and disproportionate exposure to environmental issues, as well as to develop and facilitate ongoing, robust community engagement to ensure that all community members are included as part of the conversation moving forward. A key EJ principle actively

involves the communities most impacted by climate change and other environmental problems in the public decision-making processes that can impact health, access to resources, and well-being. To support this effort, the City convened the EJWG comprised of community leaders, advocates, and community-based organizations (CBO) currently serving Sacramento's communities to provide feedback on the 2040 General Plan and CAAP development process, including the key strategies, measures, and actions. The following organizations were involved in the EJWG:

- WALKSacramento
- Sacramento Food Policy Council
- Sacramento Housing and Redevelopment Agency
- Sacramento Area Congregations Together
- Health Ed Council
- Sacramento Lesbian Gay Bi and Trans (LGBT) Community Center
- AB617
- CalEPA Department of Toxic Substances Control
- Mutual Assistance Network
- Sacramento County Public Health
- Twin Rivers/Mutual Assistance
- Sacramento Area Council of Governments
- United Latinos
- Department of Human Assistance
- AT Valdez Foundation/United Latinos
- Sacramento Metropolitan Air Quality Management District

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As part of this process, the EJWG reviewed a draft list of the CAAP measures and actions and convened two workshops in November and December of 2019 to provide their input and expertise in assessing the proposed measures and their potential impacts on equity. Specifically, the group was asked to aid in identifying any potential co-benefits, unintended consequences, or refinements that could mitigate those consequences. The feedback from the group was then analyzed by the CAAP team and integrated into the list of measures and actions in [Chapter 5](#) and [Chapter 6](#). A list of key equity considerations were used to frame the discussion:



Riverside Walkway

Photo by Carlos Eliason

- 1. Disproportionate impacts and accountability:** Does the proposed action generate burdens (including costs), either directly or indirectly, to disadvantaged communities? If yes, are there opportunities to mitigate these impacts? Are there appropriate accountability mechanisms to ensure equitable benefits and avoidance of burdens?
- 2. Shared benefits:** Can the benefits of the proposed action be targeted in progressive ways to reduce historical or current disparities?
- 3. Accessibility:** Are the benefits of the proposed action broadly accessible to households and businesses throughout the community—particularly communities of color, low-income populations, minority, women, and emerging small businesses?
- 4. Engagement and relationship building:** Does the proposed action engage and empower disadvantaged communities in a meaningful, authentic, and culturally appropriate manner? Does the action foster building of long-term trust between communities and local government?
- 5. Capacity building and opportunity:** Does the proposed action help build capacity among disadvantaged communities through funding, an expanded knowledge base or other resources (such as workforce development, contracting opportunities, or increased diversity of program or organization staff)?
- 6. Alignment and partnership:** Does the proposed action align with and support disadvantaged community priorities, creating an opportunity to leverage resources and build collaborative partnerships?



EJWG RESULTS

The EJWG reviewed the draft measures and actions for key sectors including buildings, sequestration, and transportation during the two working group meetings. The following section outlines the primary feedback provided by the EJWG that was used to develop the final CAAP strategies. This feedback was reviewed by City staff and integrated into the CAAP's measures and actions discussed in

Chapter 5 and *Chapter 6*. For measures that are critical to meeting the 2030 and 2045 GHG climate action targets but that could include equity impacts (such as electrification), specific additional actions were included with the measures to help mitigate impacts, such as dedicated programs for disadvantaged communities and specific direction to ensure equitable access to investments.



Community Members at Boards Station



New Del Paso Heights Sports Complex (Measure U)

Equity Concerns in City Buildings

The building sector measures predominantly focus on building electrification, energy efficiency, and carbon-free electricity to decarbonize the sector. It was recommended that any building-related measures avoid exacerbating displacement, which could occur as a result of housing-related investments. It was also suggested that opportunity exists to include health outcomes and health disparities around class and race. In addition to anti-displacement measures, racial impact assessments were discussed as tools to improve equity.

Key Equity Concerns

- Landlords might pass down expenses that arise from a building electrification ordinance for

existing buildings to tenants. Accompanying rent increase restrictions were suggested as a measure that might lessen this impact.⁷

- Low-income retrofits and assistance were mentioned as resources provided by several CBOs, some of which were partly funded by SMUD. However, the difficulty in applying for these programs was discussed, especially for lower income people who may not have enough savings to qualify or the time to physically apply and track the progress of the application.
- A question was posed on how people could be allowed to be self-sufficient and reduce reliance on energy providers. SMUD's new rules on net-energy metering surplus (excess energy) reimbursement for solar panels were also discussed as an example of how people could recoup solar investment costs.

7. An effort to develop an equitable Existing Building Electrification Strategy for the City is underway that will address these issues more directly. Learn more at: https://www.cityofsacramento.org/Community-Development/Planning/Major-Projects/General-Plan/About-The-Project/Climate_Change/Existing-Building-Electrification



Sequestration and Food Waste

Carbon sequestration measures/actions, such as tree plantings and food waste diversion measures/actions, such as edible food rescue were also discussed during the workshops. It was recommended that the City partner with existing community organizations to plant trees and that financial assistance may be needed for lower income individuals to cover the increased cost of deep-watering trees, especially during times of drought.

Key Equity Concerns

- Funding and financing strategies are needed to help protect low-income and disadvantaged communities from increased tree maintenance costs and increased waste disposal costs.
- It was noted that streets in lower income communities often do not have sufficient room to plant street trees, but that complete

streets measures may be able to help address this when certain site conditions are present.

- Reducing food waste through compost and food recovery was also discussed, in addition to tax incentives for and procurement from farmers who sequester carbon in soil. This could be an equity co-benefit if historically disadvantaged farmers or business owners were included.
- It was noted that tree planting opportunities could consider fruit trees as a way to increase food access, as well as drought tolerant/climate resilient trees.
- It was noted that tree survival rates were important to consider. It was suggested that tree maintenance and stewardship would be crucial to ensure increased canopy in lower income communities, with consideration of maintenance cost (e.g., water costs for deep watering) and who bears that cost.



Sacramento Community Garden

Transportation

Transportation was another key area where both significant opportunities and hurdles were identified. Participants noted the potential negative impacts of improved mobility and transit options, such as increased costs and displacement of disadvantaged communities as the result of a changing transportation landscape. A need to focus on historically marginalized communities for investment was identified as a key part of developing more equitable mobility in the city.

Key Equity Concerns

- The need for pairing active transportation and transit options with anti-displacement policies was mentioned as a consideration so investments do not inadvertently price-out lower income groups or renters.
- It was noted that as written, measures for mobility and active transportation do not have any sort of prioritization for historically marginalized communities. When investments are

being prioritized, it is important to address historic gaps in the transportation network that affect marginalized communities.

- There was also discussion about the co-benefits of transportation measures and impacts to schools. From an equity perspective, a student's ability to get to school has implications for educational attainment and other important health indicators.
- The importance of storytelling was emphasized in disadvantaged communities, and it was noted that trusted ambassadors would be needed to communicate the benefits of new transportation infrastructure in a culturally competent manner.
- It was also noted that while bicycle-friendliness and new infrastructure was a citywide focus, it is still not safe to ride bikes in many communities and that existing infrastructure needs to be addressed. Additionally, the need to address active transportation in the City's Transportation Priorities Plan rather than as a separate plan was discussed.



Active Transportation in Sacramento.



Interest-Based Focus Group

In early 2020, the City of Sacramento held an interest-based focus group meeting to discuss key draft strategies that could be the most impactful in reducing GHG emissions. The discussion topics focused on key “big and bold” GHG reduction strategies, such as electrification of new buildings, prohibition of new gas lines, elimination of parking minimums, and requirements for EV charging spaces. The focus group provided an opportunity for key interested groups and partners to provide feedback on specific measures, as well as suggestions for the City to take into account when crafting the actions that would guide implementation. This created an opportunity for the focus group to provide feedback to the City to help illuminate the tradeoffs of these key GHG reduction strategies and how they benefit or impact the community. Seventeen representatives from the following organizations were in attendance at the focus group.

FOCUS GROUP ATTENDEES

- 350 Sacramento
- Association of Sacramento Realtors
- Land Park Neighborhood Association
- North State Building Industry Association
- Sacramento EV (SacEV)
- Sacramento Regional Transit
- Sierra Curtis Neighborhood Association
- Sacramento Municipal Utility District (SMUD)
- American Planning Association
- California Air Resources Board
- Local Government Commission
- Resources for Independent Living
- Sacramento Metropolitan Air Quality Management District
- Sacramento Tree Foundation
- Upper Land Park Neighborhood Association

After a presentation on the current GHG inventory, the projected emissions forecast, and the GHG reduction targets established by the State of California and the Mayors’ Commission on Climate Change, interested group representatives were asked to provide their input on a series of questions for each proposed action:

- What do you see as potential barriers to implementing this action?
- Are there concerns about any of the actions the planning team should consider?
- Do you foresee this action impacting your industry or community? If yes, how?
- Do you have any questions about this action?

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Curtis Park Court

Several themes emerged from the discussion, particularly around potential equity impacts to lower income communities and renters, as well as development feasibility. Highlights from the energy and electrification sector discussion include the following:

- The natural gas industry could present a barrier for implementing an ordinance requiring building electrification.
- Subsidy programs would need to continue to offset the additional costs of replacing gas appliances with electric ones, especially for lower income families and renters.
- Interested groups advised the City to be mindful of potential impacts that the proposed actions could have on the real estate industry and potential home sellers.
- Opportunities should be explored to engage with the restaurant industry to help with the transition from gas to electric appliances.
- The City should ensure that all their permit requirements and processes are consistent before implementing and enforcing a permit compliance program.

During the discussion on the Mobility Element, key themes emerged focused on the following:

- Increasing Sacramento’s EV charging capacity
- Improving public transit to make it a viable option for residents
- Enhanced active transportation and transit options to help community members become less dependent on their personal vehicle
- Pricing mechanisms in employment centers as one of the most effective ways to reduce car-based commutes

The feedback gained from the focus group meeting was integral in shaping both the overall approach to these key measures, as well as the specific actions that will drive implementation over time.



Scientific Survey Results

As part of the 2040 General Plan, Goodwin Simon Strategic Research conducted a survey of Sacramento residents to identify perspectives and preferences about public policy issues that may be addressed in the City's 2040 General Plan and CAAP. Conducting a scientific survey provided the City with a statistically significant sample of Sacramento residents from which to understand overall sentiments regarding several key issues. Over 500 surveys were completed by Sacramento residents using an address-based sampling methodology derived from a list of 7,000 randomly generated Sacramento residential mailing addresses. The survey covered a wide range of topics including overall importance of addressing climate change, as well as thoughts regarding potential GHG reduction measures, including transit and electrification. For example, over 57 percent of residents surveyed support the use of redesigning some

of Sacramento's streets to use additional road space for bus-only lanes, bike lanes, and better pedestrian infrastructure (*Figure 4-6*). This feedback directed the City to continue to focus not only on transit-related measures in the CAAP, but also on prioritizing bike, pedestrian, and transit lanes throughout the city in the 2040 General Plan. On the topic of electrification, over 65 percent of Sacramento residents surveyed supported the electrification of all new buildings, and 63 percent supported the electrification of all existing buildings over the next 20 years (*Figure 4-7*). Based on this feedback and direction from the Mayors' Commission on Climate Change, the City moved forward with electrification strategies that will provide the City of Sacramento with a strong foundation to achieve carbon neutrality by 2045.

53%

Number of respondents who listed addressing climate change as a very high priority.



Solano Wind Project

CLIMATE ACTION & ADAPTATION PLAN

Figure 4-6. Scientific Survey Feedback on Transit

To improve transit reliability, make walking and biking safer, and reduce reliance on private vehicles, would you support or oppose redesigning some of Sacramento’s streets to use some of the road space for bus-only lanes, safer bike lanes, and better crosswalks and sidewalks?

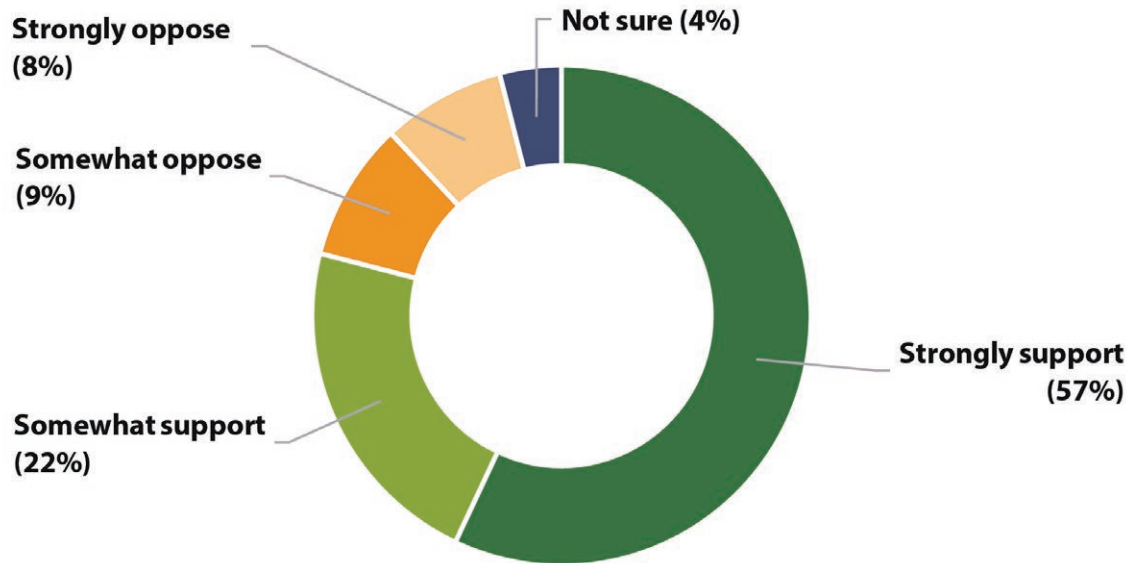
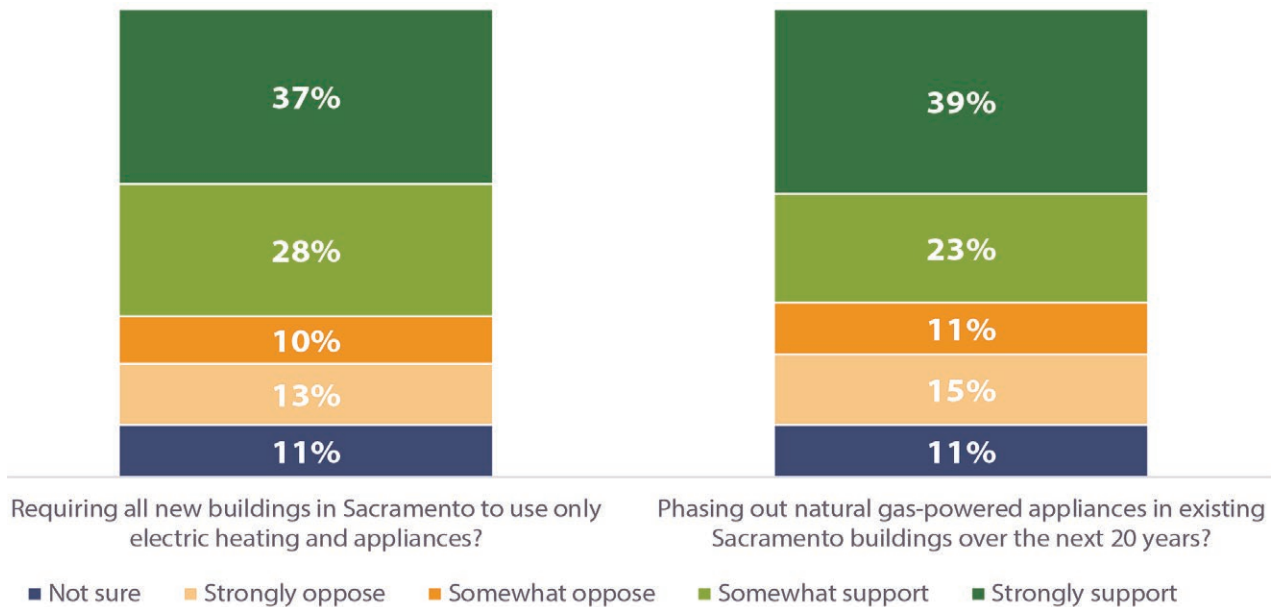


Figure 4-7. Scientific Survey Feedback on Electrification





Integrating Feedback

The extensive ideas and feedback gained throughout the outreach and engagement process has been reviewed and integrated into both the CAAP and 2040 General Plan. Policies from the Mayors' Commission on Climate Change, visions for the community from neighborhood workshops, the need for urgent action to create meaningful and tangible change, and the equity concerns highlighted by the EJWG were taken into consideration when developing the measures and actions found in [Chapter 5](#) and [Chapter 6](#). However, these community discussions will not be the last opportunities for community members to shape the future of climate action in the city. As the CAAP is implemented and lessons are learned, updates to the CAAP will be made. New technologies, best practices, and climate impacts will continue to shape the look and feel of Sacramento and drive the implementation of the CAAP forward.

ENVIRONMENTAL JUSTICE COLLABORATIVE GOVERNANCE COMMITTEE (EJCGC): In June 2020, the Mayors' Commission on Climate Change formally recommended the establishment of the EJCGC, facilitated by the cities but led by the community to support marginalized communities, particularly communities of color and youth, in owning and shaping environmental solutions. While not convened specifically to provide input on the CAAP, the EJCGC is a community-based effort to advance EJ and build community capacity, working in partnership with the City. The EJCGC first convened in early 2021 and was involved in feedback on the Draft CAAP. The City will continue to engage the EJCGC during implementation of the Final CAAP. At the time of CAAP development, the EJCGC included 16 committee members, who provide diverse representation of Sacramento in terms of age, race, gender, and lived, personal and professional experience. Learn more at <https://www.sacej.org/>.



GHG REDUCTION STRATEGY



This CAAP contains measures and actions that together close the gap between Sacramento’s projected 2030 GHG emissions and its 2030 target and make substantial progress towards achieving the 2045 goal of carbon neutrality (*Table 5-1*).¹ The CAAP’s measures and actions were developed with extensive input from residents, community stakeholders, partners like SMUD and Regional Transit, and direction from the Mayors’ Commission on Climate Change, as detailed in *Chapter 4*. Each measure was further evaluated for equity impacts by

the Environmental Justice Working Group for the 2040 GPU. Based on this feedback, additional resources and programs were identified and included to support just outcomes. This chapter provides an overview of the strategic framework for the CAAP measures and actions, the related co-benefits, and how they work together to transition Sacramento to a climate neutral future. Additional details, including specific actions for each measure, can be found in *Chapter 6*.

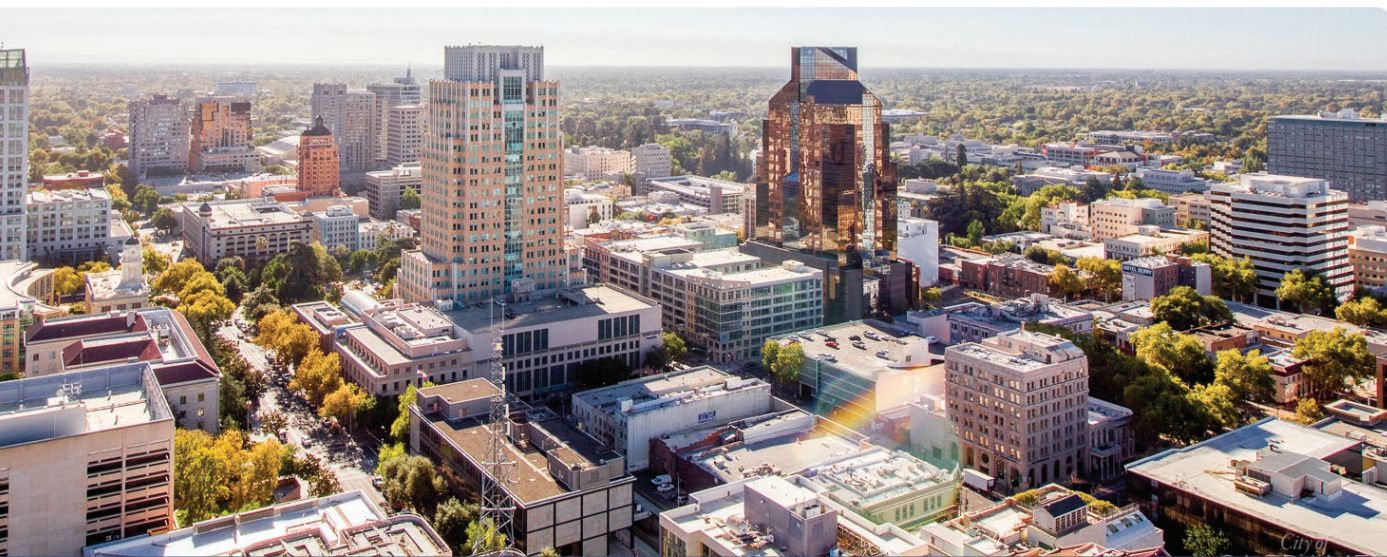
1. While achieving carbon neutrality by 2045 is the City’s long-term goal, getting to carbon neutral will require new technologies and legislative action from the State and federal government. Subsequent updates to this CAAP will identify additional GHG emissions reductions for the City to achieve carbon neutrality.

CLIMATE ACTION & ADAPTATION PLAN

Table 5-1. CAAP Adjusted Forecast Summary

Forecast Scenario	2030 GHG Emissions (MT CO ₂ e)	2045 GHG Emissions (MT CO ₂ e)
Adjusted Forecast	2,703,565	2,227,322
Total CAAP Reductions	-1,235,034	-2,060,976
Built Environment	-733,205	-537,089
Mobility	-331,995	-1,289,999
Waste	-134,991	-160,897
Water & Wastewater	-11,791	-11,517
Carbon Sequestration	-23,053	-61,474
CAAP Adjusted Forecast (Adjusted Forecast minus CAAP Reductions)²	1,468,531	166,345
Target Pathway	2,160,128	0
Remaining Gap to Target	-691,597	166,345

² The CAAP Adjusted Forecast line includes all of the GHG emissions reductions achieved by full implementation of the CAAP in addition to the legislative reductions included in the Adjusted Forecast line.



City of Sacramento Downtown



Measures and Actions Structure

Measures are specific, data-driven opportunities for reducing GHG emissions, which, when fully implemented, will allow the City to achieve its climate action targets and a variety of co-benefits. Measures were developed for each GHG emissions sector to address the specific GHG-generating activities (identified in [Chapter 2](#)) that contribute to Sacramento’s GHG emissions profile. Each measure is supported by a suite of actions, which are the implementable steps that Sacramento will take to achieve the measure goals. All actions supporting a measure, when taken together, produce a holistic approach to promoting change and achieving the metrics for success identified for each measure. The lessons learned through the development and implementation of the City’s previous CAP in 2012 have been key in developing a set of pillars that significantly improve the implementation and equity of climate action. Each action included in the CAAP was developed to support at least one of the following pillars of climate action:

- Produce measurable GHG emissions reductions
- Support information gathering for improved measure implementation (e.g., feasibility studies, pilot programs)
- Coordinate with local partners to support equitable distribution of new employment opportunities for the community in the areas of renewable energy, electrification, waste management, and new technology development and deployment
- Achieve just outcomes and avoid unintended impacts on under-resourced communities through human-centered design and engagement and the development of new resources and programs specifically for low-income communities
- Foster and equip community education, outreach, and leadership for CAAP implementation
- Partner and leverage resources to maximize impact with local organizations and agencies, with the understanding that some groups within Sacramento are better positioned than the City to implement some of the CAAP’s climate actions
- Ensure accountability through tracking, monitoring, and reporting

Measure Strategy Summary

The strategies for the CAAP measures and supporting actions vary sector by sector and in general, continue many of the themes from the previous CAP. The four top GHG reduction measures of the CAAP, however, are driven by a new over-arching strategy that leverages electricity procurement transitions by SMUD (which currently offers 70 percent carbon-free electricity to the community and is anticipated to offer 100 percent carbon-free electricity by 2030). This new strategy aims to electrify transportation and the built environment to allow clean energy to replace fossil fuel-powered appliances and vehicles over the next 24 years.

The City of Sacramento is committed to achieving carbon neutrality by 2045 with at least an 85% reduction below 1990 levels, consistent with AB 1279. The measures in this CAAP were developed to build a strong foundation for achieving carbon neutrality by the target date. The CAAP includes a specific schedule for future CAAP updates to make iterative course corrections as part of the Implementation and Monitoring Plan in [Chapter 8](#). Full implementation of the measures and action in this CAAP is expected to exceed both the State's SB 32 target and Sacramento's 2030 climate action target in 2030. However, due to the uncertainty of future technologies and legislation, this CAAP does not attempt to fully provide the specific measures and actions that will be needed over the next 24 years to achieve carbon neutrality by 2045. New technologies and

legislation will provide future opportunities for new measures and actions to be developed as a part of future CAAP updates that will leverage the most cutting-edge solutions available.

FULL IMPLEMENTATION OF THE MEASURES AND ACTION IN THIS CAAP IS EXPECTED TO EXCEED BOTH THE STATE'S SB 32 TARGET AND SACRAMENTO'S 2030 CLIMATE ACTION TARGET IN 2030.

A central tenet of the CAAP is to ensure that implementation does not result in unintended costs for under-resourced communities and that the co-benefits associated with climate action and adaptation are equitably distributed throughout the community. The strategies outlined below and expanded on in [Chapter 6](#) reflect recommendations from the Mayors' Commission on Climate Change Equity Technical Advisory Committee and the City's Environmental Justice Working Group. Climate action and adaptation has the potential to significantly improve the quality of life for the City's most vulnerable populations by lowering energy bills, improving low-cost mobility options and connectivity, increasing green space and shade in under-resourced communities, and improving air quality throughout the City. However, to ensure Sacramento's most vulnerable populations are resilient to projected climate change impacts and ensure they receive access to the many co-benefits of climate action, special care is needed. The CAAP measures prioritize under-resourced



communities to ensure an equitable transition to a carbon neutral future. Actions found under each measure help the City plan for:

- Dedicated funding and financing for under-resourced communities
- Partnerships with community organizations
- Equitable deployment of projects like tree plantings
- Continued outreach and engagement within these communities

BUILDINGS STRATEGY

GHG emissions in the buildings sector are driven primarily by electricity and natural gas usage for water heating, space heating/cooling, and to a lesser extent, cooking. Sacramento's core strategy for achieving carbon neutrality in the building sector is to leverage SMUD's plan to transition from 70 percent carbon-free electricity procurement to 100 percent carbon-free electricity procurement by 2030, by transitioning fossil fuel-powered buildings to electric-powered buildings. This process will begin with new buildings and transition to focus on existing buildings over time. The building strategy also focuses on smarter land-use to reduce vehicle-miles traveled (VMT) and to encourage smaller dwellings to improve housing affordability in Sacramento. The following measures have been developed to begin transitioning to a carbon neutral building stock:

- **E-1:** Support SMUD as it implements the 2030 Zero Carbon Plan
- **E-2:** Eliminate natural gas in new construction
- **E-3:** Transition natural gas in existing buildings to carbon-free electricity by 2045
- **E-4:** Increase the amount of electricity produced from local resources and work with SMUD to install additional local storage by 2030
- **E-5:** Support infill growth with the goal that 90% of new growth is in the established and center/corridor communities and 90% small-lot and attached homes by 2040, consistent with the regional Sustainable Communities Strategy. Project-level VMT should be 15% below (or 85% of) the regional average.

These CAAP measures directly reflect the strategies identified by the Mayors' Commission on Climate Change to electrify new construction (built-environment recommendation #1), electrify existing buildings (built-environment recommendation #3), and support sustainable land use (built-environment recommendation #1).

TRANSPORTATION STRATEGY

GHG emissions from the transportation sector are the largest contributor to Sacramento’s GHG emissions and are driven by on-road passenger vehicles, heavy duty vehicles and commercial vehicles. Getting to carbon neutral in this sector entails a three-tiered approach:

- Significantly increase the portion of trips completed via active transportation options like walking and biking,
- Transition the majority of remaining trips to public transit and carpools, and finally to
- Transition any remaining passenger and commercial vehicle trips to EVs.

While the City cannot require residents to ride a bike, take the bus, or buy EVs, the City and its partners can collaborate to incentivize this behavior change. The City and its partners will support these cleaner transportation options with incentives and by constructing or facilitating the construction of new transportation infrastructure such as bike lanes and pedestrian infrastructure, new public transit infrastructure, and public and private EV charging stations³. Although shifting away from single-passenger vehicles has been historically difficult in Sacramento and California, the City understands the importance of setting aggressive goals in this area to spur investment and innovation. Implementation of the transportation

strategy will provide substantial co-benefits to the City and help create a future Sacramento with multiple sustainable transportation options. The CAAP transportation measures are as follows:

- **TR-1:** Improve active transportation infrastructure to achieve 6% active transportation mode share by 2030 and 12% by 2045
- **TR-2:** Support public transit improvements to achieve 11% public transit mode share by 2030 and maintain through 2045
- **TR-3:** Achieve zero-emission vehicle (ZEV) adoption rates of 28% for passenger vehicles and 22% for commercial vehicles by 2030 and 100% for all vehicles by 2045

These measures directly reflect the strategies developed by the Mayors’ Commission on Climate Change to expand and enhance Sacramento’s infrastructure for active transportation (mobility recommendation #1), transit and shared mobility (mobility recommendation #2), and zero-emission vehicles (mobility recommendation #3).

Active and Shared Transportation and Public Transit: Active transportation includes walking, riding a non-motorized or electric bike, scooter, or skateboard, or any other way of getting around that does not include using a fossil-fuel motorized vehicle. Shared transportation includes publicly shared vehicle networks such as bike share, or car share programs. Public

3. On April 20, 2021, Sacramento City Council adopted the Electric Vehicle (EV) Charging Infrastructure Ordinance to establish parking incentives for zero-emission car sharing and EV-charging infrastructure beyond code requirements (previous code requirements reflect the 2019 Title 24 code cycle, which has been updated starting in January 2023) starting in May 2021 and require higher levels of EV-charging infrastructure in new construction starting in 2023.



transit includes any form of transportation provided by a regional transportation agency such as buses, shuttles, trains, or light rails.

WASTE STRATEGY

GHG emissions in the waste sector are generated primarily by organic waste sent to the landfill. As it decays, organic waste forms landfill gas that contains methane. Although methane breaks down to carbon dioxide relatively quickly in the atmosphere, it traps 25 times more heat in the atmosphere than carbon dioxide. Reducing methane emissions is an effective strategy to slow climate change in the near term. Getting to carbon neutral in the waste sector entails diverting organic waste from the landfill and reducing or recycling all non-organic waste. The State has already established a statewide goal to reduce organic waste sent to the landfill 75 percent below 2014 levels and rescue 20 percent of edible food currently disposed of by 2025 through SB 1383, which will be implemented and enforced

by local jurisdictions. Major components of SB 1383 go into effect in 2021 and 2022, including mandatory organics recycling. While SB 1383 is State legislation, it was not included in the City's adjusted GHG emissions forecast due to the level of implementation difficulty and need for City resources. Therefore, the CAAP establishes a pathway to achieve this goal within Sacramento through the following measure:

- **W-1:** Work to reduce organic waste disposal 75% below 2014 levels by 2025

This reflects the Mayors' Commission on Climate Change strategy to increase food security and support a regenerative food system by sourcing food locally and reducing food waste (community health and resiliency recommendation #2). While the Mayors' Commission on Climate Change suggests slightly less aggressive waste goals by 2025 than the CAAP, the CAAP was designed to comply with SB 1383 and therefore adopts the most stringent goals in line with the bill.



Managing Food Waste

CLIMATE ACTION & ADAPTATION PLAN

WATER AND WASTEWATER STRATEGY

Water and wastewater GHG emissions in Sacramento are driven by electricity usage for water conveyance and treatment for residential, commercial, and municipal buildings in the City. Getting to carbon neutral in this sector entails transitioning to carbon-free electricity while also increasing water efficiency, which has the added advantage of conserving water and reducing drought impacts to local ecosystems and water supplies. The CAAP water and wastewater measures are:

- **WW-1:** Reduce water utility emissions (in MT CO₂e per million gallon delivered) by 100% by 2030 and maintain that through 2045
- **WW-2:** Reduce wastewater emissions by 22% by 2030 and 40% by 2045

While the Mayors' Commission on Climate Change does not make recommendations related to water and wastewater, the City recognizes the important role that water and wastewater play as part of the GHG emissions landscape in California and has included these measures as an effort for Sacramento to do its part in reducing water use and water-related GHG emissions.

CARBON SEQUESTRATION STRATEGY

Carbon neutrality is defined as no net gain of GHG emissions in the atmosphere or when GHG emissions are equal to the GHGs removed from the atmosphere. Realistically, Sacramento will likely have some GHG emissions associated with its activities in 2045, regardless of how well GHG emissions can be reduced in each of the City's GHG-generating sectors. To offset remaining future GHG emissions, the City will invest in carbon sequestration methods that will move net GHG emissions back towards zero. The CAAP's carbon sequestration measure is:

- **CS-1:** Increase urban tree canopy cover to 25% by 2030 and 35% by 2045.

A focus on carbon sequestration has the added benefit of increasing greenspace for more robust local habitats, reducing urban heat island effects, and beautifying Sacramento, especially in historically underserved communities. This CAAP measure is consistent with the Mayors' Commission on Climate Change strategy to expand green infrastructure to ensure that all neighborhoods, starting with historically under-resourced communities and neighborhoods with low canopy cover, have access to greenspace and tree canopy shade (community health and resiliency recommendation #1).



GHG Reductions by the Numbers

Together, Sacramento’s CAAP measures have the potential to reduce GHG emissions well beyond the 2030 target. [Table 5-2](#) shows the GHG emissions that will be saved in 2030 and 2045 with implementation of each measure.⁴ As shown below in [Table 5-2](#), Sacramento’s GHG emissions reduction measures have the potential to exceed the 2030 target with full implementation.⁵ For more information on how these reductions were calculated please see [Chapter 6](#) and [Appendix C](#).

The breakdown of anticipated GHG emissions reductions by measure is shown in [Figure 5-1](#). Some measures have no associated GHG emissions reductions and are instead marked as “Supportive.” These measures could not be

quantified due to lack of data or existing case studies, but are still instrumental to successful CAAP implementation. As shown in the figure, measures E-1, E-2, E-3, and TR-3 provide some of the largest GHG emissions reductions and rely on SMUD’s 2030 decarbonization plan to provide the maximum possible reduction. While these ambitious reductions substantially exceed the State’s 2030 target, they fall short of achieving carbon neutrality by 2045 ([Figure 5-2](#)). Remaining emissions in 2045 include wastewater process emissions, some natural gas end uses like stoves and dryers, and emissions from waste. Future CAAP updates will need to further address these sectors and adopt new and innovative strategies for all sectors as new technologies and regulations are drafted. As the 2045 target is codified by the State, an updated statewide scoping plan will also reveal the long-term strategy for statewide carbon neutrality.

-
4. GHG emissions savings were calculated relative to the adjusted forecast. For example, the GHG emissions total for Sacramento in 2030 with measure implementation can be calculated as the adjusted forecast GHG emissions in 2030 minus the GHG emissions savings in 2030 from the measures.
 5. Note that without full implementation of the VMT reduction strategies (TR-1 through TR-3), which are the most capital-intensive measures in the CAAP and are contingent on funding, the City still exceeds the 2030 target. This is discussed in more detail in [Appendix C](#).

CLIMATE ACTION & ADAPTATION PLAN

Table 5-2. GHG Reduction Potential by Sector and Measure

Measure Number	Measure Name	GHG Emissions Saved in 2030 (MT CO ₂ e)	GHG Emissions Saved in 2045 (MT CO ₂ e)
Built Environment (Energy and Electrification)			
E-1	Support SMUD as it implements the 2030 Zero Carbon Plan	576,225	0 ¹
E-2	Eliminate natural gas in new construction	37,692	134,621
E-3	Transition natural gas in existing buildings to carbon-free electricity by 2045	119,289	402,468
E-4	Increase the amount of electricity produced from local resources and work with SMUD to install additional local storage by 2030	Supportive	Supportive
E-5	Support infill growth with the goal that 90% of new growth is in the established and center/corridor communities and 90% small-lot and attached homes by 2040, consistent with the regional Sustainable Communities Strategy. Project-level VMT should be 15% below (or 85% of) the regional average.	Supportive	Supportive
Mobility			
TR-1	Improve active transportation infrastructure to achieve 6% active transportation mode share by 2030 and 12% by 2045	13,509	30,557
TR-2	Support public transit improvements to achieve 11% public transit mode share by 2030 and maintain through 2045	106,035	122,371
TR-3	Achieve zero-emission vehicle (ZEV) adoption rates of 28% for passenger vehicles and 22% for commercial vehicles by 2030 and 100% for all vehicles by 2045	212,451	1,137,071
Waste			
W-1	Work to reduce organic waste disposal 75% below 2014 levels by 2025	134,991	160,897



Measure Number	Measure Name	GHG Emissions Saved in 2030 (MT CO ₂ e)	GHG Emissions Saved in 2045 (MT CO ₂ e)
Water and Wastewater			
WW-1	Reduce water utility emissions (in MT CO ₂ e per million gallon delivered) by 100% by 2030 and maintain that through 2045	6,296	0 ¹
WW-2	Reduce wastewater emissions by 22% by 2030 and 40% by 2045	5,495	11,517
Carbon Sequestration			
CS-1	Increase urban tree canopy cover to 25% by 2030 and 35% by 2045.	23,053	61,474
GHG Emissions Reduction Summary			
Estimated Reductions Achieved from Full Measure Implementation		1,235,034	2,060,976
Total Reduction Needed to Meet Climate Action Targets		543,437	2,227,322
Gap to Target		-691,597	166,345

1. GHG emissions reductions associated with Measure E-1 and WW-1 are zero in 2045 because the State has required all electricity providers to procure 100% carbon-free electricity by 2045. While SMUD has created a plan to achieve this goal by 2030, GHG emissions reductions in 2045 are already captured in the adjusted forecast for Sacramento.

CLIMATE ACTION & ADAPTATION PLAN

Figure 5-1. GHG Emissions Reductions Breakdown by Measure (2030)

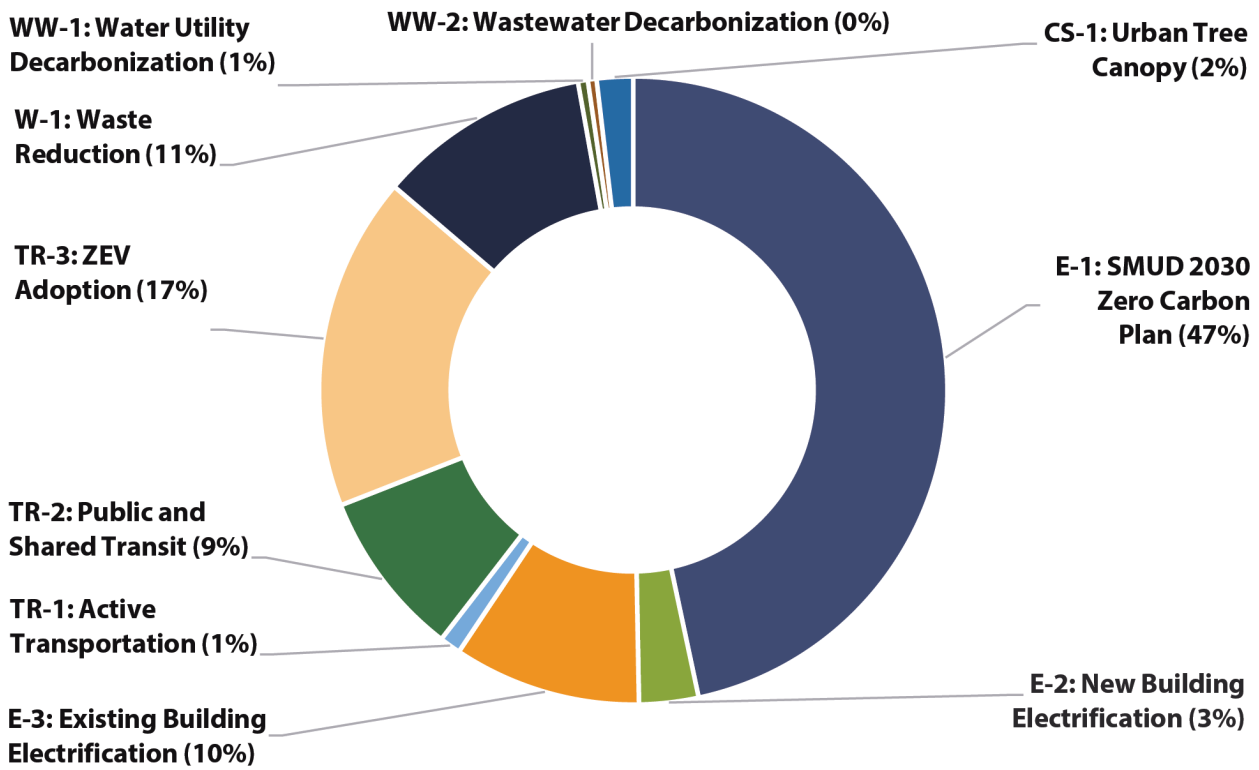
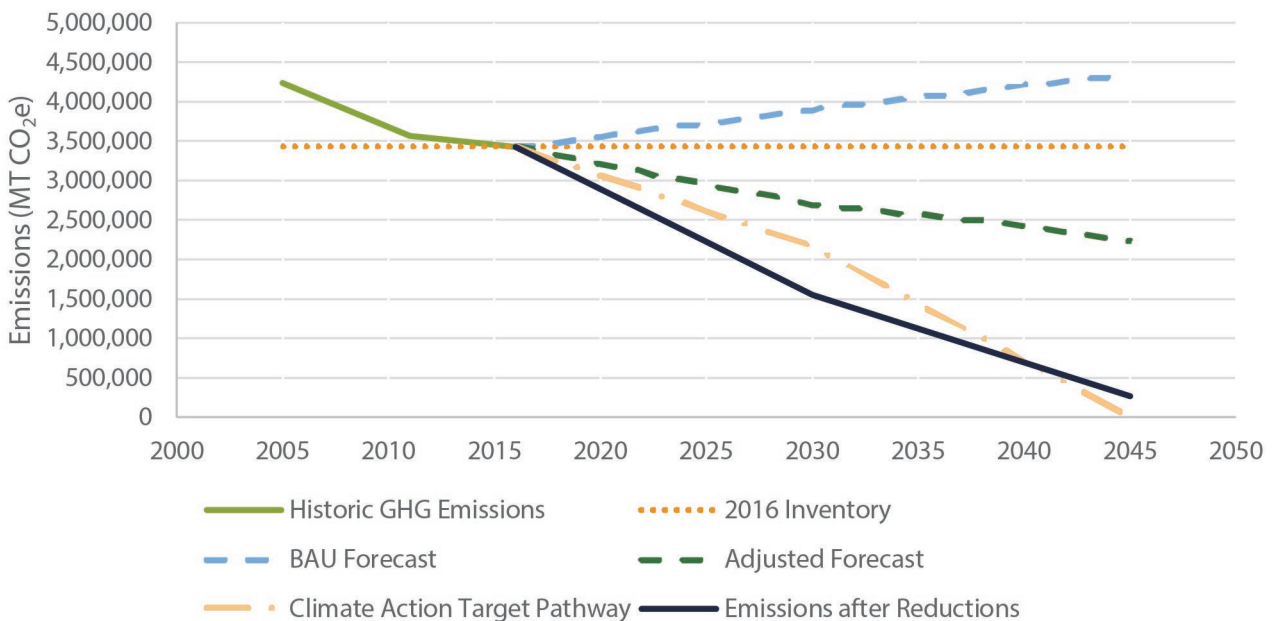


Figure 5-2. Sacramento’s Climate Action Targets and Reduction Pathway (MT CO₂e)





CONSIDERATIONS FOR ACHIEVING CARBON NEUTRALITY

The City of Sacramento is committed to achieving carbon neutrality as soon as possible. While the measures and actions detailed in this report do not achieve carbon neutrality by 2045, they do form a realistic and implementable foundation on which to decarbonize the City, achieve GHG reductions in 2030 consistent with the State's goals, and meet CEQA criteria for a "qualified" GHG reduction plan, as discussed in [Chapter 1](#). The measures and actions in this CAAP are the next steps in a long history of progress on climate in Sacramento. This iteration of the CAAP does not include measures and actions that will achieve carbon neutrality due to three main reasons:

Timeframe

This plan has a timeline of between five and ten years and the measures and actions included here are meant for implementation in the short term. This plan, if fully implemented, will put the City on a trajectory to achieve carbon neutrality by 2045. However, future CAAP updates will need to take into consideration the new conditions within the City, the State and beyond. While the City could simply include highly aggressive measures to be implemented 15 or even 20 years from now, doing so would be highly speculative and would not increase the rate of reductions today. Future CAAP updates will reevaluate the progress the City has made, increase the implementation of the strategies included in this CAAP, and develop new strategies as needed.

Equity

Sacramento's under-resourced communities are likely to face the greatest impacts from climate change (increased heat, fewer trees, poor air quality, rising costs of living) and are Sacramento's communities with the fewest resources in terms of ability to harness technology for adaptation. Addressing climate change will require financial investment such as purchasing new EVs, electrifying buildings, installing solar and battery storage, and other actions. While reducing GHG emissions is necessary, the City must have a strategy that is equitable. Therefore, before aggressive actions are considered, the costs and benefits must first be fully understood and policies to mitigate equity impacts must be in place. The Urban Sustainability Directors Network (USDN) defines three equity objectives or dimensions for incorporation into sustainability planning processes:

Procedural

- Create processes that are transparent, fair, and inclusive in developing and implementing any program, plan, or policy.
- Ensure that all people are treated openly and fairly.
- Increase the civic engagement opportunities of communities that are disproportionately impacted by climate change.

Distributional

- Fairly distribute resources, benefits, and burdens.
- Prioritize resources for communities that experience the greatest inequities, disproportionate impacts, and have the greatest unmet needs.

CLIMATE ACTION & ADAPTATION PLAN

Structural

- Make a commitment to correct past harms and prevent future unintended consequences.
- Address the underlying and institutional systems that are the root causes of social and racial inequities.

These equity objectives will be important for the City to work towards during implementation of the CAAP measures and actions. The CAAP establishes new requirements and incentives for the community, which have the potential, if not implemented effectively, to exacerbate existing inequities as described above. By developing implementation procedures to address procedural, distributional, and structural equity, the City will aim to avoid causing further harm to underserved communities.

Technology

The pace of technological change has been and will likely continue to be rapid, especially when it comes to addressing climate change. While the City could plan through 2045 using today's technology, by the time the CAAP is updated in 2030 a new suite of solutions will be available. Therefore, this CAAP focuses on the next several years, with an expected CAAP update to be initiated in 2027, for adoption in 2030 in conjunction with the next General Plan update. These updates will ensure the City achieves carbon neutrality using the most cost effective and efficient solutions including the use of cutting edge technologies.



Electric Heat Pump HVAC Unit Installation



Measure Co-Benefits

In addition to GHG emissions reductions, the CAAP measures and actions will produce many other co-benefits for the community. Co-benefits refer to the positive effects that a climate action policy will have on other community objectives, as defined by the United National Intergovernmental Panel on Climate Change (IPCC).⁶ For example, co-benefits stemming from building electrification include lower energy costs for residents and improved local air quality.

Another co-benefit of CAAP adoption will be facilitation of local development, because the CAAP itself will be used to streamline the CEQA

process for new development projects. A key priority throughout the CAAP development process has been the promotion of thoughtful development in Sacramento that will support the local economy, provide for infrastructure upgrades, and ensure affordable housing needs are met in alignment with City and State goals. The CAAP provides a clear pathway for new development to align with State climate action requirements and supports local development and investment. The sector strategies are a key component of a CEQA-qualified GHG-reduction plan, which will allow new development projects in Sacramento to “tier off” of the CAAP, significantly reducing the required CEQA review that is required for new development.

The co-benefits of successful implementation of measures in this CAAP are discussed in more detail below and paired with relevant measures throughout [Chapter 6](#).



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

6. IPCC 2007; IPCC 2014a; IPCC 2014b; <https://www.ipcc.ch/reports/>.

PUBLIC HEALTH



Climate action can improve a variety of health and safety conditions, including risk of heat-related and other illness from air quality or heatwaves, physical fitness levels, and mental wellbeing. Air monitoring data show that over 90 percent of Californians breathe unhealthy levels of one or more air pollutants during some part of the year, primarily due to the combustion of fossil fuels.⁷ Sacramento is listed as one of the most polluted cities in the United States for unhealthy ozone days, unhealthy spikes in particle pollution, and for annual particle pollution levels.⁸ Exposure to these pollutants can increase the risk of cardiovascular disease, chronic and acute respiratory illnesses, cancer, and pre-term births. Climate actions aimed at reducing traffic congestion, taking vehicles off the road, and electrifying fossil-fueled equipment will lessen the potential for health risks for Sacramento's communities. Prioritizing underserved communities for actions that

improve air quality is also important for ensuring those community members who are most vulnerable will have access to these health co-benefits.

Heat-related illness is another significant health risk that is expected to increase with climate change. As described in [Chapter 1](#), increasing temperatures from climate change are causing more intense and frequent heat waves in Sacramento. More than 600 people in the United States are killed by extreme heat events every year, making extreme heat one of the deadliest types of weather-related hazards.⁹ Climate actions like planting more trees for increased canopy cover and contributing to GHG emissions reductions can help reduce the risk of increased heat-related illness in Sacramento. Climate action can also help make residents more active. Actions like building more bikeways, crosswalks and sidewalks encourage active modes of transportation such as biking and walking and can reduce obesity and non-communicable disease risk, diminish public health service costs, and improve mental health.¹⁰

7. California Air Resources Board. *ARB Fact Sheet: Air Pollution and Health*. Retrieved September 20, 2021, from <https://ww2.arb.ca.gov/resources/health-air-pollution>.

8. American Lung Association. (2021, April 21). *Lung Association Report finds Californian's Health at Risk Due to Air Pollution and Climate Change Impacts*. Retrieved September 20, 2021, from <https://www.lung.org/media/press-releases/sota21-california>.

9. Centers for Disease Control and Prevention. (n.d.). *Natural Disasters and Severe Weather: Extreme Heat*. Retrieved September 20, 2021, from <https://www.cdc.gov/disasters/extremeheat/index.html>.

10. Litman, Todd and Victoria Transport Policy Institute. (2021, September 1). *Evaluating Active Transport Benefits and Costs*. Retrieved September 20, 2021, from <https://www.vtpi.org/nmt-tdm.pdf>.



COMMUNITY COST SAVINGS



Investments in climate action can save community members money both up front and over time. For example, investments in walking, biking, and public transit infrastructure can improve community usage of these transportation options and act as a less expensive alternative to driving for shorter trips within a city. EVs also represent an opportunity for cost savings for owners. Studies have shown that EVs have 50 to 75 percent of the average maintenance cost of a conventional vehicle and EVs cost about half as much to fuel as traditional fossil fuel vehicles.^{11,12} For low-income residents in California, who spend between 17 and 36 percent of their total household budget on transportation, obtaining the up-front capital to purchase an EV through low-income programs can contribute significantly to reducing this cost burden.¹³

Incorporating energy reduction initiatives into buildings can result in on-going cost savings for property owners. For example, using trees

to shade buildings can save money on air conditioning costs. One study of a shade-tree planting project reported energy savings from cooling ranging from 7 to 47 percent due to passive solar shading.¹⁴ Additionally, research has concluded that most all-electric buildings are cheaper to build and cheaper to operate over time when compared to traditional buildings with both gas and electricity.¹⁵ Natural gas is also getting more expensive. Without a transition plan, the bill for running a gas furnace could increase 500 percent by 2050, due to increasing natural gas infrastructure costs coupled with a naturally declining demand for gas as appliances become more energy efficient.¹⁶ Many of these saved dollars are spent in the local economy where they have economic multiplier effects. Residents have more money to spend on daily needs, education, medical care, and leisure activities, all of which feed into local economic growth. Measures that have the community cost savings co-benefit have been found to save the community money either up front, or over time.

11. Delucchi, Mark, Quanlu, Wang, and Daniel, Sperlin. *Electric vehicles: performance, life-cycle costs, emissions, and recharging requirements*. Transportation Research Part A 23A (February 1989): 255-78.
12. US Department of Energy. (n.d.). Retrieved September 20, 2021 from <https://www.energy.gov/eere/vehicles/articles/fotw-1190-june-14-2021-battery-electric-vehicles-have-lower-scheduled>
13. California Air Resources Board. (2018, February 2021). *Low-Income Barriers Study Part B: Overcoming Barriers to Clean Transportation Access for Low-income Residents*. Retrieved September 30, 2021 from https://ww2.arb.ca.gov/sites/default/files/2018-08/sb350_final_guidance_document_022118.pdf.
14. U.S. Environmental Protection Agency. (2008). *Reducing Urban Heat Islands: Compendium of Strategies*. Heat Island Reduction Activities. Retrieved September 21, 2021, from https://www.epa.gov/sites/default/files/2017-05/documents/reducing_urban_heat_islands_ch_6.pdf.
15. California Energy Codes and Standards. (n.d.). *Statewide Reach Codes Program*. Retrieved September 20, 2021, from <https://localenergycodes.com/content/2019-local-energy-ordinances/>.
16. Gridworks. (2020.) *California's Gas System in Transition*. Retrieved September 21, 2021, from <https://gridworks.org/initiatives/cagas-system-transition/>.

ADAPTATION



While the CAAP has a dedicated adaptation section ([Chapter 7](#)) many climate mitigation actions can also bolster the ability of Sacramento residents and businesses to adapt to climate change and recover quickly from climate hazards such as extreme heat days or localized flooding. For example, planting trees for carbon sequestration and increasing tree canopy cover can help keep streets and neighborhoods cooler especially in disadvantaged communities that have lower tree cover on average. Studies have shown that shading 40 percent of a city street can counteract the warming effects from asphalt.¹⁷ The value of canopy cover and cooler streets will continue to be important for Sacramento as average city-wide temperatures rise. Increasing tree canopy cover to provide cooling and carbon sequestration is one example of increased resilience.

Electrification through the use of heat pumps will significantly reduce GHG emissions associated with buildings but also provide efficient

cooling for homes that may not have air conditioning, an important adaptation strategy especially for vulnerable populations. Developing building electrification programs with equity in mind, such as SMUD's low income retrofit programs, could help improve the adaptive capacity of Sacramento's most vulnerable populations in the face of increasing temperatures.¹⁸

Climate actions can also enhance community cohesion—the networks of formal and informal relationships among neighbors that foster a mutually supporting human environment.¹⁹ One study found that even small amounts of greenery helped inner city residents have safer, less violent domestic environments.²⁰ A survey measuring the social capital of residents in a wide range of neighborhood types found a positive relationship between neighborhood walkability and knowing neighbors, participating politically, trusting others, and being socially engaged.²¹ A socially engaged community is one in which people are more willing to look out for each other and support each other in time of need.²²

17. Chodosh, S. (2019, March 25). Popular Science. Here's how many trees are required to cool a city street; An equation for throwing shade. Retrieved September 20, 2021, from <https://www.popsci.com/shade-city-streets-trees-cooling/>.

18. Sacramento Municipal Utilities District. (n.d.). *Low-income assistance and nonprofits*. Retrieved September 20, 2021, from <https://www.smud.org/en/Rate-Information/Low-income-and-nonprofits>.

19. Dale, A., Newell, R., and Roseland, M. (2018, October). The International Journal of Climate Change Impacts and Responses. *Climate Action Co-benefits and Integrated Community Planning*. Uncovering the Synergies and Trade-Offs. Retrieved September 21, 2021. From https://www.researchgate.net/publication/328539965_Climate_Action_Cobenefits_and_Integrated_Community_Planning_Uncovering_the_Synergies_and_Trade-Offs.

20. Kuo, F.E. and Sullivan, W.C. (2001). *Aggression and violence in the inner city: Impacts of environment via mental fatigue*. *Environment & Behavior*. 33(4): 543-571.

21. Leyden, K. M. (2003). *American Journal of Public Health*. *Social Capital and the Built Environment: The Importance of Walkable Neighborhoods*.

22. Wells, K.B. et al. (2013, July 3). US National Library of Medicine. National Institutes of Health. *Community Engagement in Disaster Preparedness and Recovery: A Tale of Two Cities - Los Angeles and New Orleans*. Retrieved September 20, 2021, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3780560/>.



JOB CREATION



In many cases, climate action means financial investment. These investments can boost Sacramento's economy through promoting the development of local projects, programs, and jobs. Successful implementation of the CAAP will also solidify Sacramento's position as a leader in next generation technologies and economic sectors. Investments in construction, manufacturing, clean technology, green infrastructure, and civil engineering sectors provide businesses with opportunities for growth and create skilled, well-paying "green" jobs for the community. Many of the jobs in the renewable energy and energy efficiency sector are associated with installation, maintenance, and construction—making them inherently local and influential to the local economy. Studies have shown that energy efficiency investments create more jobs than those in fossil fuel industries. It is estimated that approximately eight green jobs are generated per \$1 million invested, compared to approximately three jobs per \$1 million in fossil-fuel industries.²³ A University of California, Berkeley study found that the solar industry creates 0.87 job-years (years of work) per gigawatt hours and energy efficiency creates 0.38 job years per gigawatt

hours.²⁴ Measures with the job creation co-benefit are expected to increase the number of jobs especially in the green economy, helping to ensure Sacramento's economy is ready for the future.

ENVIRONMENTAL QUALITY



Climate change will have significant impacts on the ecosystems that support both human and environmental health. Air quality, water quality and availability, plants, and animals will all be stressed by a rapidly changing climate. Measures with the environmental quality co-benefits will help improve these areas and ensure these environmental systems continue to function. Measures like increasing the tree canopy will provide more habitat and keep temperatures cooler while building and vehicle electrification will improve air quality. Residential buildings in California have been found to produce upwards of 82 tons of NO_x on a daily basis, more than seven times what California's power plants produce. This NO_x is a precursor to smog (ozone) which impacts the health of people and the environment, including impacting airways and even plant growth.²⁵

23. Environmental Defense Fund. (n.d.). Climate Corps. Now Hiring: The Growth of America's Clean Energy and Sustainability Jobs. Retrieved from http://edfclimatecorps.org/sites/edfclimatecorps.org/files/the_growth_of_americas_clean_energy_and_sustainability_jobs.pdf.

24. UC-Berkeley. (n.d.). Center for Resource Efficient Communities. Methods to Assess Co-Benefits of California Climate Investments. Retrieved September 20, 2021, from https://ww3.arb.ca.gov/cc/capandtrade/auctionproceeds/ucb_lit_rev_on_jobs.pdf?_ga=2.164452799.1014054594.1562085485-1467300981.1559153156.

25. US Environmental Protection Agency. (n.d.). *Ground-level Ozone Basics*. Retrieved September 20, 2021, from <https://www.epa.gov/ground-level-ozone-pollution/ground-level-ozone-basics>.



GHG-REDUCTION MEASURES AND ACTIONS



This chapter provides a detailed overview of each CAAP measure and its associated actions, key performance indicators, expected GHG emissions reductions and co-benefits.¹ Each measure also includes an explanation of its alignment with the Mayors' Commission on Climate Change and how the measure and related actions contribute to a carbon-neutral Sacramento. The CAAP actions define the specific policies, programs, and steps the City and its partners will implement to achieve the measure goals and the climate action targets.



Rooftop Solar Panels

1. For a complete description of the assumptions and calculations supporting each quantified GHG reduction, see [Appendix C](#).

CLIMATE ACTION & ADAPTATION PLAN

This chapter also identifies the implementation leads, performance indicators for implementation tracking, and implementation phase associated with each action. The City of Sacramento has established two phases for implementation:

- **Phase 1** actions will begin implementation at CAAP adoption or before. These actions have been prioritized due to their

importance, cost-effectiveness, or the availability of resources for implementation.

- **Phase 2** actions will begin implementation between 2024 and 2030. These actions may require additional resources such as staff time, funding and financing, or there may need to be additional education and outreach conducted prior to implementation.



Photo by Carlos Eliason

Bicycle and Pedestrian Infrastructure in Sacramento



BUILT ENVIRONMENT



MEASURE E-1: Support SMUD as it Implements the 2030 Zero Carbon Plan

To support Sacramento’s climate action targets and achieve their own sustainability goals, SMUD developed a 2030 Zero Carbon Plan, which provides a roadmap for SMUD to eliminate GHG emissions from their power supply by 2030.² SMUD’s 2030 Zero Carbon Plan also provides a roadmap to ensure that the customers and communities they serve will reap the greatest benefits from the elimination of natural gas from their buildings. Utilizing carbon-free electricity is a central element of Sacramento’s plan to achieve its 2030 target and 2045 carbon neutrality goal, particularly in relation to measures E-2, E-3, and TR-3, which work to electrify the majority of buildings and vehicles in Sacramento by 2045. While this measure primarily falls on SMUD to implement, there may be opportunities for the City to provide support through the possible permitting of new projects, coordination of land use and energy efficiency projects, as well as public support of the plan and its benefits. The City is committed to continuing its close collaboration with SMUD through the next decade. SMUD has also identified the positive equity benefits of the 2030 Zero Carbon Plan, including alleviation of air pollution from the combustion of natural gas within buildings, and increased investment in underserved community partnerships and

programs that provide equitable access to SMUD jobs, rebate and incentive programs, and low-income programs. While this measure provides a significant GHG reduction in 2030, the impacts decrease towards zero by 2045 due to implementation of the California Renewable Portfolio Standard and SB 100, a State law requiring 100 percent renewable electricity in California already included in the forecast.

Alignment with Mayors’ Commission on Climate Change

In June 2020, the Mayors’ Commission on Climate Change provided recommendations for electrification of new construction, electrification of existing buildings, and electrification of fossil-fuel vehicles. Measure E-1 maximizes the GHG reduction benefits of these actions and supports building community trust around the electrification process. Recommendations also include allocation of resources that address historical and current inequities, inclusion of under-resourced communities historically excluded from the policymaking process, and expansion of partnerships and support for community-based organizations. Measure E-1 will support SMUD’s efforts in these areas, particularly in increased investment in low-income programs.

2. SMUD. *2030 Zero Carbon Plan*. Retrieved on November 4, 2021 from <https://www.smud.org/-/media/Documents/Corporate/Environmental-Leadership/ZeroCarbon/2030-Zero-Carbon-Plan-Technical-Report.ashx>



Key Performance Indicators

A. 100% renewable electricity citywide by 2030

Expected GHG Reductions

- **2030:** 576,225 MT CO₂e
- **2045:** 0 MT CO₂e³

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

Actions and Implementation

Action	Lead	Support	Phase	Performance Indicator
E-1.1: Support SMUD in the implementation of the 2030 Zero Carbon Plan.	<ul style="list-style-type: none"> • SMUD 	<ul style="list-style-type: none"> • Office of Climate Action & Sustainability 	Phase 1	100% renewable electricity citywide by 2030

3. The GHG-reduction value of this measure goes to zero by 2045 due to the impacts of SB 100 which are already accounted for in the forecast. Because of SB 100, all electricity will be renewable by 2045, and, therefore, the difference between SMUD electricity and baseline will be zero.

MEASURE E-2: Eliminate Natural Gas in New Construction

For Sacramento to achieve carbon neutrality by 2045, the majority of buildings in the City will need to be powered by carbon-free energy rather than natural gas (a fossil fuel). This measure enables new buildings to take advantage of renewable electricity from SMUD by eliminating natural gas in new construction. The implementing action is the adoption of a “reach code” that requires newly constructed buildings to be all-electric (See Action E-2.1). An important co-benefit of all-electric buildings is improved indoor and outdoor air quality. In addition, construction costs for all-electric buildings are lower for most building types.⁴ Constructing new buildings as all-electric eliminates the high level of investment that would be needed to retrofit new buildings in the future in order to achieve carbon neutrality. All-electric buildings are also generally less expensive to live in due to high efficiency appliances⁵ and low electricity prices from SMUD. The City of Sacramento adopted the new building electrification ordinance in spring of 2021, achieving the goals of this measure before CAAP adoption.

Alignment with Mayors’ Commission on Climate Change

The final report from the Mayors’ Commission on Climate Change recommends that Sacramento mandate all-electric construction to eliminate fossil-fuel use in new low-rise (under 4 stories) buildings by 2023 and all buildings by 2026. This mandate is contained in Action E-2.1.

Key Performance Indicators

- A. Adoption of a new construction electrification ordinance by 2023 (adopted June 1, 2021)

Expected GHG Reductions

- **2030:** 37,692 MT CO₂e
- **2045:** 134,621 MT CO₂e

4. Local Energy Codes. *Cost Effectiveness Explorer*. Retrieved on November 4, 2021 from <https://explorer.localenergycodes.com/sacramento-city/summary>

5. Natural Resources Defense Council (NRDC). *Electricity a Smarter Choice than Low-Carbon Gas in CA Homes*. Retrieved on November 4, 2021 from <https://www.nrdc.org/experts/merrian-borgeson/new-study-electricity-trounces-low-carbon-gas-buildings>



Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

Actions and Implementation

Action	Lead	Support	Phase	Performance Indicator
E-2.1: Develop and adopt an electrification ordinance that requires all new construction under four stories to be all-electric by 2023 and all construction to be all-electric by 2026.	<ul style="list-style-type: none"> Community Development Department 	<ul style="list-style-type: none"> Office of Climate Action & Sustainability SMUD 	Complete	None (completed)

IMPLEMENTATION SUCCESS:

Due to its considerable impact on GHG reductions, co-benefits, and direction from the Mayors' Commission on Climate Change, the City of Sacramento worked to implement Measure E-2 before the CAAP was adopted. City Council adopted the ordinance following a comprehensive stakeholder engagement effort, an educational webinar series, and collaboration to use the ordinance to drive just transition and equity outcomes. Each of the measures included in the CAAP strive to identify specific actions that will allow for comprehensive implementation of the identified measure. To fully implement measure E-2, the City conducted relevant community notification efforts prior to effectiveness in 2023, as required by the State.

MEASURE E-3: Transition Natural Gas in Existing Buildings to Carbon-free Electricity by 2045

While Measure E-2 focuses on achieving carbon neutrality for new construction by building all-electric, Measure E-3 focuses on achieving carbon neutrality for existing buildings through electrification of existing fossil fuel-powered equipment. The highest-emitting appliances in existing buildings, particularly homes, are space heaters and hot water heaters which are the focus of this measure.⁶ Appliances could also include gas stoves and gas dryers. Measure E-3 creates a phased approach to electrifying these appliances, including limiting natural gas infrastructure expansion and eventually requiring new appliance installations to be all-electric through the permit process (Action E-3.1). Electrification of existing buildings is expected to occur incrementally as old gas appliances wear out and need to be replaced. However, up-front investments may be needed, especially for older buildings, which can include the need for added panel capacity and additional labor and equipment costs for all-electric equipment versus natural gas-powered equipment. While existing building electrification is likely to have a long-term payback, additional resources are needed to facilitate the transition and ensure the equitable distribution of benefits and costs. On June 1, 2021, City Council approved a Resolution (2021-0166) that included direction for the City to establish a framework for the electrification of existing buildings (Action E-3.1). This framework is

anticipated to be considered by City Council in Summer 2023. Measure E-3 includes a support structure of information gathering, financial incentives, rebates, and educational programs to help residents and businesses replace their space and hot water heaters with electric alternatives and improve energy efficiency in the home through heat pumps, insulation, and air sealing (Actions E-3.2 through E-3.6). Incentives, rebates, and education programs will be coordinated through SMUD and focused on low-income community groups to reduce unintended costs to under-resourced communities (Actions E-3.3, E-3.5, and E-3.6).

Alignment with Mayors' Commission on Climate Change

The final report from the Mayors' Commission on Climate Change recommends that Sacramento transition 25 percent of existing residential and small commercial buildings to all-electric by 2030 and establish a comprehensive electrification and energy-efficiency program. Measure E-3 mirrors this goal by establishing a target of reducing natural gas usage by 28 percent through building electrification by 2030 and 74 percent by 2045. Measure E-3 also incorporates equity recommendations to operationalize equity considerations and expand the capacities of cultural brokers by establishing a commitment to electrification education and outreach programs for

6. U.S. Energy Information Administration (EIA). *Natural Gas Explained*. Retrieved on November 4, 2021 from <https://www.eia.gov/energyexplained/natural-gas/use-of-natural-gas.php>



low-income community groups and working with existing agencies and community-based organizations (e.g., SMUD, EJCGC, Community Resource Project (CRP), and GRID Alternatives) that have already established engagement efforts around this issue. A number of financing programs are available for property owners, including the State-led Go Green Financing program, property-assessed clean energy programs (PACE), and SMUD financing options.

Key Performance Indicators

- A.** Achieve natural gas usage rates of 124 therms per person or less by 2030
- B.** Achieve natural gas usage rates of 38 therms per person or less by 2045

Expected GHG Reductions

- **2030:** 119,289 MT CO₂e
- **2045:** 402,468 MT CO₂e

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

Actions and Implementation

Action	Lead	Support	Phase	Performance Indicator
E-3.1: Develop a comprehensive existing building electrification strategy that identifies associated costs and addresses potential equity impacts prior to implementation of mandatory requirements.	<ul style="list-style-type: none"> • Community Development Department 	<ul style="list-style-type: none"> • Office of Climate Action & Sustainability • SMUD • Public Works 	Phase 1	Complete an existing building electrification study

CLIMATE ACTION & ADAPTATION PLAN

Action	Lead	Support	Phase	Performance Indicator
<ul style="list-style-type: none"> E-3.2: Develop an electrification ordinance for existing buildings/ construction that will be implemented through the building permit process to transition away from fossil fuels to electric at time of replacement following adoption of Measure E3.1. The existing buildings ordinance would include the following elements: No new expansions of fuel gas piping at existing buildings/sites. Require HVAC system replacements and new water heaters to be all-electric or utilize other low-carbon technologies as the market evolves. 	<ul style="list-style-type: none"> Community Development Department 	<ul style="list-style-type: none"> SMUD Office of Climate Action & Sustainability 	Phase 2	Development and adoption of ordinance
<p>E-3.3: Work with SMUD to expand existing low-income programs within the City to weatherize and retrofit/ electrify existing buildings, with the goal of reducing energy consumption, decreasing utility bills, and converting to carbon-free energy use by 2040.</p>	<ul style="list-style-type: none"> SMUD 	<ul style="list-style-type: none"> Community Development Department . Sacramento Housing and Redevelopment Agency and other community partners 	Phase 2	Number of low-income homes retrofitted
<p>E-3.4: Promote and educate the community about existing programs and expand electrification retrofit incentives for space and water heating to support the electrification ordinances.</p>	<ul style="list-style-type: none"> SMUD 	<ul style="list-style-type: none"> Community Development Department 	Phase 2	None



Action	Lead	Support	Phase	Performance Indicator
E-3.5: Provide electrification retrofit incentives and financing for space and water heating.	<ul style="list-style-type: none"> • SMUD 	<ul style="list-style-type: none"> • Community Development Department 	Phase 1	New electrification retrofit incentives established
E-3.6: Continue to promote and incentivize electrification supportive energy efficiency in existing buildings including lighting, insulation, and air sealing upgrades through programs and financing mechanisms.	<ul style="list-style-type: none"> • Private PACE Financing programs 	<ul style="list-style-type: none"> • Office of the City Clerk 	Phase 1	None

MEASURE E-4: Increase the Amount of Electricity Produced from Local Resources and Work with SMUD to Install Additional Local Storage by 2030

Measures E-2, E-3, and TR-3 will increase the electricity demand in Sacramento, but building electrification is not expected to overburden the existing grid. This is because peak demand is during the summer, and the primary increase in electricity demand from building electrification will be in the winter from the addition of electric space heating appliances. The existing grid can comfortably support⁷ this increase with some modifications. Adding renewable energy resources and storage within the City of Sacramento (Actions E-4.1 through E-4.4) will contribute to the carbon-free electricity goals in Measure E-1. Adding local renewable electricity resources and storage helps SMUD balance the grid while generating more renewable electricity and harnessing the benefits of distributed battery storage. Advancing local clean power also stimulates job growth in green industries and creates a more resilient electrical grid, all while contributing to Sacramento's carbon neutrality goal. While SMUD will be the primary implementer of Measure E-4, the City will support SMUD's efforts by finding locations for renewables and storage, installing this

equipment at City facilities, convening stakeholders, or by other means. By helping SMUD transition away from fossil fuel-generated electricity, this measure also alleviates existing air pollution impacts to improve public health in Sacramento.

Alignment with Mayors' Commission on Climate Change

The final report from the Mayors' Commission on Climate Change recommends identifying climate adaptation strategies as part of the CAAP with a focus on early pilot projects. Measure E-4 will enhance Sacramento's electrical grid infrastructure for greater resiliency to the changing climate, while Action E-4.4 specifically commits to a community solar and storage pilot project.

Key Performance Indicators

- A. Pilot a local renewable energy project of at least 1MW by 2030

Expected GHG Reductions

- Supportive

7. Natural Resources Defense Council (NRDC). *California's Grid is Ready for All-Electric Buildings* (April 16, 2020). Retrieved on November 4, 2021 from <https://www.nrdc.org/experts/merrian-borgeson/californias-grid-ready-all-electric-buildings>



Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

Actions and Implementation

Action	Lead	Support	Phase	Performance Indicator
E-4.1: Continue to promote and support local energy generation and storage resources.	<ul style="list-style-type: none"> • SMUD 	<ul style="list-style-type: none"> • City's Office of Climate Action & Sustainability • Community Development Department 	Phase 1	Data implementation begun.
E-4.2: Work with SMUD to site storage and renewable generation at locations in the City which would best support overall grid functionality while electrifying the building stock and maximizing the utilization of existing electrical infrastructure.	<ul style="list-style-type: none"> • SMUD 	<ul style="list-style-type: none"> • Community Development Department • Public Works • City's Office of Climate Action & Sustainability • Office of Emergency Management Services 	Phase 2	Plan developed and implementation begun
E-4.3: Work alongside SMUD to promote and further incentivize battery storage as a means to maximize electrification benefits and improve resiliency.	<ul style="list-style-type: none"> • SMUD 	<ul style="list-style-type: none"> • Community Development Department/ Building Division 	Phase 1	Incentives created

CLIMATE ACTION & ADAPTATION PLAN

Action	Lead	Support	Phase	Performance Indicator
E-4.4: Develop a community solar and storage project of at least 1 MW as a pilot project collaboration between SMUD and the City with SMUD leading project development and the City supporting by providing a location and permitting support.	<ul style="list-style-type: none">• SMUD	<ul style="list-style-type: none">• City's Office of Climate Action & Sustainability• Public Works• Community Development Department	Phase 2	Pilot completed



MEASURE E-5: Support Infill Growth with the goal that 90% of new Growth is in the Established and Center/Corridor Communities and 90% Small-lot and Attached Homes by 2040, Consistent with the Regional Sustainable Communities Strategy. Project-level VMT Should be 15% Below (or 85% of) the Regional Average

This measure prioritizes infill development in the City of Sacramento. Infill development is the process of developing vacant or under-used lots within existing urban areas that are already largely developed. Infill development reduces VMT and supports a carbon-neutral future by situating new development in urban areas within shorter distances of jobs and services. Denser and more efficient development also decreases per capita energy use by the built environment.⁸ Public transit-oriented development, especially when paired with public transit improvements and parking maximums for new development projects, further incentivizes public transit over single-occupancy vehicles and reduces VMT. This measure supports infill growth with the goal of achieving 90% of new growth in established and center/corridor communities and 90% small-lot and attached homes by 2040, consistent with the Regional Sustainable Communities Strategy.

Alignment with Mayors' Commission on Climate Change

The final report from the Mayors' Commission on Climate Change recommends supporting infill growth consistent with the regional Sustainable Communities Strategy so that 90 percent of the City's growth is in the established and center/corridor communities⁹ and is 90 percent small-lot¹⁰ and attached homes by 2040, and project-level VMT is 15 percent below (or 85 percent of) the regional average, exactly in line with Measure E-5. Action E-5.1 aligns with the recommendation to support equity to address historical and current disparities with housing policies, land use designations, and implementation programs to facilitate the development of transit-accessible affordable housing, supported by anti-displacement policies and programs.

8. Joint Center for Housing Studies of Harvard University. *U.S. Households are Using Less Energy* (July 11, 2018). Retrieved on November 4, 2021 from <https://www.jchs.harvard.edu/blog/us-households-are-using-less-energy>

9. A map of Sacramento's established and center/corridor communities can be accessed here: [chrome-https://www.sacog.org/sites/main/files/file-attachments/2020_mtp-scs_final_draft_for_web.pdf](https://www.sacog.org/sites/main/files/file-attachments/2020_mtp-scs_final_draft_for_web.pdf)

10. Small-lot homes are equal to or less than 5,200 square feet for interior lots and 6,200 square feet for corner lots.

CLIMATE ACTION & ADAPTATION PLAN

Key Performance Indicators

A. 90% of infill growth occurs in established and center/corridor communities and 90% small lot and attached homes by 2040

B. 29,000 new multi-unit dwellings that are transit accessible by 2040

Expected GHG Reductions

- Supportive

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

Actions and Implementation

Action	Lead	Support	Phase	Performance Indicator ¹¹
<p>E-5.1: Adopt and implement policies, land use designations, and implementation programs which provide a framework to:</p> <ul style="list-style-type: none"> • Accommodate 30% of the region's new living-wage jobs and 30% of the region's new housing units by 2040. • Focus 90% of the city's infill growth into established and center/corridor communities with the goal of achieving 90% small-lot single family and attached homes by 2040. • Prioritize construction of lower-cost workforce and affordable housing through modifications of land-use designations and zoning, offering ministerial/staff-level review of infill housing and continue to reduce fees and the time and expense of planning approval and building permit processes. • Include anti-displacement policies and programs. 	<ul style="list-style-type: none"> • Community Development Department 	<ul style="list-style-type: none"> • None 	Phase 1	<p>30% of region's jobs and 30% of region's new housing units accommodated by 2040</p> <p>90% of city's infill growth in center/corridor communities by 2040</p>

11. Progress on E-5 actions will be reported every 5 years as a part of General Plan and CAAP updates.



Action	Lead	Support	Phase	Performance Indicator ¹¹
<p>E-5.2: Enable development of 29,000 new multi-unit dwellings that are public transit accessible (i.e., within 0.5 mile of public transit) by 2040 through the continuation of the City’s ministerial/staff-level review of infill housing, reduced fees, and identification of local funding sources.</p>	<ul style="list-style-type: none"> Community Development Department 	<ul style="list-style-type: none"> None 	Phase 2	29,000 new multi-unit dwellings that are transit accessible by 2040
<p>E-5.3: Enable the development of 8,700 new missing middle and affordable by design housing types (such as dormitories and smaller units) by 2040 within 0.25 mile of public transit by updating the City Code to allow and reduce barriers to these housing types. Couple with anti-displacement policies and programs.</p>	<ul style="list-style-type: none"> Community Development Department 	<ul style="list-style-type: none"> None 	Phase 2	8,700 new affordable by design units within 0.25 mile of transit by 2040
<p>E-5.4: Permit a greater array of housing types in existing single-family neighborhoods citywide by allowing missing middle housing types such as accessory dwelling units (ADUs), duplexes, triplexes, and fourplexes, and bungalow courts in single-family and duplex dwelling zones. Develop tools, resources and educational materials to promote and facilitate the development of ADUs in neighborhoods throughout the City.¹²</p>	<ul style="list-style-type: none"> Community Development Department 	<ul style="list-style-type: none"> None 	Phase 2	Permit additional neighborhood-scale housing single-family neighborhoods

12. See the land use policy and implementation program for the key strategy of “permitting a greater array of housing types in single-unit zones,” 2040 General Plan, Land Use Element.

TRANSPORTATION





MEASURE TR-1: Improve Active Transportation Infrastructure to Achieve 6% Active Transportation Mode Share by 2030 and 12% by 2045

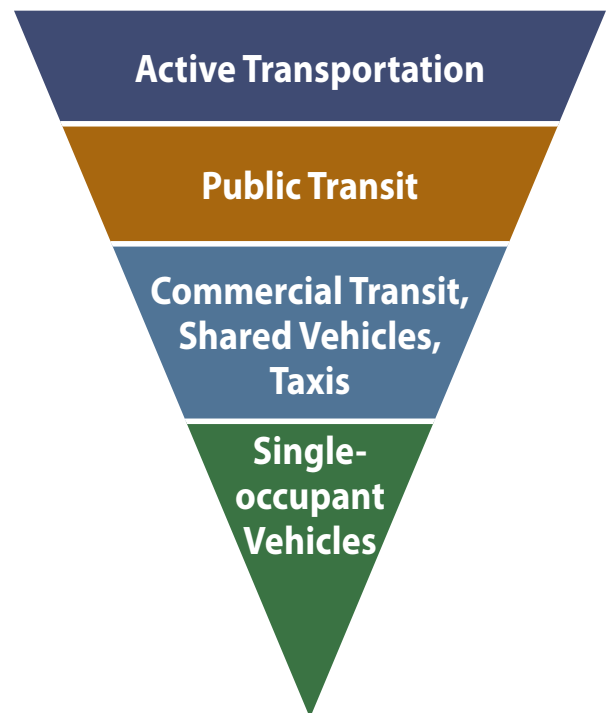
Getting to carbon-neutral will require reducing the number of miles driven by fossil fuel-powered vehicles. This CAAP prioritizes reducing VMT first through transitioning VMT to active transportation like biking and walking. To do this, the CAAP helps prioritize the development of low-stress, safe, and convenient active transportation infrastructure that will support higher rates of biking and walking. Infrastructure needs include bikeway and sidewalk improvements and expansions in all areas of the City, primarily enabled through Actions TR-1.1 and TR-1.2. Actions TR-1.3 through TR-1.5 support better, more informed implementation of TR-1.1 and TR-1.2. Actions TR-1.2, TR-1.4, and TR-1.5 have been designed to maximize the benefits of improved active transportation infrastructure by focusing on projects in historically under-resourced communities.

TR-1 will work in concert with TR-2, which encourages improvement of public transportation infrastructure, to achieve collective VMT reductions by 2030 and 2045. These reductions are captured by the City's goal to reduce VMT within the City of Sacramento from 8,471 miles per person per year to:

- 6,393 miles per person per year by 2030 (a 25 percent reduction from 2016 levels); and
- 5,625 miles per person per year by 2045 (a 34 percent reduction from 2016 levels)

The City chose to track the combined effect of TR-1 and TR-2 on VMT, in addition to the individual mode share metrics for active transportation and public transit, as an additional way to verify that the CAAP is properly implemented. The City also notes that substantial financial resources are needed to implement and achieve the goals of TR-1 and TR-2.

Figure 6-1. Sustainable Transportation Hierarchy



CLIMATE ACTION & ADAPTATION PLAN

Alignment with Mayors’ Commission on Climate Change

The final report from the Mayors’ Commission on Climate Change recommends prioritizing active transportation infrastructure for walking and rolling in a new “modal hierarchy” that places people and shared trips over single-occupant vehicles. Prioritizing active transportation is the first step to reducing transportation emissions in Sacramento, aligning with measure TR-1. Recommendations include transitioning 30 percent of all trips to active transportation by 2030 and 40 percent by 2045. Because the CAAP must quantify the GHG reductions associated with its actions, the CAAP cannot use trips as a metric for this measure, because a trip does not have a defined distance or quantity of GHG emissions. However, in 2016 approximately 10 percent of trips were taken by bike or walking according to the SACSIM model and the mode share for active transportation and public transit in this year was approximately 2 percent. The CAAP calls for increasing active transportation mode share to 6 percent by 2030, approximately a three-fold increase from 2016. This level of active transportation mode share by 2030 is consistent with outcomes of comparable case studies and peer-reviewed literature and anticipated level of investment through 2030, all of which are necessary factors to consider

for quantifying evidence-based reductions for a qualified GHG reduction plan. Action TR-1.3 also acts as a first step in aligning with the recommendation to conduct a comprehensive neighborhood-level audit to identify deficient active transportation infrastructure.

Key Performance Indicators

- A. Achieve 6% active transportation mode share by 2030 and 12% by 2045
- B. Deploy 30 miles of new bikeways by 2030
- C. Deploy 20,000 feet of new/repaired pedestrian infrastructure by 2030
- D. Install or improve at least 70 new pedestrian crossings by 2030
- E. Implement the 2016 Bicycle Master Plan by constructing 40 miles of bike lanes, 48 miles of bike routes, 40 miles of buffered bike lanes, 18 miles of separated bikeways, and 127 miles of shared-use paths, by 2045
- F. Construct the pedestrian network in the 2006 Pedestrian Master Plan by 2045
- G. Collectively reduce VMT to 6,393 miles per person per year in 2030 (25% below 2016 per capita VMT levels) and to 5,625 miles per person per year in 2045 (34% below 2016 per capita VMT levels) between measure TR-1 and TR-2

Expected GHG Reductions

- **2030:** 13,509 MT CO₂e
- **2045:** 30,557 MT CO₂e

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality



Actions and Implementation

Action	Lead	Support	Phase	Performance Indicator
TR-1.1: Implement the 2016 Bicycle Master Plan by constructing a comprehensive, connected network of safe and accessible (low-stress) bikeways, on- and off-street, within and across neighborhoods totaling 40 miles of bike lanes, 48 miles of bike routes, 40 miles of buffered bike lanes, 18 miles of separated bikeways, and 127 miles of shared-used paths.	<ul style="list-style-type: none"> Public Works 	<ul style="list-style-type: none"> None 	Phase 1	273 collective miles of active transportation lanes/paths constructed
TR-1.2: Implement the improvements in the 2006 Pedestrian Master Plan by providing a connected, safe and accessible (low-stress) pedestrian network, prioritized based on High Injury Network (crash data), school access, equity and community needs. Low-stress pedestrian network includes crossings, sidewalks, and other paths.	<ul style="list-style-type: none"> Public Works 	<ul style="list-style-type: none"> None 	Phase 1	Pedestrian Master Plan improvements implemented
TR-1.3: Conduct a study to identify the physical barriers to active transportation by 2025 and remove them by 2030 to support local partners and community groups.	<ul style="list-style-type: none"> Public Works - Transportation 	<ul style="list-style-type: none"> Public Works - Engineering Services 	Phase 2	Active transportation barriers removed and documented
TR-1.4: Conduct a study to identify educational barriers and provide education and outreach to the community on active transportation options in the City including a travel training program and incentivize a spectrum of transportation options that includes public and private shared and active services.	<ul style="list-style-type: none"> Public Works - Transportation 	<ul style="list-style-type: none"> None 	Phase 2	Education and outreach conducted and documented
TR-1.5: Identify and secure ongoing funding for and then implement active transportation programs (open streets, pilot projects, classes, etc.).	<ul style="list-style-type: none"> Public Works - Transportation 	<ul style="list-style-type: none"> None 	Phase 1	Funding identified

MEASURE TR-2: Support Public Transit Improvements to Achieve 11% Public Transit Mode Share by 2030 and Maintain Through 2045

Moving trips from single-occupancy vehicles to public transit (trains and buses) is the CAAP's second priority method for reducing VMT and getting to carbon-neutral. To do this, the City will work with its partners, including the Sacramento Regional Transportation District (SacRT) to expand service lines and increase the convenience of public transit by reducing the time it takes to reach a destination via public transit as well as reducing wait times (headways) for public transit. The City of Sacramento's role does not involve providing transit services, so many of the actions to implement this measure involve supporting SacRT. The City can work collaboratively with SacRT to develop the infrastructure needed to support public transit including dedicated public transit lanes, signal timing equipment, and more. The City notes that substantial financial resources are needed to implement and achieve the goals of TR-2. Obtaining funding for this measure will be a priority for the City under this CAAP. This measure also prioritizes setting parking maximums and managing curb space more effectively to reduce single-occupancy vehicles and prioritize public transit, as well as continuing to support other shared transportation services like electric car sharing and shared bikes and scooters.

Alignment with Mayors' Commission on Climate Change

The final report from the Mayors' Commission on Climate Change recommends prioritizing the expansion and improvement of public transit and shared transportation services as the second step to reducing transportation emissions in Sacramento, aligning with measure TR-2. Recommendations include shifting 30 percent of all trips to public transit and shared transportation by 2030 and 50 percent by 2045. As a qualified GHG reduction plan, this CAAP must provide evidence that measures are achievable and supported by evidence, including reports, case studies, and peer-reviewed research. Planning for at least an 11 percent transit mode share by 2030 is an evidence-based goal that the City considers achievable given current understanding of transit behaviors in Sacramento and comparable case studies, given that sufficient funding can be obtained to implement the necessary infrastructure.¹³ Changes in public transit technology and new programs over the next 10 to 20 years will provide new opportunities and resources. Recommendations from The Mayors' Commission on Climate Change Final Report also include making active transportation and public transit more accessible, affordable, timely, and attractive to help shift behavior. These specific improvements

13. See [Appendix C](#) for more information on case studies and other substantial evidence.



align with actions TR-2.3, TR-2.4, TR-2.8, and TR-2.11. Action TR-2.6 also aligns directly with the Mayors’ Commission recommendation to expand free or affordable ZEV carshare programs, such as Our Community CarShare. Over time, new technologies, State legislation, and funding will allow Sacramento to continue to push towards higher rates of public transit and shared transportation.

Key Performance Indicators

- A.** Implement new parking minimums and maximums by 2024¹⁴
- B.** Collaborate with SacRT to achieve an 11% transit mode share by 2030 and maintain this through 2045
- C.** Continue to achieve at least 2 million miles taken by shared transportation
- D.** Collectively reduce passenger VMT to 6,393 miles per person per year in 2030 (25% below 2016 per capita VMT levels) and to 5,625 miles per person per year in 2045 (34% below 2016 per capita VMT levels) between measure TR-1 and TR-2

Expected GHG Reductions

- **2030:**106,035 MT CO₂e
- **2045:**122,371 MT CO₂e

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

¹⁴ This refers to parking ratios for new construction

CLIMATE ACTION & ADAPTATION PLAN

Actions and Implementation

Action	Lead	Support	Phase	Performance Indicator
TR-2.1: Update and implement the City’s Transportation System Management Plan (TSMP) ordinance to shift travel behavior away from the single-occupancy vehicle.	<ul style="list-style-type: none"> Public Works - Transportation 	<ul style="list-style-type: none"> None 	Phase 2	TSMP ordinance updated and implemented
TR-2.2: Eliminate parking minimums Citywide, develop parking maximums and require parking management and transportation demand management plans for all areas of the City based on available transportation options, travel patterns, and land use.	<ul style="list-style-type: none"> Community Development Department Public Works - Parking 	<ul style="list-style-type: none"> Public Works - Transportation 	Phase 2	Parking maximums developed and implemented
TR-2.3: Encourage SacRT to provide frequent, reliable transit in the City’s priority corridors to reduce VMT and support SacRT in implementing priority transit corridors. Coordinate transit priority corridors with consideration of transportation needs as well as land use planning to provide transit-supportive land uses. Encourage the expansion of frequent, reliable transit services throughout the City.	<ul style="list-style-type: none"> Public Works - Transportation SacRT 	<ul style="list-style-type: none"> Community Development - Planning 	Phase 1	Transit headways and VMT reduced
TR-2.4: Collaborate with SacRT in planning and implementing increased transit services with reduced headways and expanded service lines to support an 11% public transit mode share by 2030.	<ul style="list-style-type: none"> Public Works - Transportation SacRT 	<ul style="list-style-type: none"> Community Development - Planning 	Phase 1	11% public transportation mode share by 2030
TR-2.5: Work with SacRT to identify changes to signals and other technological enhancements for transit prioritization and faster transit travel times.	<ul style="list-style-type: none"> Public Works - Transportation 	<ul style="list-style-type: none"> SacRT 	Phase 2	New technology implemented



Action	Lead	Support	Phase	Performance Indicator
TR-2.6: Continue to support electric car sharing options to offset at least 1 million VMT per year in the City of Sacramento through 2030.	<ul style="list-style-type: none"> Public Works 	<ul style="list-style-type: none"> Community Development - Planning 	Phase 1	Electric car share programs expanded
TR-2.7: Continue to support shared rideables (bikes and scooters) to enable a reduction of 1 million VMT per year.	<ul style="list-style-type: none"> Public Works - Transportation 	<ul style="list-style-type: none"> None 	Phase 1	Shared rideable programs expanded
TR-2.8: Support SacRT efforts to secure funding to support improved service/communications such as interactive service maps, app payments, and real time arrival info.	<ul style="list-style-type: none"> Public Works - Transportation SacRT 	<ul style="list-style-type: none"> None 	Phase 1	New technology implemented
TR-2.9: Continue to implement and improve curbside management strategies to better manage and price curb space, manage transportation network companies (TNC) and prepare for autonomous vehicles.	<ul style="list-style-type: none"> Public Works - Parking Services 	<ul style="list-style-type: none"> Public Works - Transportation 	Phase 1	VMT reduced
TR-2.10: Remove barriers to access transit stops and stations (provide low-stress connectivity) and provide enhanced, comfortable stops and stations.	<ul style="list-style-type: none"> Public Works 	<ul style="list-style-type: none"> SacRT 	Phase 1	VMT reduced
TR-2.11: Implement the City's adopted plans including modal/Citywide plans and corridor/area plans (such as the Bicycle Master Plan, Broadway Complete Streets, and 65th Street Area Plan).	<ul style="list-style-type: none"> Public Works - Transportation, Engineering Services, and Entitlements 	<ul style="list-style-type: none"> None 	Phase 1	% of each plan's infrastructure built out

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Action	Lead	Support	Phase	Performance Indicator
TR-2.12: Identify an Employee Transportation Coordinator and establish an employee commute program for City staff that includes provisions for telecommuting and encourage other public and private agencies located within the City to do the same using requirements and/or incentives.	<ul style="list-style-type: none"> Human Resources 	<ul style="list-style-type: none"> None 	Phase 2	Employee commute program with telecommuting options established
TR-2.13: Investigate and lobby for the development of a TNC user tax which would put a small fee on the use of Uber, Lyft, and others and generate funds to pay for transit and transportation infrastructure and related programs.	<ul style="list-style-type: none"> Public Works - Transportation City Manager’s Office 	<ul style="list-style-type: none"> None 	Phase 1	User tax or fee investigation completed



MEASURE TR-3: Achieve Zero-Emission Vehicle (ZEV) Adoption Rates of 28% for Passenger Vehicles and 22% for Commercial Vehicles by 2030 and 100% for all Vehicles by 2045

Getting to carbon-neutral requires reducing GHG emissions from remaining car trips while achieving mode shifts to active transportation, shared transportation, and public transit. EVs are proven technology for reducing on-road emissions and, when coupled with carbon-free electricity (i.e., Measure E-1), can reduce these vehicle emissions to zero. The City also sees hydrogen fuel-cell vehicles and plug-in hybrids as potential alternatives to EVs and therefore refers to zero-emissions vehicles (ZEV) in this CAAP. California has a goal of putting 5 million ZEVs on the road by 2030, approximately one-third of the State's vehicles. Sacramento's goals align with the State's and measure TR-3 provides the necessary infrastructure to support a 28 percent ZEV registration rate by 2030, with a long-term target of 100 percent ZEV-registration rate by 2045. While the City cannot require residents to buy and use ZEVs, the City will take actions to incentivize this behavioral change and support this level of ZEV adoption through added ZEV infrastructure, engagement, and programs. The City's primary target to achieve this measure is to provide one public EV charger for every 20 EVs and to continue to remain one of the nation's leading cities for provision of public charging infrastructure, achieved primarily through Actions TR-3.1, TR-3.2, and TR-3.3. The need for charging infrastructure may change over time depending on new technologies such as smart chargers,

battery technology, and trends in personal ZEV adoption. Actions like TR-3.6, TR-3.7, TR-3.9, and TR-3.10 lower existing barriers to ZEV adoption by streamlining associated permit processes, establishing use fees to improve turnover rates at public City chargers, working with employers to improve at-work charging opportunities across the City, and educating the public about ZEV benefits and costs. The City will continue to monitor the most recent research on EV infrastructure needs and update long-term goals as necessary (Action TR-3.12). Measure, and actions TR-3.4, TR-3.5, TR-3.11 will provide low-income communities with more equitable access to and education about ZEV programs and chargers by expanding car share and charger infrastructure in low income and under-resourced communities.

Alignment with Mayors' Commission on Climate Change

The final report from the Mayors' Commission on Climate Change prioritizes development of a comprehensive package of incentives, disincentives, and policies to promote the adoption of ZEVs as the third step to reducing transportation emissions in Sacramento, aligning with measure TR-3. Recommendations include shifting 70 percent of new vehicle registrations to ZEVs by 2030, and electrifying all public, private, and shared fleets by 2045. This CAAP recognizes that while these ambitious

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goals may be supported by advances in technologies over the next 10 to 20 years, planning for at least 28 percent ZEV registration by 2030 is an evidence-based goal that the City considers achievable given current levels of ZEV adoption in Sacramento. This phasing is also consistent with the Governor Newsom’s Executive Order N-79-20, establishing the State’s goal for 100 percent of in-state new car sales to be zero-emission by 2035 and 100 percent of medium- and heavy-duty vehicles by 2045.¹⁵ While measure TR-3 does not include a goal to electrify all public, private, and shared fleets by 2045, Actions TR-3.9 and TR-3.11 begin to address this recommendation, while information gathered and further State action during implementation of the CAAP is

expected to facilitate more aggressive goals in this direction. Action TR-3.4 also aligns directly with the recommendation to expand free or affordable ZEV carshare programs such as Our Community CarShare.

Key Performance Indicators

- A. 11% of all vehicles are ZEV and 3,230 public EV chargers in Sacramento by 2025¹⁶
- B. 28% of all vehicles are ZEV and 8,150 public EV chargers in Sacramento by 2030
- C. 100% of all vehicles are ZEV by 2045

Expected GHG Reductions

- **2030:** 212,451 MT CO₂e
- **2045:** 1,137,071 MT CO₂e

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

15. Executive Department State of California. *Executive Order N-79-20*. Retrieved on November 4, 2021 from <https://www.gov.ca.gov/wp-content/uploads/2020/09/9.23.20-EO-N-79-20-Climate.pdf>

16. Note that the number of installed public EV chargers established as a key performance indicator in 2030 and 2045 for this measure was calculated based on forecasted population and car registration data in 2030 and 2045 and may not reflect the actual number of chargers needed to establish the City’s goal of one EV charger to every 20 ZEVs in Sacramento.



Actions and Implementation

Action	Lead	Support	Phase	Performance Indicator
TR-3.1: Amend City Building Code to require at least 20% EV-capable charging spaces and at least one installed, operational Level II EV charger in new multifamily and nonresidential development. Amend the Planning and Development Code to incentivize charging in both existing and new developments.	<ul style="list-style-type: none"> Community Development - Planning and Code Compliance 	<ul style="list-style-type: none"> None 	Complete	City Building Code amended
TR-3.2: Continue to support a variety of public and public/private partnerships to provide more publicly accessible chargers throughout the City. Examples include public/private partnerships on private property (Electrify America), public/private partnerships on public property (EVgo), and public investment (SMUD).	<ul style="list-style-type: none"> Public Works 	None	Phase 1	EV chargers installed
TR-3.3: Continue to install and provide EV charger access at City-owned facilities and parking garages.	<ul style="list-style-type: none"> Public Works 	<ul style="list-style-type: none"> Community Development Department Electrify America EVgo SMUD 	Phase 1	EV chargers installed
TR-3.4: Pursue affordable, zero-emission car share expansions to serve affordable housing, such as the Sacramento Metropolitan Air District's Our Community Carshare program to more locations, contingent on funding.	<ul style="list-style-type: none"> Public Works Sacramento Metropolitan Air Quality District Our Community Carshare 	<ul style="list-style-type: none"> None 	Phase 1	Electric car share programs expanded

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Action	Lead	Support	Phase	Performance Indicator
TR-3.5: Collaborate on e-mobility hub pilot efforts, in partnership with other agencies and local groups, with special consideration for proximity to low-income/disadvantaged communities and multifamily housing.	<ul style="list-style-type: none"> Public Works 	<ul style="list-style-type: none"> UC Davis Green Tech Private developers of large multifamily housing 	Phase 1	E-mobility hub piloted
TR-3.6: Continue to maintain a highly streamlined EV infrastructure permit process.	<ul style="list-style-type: none"> Community Development Department - Building Division 	<ul style="list-style-type: none"> None 	Phase 1	Streamlined EV infrastructure permit process
TR-3.7: Develop and implement a fee for use of City-owned parking facilities and EV chargers to promote more efficient use and turnover and increase EV availability for people who really need it, including those without access to home charging.	<ul style="list-style-type: none"> Public Works 	<ul style="list-style-type: none"> None 	Phase 1	Use fee implemented
TR-3.8: Work and collaborate with major employers including the State of California and Sacramento County to promote ZEV adoption, programs, and improvements to ZEV infrastructure.	<ul style="list-style-type: none"> Public Works State of California Sacramento County 	<ul style="list-style-type: none"> None 	Phase 1	ZEV registration increase
TR-3.9: Continue to provide information and education about currently available incentives for expansion of Level II chargers on private property.	<ul style="list-style-type: none"> Community Development - Planning 	<ul style="list-style-type: none"> None 	Phase 1	Information or materials provided



Action	Lead	Support	Phase	Performance Indicator
<p>TR-3.10: Coordinate with community-based organizations, agencies, and non-profits to conduct EV education events which would include information on costs/ benefits of owning EVs, steps on how to receive incentives for EV chargers, as well as other benefits. Events will be equitably distributed across the City, focusing on disadvantaged communities.</p>	<ul style="list-style-type: none"> • Public Works • Community Development - Planning 	<ul style="list-style-type: none"> • None 	Phase 1	EV education events conducted
<p>TR-3.11: Because zero-emission technology is improving/ changing at a rapid pace, continue to monitor, test, and adapt to new and emerging zero-emission technologies and solutions.</p>	<ul style="list-style-type: none"> • Public Works • Community Development – Planning 	<ul style="list-style-type: none"> • Office of Climate Action & Sustainability 	Phase 1	CAAP and ZEV adoption progress report and recommendations to City Council

WASTE





MEASURE W-1: Work to Reduce Organic Waste Disposal 75% Below 2014 Levels by 2025

Carbon neutrality will require the elimination of methane process emissions from landfilled waste. The majority of these GHG emissions result from organic waste in the landfill that could be otherwise composted, otherwise diverted,¹⁷ or recovered¹⁸ for reduced emissions. To drive these reductions in Sacramento, the City plans to align its waste reduction efforts with SB 1383. In 2016, the State of California adopted SB 1383, a landmark waste mandate that requires the State to reduce organic waste disposal 75 percent below 2014 levels by 2025, or by about 20 million tons annually. The law also requires the State to increase edible food recovery 20 percent by 2025. CalRecycle describes the requirements¹⁹ for local governments in meeting these targets as follows:

- Provide organic waste collection to all residents and businesses
- Establish an edible food recovery program that recovers edible food from the waste stream

- Conduct outreach and education to affected parties, including generators, haulers, facilities, edible food recovery organizations, and city/county departments
- Conduct capacity planning and evaluate City's readiness to implement SB 1383
- Procure recycled organic waste products like compost, mulch, and renewable natural gas (RNG)
- Inspect and enforce compliance with SB 1383
- Maintain accurate and timely records of SB 1383 compliance

Actions W-1.1 through W-1.10 establish city-wide programs, capacity planning, education and outreach programs, and food recovery programs. As the measure is implemented and more information becomes available through Actions W-1.2 and W-1.3, the City will establish additional plans and strategies for achieving SB 1383.

17. Waste diversion consists of sending waste through a regenerative process, such as recycling or composting, so that it does not end up in the landfill.

18. Food recovery consists of capturing edible food before it enters the waste stream and instead sending it to local community organizations, like food banks, so that it is used and eaten instead of being thrown away.

19 See <https://calrecycle.ca.gov/organics/slcp/jurisdictions/>

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LOCAL FOOD PLANNING:

In June 2021, Sacramento was identified as one of 13 communities selected to participate in Local Foods, Local Places (LFLP), which supports Sacramento and its partners – Alchemist Community Development Corporation, Planting Justice, and the Sacramento Food Policy Council – in developing *Food Anchored Resiliency Hubs* in disadvantaged neighborhoods. The hubs will provide training to prepare and sell locally-sourced food, demonstrate sustainable materials, and provide training, employment, and entrepreneurship opportunities. An additional \$2 million dollars was obtained to support the *City Tree Nursery Food Anchored Resiliency Hub* in Mangan Park.

Alignment with Mayors’ Commission on Climate Change

The final report from the Mayors’ Commission on Climate Change recommends supporting a regenerative food system by sourcing 25 percent of food locally within a 200-mile radius by 2030 and 40 percent by 2045 and reducing 50 percent of aggregate food waste by 2025 and 75 percent by 2030. While the City has limited jurisdiction over food system sourcing and has not addressed this directly in the CAAP, measure W-1 exceeds the goals to reduce food waste in 2025 and 2030, to demonstrate consistency with SB 1383. Recommendations also include establishing a food recovery to food security network with restaurants, catering

companies, banks, grocery stores, local food banks, and community food hubs, which aligns directly with Action W-1.8.

Key Performance Indicators

- A. Compliance with SB 1383 requirements by 2025
- B. Compost or otherwise divert at least 75% of organic waste in 2025 relative to 2014
- C. Adopt an edible food recovery ordinance by 2025
- D. Prepare an edible food recovery capacity plan by 2025
- E. Maintain or improve these metrics through 2030

Expected GHG Reductions

- **2030:** 134,991 MT CO₂e
- **2045:** 160,897 MT CO₂e

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality



Actions and Implementation

Action	Lead	Support	Phase	Performance Indicator
<p>W-1.1: Implement the requirements of SB 1383 to compost or otherwise divert 75% of organic waste compared to 2014 levels by:</p> <ul style="list-style-type: none"> • Providing organic waste collection to all residents and businesses. • Establishing an edible food recovery program that recovers edible food from the waste stream and redistributes the food to local community organizations to be used or eaten. • Conducting outreach and education to affected parties, including generators, haulers, facilities, edible food recovery organizations, and city/county departments. • Conducting capacity planning and evaluate your jurisdiction's readiness to implement SB 1383. • -Procuring organic waste products like compost, mulch, and RNG. • Inspecting and enforcing compliance with SB 1383. 	<ul style="list-style-type: none"> • Public Works - Recycling and Solid Waste • Finance - Procurement 	<ul style="list-style-type: none"> • None 	Phase 3	75% organic waste reduction by 2025 compared to 2014
<p>W-1.2: Work with regional partners (other municipalities) and the private sector to assess the feasibility of siting long term organics processing facilities in or near Sacramento County</p>	<ul style="list-style-type: none"> • Public Works - Recycling and Solid Waste • Sacramento County 	<ul style="list-style-type: none"> • None 	Phase 1	Feasibility assessment complete and recommendations or plan developed
<p>W-1.3: Continue to provide backyard compost education and reduced-cost compost bins as well as kitchen-top food waste containers to participating residents.</p>	<ul style="list-style-type: none"> • Public Works - Recycling and Solid Waste 	<ul style="list-style-type: none"> • None 	Phase 1	Backyard compost education events conducted

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Action	Lead	Support	Phase	Performance Indicator
W-1.4: Implement a food waste diversion program for single-family residential customers by 2022.	<ul style="list-style-type: none"> Public Works - Recycling and Solid Waste 	<ul style="list-style-type: none"> None 	Phase 1	Food waste diversion program
W-1.5: Enforce new commercial waste code which requires businesses to subscribe to organics recycling collection service through the City’s franchised commercial haulers starting July 1, 2021.	<ul style="list-style-type: none"> Public Works - Recycling and Solid Waste 	<ul style="list-style-type: none"> None 	Phase 1	Ordinance effective March 3, 2021, with July 1, 2021, starting date; businesses with 2 cubic yards or more must comply by July 1, 2021; all businesses must comply by January 1, 2022
W-1.6: Serve as a regional partner in the development and implementation of an edible food recovery program which connects commercial edible food generators with local food banks, to recover at least 20% of the edible food that is currently disposed of for human consumption, consistent with SB 1383.	<ul style="list-style-type: none"> Public Works - Recycling and Solid Waste 	<ul style="list-style-type: none"> None 	Phase 1	Adopt an Ordinance, prepare a Capacity Plan, start the program and track progress by 2025
W-1.7: Explore the feasibility of capital improvement projects for reducing organics in the waste stream, such as organics extraction presses and anaerobic digesters.	<ul style="list-style-type: none"> Public Works - Recycling and Solid Waste 	<ul style="list-style-type: none"> None 	Phase 1	Feasibility assessment conducted and recommendations made
W-1.8: Consider adopting, if needed, an ordinance that aligns with AB 827, the state law that requires most restaurants to have front-of-house composting.	<ul style="list-style-type: none"> Public Works - Recycling and Solid Waste 	<ul style="list-style-type: none"> None 	Phase 2	Feasibility assessment conducted and recommendations made



WATER AND WASTEWATER



MEASURE WW-1: Reduce Water Utility Emissions (in MT CO₂e per Million Gallon Delivered) by 100% by 2030 and Maintain that Through 2045

Emissions from water use are 100 percent attributable to electricity usage to convey and treat the water. The primary way to reduce these emissions and achieve carbon neutrality in the water sector is to reduce the emissions associated with the electricity used. By 2030, the water utility will procure 100 percent carbon-free electricity and reduce GHG emissions on a per acre-foot basis to zero (Action WW-1.1). Additional supportive measures such as water conservation, greywater, and storm-water management will further this goal and reduce the amount of electricity needed by reducing overall water demand as the City continues to grow.²⁰

Alignment with Mayors’ Commission on Climate Change

The final report from the Mayors’ Commission on Climate Change does not provide recommendations for the water or wastewater sector. However, measure WW-1 aligns with the recommendation to improve adaptation and resiliency in Sacramento by working to reduce overall water demand, lessening potential future impacts and severity of drought in the region and protecting local water resources in the longer term.

Key Performance Indicators

- A. Utilize carbon-free power for 100 percent of water utility electricity demands by 2030

Expected GHG Reductions

- **2030:** 6,296 MT CO₂e
- **2045:** 0 MT CO₂e

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

20. Although the SMUD 2030 Plan will aim to provide 100% carbon-free electricity by 2030, the reductions associated with water were not included in measure E-1’s GHG reduction quantification and are instead attributed here for consistency with the inventory and forecast’s categorization of GHG emissions.



Actions and Implementation

Action	Lead	Support	Phase	Performance Indicator
WW-1.1: Reduce GHG emissions associated with the water utility by procuring 100% carbon-free electricity by 2030.	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • None 	Phase 2	Achieve 100% carbon-free electricity for water utility use
WW-1.2: Investigate the feasibility of allowing on-site non potable treatment and distributed water resources in new development.	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Community Development 	Phase 1	Completion of Feasibility study for a potential dual plumbing reach-code
WW-1.3: Continue to implement the Model Water Efficient Landscape Ordinance each year.	<ul style="list-style-type: none"> • CDD • Utilities • YPCE 	<ul style="list-style-type: none"> • None 	Phase 1	None
WW-1.4: Continue to require the use of low impact development (LID) strategies for new construction and development.	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • None 	Phase 1	None
WW-1.5: Continue to investigate the landscaping/irrigation use of non-potable reclaimed water from regional sanitation at parks.	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • YPCE 	Phase 1	Conduct a pilot and pursue funding for implementation
WW-1.6: Increase the use of renewable energy and storage to reduce GHG emissions and increase resiliency for critical infrastructure.	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • None 	Phase 2	MWh of renewable energy and MWh of installed storage
WW-1.7: Continue to encourage efficient water use by residents and businesses through expanded education, incentives and assistance services in compliance with Assembly Bill 1668 and SB 606, which help reduce the City’s water demand and related energy use.	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • None 	Phase 1	Per capita water use

MEASURE WW-2: Reduce Wastewater Emissions 22% by 2030 and 40% by 2045

Although GHG emissions from wastewater, including wastewater treatment and stormwater management, are generated by the Sacramento community, operational control of the wastewater treatment facility is covered by the Sacramento Regional Sanitation District (Regional San). This means the City of Sacramento has no direct jurisdiction over these emissions and limited capacity to align activities in this sector with carbon neutrality. However, since the GHG emissions associated with wastewater are included in the GHG emissions inventory, several of Regional San's GHG-reducing activities are included here. The GHG reductions associated with this measure are the result of methane capture projects being undertaken at Regional San facilities, as well as new solar arrays which were not taken into account in the forecast.²¹ The City of Sacramento and SMUD will continue to support Regional San in these and future partnerships to further reduce emissions from the wastewater sector.

Alignment with Mayors' Commission on Climate Change

The final report from the Mayors' Commission on Climate Change does not provide recommendations for the water or wastewater sector. However, measure WW-2 aligns with the recommendation to improve adaptation and resiliency in Sacramento by working to provide new sources of energy through biogas recovery (WW-2.1) and added solar (WW-2.3).

Key Performance Indicators

- None – projects to reduce wastewater emissions were completed before release of the CAAP

Expected GHG Reductions

- **2030:** 5,495 MT CO₂e
- **2045:** 11,517 MT CO₂e

21. RegionalSan. *Sustainability & Innovation: Projects and green programs*. Retrieved on November 4, 2021 from <https://www.regionalsan.com/sustainability-innovation>



Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

Actions and Implementation

Action	Lead	Support	Phase	Performance Indicator
WW-2.1: Regional San implements biogas recovery and improvement projects.	• Regional San	• None	Complete	None (completed)
WW-2.2: GHG Emissions Reductions from SB 100 implementation by Regional San.	• Regional San	• None	Complete	None (completed)
WW-2.3: Regional San implements solar PV generation project.	• Regional San	• None	Complete	None (completed)

CARBON SEQUESTRATION



Photo by Carlos Eliason



MEASURE CS-1: Increase Urban Tree Canopy Cover to 25% by 2030 and 35% by 2045

Carbon sequestration is the process by which carbon is taken out of the atmosphere and sequestered in soil, vegetation, or man-made structures. This measure provides GHG reduction through the carbon sequestration achieved by the urban canopy. A City's tree canopy can capture carbon through photosynthesis, whereby trees and other green plants pull CO₂ out of the atmosphere, use the carbon to grow, and release oxygen. Currently, tree canopy covers 19 percent of Sacramento's land surface area. Increasing this to 25 percent by 2030 will increase the carbon sequestration potential of the City, contribute to Sacramento's carbon neutrality goals, reduce the urban heat island effect, decrease water runoff, improve water and soil quality, and improve the City's livability.

About 10 percent of trees in the city are in public parks and along streets, the remaining 90 percent of the trees in the City are located on private property or on property owned by other agencies (e.g., state-owned land.). The costs for maintenance and drought concerns are potential barriers to tree planting, particularly for those with lower incomes. In addition, preserving and incorporating shade trees in connection with higher density development will be necessary to achieve this goal.

Additional funding, land use regulations, and new incentive programs will be needed to reach these targets.

Alignment with Mayors' Commission on Climate Change

The final report from the Mayors' Commission on Climate Change recommends expanding green infrastructure to ensure that all neighborhoods have access to green space within 0.25 mile by 2030 and a baseline canopy of 25 percent by 2030 and 35 percent by 2045. While this measure does not address access to green space (this is instead addressed in the General Plan Update), measure CS-1 meets the recommended canopy cover goals. This measure also contributes to increased resilience in Sacramento by increasing the shade potential during heat waves and lowering the energy needs of houses to stay cool, another recommendation from the Mayors' Commission on Climate Change Final Report.

Key Performance Indicators

- A.** Achieve 25% urban tree canopy cover by 2030 consistent with the Urban Forest Plan
- B.** Achieve 35% urban tree canopy cover by 2045

Expected GHG Offsets

- **2030:** 23,053 MT CO₂e (sequestered)
- **2045:** 61,474 MT CO₂e (sequestered)

CLIMATE ACTION & ADAPTATION PLAN

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

Actions and Implementation

Action	Lead	Support	Phase	Performance Indicator
CS-1.1: Implement the Urban Forest Plan with a goal to achieve 25% urban canopy cover by 2030 and 35% by 2045. Prioritize tree planting in areas with the lowest average tree canopy cover and explore strategies to reduce barriers to tree planting in disadvantaged areas and improve tree health.	<ul style="list-style-type: none"> Public Works - Urban Forestry 	<ul style="list-style-type: none"> Community Development YPCE 	Phase 2	25% urban tree canopy cover by 2030 and 35% by 2045
CS-1.2: Utilize compost and mulch for application to City-owned trees and planters to increase the carbon sequestration potential of tree plantings.	<ul style="list-style-type: none"> Public Works - Urban Forestry YPCE 	<ul style="list-style-type: none"> None 	Phase 1	Compost and mulch procured and applied to City-owned trees and planters
CS-1.3: Develop online educational materials about tree species that are adapted to Sacramento’s climate and resilient to drought and climate change.	<ul style="list-style-type: none"> Public Works 	<ul style="list-style-type: none"> None 	Phase 1	Develop flier/ education material
CS-1.4: Continue to support the SMUD/ Sacramento Tree Foundation program which provides free shade trees for residents and businesses and support increased plantings on private property in areas that are under-canopied through new partnerships and programs.	<ul style="list-style-type: none"> Public Works 	<ul style="list-style-type: none"> None 	Phase 1	None





ADAPTATION



Building Resilience

Consistent with California Government Code section 65302(g), this chapter describes the key climate change vulnerabilities in Sacramento, outlines the City's adaptation strategy to address these vulnerabilities, and presents the goals, policies, and actions that the City will take to strengthen its adaptive capacity.

Global and regional climate change will increase the frequency and severity of extreme heat events, urban heat island effect, flooding, droughts, and wildfires that will both individually and collectively have increasing impacts on the public, as well as on Sacramento's infrastructure and critical services. While

comprehensive, coordinated actions to reduce greenhouse gas (GHG) emissions can help mitigate the extent of these impacts over the long term, additional actions must be taken to address the people, places, and infrastructure most at risk and to leverage other opportunities to effectively and equitably build climate resilience in Sacramento's communities.

Climate change adaptation is the process of adjusting to current or anticipated effects of climate change to protect public health and safety. The coordinated efforts of State, regional, and local agencies and organizations contribute to a climate change readiness landscape that defines adaptive capacity in Sacramento. Recent efforts, such as studies on urban heat, anticipated changes in snowpack, and the benefit of tree canopy in Sacramento,

can inform the City on ways to bolster its existing adaptive capacity. Likewise, partnership with local organizations can leverage opportunities to strengthen resilience in vulnerable communities and help achieve equitable environmental and health outcomes.

For more information about climate change impacts, vulnerability, and existing adaptive capacity in the City of Sacramento, see the Climate Change Vulnerability Assessment in [Appendix G](#).

Climate Change Vulnerability

Although climate change largely occurs on a regional and global scale, the effects can be felt more acutely in certain locations and by certain segments of the population. For example, Sacramento has historically been vulnerable to direct riverine flooding impacts, and this vulnerability would be expected to increase absent adaptive measures. An increase in the area burned by wildfires is not an immediate threat to the City of Sacramento, but the concentration of air pollution from wildfire smoke will especially impact individuals with preexisting health conditions such as asthma and people who spend a lot of time outdoors such as construction workers and homeless populations. Reducing vulnerability to climate change effects is an opportunity to advance sustainability and equity in Sacramento by implementing mitigations and providing resources to the people and places that are hit first and worst. Ultimately, integrating adaptive measures into future City actions can strengthen

overall community resilience and provide for a more sustainable future.

CLIMATE CHANGE IMPACTS IN SACRAMENTO

The preeminent climate impacts in California include higher temperatures, sea level rise, reduced snowpack, changes in precipitation patterns including heavier precipitation events, increased droughts, and more wildfires. While not all of these occur within Sacramento, the impacts of these changes can affect the city's residents through secondary climate change effects such as flooding and air pollution. This section summarizes the level of risk that climate change impacts pose to Sacramento.

The City has undertaken a comprehensive Climate Change Vulnerability Assessment (attached as [Appendix G](#)) that evaluates the nature and extent of the climate change effects that impact Sacramento, particularly for vulnerable populations and critical facilities in the city. This study is based on scientific best practices, recent related efforts, and State guidelines. The primary data source for the Climate Change Vulnerability Assessment is Cal-Adapt, a tool developed by the Geospatial Innovation Facility (GIF) at the University of California, Berkeley under the direction of the California Energy Commission (CEC). GIF and CEC released Cal-Adapt to the public in 2011, and it has since served as a tool that synthesizes existing California climate change scenarios and climate impact research and benefits local decision-makers. Climate data available from Cal-Adapt cover the major climate change effects in California, including changes in temperature, precipitation, snowpack, sea level rise, and wildfire. Inherently, climate changes refer

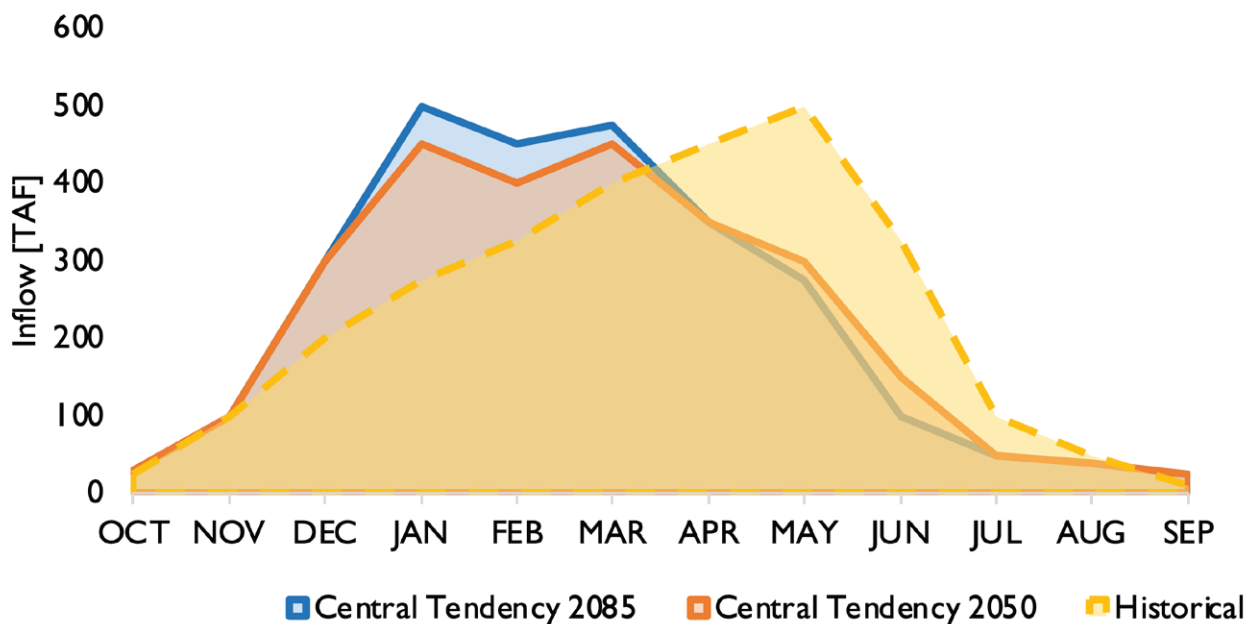


to shifts in climatic patterns rather than a comparison of specific points in time. As such, these topics are compared across 30-year periods representing the historic baseline (1961-1990), mid-century (2035-2064), and end-of-century (2070-2099) to track how climate change has affected each of these areas since the time when the majority of California’s critical infrastructure was developed and when anthropogenic climate change signals were beginning to be felt. Studying these trends and potential outcomes helps the City to design policies and take actions now to move toward a more sustainable and resilient future.

It should be noted that many of these impacts are interrelated; for example, rising temperatures affect the hydrological cycle, which

results in changes in precipitation patterns. Both of these, in turn, can contribute to reduction in snowpack. Smaller masses of snowpack melt earlier in the year leading to greater runoff earlier in the year. Coupled with storm events, this amount of increased runoff can exacerbate flood risks (see [Figure 7-1](#)). Moreover, flood management requirements may necessitate releasing water from reservoirs to create storage to mitigate flood risk. This can reduce water supply later in the year, particularly during dry periods. The complexity of these concerns makes understanding the nature of climate change impacts that affect Sacramento—and tackling the root cause by reducing greenhouse gas emissions—a critical priority.

Figure 7-1. Monthly Average Unimpaired Inflows to Folsom Reservoir



*Projected timing of inflows to Folsom Reservoir under future climate change conditions compared to historical conditions (under the median range of projected change in precipitation and temperature).
Source: Adapted from Figure ES.4 of the American River Basin Study, U.S. Bureau of Reclamation*

CLIMATE ACTION & ADAPTATION PLAN

Temperature Increase

Secondary Impacts

- More frequent, extreme, and longer heat waves
- Exacerbated urban heat island effect
- Increased warm nights
- Higher source water temperature
- Negative impacts to air quality

Temporal Extent

Moderate. Effects will be most extreme in July and August, but may be felt anytime between May and October.

Spatial Extent

High. Effects will be felt throughout the City, but will be most extreme in and around urban heat islands.

Permanence

High. The most extreme effects will be seasonal, but average ambient temperatures will increase steadily over the century.

Level of Disruption

High. Increased strain and potential physical damage to energy, utility, and transportation infrastructure from extreme heat; risk of black-outs; and heat-related illness/death. Higher source water temperature create a need for additional water treatment technologies.

Level of Uncertainty

Low.

Precipitation Changes

Secondary Impacts

- Winter precipitation shift – more as rain, less as snow
- Reduced snowpack
- More extreme storm events
- Increased runoff and flood risk
- Increased drought conditions
- Decreased regional water supply

Temporal Extent

High. Increased likelihood of riverine flooding in winter/early spring. Reduced surface water supply in summer due to reductions in winter snowpack.

Spatial Extent

High. Nearly all of the city is low-lying and dependent on levee protection, but areas already susceptible to localized, riverine, and flash flooding and/or with limited stormwater infrastructure will be most affected by increased winter rain and flows. Drought will affect most areas and increase demand for groundwater use.

Permanence

High. The most extreme effects will be seasonal, with continued changes expected over the century.

Level of Disruption

High. A large storm could cause significant health and infrastructure impacts, including loss of life and property, over potentially large portions of the City. Increased water temperature is harmful to water treatment, reservoir and hydroelectric operation, and ecological health.



Level of Uncertainty

Moderate. While impacts vary year to year, climate change is increasing the likelihood of a storm event capable of significant flooding; drought frequency is projected to increase in California.

Wildfire

Secondary Impacts

- Declines in air quality
- Soil erosion and water quality impacts

Temporal Extent

Moderate. Projected wildfire extent/severity is highly variable but will generally increase over the century. Future fire seasons may become longer.

Spatial Extent

High. A wildfire is unlikely to break out within City limits, but wildfire smoke will affect the entire city.

Permanence

Moderate. Wildfire intensity is expected to gradually increase, with significant year-to-year variability.

Level of Disruption

Moderate. The wildfire impact most likely to have a significant impact on the city is air pollution from wildfire smoke.

Level of Uncertainty

Moderate.

Sea Level Rise

Secondary Impacts

- Higher river levels during major storm events

Temporal Extent

Low. Sea level rise is projected to occur gradually over the course of the century

Spatial Extent

Moderate. Areas within or near the Delta are most at risk.

Permanence

High. May exacerbate flood risk associated with major storm events in the longer term.

Level of Disruption

Low. Effects may be significant when coinciding with riverine or flash flooding.

Level of Uncertainty

Moderate.



Flooding Along the American River

CLIMATE ACTION & ADAPTATION PLAN

VULNERABLE POPULATIONS

Certain populations are particularly vulnerable to the effects of climate change and may require additional interventions to increase adaptive capacity. These include:

- **Children** under 15 years old have physiological characteristics and lifestyles that make them particularly vulnerable to the impacts of climate change. For example, increased time spent outdoors, especially for student athletes, can expose children to high temperatures and smoke from wildfires, potentially resulting in heat- and air-pollution-related illness or mortality. In addition, rapid lung development generally occurs from the ages of 10 to 18, and children’s exposure to air pollution during this stage can lead to significant, adverse, and chronic effects on lung function.¹ In Sacramento, about 19.2 percent of the population is under 15 years old, and about a third of this group (6.5 percent of total population) is under the age of five.²



Children Playing Outdoors

- **Older adults** ages 65 and older are a diverse population whose potential vulnerability to climate change is influenced by factors such as underlying health status, economic situation, and social connectedness. Physiological susceptibility to extreme heat and air pollution make older adults vulnerable to climate change effects, while older adults with limited mobility can be at greater risk during emergencies requiring evacuation. In addition, the financial burden of increased energy costs (e.g., for air conditioning) can disproportionately impact those on fixed incomes.
- **Individuals with a disability** may be more vulnerable to climate change due to limitations that may impact their ability to access information about or respond to an emergency event. About 11.8 percent of Sacramento’s population has at least one disability³, many of whom also fall under another category of vulnerable populations described in this section.
- **Black, Latino/a/x, Asian, Pacific Islander, and Indigenous communities** may be exposed to a variety of factors that increase their vulnerability to climate change due to structural racism, or the social relations and practices that reinforce white privilege in the urban environment and economy. As a result, communities of color are more likely than white residents to have lower income, be in poorer physical health, lack access to air-conditioning, live in areas with sparse vegetation, and work outdoors. In addition, communities of color are disproportionately impacted by poor air quality, due to both levels of exposure to air pollutants and elevated rates of diseases including asthma

1. W. James Gauderman, Edward Avol, Frank Gilliland, et al, “The Effect of Air Pollution on Lung Development from 10 to 18 Years of Age,” *The New England Journal of Medicine* 351, no. 11 (September 2004):1057-1067, <https://doi.org/10.1056/NEJMoa040610>.
2. U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates Table S0101.
3. U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates Table S1810.



and Chronic Obstructive Pulmonary Disease. Sacramento is a racially diverse city consisting of 32.0 percent white residents, 28.3 percent Hispanic or Latinx residents, 19.0 percent Asian residents, 12.3 percent Black or African American residents, 1.6 percent Native Hawaiian or Pacific Islander residents, and 0.3 percent Native American. About 5.5 percent of residents identified as belonging to two or more races or a race not identified in the U.S. Census.⁴

- **Low-Income** people can be more vulnerable to climate change due to pre-existing health conditions, reduced mobility options, reduced access to health care, housing instability and/or substandard housing, and limited ability to purchase goods and services that could mitigate the negative effects of climate change. Poverty is associated with societal exclusion, mental illness, and increased likelihood of suffering from chronic illnesses. Low-income individuals and families are also more likely to work or live in environments that expose them to pesticides, lead, and outdoor air pollution. Additionally, in the aftermath of an extreme climate event, low-income households may also have difficulty covering home repair or relocation costs, perpetuating housing-related vulnerability. About 9.6 percent of Sacramento families live in poverty.⁵
- **Outdoor workers** have disproportionate exposure to some effects of climate change such as increased ambient temperature and degraded air quality. Outdoor occupations include landscapers, emergency responders, utility repair crews and construction workers.

Some have low wages, little job security and no health insurance or paid sick leave.

- **Cost-burdened households** are those that spend 30 percent or more of their household income on housing costs, and households that spend 50 percent or more are considered severely cost-burdened. In Sacramento, the median housing cost in 2021 was \$1,558 per month, while the median household income is about \$6,275 per month – of which 30 percent (\$1,883) is only slightly above the median housing cost. This corresponds with about 40 percent of Sacramento households being cost-burdened.⁶ Additional living costs, including for energy, transportation, food, and medical care further exacerbate financial burden on cost-burdened households. Climate change effects like extreme heat can increase energy costs due to increased use of air conditioning. Similarly, cost-burdened households may be particularly vulnerable due to inability to pay for adaptive housing upgrades such as energy-efficient appliances and water-efficient landscaping that could help reduce costs over time.
- **Renters** are at an increased risk of climate vulnerability because they have less control than homeowners in making home upgrades to reduce climate exposure or increase resilience. For example, within the Sacramento Municipal Utility District service area, 30.3 percent of renters do not have central air conditioning whereas only 11.5 percent of owners do not have central air conditioning.⁷ Even among renters with access, they are more likely than

4. U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates Table B03002.

5. U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates Table S1702.

6. U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates Table S2503.

7. California Energy Commission, 2019 California Residential Appliance Saturation Study (RASS) [Subset of Volume 2 banners - 2019 Results for Sacramento Municipal Utility District], last updated May 26, 2021, downloaded October 8, 2022 from: <https://www.energy.ca.gov/data-reports/surveys/2019-residential-appliance-saturation-study>

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homeowners to use window conditioning units, which are less energy efficient and can contribute to higher energy costs. In addition, a neighborhood’s proportion of renter-occupied housing units has been shown to be positively correlated with higher mortality rates among the elderly during extreme heat events.⁸ Rental housing, multifamily housing, and subsidized housing are correlated with higher neighborhood sensitivity to heat. Thirty-one percent of Sacramento County’s subsidized housing units are in high-heat census tracts – one of the highest rates in California.⁹ About 50.2 percent (94,124) of Sacramento’s housing units are renter-occupied.¹⁰

- **People experiencing homelessness** are especially vulnerable to climate change impacts due to elevated exposure to environmental stressors, lack of secure shelter, and lack of access to information in climate emergencies such as extreme weather. Homeless communities are often overlooked in disaster planning, have limited access to emergency alert systems, and often lack the legal standing to help ensure their protection during emergencies. Sacramento County’s Point in Time Count estimated 9,278 individuals experience homelessness in Sacramento each night as of 2022, consisting of 79 percent of single adults over 25, 15 percent in family units and 5 percent of unaccompanied youth.¹¹ There was a 67-percent increase in

nighttime homelessness between 2019 and 2022. Approximately 30 percent of individuals sleeping outside in Sacramento County are over the age of 55, and Black and American Indian or Alaska Native people are disproportionately represented in the homeless population.¹²

- **Linguistically isolated households**, in which no members aged five years or older speak English fluently, often experience limited access to or understanding of health and safety warnings and information during extreme weather events or disasters. Linguistic isolation may thus inhibit protective behaviors, and in the aftermath of an extreme event can create barriers to proper care and recovery services. Language barriers can also contribute to vulnerability for new immigrants, older first-generation immigrants, asylum seekers, and young children. Approximately 36.1 percent of Sacramento residents speak a language other than English at home, and 38.5 percent of these individuals have limited English proficiency.¹³ In the City of Sacramento, neighborhoods with high rates of linguistic isolation show significant overlap with neighborhoods high in poverty, residents with disabilities, and substandard housing. While a number of these neighborhoods are low-density or adjacent to industrial land uses, many linguistically isolated residents live downtown.

8. Klein Rosenthal J, Kinney PL, Metzger KB. “Intra-urban vulnerability to heat-related mortality in New York City, 1997-2006.” *Health & Place* (2014). May 11 2020: <https://www.sciencedirect.com/science/article/pii/S1353829214001087>.

9. Gabbe CJ, Pierce G. “Extreme Heat Vulnerability of Subsidized Housing Residents in California.” *Housing Policy Debate*. (Jul 2020). July 27 2020: <https://www.tandfonline.com/doi/full/10.1080/10511482.2020.1768574>

10. U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates Table S2502.

11. Baiocchi A, Curry S, Morris J, Newham J, Caler, K, et al. “Homelessness in Sacramento County: Results from the 2022 Point-in-Time Count.” (Sacramento, CA: Center for Health Practice, Policy & Research, California State University Sacramento and Sacramento Steps Forward, 2019). July 2022: <http://sacramentostepsforward.org/wp-content/uploads/2022/06/PIT-Report-2022.pdf>.

12. Ibid.

13. U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates Table S1601.



CRITICAL FACILITIES

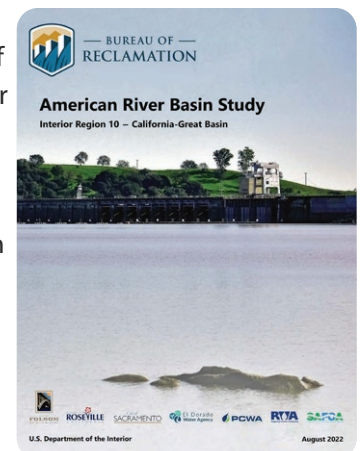
A critical facility is any facility whose damage or disruption would result in severe consequences to public health and safety or interrupt essential services for the community. Climate change has the potential to exacerbate impacts to critical facilities in Sacramento. These include:

- **Water quality and supply**, from both surface water and groundwater sources, is essential for the City to provide domestic water service to the area within the city limits and to several small areas within Sacramento County. The City operates groundwater supply wells in addition to drawing surface water from the American River and Sacramento River. The City works with multiple partner agencies to plan for and manage groundwater and surface water. One key effort that was completed in 2022 with several agency partners was the American River Basin Study,¹⁴ which developed data, tools, and analysis to forecast potential impacts on water supply and water quality. While major changes in total precipitation within the American River Basin are not anticipated, the study projects that precipitation will be more likely to arrive in the fall and early winter, with the percentage of precipitation that will fall as rain projected to increase, with a corresponding decrease in precipitation falling as snow. This will lead to reduced snowpack in the upper watershed, increased runoff in fall and winter, increased flood risk in the winter, and decreased flows in the American River in summer and fall. The study outlines six potential climate change adaptation strategies for the American River Basin, providing a roadmap to ensure water reliability into the future. The American River Basin

Study will also inform the work of the Regional Water Authority (RWA), a Joint Powers Authority representing two dozen water providers and affiliates in the greater Sacramento region, including the City of

Sacramento, to serve, represent, and align the interests of regional water providers and stakeholders for the purpose of improving water supply reliability, availability, quality, and affordability. A key RWA program is the Regional Water Bank, an innovative groundwater storage program that will improve regional water supply reliability into the future. The Sacramento region's unique setting at the confluence of the American and Sacramento Rivers, near Folsom Reservoir, and overlying the North American and South American groundwater subbasins, provides an ideal location for development of a water bank.

- **Water Treatment Facilities.** Warmer source water conditions can degrade the quality of the water and may trigger conditions where treatment technologies currently being employed are inadequate to meet appropriate drinking water standards. Higher water temperatures are associated with increased algal growth, sometimes even contributing to blooms, in reservoirs such as Lake Natoma and along slower-moving stretches and the banks of river systems such as parts the lower



14. U.S. Bureau of Reclamation, American River Basin Study: Interior Region 10 – California Great Basin, August 2022, <https://www.usbr.gov/watersmart/bsp/completed.html>

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American River. With this algal growth comes a greater potential for the production of algal cyanotoxins and, more germane to the City's situation, production of taste- and odor-causing algal byproducts like geosmin and 2-methylisoborneol (MIB). Over the years, City staff have noted a direct correlation between elevated geosmin and MIB values in surface water sources and customer taste and odor complaints. Similarly, warmer water temperatures could lead to an increased rate of disinfection byproduct formation. The City's surface water treatment plants are being evaluated to add additional treatment technologies to adapt to changing conditions. Other benefits of more advanced treatment would be a reduction in disinfection byproduct formation compared to current treatment processes.

- **Sewer, stormwater, and flood control infrastructure.** Sanitary sewer and stormwater utilities are critical to the collection and conveyance of wastewater and stormwater in the city. A combined sewer and storm water system (CSS) serves a portion of the city, while the remainder is served by separated sewer and storm drainage systems. Wastewater systems and services are provided by the City of Sacramento Department of Utilities (DOU), the Sacramento Area Sewer District (formerly County Services District CSD-1), and the Sacramento Regional County Sanitation District (Regional San). DOU maintains and operates two Combined Sewer System treatment plants (Pioneer Reservoir Treatment Plant and Combined Wastewater Treatment Plant), which operate only during significant rain events. Climate change poses a threat to wastewater and stormwater systems via flooding or increased flows, which can overwhelm and damage stormwater and sewer systems. A combined sewer overflow (CSO) occurs when flows to the CSS exceed the treatment system



Levee Along the Sacramento River

- capacity, which causes untreated stormwater and wastewater to be discharged into nearby streams, rivers, and other water bodies, threatening public and ecosystem health. While Sacramento has an extensive network of levees, dams, and weirs to protect the city from flooding, a storm event that exceeds the capacity of this flood protection infrastructure could cause significant damage and injury.
- **Energy supply and infrastructure** can be interrupted because of increased temperatures, changes in the hydrological cycle, wildfire, and heavy storms. For example, heat events increase demand for energy-intensive uses such as air conditioning and cooling equipment but reduces efficiency of energy transmission. This can make the city more susceptible to energy blackouts and increase energy bills during the summer. Both wildfire and heavy storms can damage infrastructure, producing electricity and phone line outages, which could limit emergency communication during a climate hazard. Heat and wildfires also threaten energy production and distribution, damaging powerlines or pipes, reducing transmission capacity via smoke and high heat, and shutting down lines as a safety measure. The Sacramento Municipal Utility District (SMUD) serves 900 square miles and is responsible for the acquisition, transmission, and distribution of electrical service to City of Sacramento customers. SMUD



Wind Turbines Contribute to the Energy Supply

serves 1.5 million people, supplying power through a distribution grid in a looped system.

- **Transportation infrastructure** including roadways, railways, bridges, sidewalks, and transit lines can experience physical damage under extremely high temperatures. In addition, extreme heat and poor air quality can make taking transit, walking, and biking uncomfortable or infeasible. Wildfires can lower air quality, cause road and airport blockages and closures, and reduce road visibility. Flooding can make transportation routes inaccessible when storm events put roadways underwater, destroy critical infrastructure, knock out streetlights, cause trees to fall and block roadways, and wash out bridges. Maintaining a resilient network of evacuation routes and transportation corridors is essential to providing critical services during environmental crises. Certain groups such as the elderly, the hospitalized, individuals with mobility issues, those without a car or other access to reliable transportation, or those who do not receive language-appropriate warning and evacuation information may not be able to evacuate in a timely manner even if they wish to do so. In the absence of an evacuation event, disruptions to the transportation network can disproportionately affect low-income individuals, older adults, those with limited English proficiency, and those who have

limited mobility. Households without a vehicle may lack the capacity to evacuate without assistance. About 8.3 percent of Sacramento's households lack access to a household vehicle.¹⁵

- **Medical facilities and services** will experience increased demand under climate change impacts including higher ambient temperature, reduced ambient air quality, flooding, and wildfire that have the potential to strain medical services infrastructure. Six hospitals are located within the city of Sacramento: Kaiser Permanente South Sacramento Medical Center, Mercy General Hospital, Methodist Hospital of Sacramento, Shriners Hospital for Children, Sutter Medical Center, and UC Davis Medical Center. There are also several health clinics designed to address the needs of specific underserved populations throughout the Sacramento area, many of which are operated in coordination with the UC Davis Medical Hospital. The Department of Health and Human Services operates the Sacramento County Mental Health Treatment Center (SCMHTC), which includes the Minor Emergency Response Team unit, providing crisis intervention and stabilization for children and youth experiencing a psychiatric emergency.
- **Emergency response and management** systems will be increasingly relied on as the severity and frequency of floods and wildfires

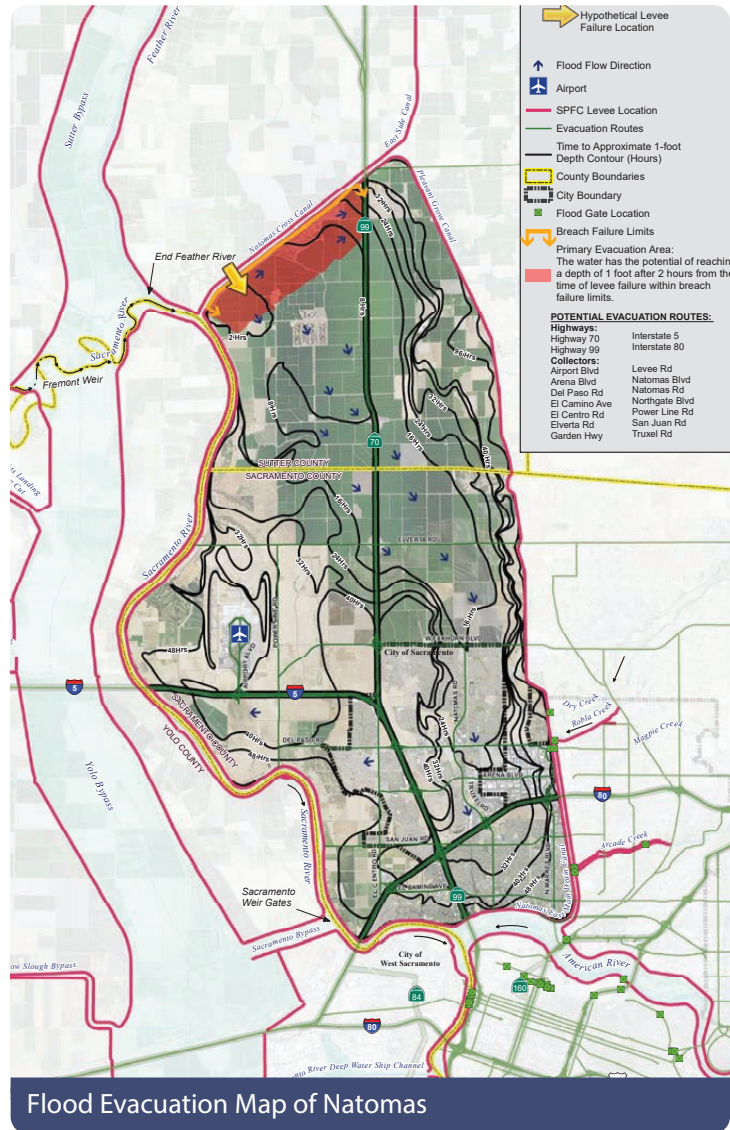
15. U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates Table S2504.

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increase across the Sacramento region and beyond. Demand for emergency response/staff and social services, the need for more cooling/clean air/evacuation centers, and the need to manage emergency evacuation traffic may be expected to increase, leading to an increase in the need for physical facilities, resources, and services to manage the expanding frequency and severity of threats. While Sacramento does not have extensive urban-wildland interface, demand for fire protection services may also increase as the fire department may be called to respond to fires across the region and the state. Demand for medical services could increase as wild-fires exacerbate air quality issues already experienced and contribute to health-related impacts, especially for vulnerable populations. Housing insecurity may be exacerbated following major flood events, creating another source of demand for social services. Community Centers can provide safe refuge during emergency events. Flooding is the primary threat that would cause the City to begin an evacuation. Significant flood events could have an extensive impact on the City's street network and hinder evacuation and/or emergency response. It is critical for the City to communicate any changes to evacuation routes in response to such events via local and agency websites as well as through educational campaigns and public service announcements. In the event of a climate hazard, special care should be given to transport vulnerable populations.

- **Telecommunications Services** are essential to everyday and emergency

communications. Many telecommunications components (landline, wireless, and internet) are susceptible to damage in a severe storm, and telecommunications networks are susceptible to being slowed or blocked when overloaded by call volume. Emergency preparedness and alternative modes of communications during a climate hazard or emergency event can help reduce the impact of disrupted telecommunications services or damage to this critical facility.





ADAPTATION STRATEGY

Where key climate change risks and vulnerabilities in Sacramento intersect, there is an opportunity to improve adaptive capacity. The adaptation strategy presented in this section prioritizes the areas in which existing levels of adaptive capacity are low, especially in comparison to high levels of risk and/or vulnerability. These priorities reflect the City's aim to achieve climate equity while also most effectively building resilience.

EXISTING ADAPTIVE CAPACITY

Planning and Management Capabilities

Existing regulatory capabilities across City departments and offices can help implement climate adaptation and mitigation activities. For example, the Community Development Department (CDD) regulates new development through the implementation of City development standards and the California Building Standards Code. CDD also develops and updates long-range plans for the city's future, such as the Sacramento General Plan and the Climate Action and Adaptation Plan, which lays out a set of strategies to achieve substantial greenhouse gas reductions and increase community-wide resilience to climate change.

Other City departments also prepare plans to guide operations within their respective areas of responsibility, many of which are related to climate change adaptation. For example, DOU updates the City of Sacramento Urban Water Management Plan on a five-year cycle to assess the availability and reliability of water

supplies and projected water use. Additionally, DOU's Comprehensive Flood Management Plan guides the City's flood risk and mitigation efforts.

The Sacramento Office of Emergency Management (SacOEM) prepares and coordinates the City of Sacramento Emergency Operations Plan, which provides guidance for those with emergency management responsibilities within the City of Sacramento. This plan covers a broad range of planned responses to emergencies associated with disasters, technological incidents, or other dangerous conditions to support effective mitigation of disaster damage, reconstruction, and repeated damage.

The City also coordinates with other agencies to develop plans that guide operations. For example, the Sacramento County Multi-jurisdictional Local Hazard Mitigation Plan (LHMP) is a FEMA-approved plan that serves as a tool to reduce or eliminate long-term risk to people and property from hazards. The 2021 LHMP was prepared in coordination with Sacramento County, seven incorporated communities and 24 special districts.

Collaborative Structures, Planning, and Management Capabilities

Like many agencies throughout California, the City of Sacramento must find the way to address climate impacts in a resource-constrained environment. It will be essential to find holistic and integrated approaches to address projected climate impacts. This can take the form of multi-benefit projects, in which mitigation measures are integrated and delivered through existing capital improvement plans. Alternately, this can be achieved through

CLIMATE ACTION & ADAPTATION PLAN

multi-agency partnerships that streamline and coordinate local investments to drive more cost-effective regional solutions where risk and mitigation approaches can be aligned. The City of Sacramento has already partnered with a range of government entities including federal, State, County, special districts, and other local municipal agencies, on a range of issues and projects that are central to Sacramento's successful adaptation to projected climate change impacts. Likewise, the City has key partnerships with community-based organizations that can be further developed to integrate vulnerable populations and further disseminate mitigation activities throughout the community.

Leveraging resources developed by the City's partners is essential to successful CAAP implementation. For example, following Assembly Bill 661 (2019), the Sacramento Metropolitan Air Quality Management District (SMAQMD) led a regional process to develop a Wildfire Smoke Air Pollution Emergency Plan and associated education materials for schools, businesses, and other organizations. The City can leverage these resources in programs and projects to adapt to wildfire smoke and other air quality hazards. Similarly, the Capital Region Climate Readiness Collaborative creates and disseminates educational resources on extreme heat that can support the City's adaptation goals. The California Natural Resources Agency is also drafting an Extreme Heat Action Plan as part of the California Climate Adaptation Strategy. Effectively leveraging such resources can support the City's climate adaptation efforts.

Another key example is the regionwide water resources and flood risk management effort between agencies including the U.S. Bureau of Reclamation, State Department of Water Resources, Sacramento Area Flood Control

Agency, the City of Sacramento Department of Utilities, and others. Findings from the American River Basin Study have affirmed the need for strategic actions including maintaining the Sacramento Regional Water Bank, which helps coordinate conflicting requirements for flood risk management and water supply throughout the region. Given that the scale of climate change impacts extend beyond City boundaries, these types of partnerships will continue to be instrumental in implementing effective adaptation measures.

Administrative/Technical Capabilities

Authority for emergency management in the City of Sacramento resides with the City Manager, who is designated by City Code as the Director of Emergency Services. Several important divisions related to climate change adaptation reside within the City Manager's Office. These include the Office of Climate Action and Sustainability, which leads the City's efforts to address climate change; the City's Office of Media and Communications, which facilitates communication with citizens and businesses; and SacOEM, which is responsible for conducting all-hazard preparation, mitigation, response, and recovery for the whole community. SacOEM also manages the Emergency Operations Center (EOC), which is staffed with City personnel who are trained to ensure unified, enduring support to first responders and the community for the duration of any disaster. For events that do not necessitate activating the EOC but still involve multiple departments, OEM may activate and lead a Crisis Action Team (CAT) to facilitate integrated Citywide response. For multi-jurisdictional cohesion, SacOEM also has a staff member



assigned to the Sacramento Regional Type-III Incident Management Team. In an emergency, the Office of Media and Communications helps disseminate and coordinate vital information to ensure public safety.

Several other City departments are responsible for activities related to loss prevention in Sacramento. DOU's Storm Drainage Division operates and maintains the City's storm drainage system, which consists of pumping stations, pipes, ditches, channels. DOU also helps maintain levees on several waterways, while others are maintained by other agencies, and conducts educational Flood Ready outreach to residents.

The Public Works Department manages and maintains the City's transportation system, responds to hazards in the public right of way, manages City trees and responds to downed trees, streetlight poles, traffic signal poles, guardrails, operates flood gates, and upgrades the City's transportation network as funding permits.

Fiscal Capabilities

The City of Sacramento will continue to seek and coordinate funding to effectively drive mitigation actions. For example, the City will seek to combine similar actions to align local funding and integrate mitigation measures into identified capital projects to bolster systemic resilience. The City will seek to build on General Fund dollars, water and stormwater utility enterprise funds, impact fees for new development, and other current City revenue sources to leverage State and federal funding to drive mitigation projects. The City continuously seeks to acquire grant funding from both State and federal agencies: some key opportunities

include grant funding from the FEMA Hazard Mitigation Assistance (HMA) program, which includes Pre-Disaster Mitigation and Flood Mitigation Assistance Grant Programs; FEMA Public Assistance Section 406 Mitigation; Community Development Block Grants (CDBG); and Increased Cost of Compliance funding. Key State funding sources for adaptation projects include CalOES, the Department of Water Resources (DWR), and the California Strategic Growth Council.



CAAP Community Outreach Event

Education, Outreach, and Partnerships

Numerous education and outreach programs and methods exist currently to implement mitigation activities and communicate hazard-related information. Local citizen groups or non-profit groups such as American River Parkway Foundation and Community Emergency Response Team focus on environmental protection, emergency preparedness, access, and functional needs. Continued public education and information programs, Firewise Communities certification, and public-private partnership initiatives addressing disaster related issues also help to promote preparedness and mitigation information and strategies.

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In addition, the City conducts a number of out-reach programs on an annual basis. Some examples include the “Flood Watch” newsletter developed by the Sacramento Area Flood Control Agency to inform the public on levee work status and assessment information and the Sacramento Splash in the Class program which provides presentations on stormwater pollution prevention to third through sixth grade classrooms.



The Tower Bridge

ADAPTATION PRIORITIES

Implementing climate adaptation will require addressing a broad range of issues, from extreme heat to flood risk. Yet, each of these issues pose a different level of risk in Sacramento, and certain residents are more at-risk than others. For example, many communities and critical facilities are located in areas of high vulnerability to flooding due to low elevation, and climate change will further increase the chances of such events. While Sacramento has extensive storm drainage and flood control infrastructure, the adaptive capacity of this infrastructure to climate change impacts is not fully understood. Due to the potential for serious harm that a major flood event could cause, the City and partner agencies

such as the Sacramento Area Flood Control Agency, State DWR, and the Federal Bureau of Reclamation will continue to proactively coordinate to improve flood control infrastructure and management to adapt to climate change. The American River Basin Study is one example of a regional effort that bolsters the City’s existing adaptive capacity in response to flooding and water supply availability impacts. On the other hand, while there is low risk of wildfire occurring within the city, the impact of smoke from regional wildfires in the surrounding area can substantially affect Sacramento residents. This effect will be felt most acutely by vulnerable populations such as people with asthma, outdoor workers, and other groups that are not specifically addressed by existing programs or policies.

The following priorities have been established based on the Climate Change Vulnerability Assessment, taking into account the risk level of the climate change impact and the level of existing adaptive capacity. These priorities correspond to the goals discussed in the next section.

- 1. Strengthen City Government Capacity for Integrated, Holistic Climate Adaptive Strategies**
- 2. Extreme Heat and Urban Heat Island Effect**
- 3. Flooding**
- 4. Air Quality Impacts of Wildfires and Heat**
- 5. Climate Disaster Events**
- 6. Water Supply Availability and Water Conservation**



Goals, Policies, and Actions

This section, consistent with Government Code section 65302(g), presents the goals and policies that will guide the City, and actions that the City and its partners will implement to adapt to climate change impacts and improve resiliency. The Adaptation Strategy is intended to address Sacramento’s key climate vulnerabilities identified in the Climate Change Vulnerability Assessment. Goals and policies are supported by a suite of actions and a description of co-benefits.

The City has proactively incorporated extensive climate adaptation and resilience actions into the Draft 2040 General Plan, Draft Urban Forest Plan, and 2021 Local Hazard Mitigation Plan (LHMP). For each Adaptation Goal in this section, supporting policies are referenced from the Draft 2040 General Plan as applicable. Each goal is then followed by a table of related implementing actions from the Draft 2040 General Plan and LHMP. If the action is derived from another document, such as the LHMP, then that original source is provided in brackets. LHMP actions are provided in full detail in [Appendix G](#). Finally, newly drafted CAAP actions are included at the end of the table to help address any remaining gaps not covered by other documents. Timing for these actions is summarized in the “Phase” column, where the phases are defined as follows:

- **Phase 1** actions will begin implementation at CAAP adoption or before. These actions have been prioritized due to their importance,

cost-effectiveness, or the availability of resources for implementation.

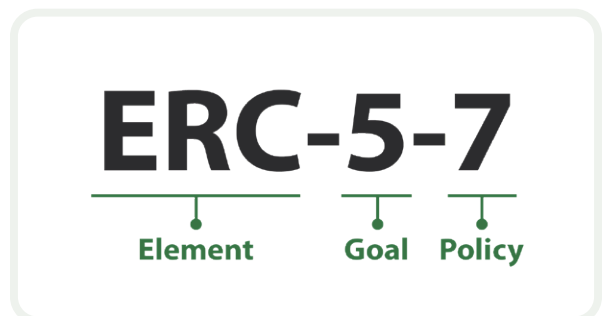
- **Phase 2** actions will begin implementation between 2024 and 2030. These actions may require additional resources such as staff time, funding and financing, or there may need to be additional education and outreach conducted prior to implementation.

Acronyms for each of the General Plan elements used in this scheme are defined below:

- **ERC:** Environmental Resources and Constraints
- **EJ:** Environmental Justice
- **HCR:** Historic and Cultural Resources
- **PFS:** Public Facilities and Safety

GENERAL PLAN ELEMENTS

Policies in the General Plan are uniquely numbered by each element using a naming convention that identifies the element, the goal number, and the policy number, as demonstrated below:



CLIMATE ACTION & ADAPTATION PLAN

GOAL A-1: Strengthen City government capacity for integrated, holistic climate adaptive strategies and to reduce climate risks.

Responding to climate impacts requires new, systemic approaches and solutions. Opportunities for multi-benefit approaches can happen with creative partnership and the repurposing of existing limited resources. Preparing for the increasing scale and severity of climate impacts necessitates new approaches. Resiliency will require embedding and institutionalizing new approaches into City operations to address existing limitations of funding, special use funds, and staff capacity.

Integrated planning, funding, and implementation partnerships will be essential to timely meeting the adaptation challenges ahead. The following actions entail evaluating climate risk and identifying funding needs, opportunities, and staff resources necessary for implementation. This goal establishes important foundational steps for the organization to quantify and prepare to reduce climate risks, to the community, as well as to City operations and expenditures.

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality



Open Space Helps Sequester Carbon, Reduce Run-Off, and Improve Quality of Life



Actions and Implementation

Action	Lead Agency	Support/ Partner	Phase
<p>A-1-1: Climate Risk Reduction – Evaluate and reduce climate risks and vulnerability in City expenditures and operations.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • City Manager’s Office 	<ul style="list-style-type: none"> • Budget Office 	Phase 1
<p>A-1-2: Adaptation and Resilience Staff – Dedicate City staff and resources for long-term climate adaptation and resiliency needs.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • City Manager’s Office 	<ul style="list-style-type: none"> • Community Development • Public Works • Utilities 	Phase 2
<p>A-1-3: Climate-Informed Infrastructure Planning – Establish guidance and procedures for the consideration of climate impacts in all City infrastructure and capital projects, including minimum levels of preparation as applicable.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • City Manager’s Office 	<ul style="list-style-type: none"> • Utilities • Public Works • Youth, Parks, and Community Enrichment 	Phase 2
<p>A-1-4: Resilient City Facilities – Evaluate and prioritize climate vulnerabilities in City facilities and infrastructure and establish a coordinated plan for the pursuit of related grants across City departments.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • City Manager’s Office 	<ul style="list-style-type: none"> • All 	Phase 2
<p>A-1-5: Climate Change Collaboration and Partnerships – Support regional climate collaboration and provide continued leadership, with continued support of the Capital Region Climate Readiness Collaborative and related adaptation efforts.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • City Manager’s Office 	<ul style="list-style-type: none"> • Community Development • Public Works • Utilities 	Phase 1
<p>A-1-6: Climate Change Data and Resources – Use and disseminate available resources on climate adaptation and impacts, with a focus on Sacramento’s vulnerable communities.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • All 		Phase 2

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GOAL A-2: Create built environments that reduce exposure to extreme heat and mitigate urban heat island effect.

As high temperatures during summer months become more extreme and occur over a longer period of time, the cost burdens and resource strain of greater energy use, incidence of heat-related sickness or death, and exacerbation of urban heat island effect will also increase. By understanding the primary components of urban heat—shade, evapotranspiration, and albedo—the City can make changes to the physical environment to create places that are more livable. For example, Measure CS-1 to increase urban tree canopy cover will provide more shade, which will reduce exposure to direct sun and reduce heat impacts. Trees also contribute to a cooler microclimate through evapotranspiration, which is the process of moisture evaporating from plants into the atmosphere. Meanwhile, increasing albedo (reflectivity) of built surfaces such as using white or light-colored “cool roofs” can help limit indoor temperature, thereby

reducing the need for air conditioning. As such, many of the mitigations addressed by this goal can achieve co-benefits that strengthen the City’s adaptive capacity.

Alignment with Mayors’ Commission on Climate Change

The Mayors' Commission on Climate Change made recommendations on community health and resilience that are addressed in the actions supporting this goal. Specifically, the actions under this goal will substantially further the objectives of providing access to green space within a quarter-mile of home for all residents by 2030 and of achieving a baseline tree canopy of 25 percent by 2030 and 35 percent by 2045. The actions under this goal also have important public health and climate resilience benefits, in line with MCCC recommendations.

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality



Supporting Draft General Plan Policies

The following Draft 2040 General Plan policies support the goal of creating built environments that reduce exposure to extreme weather events and mitigate urban heat island effects:

ERC-8-1: Cooling Design Techniques.

Through design guidelines and other means, in all new development the City shall promote the use of tree canopy, cool pavements, landscaping, building materials, and site design techniques that provide passive cooling and reduce energy demand. In particular, the City shall promote the use of voluntary measures identified in the California Green Building Code (Title 24, Part 11 of the California Code of Regulations) to minimize heat island effects, including hardscape and roof materials with beneficial solar reflectance and thermal emittance values and measures for exterior wall shading.

ERC-8-2: Large Heat Islands. The City should work with property owners and businesses identified in urban heat island hot spots, informed by [Figure 7-2](#) to address the urban heat island effect and reduce ambient temperatures in surrounding residential areas. City actions may include the following:

- Facilitating coordinated action among property owners and;
- Providing information and incentives for cost-effective heat reduction strategies, including front yard tree plantings and vegetation where streets lack room for street trees.

ERC-8-3: Urban Heat Pilot Projects. The City should continue to pursue pilot projects to test the use of new materials (e.g., landscaping, building materials, and site

design techniques) in City infrastructure projects that can mitigate urban heat when implemented at scale.

ERC-8-4: Municipal Cool Roof Retrofits. The City should evaluate cool roofing options and plan for the retrofit of municipal facilities in coordination with energy efficiency upgrades, including administrative offices, community centers, and maintenance buildings. City buildings located in the most vulnerable areas, informed by [Figure 7-2](#) should be prioritized for retrofits.

ERC-8-5: Cool Libraries. The City shall work with the Sacramento Public Library (SPL) to facilitate the incorporation of cooling techniques into neighborhood library facilities, including the application of cool roofing materials, cool paving treatments, landscaping, and shading amenities as funding allows.

ERC-8-6: Heat-Reducing Public Amenities. The City shall strive to install heat-reducing public amenities in areas most affected by urban heat, prioritizing the areas with vulnerable populations. Amenities could include the following:

- Drinking water fountains or bottle refilling facilities in public parks, at community facilities, transit centers, or other appropriate locations.
- Splash pads, sprinklers, fountains, and other water features in public parks, where appropriate.

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- Shade structures and shading elements in parks and public facilities, where appropriate.
- Additional trees planted in passive landscape areas in parks and public facilities.

ERC-3-2: Tree Canopy Expansion. The City should strive to achieve a 25 percent urban tree canopy cover by 2030 and 35 percent by 2045. Prioritize tree planting in areas with the lowest average canopy cover and explore strategies to reduce barriers to tree planting in disadvantaged communities and improve tree health.

ERC-3-3: Tree Protection. The City shall encourage public agencies and require private development projects to consider alternatives to removals of healthy trees whenever feasible and to evaluate the longer-term consequences of the inability to meet tree canopy objectives when conducting project analyses and environmental documents. Ensure adequate protections during construction to protect existing tree roots and structure.

ERC-3-5: Tree List. The City shall maintain and update a list of desirable trees that suit soil and climate conditions in specific areas of Sacramento. Continue to explore and promote tree species that demonstrate greater adaptiveness to higher temperatures, reduced water use, grey and recycled water, and pest and disease resistance.

ERC-3-9: Watering and Irrigation. The City shall encourage appropriate watering practices and irrigation to minimize needed water use and support healthy tree growth; support responsible tree irrigation during droughts to minimize tree

stress and loss; and convert irrigation in parks and streetscapes where needed.

ERC-3-10: Parking Lot Shading. The City shall review and amend the Parking Lot Shading Design and Maintenance Guidelines and Parking Lot Shading Ordinance as needed to promote tree health, growth, and maintenance of trees to reduce urban heat island impacts.

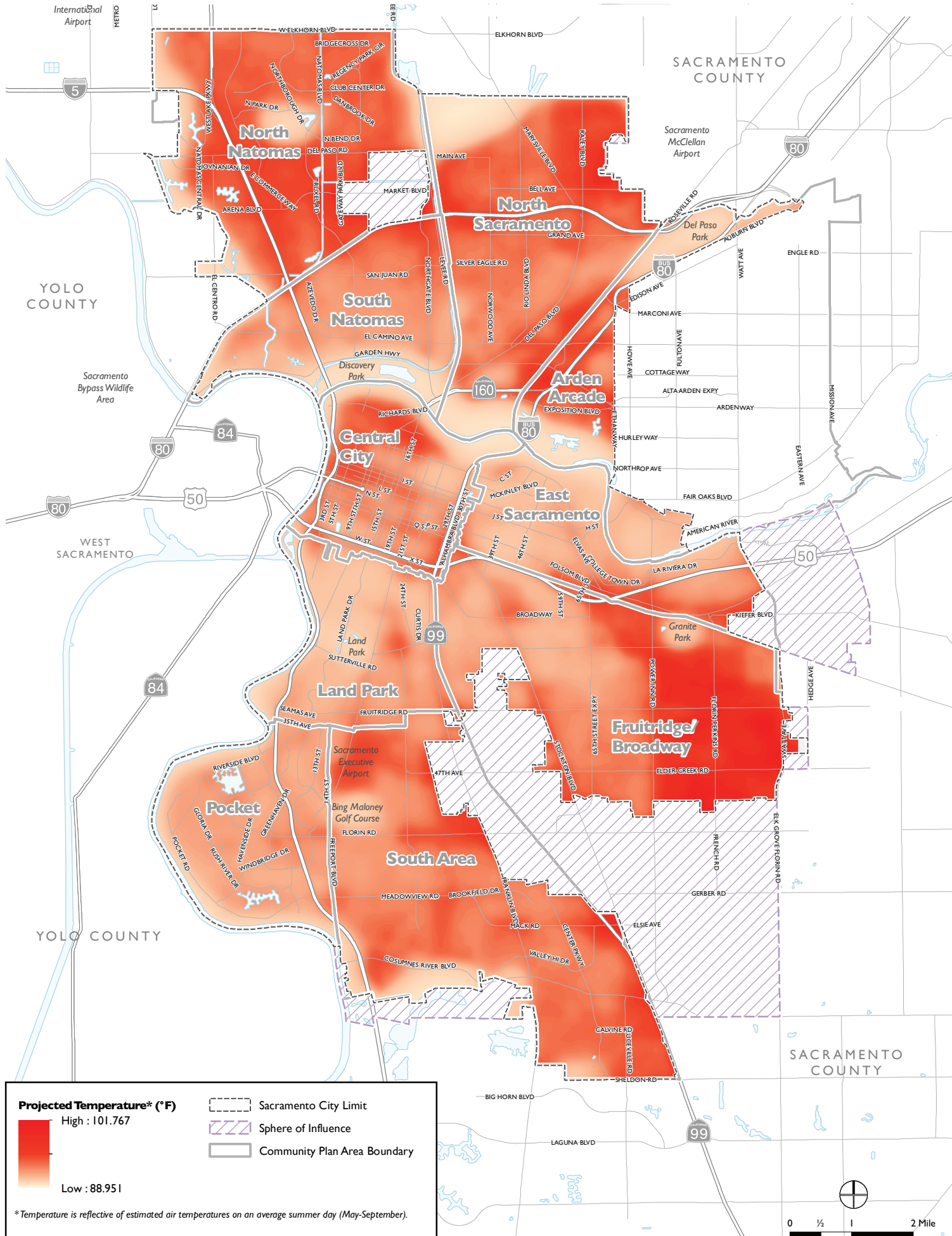
ERC-3-6: Urban Forest Maintenance. The City shall continue to plant, manage, and care for all trees on City property and within the public right-of-way to maximize their safe and useful life expectancy and continue to explore the selection of tree species that are adapted to future climate conditions.

ERC-3-11: Planting. The City should encourage development to provide trees with appropriate irrigation methods and adequate growing space; site trees to reduce building heat and provide shade to public walkways to the extent feasible; and include appropriate soil treatment methods to promote healthy thriving trees.



Youth Workers in the City's Landscape & Learning Program

Figure 7-2. Urban Heat Priority Intervention Areas Map



Source: Natural Capital Project, Stanford University, 2021; NASA, 2018-2021; USGS, 2018-2021; County of Sacramento, 2018; City of Sacramento, 2018; Dyett and Bhatia, 2021

CLIMATE ACTION & ADAPTATION PLAN

Actions and Implementation

The following implementation actions are drawn from the Draft 2040 General Plan and adopted 2021 Local Hazard Mitigation Plan and support the goal of creating built environments that reduce exposure to extreme weather events and mitigate urban heat island effects:

Action	Lead Agency	Support	Phase
<p>A-2-1: Heat Reduction in the Public Realm – The City should evaluate updating the City Code to require the use of heat mitigation strategies to reduce temperatures in the public realm, particularly near light rail transit (LRT) stations and along transit corridors. Requirements may include the incorporation of:</p> <ul style="list-style-type: none"> • Building design strategies (varied building heights; setbacks from sidewalks; vertical and horizontal shade features); • Cooling materials, treatments, and coatings; • Multiple layers of shading to maximize coverage throughout the day; and • Street trees, and landscaping. <p><i>[Draft General Plan ERC-Action 4]</i></p>	<ul style="list-style-type: none"> • Community Development 	<ul style="list-style-type: none"> • Public Works 	Phase 2
<p>A-2-2: Bus Shelter Design – The City shall encourage Sacramento Regional Transit District (SacRT) to study the feasibility of designing and installing bus shelters that are designed to offer protection and relief from heat, including the incorporation of shade trees.</p> <p><i>[Draft General Plan ERC-Action 5]</i></p>	<ul style="list-style-type: none"> • Public Works 		Phase 2
<p>A-2-3: Cooling Landscape Standards – The City shall prepare a Landscape Manual or enhance landscape standards to mitigate urban heat island effects. Such standards could include a climate appropriate planting palette and recommended plant mix, targets for street tree canopy, shade structure coverage, and asphalt paving coverage.</p> <p><i>[Draft General Plan ERC-Action 7]</i></p>	<ul style="list-style-type: none"> • Public Works 	<ul style="list-style-type: none"> • Community Development • Youth, Parks, and Community Enrichment 	Phase 2



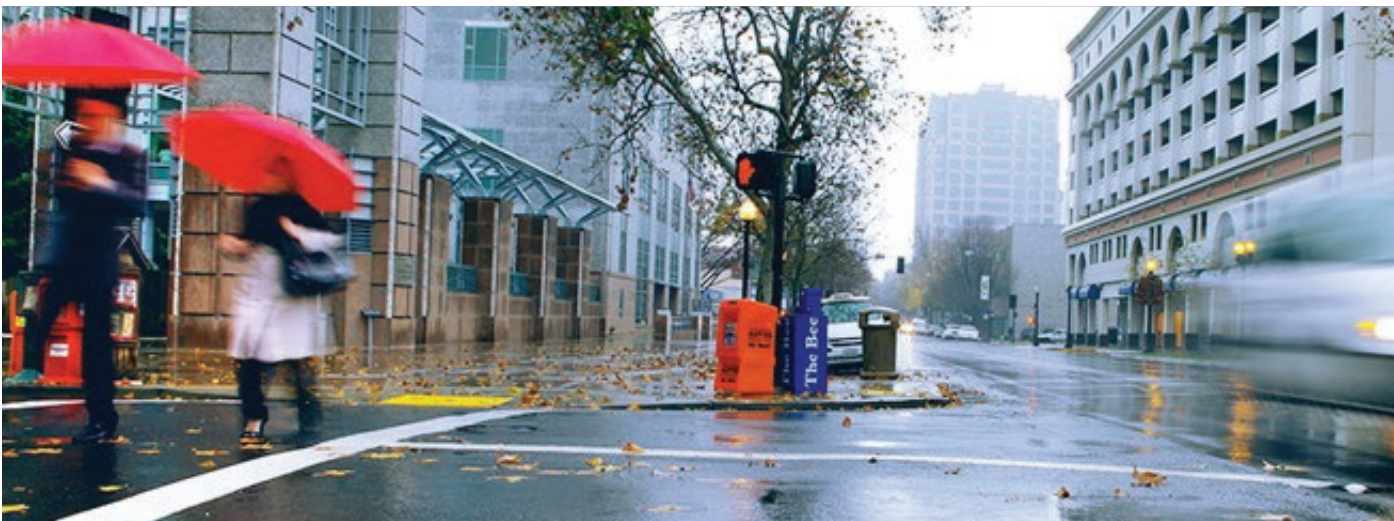
Action	Lead Agency	Support	Phase
<p>A-2-4: Heat-Resilient Design Techniques – The City shall evaluate the feasibility of updating design guidelines, standards, and the municipal code to promote building materials and site design techniques that provide passive cooling and reduce energy demand.</p> <p><i>[Draft General Plan ERC-Action 8]</i></p>	<ul style="list-style-type: none"> • Community Development 		Phase 2
<p>A-2-5: Urban Forest Plan – The City shall develop and implement an Urban Forest Plan as a primary planning tool for the protection, expansion, maintenance, sustainability, and enhancement of Sacramento’s urban forest.</p> <p><i>[Draft General Plan ERC-Action 1]</i></p>	<ul style="list-style-type: none"> • Public Works 	<ul style="list-style-type: none"> • Community Development • Youth, Parks, and Community Enrichment 	Phase 2
<p>A-2-6: Minimum Tree Requirements – The City shall review and amend the planning and development code as necessary to require minimum levels of tree planting in new development and significant remodels, and improve tree canopy inclusion. Review the following topics at a minimum:</p> <ul style="list-style-type: none"> • Requirements for trees in setback areas, particularly located to shade sidewalks and streets; • Opportunities to provide incentives or requirements for inclusion of trees in front, back and side yards; • Tree plantings in site plan review to place trees to maximize energy conservation; • Chapter 12.56 of the City Code related tree permits for ministerial development project review; and • Solar panel installation requirements to minimize potential conflicts with tree planting. <p><i>[Draft General Plan ERC-Action 9]</i></p>	<ul style="list-style-type: none"> • Community Development 	<ul style="list-style-type: none"> • Public Works 	Phase 2

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Action	Lead Agency	Support	Phase
<p>A-2-7: Parking Lot Shade Ordinance Update – The City shall update the Parking Lot Shade Ordinance and Guidelines to ease compliance, improve site plan review and inspection, monitoring, and to strengthen requirements for ongoing maintenance and replacement of trees in parking lots. Identify when and how shading requirements may be satisfied through alternate methods such as canopies and solar arrays.</p> <p><i>[Draft General Plan ERC-Action 10]</i></p>	<ul style="list-style-type: none"> • Public Works 	<ul style="list-style-type: none"> • Community Development 	Phase 2
<p>A-2-8: Street Standards for Tree Canopy – The City shall update Street Standards to optimize tree canopy and provide solutions for various street functions and conditions.</p> <p><i>[Draft General Plan ERC-Action 11]</i></p>	<ul style="list-style-type: none"> • Public Works 	<ul style="list-style-type: none"> • Community Development 	Phase 2
<p>A-2-9: Tree Education – Develop informational materials to provide to new residents and businesses to support tree canopy, including but not limited to the following:</p> <ul style="list-style-type: none"> • Information for new residents and businesses on tree benefits, planting guidance, tree selection and care, available programs, and water-wise irrigation. • Guidance on tree planting to maximize building energy conservation. • Guidance to plant and maintain healthy trees in parking lots. • Options and strategies to convert paved areas to tree planting areas. <p><i>[Draft General Plan ERC-Action 2]</i></p>	<ul style="list-style-type: none"> • Public Works 	<ul style="list-style-type: none"> • Community Development 	Phase 2



Action	Lead Agency	Support	Phase
<p>A-2-10: Cooling Centers in High Priority Locations – This project includes the opening of cooling centers and respite centers in high priority locations throughout the City where these at risk populations are centered as well as high population areas where the general public may need to cool down. This can be an incentive for recreational centers and faith-based centers that can receive stipends for each day they are operational. <i>[Local Hazard Mitigation Plan Action 37]</i></p>	<ul style="list-style-type: none"> • Community Response 	<ul style="list-style-type: none"> • Office of Emergency Management • Youth, Parks, and Community Enrichment • City Libraries 	Phase 1
<p>A-2-11: Extreme Weather Outreach Strategy – This project is meant to serve as an outreach mechanism to the population in Sacramento City. It will be completed mainly by providing social media toolkits for the general population with access to internet. For more at-risk populations, such as the homeless, the outreach will be completed in person by targeting the areas of Sacramento where the homeless population tends to stay. Outreach will also be completed via food banks and homeless assistance centers. <i>[Local Hazard Mitigation Plan Action 38]</i></p>	<ul style="list-style-type: none"> • Community Response 	<ul style="list-style-type: none"> • Sacramento Steps Forward • Community Response • Office of Emergency Management • Public Information Officer 	Phase 1



The Department of Public Works Works Year-Round to Help Prepare for Winter Storms.

CLIMATE ACTION & ADAPTATION PLAN

Action	Lead Agency	Support	Phase
<p>A-2-12: Severe Weather Action Plan – The Severe Weather Action Plan will outline key triggers, such as, when to begin weather monitoring and cooling/warming centers activations. The Plan would also outline media and boots-on-the-ground outreach to the populations in need. The Plan will also identify community partners who will provide shelter and/or services during severe weather events.</p> <p><i>[Local Hazard Mitigation Plan Action 39]</i></p>	<ul style="list-style-type: none"> Office of Emergency Management Planning Process 		Phase 2
<p>A-2-13: Home Air Conditioning – Increase access to home air conditioning for vulnerable populations that do not currently have access, in tandem with heat pump installation to ensure energy and cost-effectiveness.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> Community Development City Manager’s Office 		Phase 2
<p>A-2-14: Heat Reduction in Parks – The City shall increase parkland tree plantings in passive landscape areas, especially in under-canopied neighborhoods. Other heat-reducing public amenities such as drinking fountains, water mister/spray areas, and shade structures will continue to be installed and maintained to mitigate urban heat island effects.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> Youth, Parks, and Community Enrichment 		Phase 2



GOAL A-3: Reduce the risk of damage to life, infrastructure, and property due to flooding.

The City of Sacramento is susceptible to various types of flood events, including riverine, flash, and localized stormwater flooding. Climate change is increasing the risk of extreme storms that cannot be contained by levees and dams. Regardless of the type of flood, the cause is most often the result of severe weather patterns and excessive rainfall, either in the flood area or upstream reach. Flooding is the most significant natural hazard that the City faces, and the extent and frequency would be expected to increase without adaptive actions. Climate change exacerbates Sacramento's flood risk because of the projected increase in severity of extreme storm events and because warmer winters will lead to an increasing fraction of precipitation falling as rain rather than snow in the upper American River and Sacramento River watersheds, leading to increased runoff in the fall and winter. Adaptive measures such as those identified in the American River Basin Study, and other planned projects including levee enhancements, will be essential to mitigate the risk of significant flooding.

In addition, climate resilience can be significantly strengthened by focusing efforts on proactive adaptation measures including relocating critical municipal facilities outside of hazard risk areas and building the community's knowledge, ability and capacity to reduce vulnerability to flood event disasters.

Sea level rise also has the potential to gradually exacerbate riverine flood risk in Sacramento from major storm events over the course of the century. However, additional studies will be needed to better understand the potential impacts of sea level rise on Sacramento. Nevertheless, sea level rise will generally increase salinity of the Delta's fresh waters and increase reliance on upper watershed sources, including Folsom Reservoir, underlining the challenge of balancing flood risk management and water supply.

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

CLIMATE ACTION & ADAPTATION PLAN

Supporting Draft General Plan Policies

The following Draft 2040 General Plan policies support the goal to reduce the risk to damage of life, infrastructure, and property due to flooding:

ERC-6-1: Protection from Flood Hazards. The City shall strive to protect life, the natural environment, and property from natural hazards due to flooding.

ERC-6-2: Flood Management Planning Coordination. The City shall work with local, regional, State, and federal agencies to do the following:

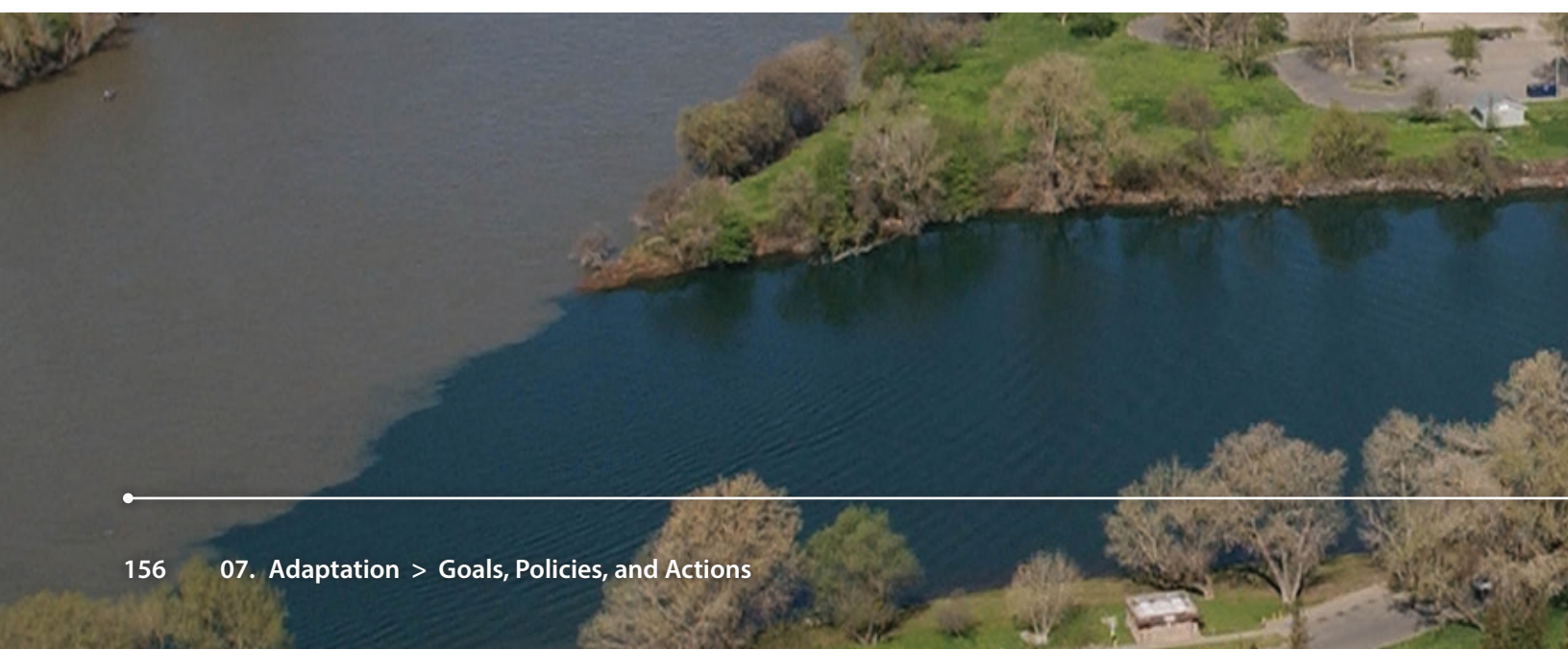
- Maintain an adequate information base; monitor long-term flood safety; and assess long-term flood event probabilities;
- Prepare risk assessments that account for urbanization and the effects of climate change;
- Identify strategies to mitigate flooding impacts; and
- Participate in regional planning efforts.

ERC-6-3: Floodplain Capacity. The City shall preserve urban creeks and rivers to maintain existing floodplain capacity while enhancing environmental quality and recreational opportunities.

ERC-6-4: Floodplain Requirements. The City shall regulate development within floodplains in accordance with State and federal requirements and maintain the City's eligibility under the National Flood Insurance Program.

ERC-6-5: Community Rating System. The City shall continue its participation in the Federal Emergency Management Agency's (FEMA's) Community Rating System program, which gives property owners discounts on flood insurance.

ERC-6-6: Flood Regulations. The City shall continue to regulate new development in accordance with State requirements for 200-year level of flood protection and federal requirements for 100-year level of flood protection.





ERC-6-7: Flood Hazard Risk Evaluation. The City shall require evaluation of potential flood hazards prior to approval of development projects and shall require new development located within a Special Flood Hazard Area to be designed to meet federal and State regulations and minimize the risk of damage in the event of a flood.

ERC-6-8: Interagency Levee Management. The City shall coordinate with local, regional, State, and federal agencies to ensure new and existing levees are adequate in providing flood protection and coordinate to achieve local certification of levees for 200-year flood protection by 2025.

PFS-3-11: Joint-Use Facilities. Wherever feasible, the City shall pursue the development of joint-use water, stormwater quality, flood control and other utility facilities as appropriate in conjunction with schools, parks, bike paths, golf courses, and other suitable uses to achieve economy and efficiency in the provision of services and facilities.

PFS-3-16: Stormwater Design in Private Development. The City shall require proponents of new development and redevelopment projects to submit drainage studies that adhere to City stormwater design requirements and incorporate measures, including “green infrastructure,” Low Impact Development (LID) techniques, stormwater treatment, and if applicable, trash capture devices, to prevent on- or off-site flooding and improve runoff water quality.

PFS-3-17: Regional Stormwater Facilities. The City shall coordinate efforts with Sacramento County and other agencies in the development of regional stormwater facilities.



Sacramento's Natomas Basin is One of the Most At-risk Areas in the Nation for Catastrophic Flooding.

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Actions and Implementation

The following Draft 2040 General Plan and 2021 Local Hazard Mitigation Plan implementation actions support the goal to reduce the risk to damage of life, infrastructure, and property due to flooding:

Action	Lead Agency	Support	Phase
<p>A-3-1: Stormwater Master Planning – The City shall implement a stormwater master plan program to:</p> <ul style="list-style-type: none"> • Identify facilities needed to prevent 10-year event street flooding and 100-year event structure flooding; • Ensure that public facilities and infrastructure are designed pursuant to approved basin master plans; • Ensure that adequate land area and any other elements are provided for facilities subject to incremental sizing (e.g., detention basins and pump stations); and • Incorporate the use of “green infrastructure,” Low Impact Development (LID) techniques, stormwater treatment controls, and, if applicable, trash capture devices. <p><i>[Draft General Plan PFS-Action 4]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 2
<p>A-3-2: Evaluation and Mitigation of Critical Facilities in Identified Hazard Areas – This project addresses the additional evaluation of identified critical facilities to determine options for mitigation. The initial focus will be on those facilities within the flood hazard areas, with other hazard-prone facilities to follow. The end result of this analysis will be a list of facilities within the 100- and 500-year floodplain and their mitigation recommendations and priorities.</p> <p><i>[Local Hazard Mitigation Plan Action 6]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 2
<p>A-3-3: Retrofit of Repetitive Loss Properties – The City must identify property owners interested in retrofits and also obtain grant money to assist with the retrofits.</p> <p><i>[Local Hazard Mitigation Plan Action 7]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 2



<p>A-3-4: National Flood Insurance Program (NFIP) & Community Rating System (CRS) Continuation – Continue to meet minimum NFIP requirements and exceed those requirements by participating in the CRS program. <i>[Local Hazard Mitigation Plan Action 11]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 1
<p>A-3-5: Develop a Master Generation Plan for Pump Stations – Develop a plan for identifying, prioritizing, and implementing power generation needs for pumping stations. Perform a power audit to identify needs. Plan will identify needs, costs, funding, and lead personnel. Plan will include the purchase and installation of necessary built-in and mobile generators and additional equipment. The City has a robust generator plan but a master plan is still in the process. Sumps that need generators have been identified but the program has been delayed due to funding. <i>[Local Hazard Mitigation Plan Action 12]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 2
<p>A-3-6: Flood Recovery Plan – Create a plan that addresses key elements of flood recovery, such as, restoring infrastructure, debris removal, water quality, building inspection, facilitating access to individual assistance, providing temporary housing, assisting with business recover, and identify needed resources to support recovery efforts. Continue to update plan. <i>[Local Hazard Mitigation Plan Action 17]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Office of Emergency Management 	Phase 1
<p>A-3-7: Public Information Flood Response Plan – Develop a pre-flood plan for public information projects that will be implemented during and after a flood. The plan will include a collection of outreach templates including key messages that need to be disseminated before, during, and after a flood. The plan will also include written procedures that explain how the materials will be disseminated and when the information should be released. <i>[Local Hazard Mitigation Plan Action 18]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Office of Emergency Management 	Phase 2

CLIMATE ACTION & ADAPTATION PLAN

Action	Lead Agency	Support	Phase
<p>A-3-8: Purchase Drones for Use in Disaster Preparedness, Mitigation, and Response – Integrate the use of drones into the City’s scheduled facility inspection program. Implement inspection of areas that may have been impossible and/or very difficult to inspect in the past, with a program goal to increase efficiency, comprehensiveness, and frequency of inspections as a best practices measure.</p> <p><i>[Local Hazard Mitigation Plan Action 29]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 1
<p>A-3-9: Map and Assess Vulnerability to Sea Level Rise – Model various “what-if” scenarios to estimate potential vulnerability in order to develop sea level rise mitigation priorities. Develop an inventory of critical facilities and infrastructure that may be particularly vulnerable to sea level rise.</p> <p><i>[Local Hazard Mitigation Plan Action 30]</i></p>	<ul style="list-style-type: none"> • Utilities, Drainage Levee Inspection Section 		Phase 2
<p>A-3-10: Coordinate with Stakeholders on Proposed Flood Control Project on Magpie Creek – The project would raise approximately 2,100 feet of the Magpie Creek Diversion Channel left bank levee and extending the levee south along the west side of Raley Boulevard to Santa Ana Avenue, with floodgates at two driveways.</p> <p><i>[Local Hazard Mitigation Plan Action 40]</i></p>	<ul style="list-style-type: none"> • Sacramento Area Flood Control Association 	<ul style="list-style-type: none"> • Utilities • County of Sacramento Department of Water Resources • US Army Corps of Engineers 	Phase 1
<p>A-3-11: Adopt Additional Floodplain Development Standards The Development Services Task Force – will discuss adoption of additional development standards related to floodplain management and best practices.</p> <p><i>[Local Hazard Mitigation Plan Action 41]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Community Development 	Phase 2
<p>A-3-12: Drainage Projects for Repetitive Loss Properties – Many drainage projects have been identified in the City’s Drainage Master Plans. These projects include upsizing pipelines, adding detention basins, adding bypass pipelines, retrofitting pump stations, and land acquisition. These projects will be ranked and grant funding will be pursued.</p> <p><i>[Local Hazard Mitigation Plan Action 42]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Youth, Parks, and Community Enrichment 	Phase 1



Action	Lead Agency	Support	Phase
<p>A-3-13: Historic Magpie Creek – The Magpie Creek Diversion Channel is part of the Corps levee improvement project under the WRDA 16 authorization. The work consists of cutting off all (or the majority) of the spill into historic Magpie and keeping it contained in the diversion channel as it heads north then west.</p> <p><i>[Local Hazard Mitigation Plan Action 44]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 2
<p>A-3-14: Natomas Internal Drainage Canals/Levees – Certify the Natomas Internal Drainage Canals/Levees to the 100-year and 200-year Level. DOU has contracted to provide the evaluation and recertification of the interior levees in the Natomas Basin.</p> <p><i>[Local Hazard Mitigation Plan Action 45]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • County of Sacramento Department of Water Resources • Sutter County, Reclamation District 1000 	Phase 2
<p>A-3-15: Drainage Projects from the City’s Priority Drainage Project List – Many potential drainage projects that have been identified in the City’s Drainage Master Plans and have been prioritized on a Basin Master Planning and Improvement Projects priority list. These projects include upsizing pipelines, adding detention basins, adding pipelines, retrofitting pump stations, and land acquisition. These projects are ranked by priority.</p> <p><i>[Local Hazard Mitigation Plan Action 46]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Youth, Parks, and Community Enrichment 	Phase 1

CLIMATE ACTION & ADAPTATION PLAN

Action	Lead Agency	Support	Phase
<p>A-3-16: Projects Identified in the Combined Sewer System Improvement Plan Update – Identified projects were categorized into storage and conveyance. The storage projects are located upstream or downstream of local flooding areas and are intended to detain flows until the CSS has re-generated capacity (i.e., peak of the storm has passed and HGL in the system has receded from peak conditions) and the storage facilities can be dewatered. The storage projects can be linear or parcel based. Conveyance projects would generally be located in proximity to or just downstream of localized flooding areas. Their objective would generally be to convey peak flows from and through the flood-prone areas to points downstream with greater capacity. The analysis carefully considered whether the increased conveyance had the potential to cause or exacerbate downstream flooding. If that was determined to be true, the conveyance project(s) were combined with upstream or downstream storage projects to mitigate the downstream flood exacerbation risk. Conveyance projects included upsizing existing pipes or constructing new pipes. Where baseline flooding occurred in a location with no opportunities for storage, a new pipe was sized to convey the 10-year storm design peak flows to the downstream system. Factors such as ground cover requirements, right-of-way width, and existing system pipe invert elevations (to which linear storage facilities must connect) were factored into the storage configurations.</p> <p><i>[Local Hazard Mitigation Plan Action 47]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Wastewater and Storm Drain Engineering Program 	<p>Phase 1</p>
<p>A-3-17: Easements for Open Land Along Levees – Analysis of current levee easements and setback to determine where additional and future easements will be needed. Develop a method and funding source to acquire the needed easements and open space to meet the ULDC standards.</p> <p><i>[Local Hazard Mitigation Plan Action 48]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Community Development • Sacramento Area Flood Control Agency 	<p>Phase 1</p>



Action	Lead Agency	Support	Phase
<p>A-3-18: Flood Fighting Equipment – Purchase flood fighting equipment such as a utility landing craft, long reach excavator, and the truck (tractor) trailer. <i>[Local Hazard Mitigation Plan Action 50]</i></p>	<ul style="list-style-type: none"> • Utilities, Operations and Maintenance 		Phase 1
<p>A-3-19: Flood Management Land Use Planning and Development – Implementation of the land use planning and development action items outlined in the City of Sacramento’s Comprehensive Flood Management Plan. Highlighted projects include 200-year floodplain ordinance and projection plan, development guidelines for rescue and evacuation areas, City Code update for new development adjacent to levees. <i>[Local Hazard Mitigation Plan Action 51]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Youth, Parks, and Community Enrichment 	Phase 1
<p>A-3-20: Florin Creek Pump at Pomegranate Avenue – Construction of a relief pipeline and a pump station near Pomegranate Avenue. <i>[Local Hazard Mitigation Plan Action 52]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 1
<p>A-3-21: Internal Drainage System Improvements – Implementation of the internal drainage system improvements outlined in the City of Sacramento’s Comprehensive Flood Management Plan. Highlighted projects include development of a grant program to fund drainage improvements, develop an Engineering Services efficiency plan, work on the passage of Proposition 218 drainage fee increase, and drainage master planning. <i>[Local Hazard Mitigation Plan Action 53]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 1
<p>A-3-22: Levee and Structural Flood Management Improvements – Implementation of the levee and structural improvement action items outlined in the City of Sacramento’s Comprehensive Flood Management Plan. Highlighted projects include support of local efforts to improve flood facilities, plan and implement modernization phase of levee accreditation and ULDC, and participate in the Regional Flood Management Plan. <i>[Local Hazard Mitigation Plan Action 54]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Community Development • Sacramento Area Flood Control Agency 	Phase 1

CLIMATE ACTION & ADAPTATION PLAN

Action	Lead Agency	Support	Phase
<p>A-3-23: Master planning to identify facilities needed to prevent 10-year event street flooding and 100-year event structure flooding – Develop master plans to identify facilities needed to prevent 10-year event street flooding and 100-year event structure flooding in areas of the City that do not currently have master planning. Prioritize the projects and formulate timeline for the identified projects. Execute the projects to provide protection from flooding.</p> <p><i>[Local Hazard Mitigation Plan Action 55]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Wastewater and Storm Drain Engineering Program 	Phase 1
<p>A-3-24: Multi-Jurisdictional Modeling for Drainage Watersheds Greater than 10 Square Miles – Development of a unified model for each watershed that extends over jurisdictional lines. The model would be maintained to reflect changes to the watershed, including development.</p> <p><i>[Local Hazard Mitigation Plan Action 59]</i></p>	<ul style="list-style-type: none"> • Sacramento Area Flood Control Agency 	<ul style="list-style-type: none"> • Utilities • County of Sacramento Department of Water Resources 	Phase 1
<p>A-3-25: Stabilization of Erosion Hazard Areas – This project will include the identification and mitigation of erosion sites along the Sacramento river and other rivers in the region that pose a threat to levees and raise flooding concerns.</p> <p><i>[Local Hazard Mitigation Plan Action 63]</i></p>	<ul style="list-style-type: none"> • California Department of Water Resources 	<ul style="list-style-type: none"> • City of Sacramento • County of Sacramento • US Army Corps of Engineers 	Phase 1
<p>A-3-26: Flood Resilient Design Techniques – The City shall evaluate the feasibility of updating design guidelines, standards, and the municipal code to promote building materials and site design techniques that minimize the disruption of and speed recovery from flood impacts.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • Community Development 		Phase 2



GOAL A-4: Increase awareness of and expand community resources to address the adverse health effects of air pollution.

Climate change is expected to exacerbate air pollution in Sacramento from both wildfires and other sources. Although a wildfire is unlikely to break out within Sacramento, smoke from wildfires occurring throughout the region can indirectly impact the entire city with elevated particulate matter (PM) pollution. Moreover, ozone pollution remains a critical air quality challenge in the Sacramento region, which is a nonattainment area for the federal 8-hour ozone standard.¹⁶ Both wildfire smoke and increasing numbers of hot, sunny days can contribute to greater ozone formation.¹⁷ Increasing adaptation to wildfire smoke and other air pollution is a priority for the City of

Sacramento due to the numerous populations that are vulnerable to air pollution, and the lack of existing adaptive capacity.

Alignment with Mayors' Commission on Climate Change

The Mayors' Commission on Climate Change made recommendations on community health and resilience that are addressed in the actions supporting this goal. Specifically, actions A-6.2 and A-6.3 under this goal will raise awareness in the community of how to prepare for and respond to wildfire smoke events.

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

16. CARB Review of the Sacramento Regional NAAQS 8-Hour Ozone attainment and reasonable further progress plan, <https://ww2.arb.ca.gov/sites/default/files/2021-02/Sacramento%20Region%20Final%20Staff%20Report.pdf>.

17. Dmitri A. Kalashnikov, et al, "Increasing co-occurrence of fine particulate matter and ground-level ozone extremes in the western United States," Science Advances 8, no. 1 (January 5, 2022), https://www.researchgate.net/publication/357631913_Increasing_co-occurrence_of_fine_particulate_matter_and_ground-level_ozone_extremes_in_the_western_United_States.

CLIMATE ACTION & ADAPTATION PLAN

Supporting Draft General Plan Policies

The following Draft 2040 General Plan policies support the goal to increase awareness of and expand community resources to address the adverse health effects of air pollution:

EJ-1-1: Air Quality Monitoring. The City shall support the expansion of air quality monitoring efforts in Sacramento, prioritizing locations in the north and south of the city that have been identified with community input as a high priority for air pollution control initiatives.

EJ-1-3: Data-Informed Efforts. The City shall collaborate with the Sacramento Metropolitan Air Quality Management District (SMAQMD), community organizations, and other stakeholders, and use air quality monitoring data to inform area-specific improvement actions outside of AB 617-related efforts. Such actions may include the following:

- Prioritizing areas for the installation of indoor air filtration rated MERV 13 or greater in existing buildings containing sensitive populations;
- Prioritizing areas for capital investments with co-benefits for air quality, such as tree planting and installation of electric vehicle (EV) charging infrastructure;
- Integrating air quality improvement actions into planning efforts, such as new specific plans, master plans, or area plans that will guide development in impacted areas; or
- Limiting the establishment of new sources of air pollutants in areas with elevated

levels of pollutant concentrations unless appropriate mitigation is implemented.

ERC-4-3: Project Design. The City shall promote the incorporation of new technologies, materials, and design and construction techniques in private development projects that minimize air pollution, noise, excess heat, and other forms of pollution and its impacts.

ERC-4-2: Air Quality Awareness. The City shall cooperate with the Sacramento Metropolitan Air Quality Management District (SMAQMD), Sacramento Area Council of Governments (SACOG), Sacramento Municipal Utility District (SMUD), and other groups to promote public access to air quality monitoring data and awareness about impacts of indoor and outdoor air quality on health and protective strategies.

ERC-4-1: Regional Coordination. The City shall support air quality planning efforts led by other local, regional, and State agencies while simultaneously leveraging City authority and resources to focus on reducing air pollution burden in disadvantaged communities.



Family on a Walk



Actions and Implementation

The following proposed actions drawn from the Draft 2040 General Plan and adopted 2021 Local Hazard Mitigation Plan support the goal of increasing awareness of and expanding community resources to address the adverse health effects of air pollution:

Action	Lead Agency	Support	Phase
<p>A-4-1: Air Filtration Systems – The City shall explore opportunities to accelerate the installation of air filtration systems in existing buildings in partnerships with SMAQMD and other partners in the Sacramento region. Schools, nursing homes, and other sensitive uses within DACs and areas most affected by air quality issues should be prioritized.</p> <p><i>[Draft General Plan EJ-Action.1]</i></p>	<ul style="list-style-type: none"> Office of Climate Action and Sustainability Community Development 	<ul style="list-style-type: none"> Public Works 	Phase 2
<p>A-4-2: Implement a Fire Education and Information Program – Implement an urban-wildfire safety program using materials for the community. Train educators and inspectors, identifies high risk neighborhoods and buildings, and develop agreed-upon, area specific solutions to fire issues.</p> <p><i>[Local Hazard Mitigation Plan Action 64]</i></p>	<ul style="list-style-type: none"> Sacramento Fire Department 		Phase 1
<p>A-4-3: Outreach on the Effects of Smoke on Air Quality – The purpose of the project is to educate Sacramento residents on the effects of smoke in the air and provide resources to check the air quality in their area. This will be carried out via social and network media. The city will utilize its social media pages and radio to convey knowledge and resources residents can use to know when to use precaution. The project will also provide helpful tips to decrease the impacts of poor air quality in their homes and through the daily routines.</p> <p><i>[Local Hazard Mitigation Plan Action 66]</i></p>	<ul style="list-style-type: none"> Sacramento Fire Department 	<ul style="list-style-type: none"> Public Information Office Spare the Air Sacramento Region 	Phase 1

CLIMATE ACTION & ADAPTATION PLAN

GOAL A-5: Increase community resilience to prepare for climate impacts.

Two pillars of disaster preparedness include community readiness and adequacy of City resources and services. The City seeks to provide a multitude of community resources, including resources specific to linguistically isolated and special needs populations, that help enhance general public awareness. Public safety services are also maintained and regularly assessed. However, the impacts of

climate change will increase demand for City services and the need for disaster preparedness. Existing community programs and City resources can be more effectively implemented to align these efforts with the greatest needs. Building an information and support network of community preparedness can be a powerful tool for adaptive capacity that decreases the dependence on City emergency services.

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

Supporting Draft General Plan Policies

The following Draft 2040 General Plan policies support the goal to increase community resilience investments to prepare for climate disaster events:

ERC-8-7: Extreme Heat Education. The City should work with community organizations and the Office of Emergency Management to provide information and services to residents to manage heat.

ERC-8-8: Heat Waves. The City shall work with labor organizations, the business community, and County and State health and safety agencies to publicize programs and standards for preventing heat-related illness in employees who work outdoors and publicize precautions for preventing heat-related illness during heat waves.

ERC-8-9: Cooling Centers. The City shall continue to open and operate City Cooling Centers in coordination with Office of Emergency Management during extreme heat events.



ERC-9-7: Emergency Power. The City shall evaluate options for ensuring emergency power at critical and community facilities such as resiliency hubs, including the following:

- Microgrids,
- Solar capture and storage,
- Distributed energy, and
- Back-up generators.

The City should consider the ability to reduce utility costs and carbon emissions in the assessment.

ERC-9-11: Neighborhood Resilience. The City shall facilitate and coordinate with community organizations for the development of neighborhood-level resilience plans to improve initial emergency response, subsequent recovery, and ongoing self-sufficiency throughout the city. The City should provide resources, training, and information, prioritizing disadvantaged communities (DACs) and vulnerable areas of the city for creation of these plans.

PFS-2-1: Hazard Mitigation Planning. The City shall continue to use the Local Hazard Mitigation Plan, Comprehensive Floodplain Management Plan, Emergency Operations Plan, and Operational Area Plan to guide actions and investments addressing disasters such as flooding, dam or levee failure, hazardous material spills, epidemics, fires, extreme weather, major transportation accidents, earthquakes, and terrorism.

PFS-2-2: Critical Infrastructure. The City shall protect and maintain critical infrastructure such as emergency shelters, fire stations, police stations, emergency operations centers, communications networks, and

other emergency service facilities and utilities to ensure continuity of essential operations, including, but not limited to, uninterrupted public safety services, during flooding, seismic, geologic, wildfire, and other hazards.

PFS-2-3: Evacuation Routes. The City shall partner with Caltrans and neighboring jurisdictions on measures to protect critical evacuation routes such as I-5, I-80, Highway 50, and State Route 99 and work with local agencies to develop contingency plans for operations when these and other roads are inoperable due to flooding or wildfire.

PFS-2-4: Post-Disaster Response. The City shall plan for the continuity of operations for critical facilities following a disaster to help prevent interruption of emergency response related to life, property, and environment preservation.

PFS-2-5: Communitywide Resilience. The City shall plan to accommodate the whole community during disaster preparedness, response, and recovery, including members of at-risk populations with access and functional needs concerns.

PFS-2-6: Emergency Operations Center. The City shall ensure operational readiness of the Emergency Operations Center (EOC) and coordinate applicable training to EOC assigned staff.

PFS-2-7: Emergency and Disaster Preparedness Exercises. The City shall coordinate with local and regional jurisdictions on an ongoing basis to conduct emergency and disaster preparedness exercises to test operational and emergency plans.

CLIMATE ACTION & ADAPTATION PLAN

PFS-2-8: Emergency Preparedness Programs. The City shall sponsor and support educational programs regarding emergency response, disaster preparedness protocols and procedures, and disaster risk reduction.

PFS-2-9: Neighborhood Preparedness. Encourage community-based approaches to emergency preparedness and response, especially in higher-risk communities with more significant barriers to personal mobility, transportation, and other resources necessary for disaster response.

PFS-2-10: Sacramento Alert. The City shall promote and encourage participation in Sacramento Alert, the regional early warning notification system used to notify residents by phone, text, or email of the need to evacuate or shelter-in-place in the event of an emergency and the location of evacuation centers.

HCR-1-9: Disaster Preparedness. The City shall seek to minimize or avoid adverse impacts to historic and cultural resources from natural disasters. To this end, the City shall promote seismic safety, flood protection, and other building retrofit programs that preserve, enhance, and protect these resources consistent with their historic design character.

Actions and Implementation

The following Draft 2040 General Plan and 2021 Local Hazard Mitigation Plan implementation actions support the goal to increase community resilience investments to prepare for climate disaster events:

Action	Lead	Support	Phase
<p>A-5-1: CERT Training – The City shall expand the Community Emergency Response Training (CERT) program to address community and neighborhood preparedness for climate impacts. Pilot implementation of the updated program in disadvantaged communities and areas with populations most vulnerable to climate impacts.</p> <p><i>[Draft General Plan ERC-Action 3]</i></p>	<ul style="list-style-type: none"> Sacramento Fire Department 		Phase 2
<p>A-5-2: Post-Disaster Plan – The City shall develop a plan for post-disaster demolition and repair that protects historic resources against unnecessary loss of historic fabric and speculative demolitions.</p> <p><i>[Draft General Plan HCR-Action 5]</i></p>	<ul style="list-style-type: none"> Community Development Department 		Phase 2



Action	Lead	Support	Phase
<p>A-5-3: Enhance Public Education and Awareness of Natural Hazards and Public Understanding of Disaster Preparedness – A comprehensive multi-hazard outreach program will ascertain both broad and targeted educational needs throughout the community. The City will work with the County and other agencies as appropriate to develop timely and consistent annual outreach messages in order to communicate the risk and vulnerability of natural hazards of concern to the community. This includes measures the public can take to be better prepared and to reduce the damages and other impacts from a hazard event. The public outreach effort will leverage and build upon existing mechanisms.</p> <p><i>[Local Hazard Mitigation Plan Action 2]</i></p>	<ul style="list-style-type: none"> • Office of Emergency Management 	<ul style="list-style-type: none"> • Sacramento County 	Phase 1
<p>A-5-4: Maintain and Identify Changes in Critical Facilities GIS Layer to Support Emergency Management Efforts – Businesses, schools, EMS Services or any other identified critical facilities will have contact information collected and mapped for analyzing and preparation for the Multi-Hazard Mitigation Plan. Protection of critical infrastructure are supported by City Ordinance 2020-0009.</p> <p><i>[Local Hazard Mitigation Plan Action 4]</i></p>	<ul style="list-style-type: none"> • City GIS Technical Group 	<ul style="list-style-type: none"> • Utilities • Office of Emergency Management • County of Sacramento Office of Emergency Services 	Phase 2
<p>A-5-5: Community Outreach on Multi Hazard Preparation & Pre-mitigation – Continue to maintain and improve webpage that addresses the multi-hazard threat and add measures for preparation and pre-mitigation. Continue to participate and host many community outreach events associated with Hazard awareness and preparation. These events include: “Capitol Action Day”, “Flood Preparedness Week”, “Highwater Jamboree” Annual Flood Preparedness Event and visiting neighborhood meetings and community events to share preparedness information.</p> <p><i>[Local Hazard Mitigation Plan Action 5]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Office of Emergency Management 	Phase 2

CLIMATE ACTION & ADAPTATION PLAN

Action	Lead	Support	Phase
<p>A-5-6: Multi-lingual Disaster Education – Develop Public Service Announcements, educational videos, a social media campaign, and other material in a variety of languages to provide our diverse community with information on how to develop a personal/family safety plan.</p> <p><i>[Local Hazard Mitigation Plan Action 9]</i></p>	<ul style="list-style-type: none"> • Office of Emergency Management 	<ul style="list-style-type: none"> • Utilities • Community Development 	Phase 1
<p>A-5-7: Develop a Disaster Housing Plan – Develop a Disaster Housing Plan to identify potential disaster housing partners and outline the principles, practices, and implementation phase of such a plan. Supplement with OEM Emergency Operations Plan and Pre-Disaster Recovery Plan.</p> <p><i>[Local Hazard Mitigation Plan Action 13]</i></p>	<ul style="list-style-type: none"> • Community Development 	<ul style="list-style-type: none"> • Office of Emergency Management • Office of Innovation and Economic Development 	Phase 2
<p>A-5-8: Disaster Resistant Business Program – Provide materials and administrative support for a comprehensive Business Continuity Planning (BCP) program, to include presentations to business, non-profits and professional groups, Chamber of Commerce events, etc. The program would include a one-day event with an overview on developing a Business Continuity Plan and breakout sessions addressing specific BCP issues.</p> <p><i>[Local Hazard Mitigation Plan Action 14]</i></p>	<ul style="list-style-type: none"> • City of Sacramento • Local Business Partners 		Phase 2



Action	Lead	Support	Phase
<p>A-5-9: Develop Enhanced Emergency Planning for Special Needs Populations in the City of Sacramento Emergency Operations Plan and Other Planning Documents – By working with local advocacy groups, and by identifying weaknesses and gaps in the City’s emergency planning, the increased capabilities of the enhanced plan will enable emergency responders to more effectively support the most vulnerable segment of the population. Access and Functional Needs (AFN) is included throughout the Emergency Operations Plan (EOP) and Pre-Disaster Recovery Plan. OEM continues to meet with AFN leaders to ensure accessibility and inclusion are maintained in compliance with the Americans with Disabilities Act. OEM plans are updated on a continuous basis and ensure that AFN is included throughout the entirety of the plan. Efforts to strengthen inclusivity continues as OEM networks and attends trainings, seminars, and events pertaining to AFN and diversity.</p> <p><i>[Local Hazard Mitigation Plan Action 15]</i></p>	<ul style="list-style-type: none"> • County of Sacramento Office of Emergency Management 		Phase 1
<p>A-5-10: Establish a Post-Disaster Action Plan – Establish a City post-disaster action plan that outlines the procedures for public information, post-disaster damage assessment, code enforcement, financial recovery, and redundant operations. Continue to update the plan.</p> <p><i>[Local Hazard Mitigation Plan Action 16]</i></p>	<ul style="list-style-type: none"> • Office of Emergency Services 	<ul style="list-style-type: none"> • Utilities • Community Development 	Phase 1

CLIMATE ACTION & ADAPTATION PLAN

Action	Lead	Support	Phase
<p>A-5-11: Construction of a New Emergency Operations Center (EOC) – Build and equip a new Emergency Operations Center, to replace the inadequate EOC currently located in the city of Sacramento’s dispatch center. The new facility would be developed to FEMA 361 standards. Grant funding would be used to supplement normal construction costs with the additional cost for increasing the armoring of the facility to meet the FEMA 361 standards for Community SafeRooms.</p> <p><i>[Local Hazard Mitigation Plan Action 19]</i></p>	<ul style="list-style-type: none"> Office of Emergency Management 	<ul style="list-style-type: none"> Public Works 	Phase 2
<p>A-5-12: Emergency Operation Center (EOC) Expansion and Information Technology Upgrade – Improvements to the City’s current EOC is necessary to meet the demands of a large-scale natural disaster. The facility has size limitations that will restrict the amount of personnel located in the same room. Potentially units will have to operate in separate rooms or buildings which would reduce real-time communications. Also, the facility needs improvements on the usability of the information technology infrastructure. A network separate from the police dispatch’s system is needed. Currently there is a shared network which has high security restrictions. The security restrictions make it difficult for a city employee to sign in at the EOC and be fully functional.</p> <p><i>[Local Hazard Mitigation Plan Action 20]</i></p>	<ul style="list-style-type: none"> Office of Emergency Management (Budget, Grants) 	<ul style="list-style-type: none"> Public Works Information Technology 	Phase 2
<p>A-5-13: Public Education Campaign for Everbridge System – Outreach will be performed using a variety of methods to inform residents about the City emergency alert system, Everbridge. The campaign will direct resident to sign up for emergency alerts.</p> <p><i>[Local Hazard Mitigation Plan Action 22]</i></p>	<ul style="list-style-type: none"> Office of Emergency Management 		Phase 2



Action	Lead	Support	Phase
<p>A-5-14: Regional Emergency and Disaster Preparedness Exercises to Test Operational & Emergency Plans – Conduct regional, multi-agency emergency and disaster preparedness exercises to test operational and emergency plans. Tests will include levee or dam failure and other natural hazards.</p> <p><i>[Local Hazard Mitigation Plan Action 23]</i></p>	<ul style="list-style-type: none"> • County of Sacramento Office of Emergency Services • Office of Emergency Management 		Phase 1
<p>A-5-15: Special Needs and Critical Facilities Database and Advanced Warning System – Through outreach activities, develop a database of vulnerable population groups and critical facilities in need of advance warning or evacuation assistance. Development and implementation of an advanced warning procedure. Successful programs have been developed in Houston, San Antonio and Florida and could serve as a model for implementation and personnel training.</p> <p><i>[Local Hazard Mitigation Plan Action 24]</i></p>	<ul style="list-style-type: none"> • Office of Emergency Management 		Phase 1
<p>A-5-16: Emergency Notification and Evacuation Planning – Enhancements to the existing Reverse 911 system to more effectively notify mass populations of evacuation orders and routes, consistent with FEMA guidelines, identifying special needs communities and transportation providers, targeted outreach to maximize the capabilities of Reverse 911, and strategic training to assure effective deployment of the enhanced capabilities.</p> <p><i>[Local Hazard Mitigation Plan Action 43]</i></p>	<ul style="list-style-type: none"> • County of Sacramento Office of Emergency Services 		Phase 1

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Action	Lead	Support	Phase
<p>A-5-17: Emergency Management Planning and Levee Security – Implementation of the emergency management and levee security action items outlined in the City of Sacramento’s Comprehensive Flood Management Plan. Highlighted projects include continued National Incident Management System (NIMS) and Standardized Emergency Management System (SEMS) exercises and training, creation of a disaster housing plan, increased public education and alerts efforts, development of an intergovernmental flood management and control standards, annual review of the Levee Security Plan, and improvement of flood warning systems.</p> <p><i>[Local Hazard Mitigation Plan Action 49]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Office of Emergency Management • Other maintaining agencies responsible of levee systems within the region 	Phase 2
<p>A-5-18: Risk Communication and National Flood Insurance Program/Community Rating System Projects – Implement the risk communication and NFIP/CRS action items outlined in the City of Sacramento’s Comprehensive Flood Management Plan. Highlighted projects include implementation of the City’s Program of Public Information, develop Flood Response PPI projects, increase freeboard development to two feet, write a Levee Failure Response Plan for Critical Facilities, and sign a Memorandum of Agreement with the County of Sacramento for flood control planning of the South Sacramento County Streams.</p> <p><i>[Local Hazard Mitigation Plan Action 57]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Community Development • County of Sacramento Office of Emergency Services • Office of Emergency Management 	Phase 1
<p>A-5-19: Resilience Platform – Create a centralized, easily accessible platform that compiles resources and serves as a “one-stop-shop” for residents to learn more about and access community resources. In recognition of equity gaps like the digital divide and in an effort to reach all segments of the community, this platform should be available in multiple languages and marketed most effectively as a multi-media hybrid.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • City Manager’s Office 	<ul style="list-style-type: none"> • Community Development • Public Works • Utilities • Sacramento Metropolitan Utilities District 	Phase 2



Action	Lead	Support	Phase
<p>A-5-20: City Resiliency Centers – Develop a strategy to optimize existing City-owned community centers and libraries for dual use as resiliency centers which provide resources to the community related to climate change impacts such as cooling, enhanced air filtration, onsite solar power and backup storage, vehicle charging, and supportive programming and services. Evaluate cost-benefits, infrastructure feasibility, and funding opportunities, and prepare a list of priority facilities as funding becomes available. Develop a resilience communications strategy that integrates Resilience Centers with the City’s regular and emergency communication strategies.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • City Manager’s Office • Office of Emergency Management 	<ul style="list-style-type: none"> • Public Works • Youth, Parks, and Community Enrichment 	Phase 2
<p>A-5-21: Coordinated Regional Resiliency Centers – In collaboration with Sacramento Municipal Utility District (SMUD), other local and regional agencies, and community groups, develop a strategy for coordinated regional resiliency centers, including the prioritization of technology, cost-benefit and operations and maintenance information, partnerships, and project approaches. Seek to prioritize efforts that support vulnerable populations regionwide during climatic events.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • City Manager’s Office • Office of Emergency Management 	<ul style="list-style-type: none"> • Public Works; • Youth, Parks, and Community Enrichment • Community Development 	Phase 2
<p>A-5-22: Resilient Transportation Infrastructure – Conduct an assessment of infrastructure at risk from flooding and climate impacts and prioritize improvements to those facilities that are most critical and at greatest risk.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • Public Works 		Phase 2

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GOAL A-6: Enhance water supply diversification and prioritize water use efficiency to build resilience to the effects of climate change.

California water suppliers and public agencies have worked toward the goals and targets established by the 2009 Water Conservation Act (SB X7-7) and the 2018 Making Water Conservation a California Way of Life framework, which emphasize the need to improve statewide water conservation and drought planning to help prepare California for longer, more intense droughts caused by climate change. Changes in precipitation patterns and reduced snowpack are compounded with the impact of drought on Sacramento’s climate and put greater strains on water resources. Beyond water supply, drought conditions also threaten environmental quality and public health and

safety. Drought can increase concentration of industrial chemicals, heavy metals, and agricultural runoff contaminants in groundwater, with greatest risk of exposure in communities living near these pollution sources. Soil drying and weakening caused by long-lasting droughts can compromise levee integrity. Drought can also weaken Sacramento’s urban forest and kill trees that are needed for cooling and urban heat island mitigation. There are many recent regional efforts and more underway to address some of these risks, and Sacramento’s leadership in providing relief for the city’s vulnerable populations can broaden capacity for adaptation to drought.

Co-Benefits



Public Health



Community Cost Savings



Adaptation



Job Creation



Environmental Quality

Supporting Draft General Plan Policies

The following Draft 2040 General Plan policies support the goal to enhance water supply diversification and prioritize water use efficiency to build resilience to the effects of climate change:

ERC-5-1: Active Water Conservation Program. The City shall continue to implement an active water conservation program to enhance the efficient use of the resource, consistent with State law, the objectives of the Climate Action and Adaptation Plan (CAAP), and the Water Conservation Plan. To achieve State-mandated water conservation standards, the City shall monitor use, conduct studies, and research, develop, and implement



incentives and programs to increase water efficiency and/or reduce water consumption. When implementing the Water Conservation Program, a prioritization of program elements that enhance water affordability and promote livability in the City will be a factor.

ERC-5-2: Reducing Storm Runoff. The City shall encourage project designs that minimize drainage concentrations, minimize impervious coverage, utilize pervious paving materials, utilize low impact development (LID) strategies, and utilize Best Management Practices (BMPs) to reduce stormwater runoff.

ERC-5-3: Water Efficiency Training. The City shall support the development of partnerships and collaborations to train and educate City staff, maintenance professionals, designers, contractors, and property managers about water efficiency.

ERC-5-4: Municipal Energy and Water Efficiency. The City shall continue to implement energy and water conservation measures in City facilities and operations, conducting municipal energy benchmarking on City facilities in an effort to continually improve municipal energy efficiency.

ERC-5-5: Publicize Voluntary Programs. The City shall connect businesses and residents with voluntary programs that provide energy and water efficiency audits, retrofit installations, rebates, and financing assistance by publishing information on the City's website.

ERC-5-7: Onsite Water Reuse. The City shall explore the feasibility of onsite reuse of greywater and blackwater for end uses

such as toilet flushing and irrigation to offset supplies of potable water and support more resilient and sustainable water management.

PFS-3-2: Utility Sustainability. The City shall continue to improve the sustainability, resilience, and energy efficiency of its facilities, infrastructure, and operations consistent with the Climate Action and Adaptation Plan and the goal of achieving carbon neutrality by 2045.

PFS-4-2: Water Supply Sustainability. The City shall maintain a surface water/groundwater conjunctive use program, which uses more surface water when it is available and more groundwater when surface water is limited.

PFS-4-4: Groundwater Infrastructure. The City shall maintain investment in groundwater infrastructure to provide for water supply reliability. Groundwater sustainability, cost effectiveness, and the quality of the resource shall be factored into groundwater investments.

PFS-4-5: Comprehensive Water Supply Planning. The City shall prepare and implement an Urban Water Management Plan, updating it on a 5-year cycle, to ensure a reliable, long-term water supply and service under projected future conditions.

PFS-4-6: Recycled Water. The City shall continue to monitor the feasibility of utilizing recycled water where appropriate, cost effective, safe, and environmentally sustainable.

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Actions and Implementation

The following Draft 2040 General Plan and 2021 Local Hazard Mitigation Plan implementation actions support the goal to enhance water supply diversification and prioritize water use efficiency:

Action	Lead	Support	Phase
<p>A-6-1: Onsite Non-Potable Water Reuse – The City shall assess the feasibility of requiring on-site water reuse for new commercial development.</p> <p><i>[Draft General Plan PFS-Action 5]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Community Development Department 	Phase 2
<p>A-6-2: Perform a Groundwater Recharge Feasibility Study – Perform a groundwater recharge feasibility study to determine the most cost-effective way to replenish groundwater resources within Sacramento.</p> <p><i>[Local Hazard Mitigation Plan Action 34]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 2
<p>A-6-3: Water Conservation Resources and Incentives – Implement innovative water conservation programs and provide incentives to support water conservation such as leak repair assistance, landscape design assistance, rebates for turf conversions, irrigation upgrades, smart controllers, rain barrels, high-efficiency fixtures and appliances, and graywater systems for residents and businesses.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 2
<p>A-6-4: Implement Groundwater Well Replacement Program – As recommended in the City’s Groundwater Master Plan, replace up to 38 groundwater extraction wells within the City’s water service area to allow the City to reliably meet its long-term water supply demands.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 2
<p>A-6-5: Modify Water Treatment Technologies – Modify water treatment technologies to adapt to changing source water quality conditions.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 2



Action	Lead	Support	Phase
<p>A-6-6: Support Regional Groundwater Bank Programs – Continue to collaborate with regional water agencies and local partners to support groundwater bank programs including the Sacramento Regional Water Bank, RiverArc, Alder Creek Reservoir and Conservation Project, and Folsom Dam Raise with Groundwater Banking.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 1
<p>A-6-7: Diversify Surface Water Supply – Evaluate additional diversification of surface water supply to shift supplies to the Sacramento River, including collaboration with other partners to increase regional and system flexibilities, enhance water reliability, and benefit the ecosystem of the lower American River.</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • Utilities 		Phase 2
<p>A-6-8: Water Resiliency – Construct water resiliency projects including the Groundwater Well Replacement Program</p> <p><i>[New Proposed Action]</i></p>	<ul style="list-style-type: none"> • Utilities 	<ul style="list-style-type: none"> • Youth, Parks, and Community Enrichment 	Phase 2



Surface Water is Treated at the E.A. Fairbairn and Sacramento River Water Treatment Plants.



IMPLEMENTATION AND MONITORING



Sacramento's CAAP identifies measures and actions that have been designed to achieve GHG emissions reductions consistent with the City's 2030 climate action target and make substantial progress towards achieving the 2045 goal of carbon neutrality. As a qualified GHG reduction plan (explained in [Chapter 1](#)), Sacramento's CAAP is required to specify performance standards for measures and actions, establish a mechanism to monitor the plan's progress towards achieving its climate action targets, and include the requirement for amendment if the plan does not demonstrate achievement of its climate action targets.¹



Photo by Carlos Eliason

Sacramento Sidewalk

1. CEQA Guidelines § 15183.5, paragraphs (b)(D)-(E)

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While the measures and the supportive evidence presented in [Appendix C](#) scientifically demonstrate that the CAAP's actions can yield the necessary GHG emissions reductions to achieve the 2030 climate action target, achievement of the targets also requires action from City staff and the community to ensure that the CAAP is being implemented, progress and lessons learned are being tracked, and the CAAP is being updated on a regular basis. Implementation progress will be monitored via two pathways:

1. Evaluation of the implementation progress of each action and measure metric; and
2. Calculation of future GHG emissions utilizing activity data obtained from Sacramento's utility providers, City databases, and comparison of the results to Sacramento's climate action targets.

This chapter details Sacramento's approach to implementing and monitoring the CAAP to ensure actual GHG reductions are achieved in line with the City's climate action targets and demonstrates alignment with the CAAP for CEQA streamlining of future development projects.

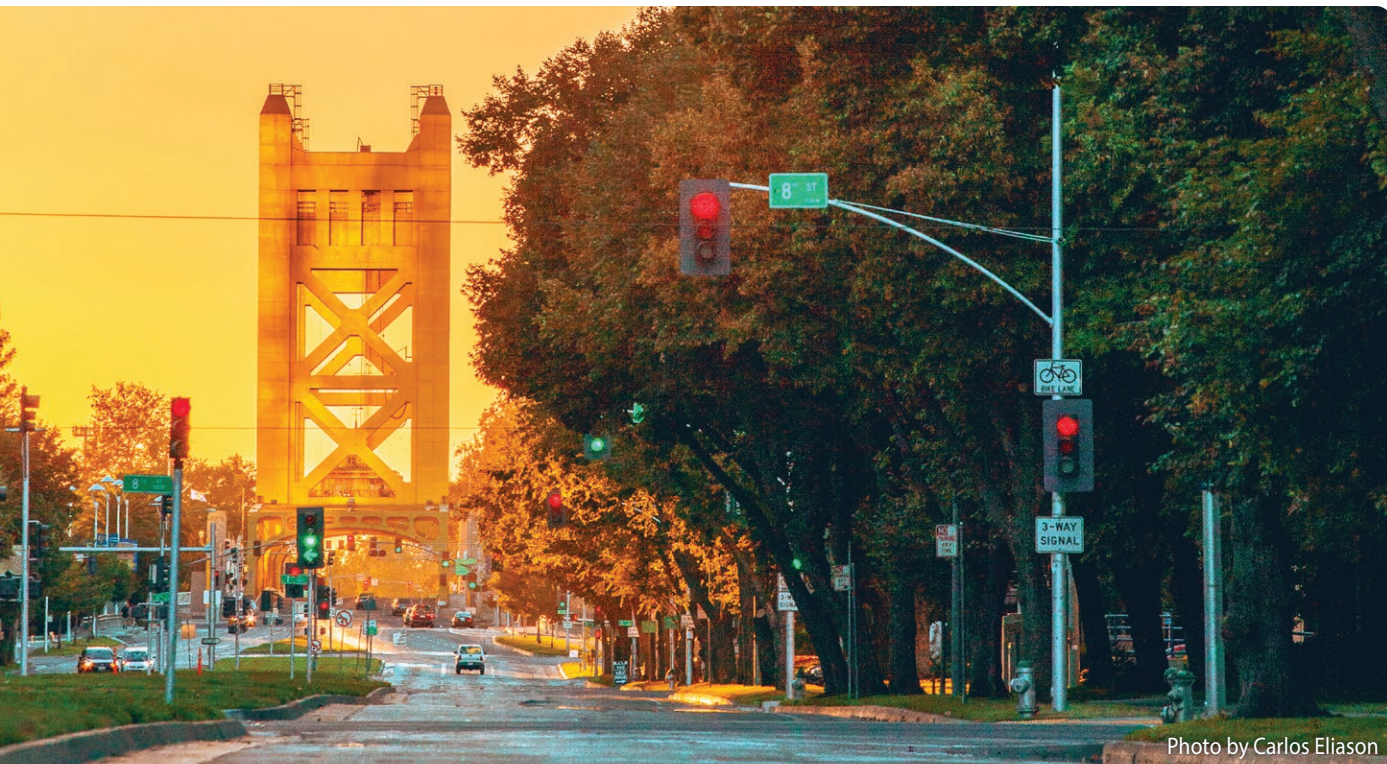


Photo by Carlos Eliason

Tower Bridge at Sunset



Implementation Approach

The City's Community Development Department Planning Division will lead the monitoring effort among various City departments and the CAAP's partners (e.g., SMUD, SacRT), in coordination with the City Manager's Office of Climate Action & Sustainability, to drive implementation of each CAAP action over the next 10 years. Implementation will also occur through alignment of future development projects with the measures and actions contained in the CAAP, primarily through the CEQA "tiering" process explained in [Chapter 1](#). Each CAAP action was vetted via a comprehensive feedback process that involved relevant City departments, community stakeholders, and Sacramento business owners and residents, as described in [Chapter 4](#). Strategies also build on the recommendations of the Mayors' Commission on Climate Change. This process has well positioned the City to implement each of the actions in the CAAP, in partnership with the necessary partners and community groups. Implementation will be results-driven and informed by regular monitoring, reporting, and learning, so that the City can adjust the implementation approach if Sacramento does not see demonstrated and steady progress towards measure goals and the City's climate action targets. The roles and responsibilities of the City, its partners, and the Sacramento community are identified below.

IMPLEMENTATION ROLES AND RESPONSIBILITIES

While CAAP implementation will be coordinated and driven primarily by the City and its partners (as identified for each action in [Chapter 6](#) and [Chapter 7](#)), the community, local businesses, and residents also have roles to play in maximizing the CAAP's effectiveness.

City Role

The City is directly responsible for updating and administering building codes, City services, and programs, developing ordinances, fostering partnerships, securing funding, such as grants, for applicable projects, maintaining and expanding public infrastructure, and implementing a number of infrastructure improvements (e.g., publicly accessible EV charging infrastructure, bicycle, and pedestrian infrastructure) associated with the CAAP measures and actions. As policies and programs are developed and infrastructure is constructed in alignment with the CAAP, City staff will engage the Sacramento community on associated opportunities, programs, or requirements. As part of its CAAP outreach commitment, the City will also continue to engage communities, particularly low-income and historically under-resourced communities, to avoid unintended impacts and ensure that CAAP implementation supports a more equitable city. A summary of each City department's measure implementation responsibilities is shown in [Table 8-1](#).

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Table 8-1. Primary City Department Measure Implementation Responsibilities

Community Development Department	Public Works Department	Utilities
Measure E-2: Eliminate natural gas in new construction.	Measure TR-1: Improve active transportation infrastructure to achieve 6% active transportation mode share by 2030 and 12% by 2045.	Measure E-1: Support SMUD as it implements the 2030 Zero Carbon Plan
Measure E-3: Transition natural gas in existing buildings to carbon-free electricity by 2045.	Measure TR-2: Support public transit improvements to achieve 11% public transit mode share by 2030 and maintain through 2045.	Measure WW-1: Reduce water utility emissions (in MT CO ₂ e per million gallon delivered) by 100% by 2030 and maintain that through 2045.
Measure E-4: Increase the amount of electricity produced from local resources and work with SMUD to install additional local storage by 2030.	Measure TR-3: Achieve zero-emission vehicle (ZEV) adoption rates of 28% for passenger vehicles and 22% for commercial vehicles by 2030 and 100% for all vehicles by 2045.	Measure WW-2: Reduce wastewater emissions by 22% by 2030 and 40% by 2045.
	Measure W-1: Work to reduce organic waste disposal 75% below 2014 levels by 2025.	
	Measure CS-1: Increase urban tree canopy cover to 25% by 2030 and 35% by 2045.	

This table provides a summary of the primary City Department in charge of measure implementation; City Departments with supportive roles (e.g., City of Sacramento Department of Youth, Parks, & Community Enrichment and City Manager's Office of Innovation & Economic Development (OIED)) are detailed in [Chapter 6](#), GHG Reduction Actions.



Photo by Carlos Eliason

Children Recreating

Partner Role

While the City holds the primary responsibility for driving implementation of the CAAP, local partners, including local utilities, special districts, regional jurisdictions, businesses, community-based organizations and other local groups, and the community at large, are in many cases better positioned to implement CAAP actions. For example, SacRT has responsibility for public transit in Sacramento and is best positioned to improve transit. Similarly, SMUD has responsibility as the public utility for electricity service and already has a suite of established rebate programs and other funding options for electrification and efficiency projects. While the City's Urban Forestry Division in Public Works is responsible for street trees, the Sacramento Tree Foundation is already doing work to increase canopy cover in the City outside of the public right-of-way. Through the partnerships fostered by the City, key CAAP partners will take the lead on implementing

measures and actions in their realm of responsibility and expertise. They may conduct outreach to the community, develop incentives and rebates, or even fund community infrastructure or improvements. The following provides a summary of primary partners, with specific information provided on the role of businesses, community-based organizations, and residents.

- Sacramento Municipal Utility District (SMUD)
- Sacramento Metropolitan Air Quality Management District (SMAQMD)
- Sacramento Regional Transit (SacRT)
- Sacramento County
- Sacramento Regional Sanitation District (Regional San)
- Sacramento Regional Water Authority (RWA)
- Private industry and third-party operators (e.g., EV charging network companies, shared rideable operators, and other zero-emission mobility program operators like car share companies)

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Business Role

Businesses in Sacramento will need to build new services and update skills to address new technologies supported by the CAAP like electric appliances and cars. Businesses, including the development community, will also need to adopt these technologies themselves and utilize programs and incentives to upgrade their buildings and equipment as they become available. The CAAP additionally represents opportunities for workforce development in Sacramento, associated with electric technologies. Some of the highest priority actions businesses can take to support implementation of the CAAP are included in [Chapter 9](#).

Community-Based Organizations

Community-based organizations (CBO) are essential to a successful climate action implementation process, because they aim to make real change in the community's overall health and well-being and provide an avenue of trust that invites diverse members of the community to the table, allowing their voices to be heard. In general, CBOs are public or private nonprofit organizations that are representative of a community or significant segments of a community that provides educational or related services to individuals in the community.² The primary role of CBOs is to advocate for the diverse needs of the community, proactively and thoughtfully share information, and actively work to provide boots on the ground support for various initiatives that are important to the specific community that they represent. Multiple local CBOs

were involved in the development of this CAAP, and those involved in CAAP implementation are shown in the tables in [Chapter 6](#).

Resident Role

Residents of Sacramento can enjoy the benefits of the CAAP by utilizing new infrastructure, programs, and incentives to adopt new technologies and behaviors. The CAAP does not establish many requirements for residents, but instead provides behavioral incentives for residents to adopt lower GHG-emissions activities, like biking instead of driving, or composting instead of sending organic waste to the landfill. It will be up to the residents of Sacramento to adopt these new behaviors once the City and its partners have removed cost and stress barriers. More information on key actions the community can take to support implementation of the CAAP are found in [Chapter 9](#).



2. Cornell Law School. (n.d.). *Definition: Community-based organization from 20 USC § 7801(5)*. LII / Legal Information Institute. Legal Information Institute. Retrieved September 20, 2021, from: <https://www.law.cornell.edu/uscode/text/20/7801#5>



Funding and Financing Plan

Implementation of the CAAP to achieve Sacramento's ambitious climate action targets is contingent on completion of a number of actions, many of which will require significant up-front costs, even if they provide long term cost savings and other benefits. This is especially true for capital-intensive actions related to modernization and infrastructure improvements. However, this CAAP focused on identifying cost-effective measures and actions available to Sacramento. While some measures and actions carry significant costs, other funding sources or strategies, such as grants or low interest financing, may be available to reduce or avoid incremental costs (as defined below) to the City and the community.

COST CONSIDERATIONS

As part of the climate action planning process, it is essential to consider the various costs associated with implementing climate action measures and also recognize that there is a very high cost of not implementing a CAAP (see the Cost of Doing Nothing below). There are many components to consider when it comes to the cost of implementing various measures. For example, costs may refer to the costs to individuals, or to the City. Additionally, there are up-front costs and lifecycle costs that range significantly depending on the specific measure or action and proposed implementation timeframe. Furthermore, it is understood that there is a general cost of doing business, and

therefore understanding the incremental costs of changing the status quo are also important to recognize to build a foundation of thoughtful decision making. To offset some of the costs, there are a variety of funding opportunities that aim to reduce the up-front financial burden of a jurisdiction for projects that reduce emissions and/or increase resilience. These specific funding considerations, including financing opportunities, are discussed below in further detail.

Costs to the Individual versus City

The measures contained in this CAAP come with both individual and City costs. For example, electrifying vehicles brings costs to the individual to buy an EV, and costs to the City to install EV chargers. The cost to improve public transit infrastructure is a cost to the City and SacRT but may save individuals money. Who bears the cost, and what funding mechanisms are available to offset those costs, were therefore carefully considered as part of the development of this CAAP.

Up-front versus Lifecycle Costs

When discussing how much a measure or action costs it is important to differentiate between up-front costs (e.g., the cost of an LED light bulb) and lifecycle costs (e.g., purchasing, operating, maintaining, and ultimately disposing of that lightbulb). While LED lightbulbs may be more expensive up-front when compared to an incandescent bulb, the lifecycle costs of owning an LED lightbulb are significantly lower, providing a significant return on investment over time.

Incremental Costs

When discussing costs, it is important to specify the difference between how much a measure or action costs overall and what the incremental cost is. The incremental cost is the difference in cost between the new action and the old or standard action. For example, purchasing a new EV could cost \$30,000 up-front,³ which should be considered a high cost. However, the incremental cost of purchasing an EV versus purchasing a new internal combustion vehicle may be zero or near zero because of up-front incentives and reduced long-term operating and maintenance costs including no fluids to replace, fewer moving parts like transmissions, and less brake wear. It is important to consider what the incremental costs are for each measure by keeping in mind what the alternative costs are. In many cases, the difference is negligible.⁴

Financing

One of the major financial tools available to make large investments in infrastructure, vehicles, or buildings is public and private financing. Financing solutions allow for leveraging the time value of money and putting future expected money flows to use today. For example, a solar array may cost \$20,000 and result in an energy bill that is \$200 less per month. The up-front cost of the solar array

could be considered high. However, the loan for the solar array requires a monthly payment of \$150 dollars (inclusive of energy costs), which would still offer a net monthly savings of \$50 dollars. Under this scenario the solar array does not carry a high cost; rather, it provides overall savings. The ability to finance can make seemingly high-cost investments low to no cost. Additionally, there are grants and federal rebates available to help offset the entire cost of solar arrays.

Understanding the ranges of cost savings and revenue streams, and how those costs and revenues accrue over time into a payback or return on investment (ROI) calculation, are prudent factors to structuring partnerships, engaging stakeholders, and making optimal financial decisions. For example, energy efficiency retrofits can generate cost savings of more than 30 percent for 15 to 20 years.⁵ If external partners are involved, such as with an energy savings performance contract (ESPC), cities may not need to provide any up-front capital, but the project's cost savings would accrue with a private third party and be lost by the city. The City must consider the estimated ROI, how project costs and revenues balance out over the useful life of the project, and whether they are willing to forego long-term cost savings or revenue generation capacity by partnering with a private third party.

3 Inside EVs. 2022. *US Electric Car Prices: Cheapest to Most Expensive*. Retrieved from <https://insideevs.com/news/565883/electric-car-prices-us-20220207/>

4 Massachusetts Institute of Technology Trancik Lab. 2016. *CarbonCounter.com*. Retrieved from <https://www.carboncounter.com/>

5 Office of Energy Efficiency & Renewable Energy. 2021. *Why Energy Efficiency Upgrades*, from: <https://www.energy.gov/eere/why-energy-efficiency-upgrades>



The Cost of Doing Nothing

Finally, doing nothing to prepare for and slow down climate change will also carry a cost. Research published in the journal *Nature* predicts the cost of not decreasing emissions to carbon neutrality by mid-century could range between \$149.78 trillion to \$791.98 trillion globally by the end of the century.⁶ That same study found that if climate change is slowed and carbon neutrality is achieved by mid-century, the world could see a \$127 to \$616 trillion economic benefit after considering the costs associated with taking action. The humanitarian impact is also significant. The Red Cross and Red Crescent Societies estimate that the number of people in need of humanitarian aid each year could double to 200 million annually by 2050 due to climate change costing \$20 billion per year.⁷ Furthermore, the World Resources Institute has found that investing in adaptation and resilience provides a benefit-cost ratio ranging from 2:1 to 10:1, meaning that for every dollar invested in resilience and adaptation there are \$2 to \$10 dollars' worth of benefits.

Taking action to reduce GHG emissions and adapt to climate change now allows the City to use resources effectively and lessen future damages. One immediate example is the cost to install conduit and panel capacity for EV chargers for all new construction. While this action increases up-front construction costs by a few hundred dollars, doing that same work

after the building is completed can be an order of magnitude higher (~\$3,000). Given the move towards EVs, the cost of not installing EV infrastructure today could cost the community significantly more in the future. In a similar vein, adaptation measures will cost the city and the community today. Planting trees, installing microgrids, and setting up cooling centers all have up-front costs. However, it's imperative that these costs be weighed against the costs of a future without these adaptive measures given what is known about the projected climate impacts on the Sacramento region.



Photo by Carlos Eliason

Active Transportation

6. Wei, Yi-Ming et al. *Nature Communications*. 2020. *Self-preservation strategy for approaching global warming targets in the post-Paris Agreement era*, from <https://www.nature.com/articles/s41467-020-15453-z>.
7. International Federation of Red Cross and Red Crescent Societies. 2019. *The Cost of Doing Nothing: The Humanitarian Price of Climate Change and How it Can be Avoided*. Retrieved June 9, 2021, from <https://reliefweb.int/report/world/cost-doing-nothing-humanitarian-price-climate-change-and-how-it-can-be-avoided>.

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Funding and Financing Plan

In order to develop transparency around the prioritization of the CAAP measures and actions the City has developed a high-level funding and financing plan which can be found in [Appendix D](#). While many of the CAAP measures will need more detail on the specific project before a detailed cost and funding or financing approach can be taken, the funding and financing plan provides the estimated cost to the City associated with the implementation of many of the City's most impactful measures and provides a funding and financing plan to allow the City to begin implementation of these major projects. The funding and financing plan arranges the CAAP measures into three cost segments which include:

- **Low-Cost:** Measures associated with relatively low up-front costs. These actions are assumed to be handled through existing resources or through smaller low-cost changes to staffing/operations, e.g., policies and ordinance.
- **Moderate-Cost:** These measures will require additional funding or increase short term costs to the City and community, e.g., EV charging infrastructure and program development.
- **High-Cost:** longer term projects requiring substantial investments over time to reduce emissions, e.g., new infrastructure and transit. These measures will require significant investment that cannot be paid for by the City alone. Funding and financing will be key to the implementation of these measures.

The funding and financing strategy focuses on the high- and moderate-cost measures which will need the greatest level of support. The funding and financing strategy is only a snapshot, however. The State supports local climate action in part by providing limited funding that is typically available in the form of competitive grants. The City has recognized that ambitious climate action targets invite resources for identified actions and projects and placed Sacramento in a competitive position to pursue additional funding to support these aggressive actions and goals, particularly in the transportation sector. In particular, additional significant sources of funding will need to be identified to achieve the transportation infrastructure improvements outlined in this CAAP. The strategies in the funding and financing plan represent a well-researched starting point for the City and its partners to obtain the funding and financing necessary to begin implementing the CAAP.





Monitoring the CAAP

The City will monitor progress implementing the CAAP actions and measures. The City will also develop GHG emissions inventories on a regular basis according to the schedule in [Table 8-2](#) to monitor progress in achieving Sacramento’s climate action targets. The City will coordinate with its partners to conduct regular monitoring and reporting as shown in [Table 8-2](#), Implementation Timeline. As there are many different ways to determine CAAP implementation progress both qualitatively and quantitatively, the City has defined three monitoring levels that will occur simultaneously throughout the life of the CAAP. All monitoring activity will be conducted transparently for the community’s reference through CAPDash, an online CAP tool tailored for monitoring Sacramento’s CAAP.

CAAP MONITORING LEVELS

Action Monitoring

Tracking implementation status involves qualitative tracking of the metrics developed for CAAP actions as a part of the General Plan Annual Progress Report. For example, for action E-2.1, the City would track whether or not

the ordinance was developed and adopted; for action TR-1.1, the City would track what portion of new transportation lanes/paths have been built.

Measure Monitoring

Tracking measure performance metrics involves determining to what extent the CAAP actions are achieving the measure goals. This involves quantitative tracking of the performance metrics associated with each measure. For example, measure TR-3 contains the goal to achieve ZEV adoption rates within Sacramento of 28 percent for passenger vehicles and 22 percent for commercial vehicles by 2030; the City would therefore track ZEV adoption rates relative to these goals.

GHG Emissions Monitoring

GHG emissions would be monitored by conducting regular GHG emissions inventories to evaluate Sacramento’s progress against its climate action targets and the 2030 GHG emissions milestone. This involves quantitatively inventorying Sacramento’s community wide GHG emissions on a regular basis, to determine to what extent GHG emissions are actually being reduced in the City. The City would conduct ongoing GHG emissions inventories using methods similar to those used for this CAAP’s inventory (see [Appendix A](#) for method details).

Reporting on Progress

The City will provide a report with information on the implementation status and monitoring results to City Council in 2027. The report will include a qualitative and quantitative discussion of barriers to implementation for each measure and the results of the GHG emissions inventory. The report will quantitatively analyze whether the City is on track to reach its 2030 target, or if changes or additional measures and actions are needed. If the City is not on target to achieve the GHG emissions milestones as a part of the next General Plan update, the City will work to develop additional measures and actions beyond those identified here as part of a CAAP update for Sacramento to stay on track to meet the 2030 target.

Updating the CAAP

The City is committed to routine tracking and evaluation of the CAAP. In addition to progress reporting, a CAAP update will be completed concurrently with periodic General Plan updates, including comprehensive reporting on progress of measures and actions. The periodic CAAP updates will revisit and update the approach for reducing GHG emissions in Sacramento outlined in this CAAP and establish new strategies, measures, and actions, based on State legislation at that time and progress made towards the 2030 target. Finally, a complete CAAP update for post-2030 climate action targets will be required to consider new technological and political conditions that may warrant new approaches. It is anticipated that new technologies and legislation will facilitate GHG emissions reductions beyond what is currently possible and allow the City to continue towards its long-term goal of carbon neutrality by 2045.



Sacramento in the Fall



Table 8-2. Implementation Timeline

Phase	Year	Implementation Actions
1	2023	<ul style="list-style-type: none"> • Adopt CAAP (end of 2023) • Phase 1 Implementation
	2024	<ul style="list-style-type: none"> • Begin Phase 2 Implementation
2	2027	<ul style="list-style-type: none"> • Progress Report – qualitative and quantitative analysis of implementation actions • GHG Inventory and Forecast Update • Initiate CAAP Update concurrent with General Plan Update
	2030	<ul style="list-style-type: none"> • Progress Report– qualitative analysis of implementation actions • GHG Inventory • Adopt new CAAP/General Plan

Chapter 6 provides detailed information on the implementation phase associated with each action. As outlined in *Chapter 6*, the City of Sacramento has established two phases for implementation. Phase 1 actions will begin implementation at CAAP adoption or before. These actions have been prioritized due to their importance, cost effectiveness, or the availability of resources for implementation. Phase 2 actions will begin implementation between 2024 and 2030. These actions may require additional resources such as staff time, funding and financing, or there may need to be additional education and outreach conducted prior to implementation.



COMMUNITY ACTION AND SUSTAINABILITY



Many of the measures and actions in the CAAP will support community members in adopting new technologies, services, and behaviors like electrifying their homes and cars, driving less, or composting organic waste. While the City and its partners are responsible for leading this effort by developing programs and infrastructure, the community will need to utilize the opportunities created by the City and adopt new technologies and behaviors. Community members or groups that embrace these opportunities will directly experience many of the co-benefits identified in [Chapter 5](#), such as cleaner air in their homes and businesses, healthier lifestyles, and long-term decreased cost of living in many cases.

For example, [Measure TR-3](#) creates a holistic framework to achieve increased ZEV-adoption rates for passenger and commercial vehicles by amending the City's Building Code to require increased EV capability and amending the Planning and Development Code to incentivize charging in both existing and new developments, continuing to install and provide EV charger access at City-owned facilities and parking garages, continuing to support and collaborate with community partners, pursuing affordable, zero-emission car-share expansions to serve affordable housing, developing and implementing a fee for use of City-owned parking facilities and EV chargers to encourage and promote more efficient use and turnover

CLIMATE ACTION & ADAPTATION PLAN

and increase EV availability, continuing to maintain a highly streamlined EV-infrastructure permit process, and engaging with the community and providing educational information in an ongoing manner.¹ This framework creates various strong incentives and support structures for ZEV adoption and use, but it will still be up to community members to transition from gas-powered vehicles to electric-powered vehicles using the approach and funding mechanisms provided.

This chapter is intentionally incorporated in this CAAP to provide a clear pathway for community members to make direct change and includes resources and community-level

actions that can be taken to support the CAAP and help create a more sustainable Sacramento. These actions provide a roadmap for voluntary action by the community and are not required to ensure that the CAAP is a qualified GHG emissions reduction plan. However, providing a clear route for community involvement is critical to developing an implementable plan. The community-level actions are divided into sections for different segments of the community: residents, homeowners and property owners, businesses and employers, and developers. Readers of the CAAP can explore this section and discover opportunities for contributing to GHG reductions, resiliency, and sustainability in the City of Sacramento.

1. See [Chapter 6](#) for a full list of the actions that support implementation of [Measure TR-3](#).



Electric Vehicle Chargers



Community Action Guide

This community action guide includes actions that can be taken at the community level by residents, homeowners and property owners, businesses and employers, and developers to support Sacramento’s GHG emission reduction goals, improve sustainability, and help mitigate the impacts of climate change. This section also includes resources specific to Sacramento that make taking these actions possible. These actions focus on Sacramento’s most important GHG reduction measures. Together, the City of Sacramento and the community can improve sustainability within the City and meet the science-based climate action targets developed for 2030 and 2045.

RESIDENTS

Residents play a big role in helping Sacramento achieve its climate action targets. This section includes information and resources related to actions residents can take that will make the biggest impacts towards reducing GHG emissions.

Bike, Walk, Skateboard, Scooter, Take Transit, Carpool, or Telecommute when Possible

Impact: Moderate to high. Finding alternative transportation options to single-occupancy vehicles is key to reducing your transportation footprint. Biking, walking, skateboarding, scootering, taking the bus or light rail, and carpooling are all good alternative transportation options and support Sacramento’s efforts to increase active and shared transportation and public transit (*Measure TR-1* and *Measure TR-2*).

Cost: Low to none. Walking, biking, skateboarding, and scootering are great low- and no-cost alternatives to driving and can help improve resident’s health and wellness. Taking the bus or carpooling can also help save on transportation costs. In Sacramento, remember that students ride free on transit!

Links to Resources:

- ▶ [Explore Sacramento’s expanding bikeways](#)
- ▶ [Learn more about shared rideables in Sacramento](#)
- ▶ [Find transit routes and schedules](#)
- ▶ [Students ride free!](#)

Buy, Lease, or Borrow an EV when it's Time for a New Car or to Make a Trip Around Town

Impact: High. Transportation is the largest contributor to Sacramento's GHG emissions, and a vast majority of those emissions come from passenger vehicles. Sacramento's transportation strategy includes electrifying car trips to the greatest extent possible (*Measure TR-3*). Buying an EV will directly support this strategy and may provide life cycle cost savings in the long run. Sacramento is one of the best places in California to own an EV with low electricity rates and over 600 public chargers with more on the way!

Cost: High. Costs for residents who choose EVs are highly dependent on vehicle choice. Many EVs are comparable in cost to gasoline-powered vehicles and can be comparatively less expensive over the full life of the car.² Costs can also be associated with installing an EV charger at home. Level 1 chargers can cost between \$300 to \$600 to install.³ Sometimes electrical upgrades may be required for older homes. However, the ongoing maintenance and operation costs of owning or leasing an EV have been shown to be significantly lower than internal combustion vehicles.

Links to Resources:

- [Evaluate the GHG footprint and lifecycle costs of different cars](#)
- [Explore a list of affordable electric cars on the market](#)
- [Check the costs of charging an EV versus gas prices](#)
- [Find more information and ask questions at SacEV](#)



Electric Vehicle Charging

2. CarbonCounter. *Cars evaluated against climate targets*. Retrieved November 4, 2021, from <https://www.carboncounter.com/#!/explore>.
3. Carvana. 2022. *How Much Does it Cost to Install an EV Charger?* Retrieved from <https://blog.carvana.com/2021/07/how-much-does-it-cost-to-install-an-ev-charger/>



Compost Your Yard and Food Waste

Impact: *Low to moderate.* Sacramento has adopted a strategy to increase the diversion of organic waste from the landfill by adding food collection and composting programs in the City (*Measure W-1*). You can support this work by doing your own composting and recycling now. It's low cost and has the added benefit of reducing strain on local landfills. Furthermore, compost, when added to the soil, increases the rate of carbon sequestration by the soil microbes for years after the compost is applied.⁴

Cost: *Low to none*

Links to Resources:

- ▶ [Compost at home](#)
- ▶ [Compost with ReSoilSac](#)
- ▶ [Get involved at a community garden near you](#)
- ▶ [Curbside composting program](#)
- ▶ [State requirements for jurisdiction organics recycling under SB 1383](#)
- ▶ [City of Sacramento organics recycling](#)



4. University of California - Davis. (2019, August 14). *Compost key to sequestering carbon in the soil: Study dug deep to uncover which agricultural systems store the most carbon.* ScienceDaily. Retrieved September 21, 2021, from www.sciencedaily.com/releases/2019/08/190814161818.htm

Track Your Water Usage and Check for Leaks

Impact: High. Saving water in Sacramento is also part of reducing our environmental impact and begins at the individual level. Tracking your home's usage and detecting leaks is now easier than ever with advanced technology and the City's Water Conservation Team. Toilets are very common sources of leaks and often exceed 400 gallons per day.

Cost: Free. Residents can access water wise services through the City's website, including a free house call to determine water efficiency, leak repair assistance, and rebates for low-water appliances.

Links to Resources:

- ▶ [Learn more about water wise services](#)
- ▶ [Residential water wise services](#)



Leaking Faucet



Use an Induction Cooktop Instead of Your Gas Stove

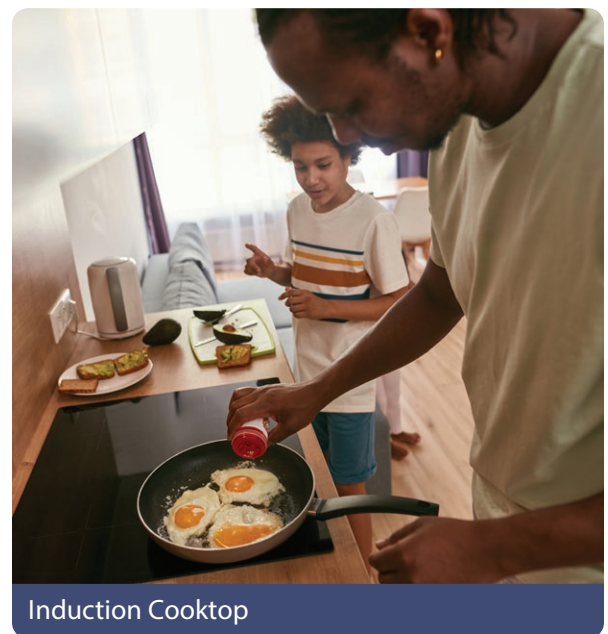
Impact: Moderate. In Sacramento, natural gas use equates to approximately 14 percent of the City's emissions and reducing these emissions is essential to reaching the long-term goal of carbon neutrality. One opportunity to reduce natural gas usage in homes is by switching from a gas-powered stove to an induction cooktop, which also improves indoor air quality and could make your home healthier. According to CARB, natural gas and propane stoves can release carbon monoxide, formaldehyde, and other harmful pollutants into the air, which can be toxic to people and pets.⁵ Furthermore, a 2020 report from Rocky Mountain Institute⁶ found that peak indoor air pollution from gas stoves can reach levels as much as five times higher than the legal outdoor limit.

Cost: Low. Induction cook tops generally range in price from approximately \$50 to \$75 and can be set on the countertop to be powered by electricity. By transitioning appliances in buildings from the consumption of natural gas to electricity, emissions from this source can be reduced. This reduction will become greater over time through SB 100 requirements which requires utilities to provide increased renewable electricity. A variety of studies have found that electrification of buildings,

combined with renewable power generation, is a potential path towards reaching carbon neutrality.⁷ Additionally, indoor air quality would be improved.

Links to Resources:

- ▶ [The Best Portable Induction Cooktops](#)
- ▶ [Check out an induction burner from the Sacramento Public Library](#)
- ▶ [Get a SMUD rebate for an induction cooktop/range](#)
- ▶ [Lean more about switching to electric appliances](#)



Induction Cooktop

5. California Air Resources Board (CARB). *Cooking can contaminate the indoor air with harmful pollutants, but range hoods can effectively remove them.* Retrieved November 4, 2021, from <https://ww2.arb.ca.gov/resources/documents/indoor-air-pollution-cooking>
6. Rocky Mountain Institute. *Gas Stoves: Health and Air Quality Impacts and Solutions.* Retrieved on November 4, 2021 from <https://rmi.org/insight/gas-stoves-pollution-health>
7. Williams, James et al. *Pathways to Deep Decarbonization in the United States.* San Francisco: Energy and Environmental Economics, 2014; Northeastern Regional Assessment of Strategic Electrification (Northeast Energy Efficiency Partnerships, 2017); Steinberg, Daniel et al. *Electrification and Decarbonization: Exploring US Energy Use and Greenhouse Gas Emissions in Scenarios with Widespread Electrification and Power Sector Decarbonization* (National Renewable Energy Laboratory, 2017).

CLIMATE ACTION & ADAPTATION PLAN

Upgrade to Clean Energy from SMUD

Impact: High. In Sacramento, approximately 24 percent of GHG emissions are generated by electricity use. Increasing the rate of renewable and carbon-free energy would decrease the emissions generated from electricity use and would help support the long-term goal of carbon neutrality.

Cost: Low. SMUD offers two low-cost options for residents to purchase clean energy through the Greenergy program. For \$4 a month (\$48/year), SMUD will provide residents with 50 percent clean energy sources and for \$8 a month (\$96/year), SMUD will provide residents with 100 percent clean energy, which is a mix of renewable and carbon-free resources like wind, solar, and hydroelectric power. There is also an option for businesses to purchase 100 percent clean energy.

Links to Resources:

- ▶ [SMUD's Greenergy options and sign-up page](#)



Renewable Energy Options



Talk to Your Landlord or Property Manager and Ask for Sustainability Upgrades

Impact: *Moderate to high.* As mentioned above, a majority of the City’s housing units were built prior to 2005 and may not include the most current energy efficient appliances, fixtures, and fittings. Likewise, these units may not include the necessary infrastructure to charge EVs. Replacing antiquated equipment with current equivalents would likely result in significant emissions reductions. Likewise, providing safe, convenient EV charging infrastructure would encourage residents to investigate alternative vehicles options at the time of purchase.

Cost: *Low or free.* The primary cost associated with this initiative would be the time associated with completing a personal review and then reaching out to landlords or property managers, as applicable. However, there may be reduced costs for tenants that would be achieved through installation or implementation of energy efficient design. As noted by the EPA in *Successes in Sustainability: Landlords and Tenants Team Up to Improve Energy Efficiency*,⁸ working together to create green, efficient space not only offers environmental and financial benefits but also creates opportunities for a strong landlord-tenant relationship. Although the conclusions included in the EPA’s paper are based on commercial landlords and tenants, there is a direct connection

to residential uses, and these lessons learned can be applied. Three of the key initiatives that are discussed include the value of retrofitting leased space as green space, measuring and sharing energy data to enable efficiency, and engaging tenants around sustainability.

Links to Resources:

- [U.S. EPA – Successes in Sustainability: Landlords and Tenants Team Up to Improve Energy Efficiency](#)



Induction Stove Installation

8. United States Environmental Protection Agency. *Successes in Sustainability: Landlords and Tenant Team Up to Improve Energy Efficiency*. Retrieved on November 4, 2021 from https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/EPA_ES_Tenant_Report_508.pdf

HOMEOWNERS AND PROPERTY OWNERS

Homeowners and property owners have power over how their property uses resources like energy for heating and cooling and water for washing and landscaping. If you're a homeowner or property owner in Sacramento, this section includes a list of suggested actions for reducing the energy and water usage of your property while maintaining comfort in a cost-effective way.

Install Solar Panels and/or Battery Storage

Impact: Moderate to high. Installing solar with batteries on your property reduces your electricity emissions and increases Sacramento's electrical grid resilience. These are key aspects of Sacramento's energy strategy (see [Measures E-2](#) and [Measure E-4](#)). Battery storage takes this one step further by allowing you to store solar energy for use at night, decreasing your emissions footprint even further at the time when the grid is supplying the most carbon intensive electricity. Battery storage can also increase your property's resiliency by providing electricity during power outages or disasters.

Cost: Up-front cost for installing solar panels and batteries on your home can be high (currently anywhere from \$5,000 to \$17,000 after tax breaks for solar and \$11,000 to \$18,000 for batteries), but on-bill cost savings start right away and can pay off the installation in 7 to 20 years for solar and 6 to 12 years for battery storage. Average savings for solar after

20 years is \$20,000 on average. SMUD and other programs provide financing options for installing solar.

Links to Resources:

- ▶ [Learn about batteries and rebates from SMUD](#)
- ▶ [Use SMUD's solar calculator tool to estimate your solar savings potential](#)
- ▶ [Learn about solar permits from the City online](#)
- ▶ [Explore opportunities to get free solar installed on your home through Grid Alternatives Energy for All Program for families with limited or fixed incomes](#)
- ▶ [Explore the Low Income Home Energy Assistance Program \(LIHEAP\)](#)



Solar PV Being Installed



Install an Electric Water Heater, Heat Pump HVAC, and/or Stovetop

Impact: High. Support the effort to electrify existing buildings (*Measure E-3*) by installing electric appliances instead of gas appliances which depend on fossil fuels. The electricity provided by SMUD today is already approximately 72 percent carbon-free. SMUD has a goal to provide 100 percent carbon-free electricity by 2030 (*Measure E-2*). In addition to significant reductions in GHG emissions, due to SMUD's low electricity rates, electric appliances can save you money on your energy bills and reduce indoor air pollution from natural gas combustion. Time of replacement (when your old appliance breaks or is no longer working efficiently) is the best time to make the switch, but you may need additional upgrades like an electric panel so make sure to start looking into electric replacements now. Be sure to check out the resources linked here, since SMUD has some of the best electric appliance rebates in California.

Cost: Moderate. In general, electric induction models are more expensive than natural gas fueled⁹ counterparts upfront but provide long-term on-bill savings. Current marginal costs (the cost increase compared to replacement with a natural gas appliance) after rebates for a heat pump HVAC (which also provides cooling) is about \$3,600 to \$8,200 before incentives. However, if a household expects to replace both an air conditioner and a furnace, a single

heat pump unit provides the same heating and cooling at a lower upfront cost. Heat pump hot water heaters represent a marginal cost between \$1,700 and \$2,600 before incentives and offers significant cost savings over time.¹⁰ SMUD offers rebates that can reduce to zero the marginal cost of switching to all-electric.

Links to Resources:

- ▶ [Explore SMUD's electrification rebates](#)
- ▶ [Learn more about installing electric appliances from The Switch is On](#)
- ▶ [Search SMUD's Contractor Network for going Electric](#)



Heat Pump HVAC

9. On average, traditional electric coil cook tops are approximately the same price as natural gas-powered cook tops.

10. E3 Residential Building Electrification in CA 2019

Upgrade to Water-wise Landscaping and Water-efficient Fixtures

Impact: High. With Sacramento’s hot and arid climate, water is a precious commodity to the City. The City’s Water Conservation Team provides many rebates on indoor fixtures and outdoor irrigation fixtures.

Cost: Moderate to high. Take advantage of rebates available to help you upgrade a lawn to a beautiful and drought-tolerant landscape, upgrade irrigation sprinklers and smart controllers, purchase a rain barrel, or design a laundry-to-landscape system. The City’s Water Conservation Team can help connect you to a landscape designer and conduct a water-wise house call to provide information on making the most of your home. Within the house, rebates for upgrading to high-efficiency toilets and washing machines. The SMUD Energy Store also provides rebates for smart controllers, aerators, and showerheads.

Links to Resources:

- ▶ [Check out the City’s Residential Rebates for outdoor landscaping and toilets](#)
- ▶ [Find other rebates on water efficient home fixtures at the SMUD Energy Store](#)



Drought-tolerant Landscape



Conduct Energy Efficiency Upgrades

Impact: Moderate. Conducting a home energy audit, completing weatherization upgrades, or using cool roof materials when its time for a new roof can all help lower costs and save energy. The SMUD energy efficiency home website has great resources to upgrade your home and save money.

Cost: Low to Moderate. SMUD has tips available for saving money under the Time-of-Day rates found in Sacramento. Many options are no cost at all such as shifting when you do laundry or run the dishwasher. Rebates for weatherization are also available through the State.

Links to Resources:

- ▶ [Check out SMUD's Energy Efficiency Home Website](#)
- ▶ [SMUD provides rebates for air-sealing and insulation](#)
- ▶ [The Community Resource Project has a free low-income energy efficiency program](#)



Weatherizing Homes Saves Energy and Costs

BUSINESSES AND EMPLOYERS

Businesses and employers will play a key role in reducing GHG emissions in Sacramento and supporting this CAAP. This section provides a list of actions that businesses and employers can take to support GHG emissions reductions in Sacramento.

Install Bike-friendly Facilities for Your Employees and Encourage Public Transit Use

Impact: High. You can help your employees decarbonize their commute and bike, walk, or take the bus to work. Consider installing bike racks or secure parking rooms for employees to safely store their bikes during the workday, providing showering facilities, and/or offering financial incentives for employees to bike, walk, carpool, or take the bus to work.

Cost: Low to moderate. Bike racks and secure parking rooms can range significantly in price. Installation of showering facilities and financial incentives could range depending on current infrastructure in place and number of employees. Reducing emissions from transportation will be crucial to reaching the City's long-term goals because approximately 57 percent of the City's emissions come from the transportation sector. In addition to providing the necessary infrastructure, there are a variety of initiatives in place to encourage employees to actively commute. For example, the Federal Bike Commuter Benefit became effective in 2009, and if a company elects to offer this benefit, employees can receive up to \$20 a month for

each month they commute primarily by bike, as long as they don't accept any of the other transit benefit.

Links to Resources:

- ▶ [Explore more ways to encourage your employees to bike to work](#)
- ▶ [Check out Transportation Demand Management ideas from SACOG](#)
- ▶ [Learn more about developing a successful bike commuting program for employees](#)



Bicycle Locker



Install EV Chargers in the Employee Parking Lot and Convert Fleet to Electric when Possible

Impact: High. Transportation is the largest contributor to Sacramento's GHG emissions, and a vast majority of those emissions come from passenger vehicles. Sacramento's transportation strategy includes electrifying vehicle trips to the greatest extent possible (*Measure TR-3*). Converting your fleet to electric, installing EV chargers in your workplace parking lot, and developing a workplace charging program for your employees will support this important effort.

Cost: Moderate to high. EV-charging infrastructure can range in price depending on categories of EV charger from approximately \$813 (Level 1 – Non-networked charger) to \$140,000 (DC fast – Networked 350 kW) per charger.¹¹ However, there are a variety of funding opportunities, including grants, that support the installation of EV-charging infrastructure. Replacement of fossil fuel powered fleet vehicles at the end of their life with electric alternatives would mean only the marginal cost (difference between a standard vehicle and EV) would need to be considered as a cost increase. The long-term savings associated with EV's as well as the incentives available could more than make up for this increased upfront cost.

Links to Resources:

- [Review Sacramento's guide for going electric](#)
- [Explore the Clean Vehicle Rebate Project for Fleets Program](#)



EV Charging Stations

11. The International Council on Clean Transportation (ICCT). *Estimating electric vehicle charging infrastructure costs across major U.S. metropolitan areas*. Retrieved on November 4, 2021 from https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf

Install Solar Panels and/or Battery Storage at Your Business

Impact: *Moderate to high.* Installing solar at your business reduces your electricity emissions and your bills. These are key aspects of Sacramento’s energy strategy (see [Measure E-2](#) and [Measure E-4](#)). Battery storage takes this one step further by allowing you to store solar energy for use at night, decreasing your emissions footprint and energy costs even further at the time when the grid is supplying the most carbon-intensive electricity. Battery storage can also increase your business’s resiliency by providing electricity during power outages or disasters.

Cost: Up-front cost for installing solar panels and batteries on your business can be high (currently anywhere from \$5,000 to \$17,000 after tax breaks for solar and \$11,000 to \$18,000 for batteries), but on-bill cost savings start right away and can pay off the installation in 7 to 20 years for solar and 6 to 12 years for battery storage. Average savings for solar after 20 years is \$20,000 on average. SMUD and other programs provide financing options for installing solar.

Links to Resources:

- [Explore benefits and case studies on solar energy for commercial buildings](#)
- [Get your business started with solar](#)
- [Learn more about battery storage for your business](#)



Energy Storage



Develop (or Keep) Work-from-home Policies for Employees

Impact: *Moderate to high.* Allowing your employees to work from home, even one day per week, will reduce vehicle miles traveled in Sacramento, save your employees money, improve air quality, and reduce traffic impacts. Most passenger vehicle miles in California are from commuting to and from work. Removing the need to commute to work via car supports Sacramento's efforts to reduce vehicle miles traveled, traffic congestions, and helps reduce GHG emissions. As the impacts of COVID-19 recede, consider leaving employees flexibility to work from home some or all the time as feasible. Due to the COVID-19 pandemic, a number of employees have already been telecommuting, showing the potential for the efficacy of telecommute options. Not only does employee telecommuting provide GHG reductions but it also provides flexibility for employees with longer commute times.

Cost: *Free.* There are no additional costs associated with developing or retaining work-from-home policies for employees. In fact, in most instances, employers are able to save money on overhead. For example, according to Forbes, prior the pandemic, employers saved an average of \$22,000 per full-time remote employee.¹² Likewise, the costs would be reduced for employees. According to a recent FlexJobs survey, the average remote

worker saves \$4,000 per year by not spending money on gas, coffee, lunches, and clothes for their wardrobe.¹³

Links to Resources:

- ▶ [Review suggestions for how to create an effective work-from-home policy from BuiltIn](#)
- ▶ [Explore sample telecommuting policies](#)
- ▶ [Review the State's suggestions for how to support teleworking](#)



Working from Home

12 Jeff DeVerter. Forbes Technology Council. *In Defense of Remote Work*. Retrieved on November 4, 2021 from <https://www.forbes.com/sites/forbestechcouncil/2020/12/02/in-defense-of-remote-work/?sh=2dbab07a144a>

13 Rachel Pelta. FlexJobs. *6 Ways Working from Home will Save you \$4,000 or More Annually*. Retrieved on November 4, 2021 from <https://www.flexjobs.com/blog/post/does-working-remotely-save-you-money/>

Reduce Food Waste

Impact: *Low to moderate.* Sacramento has adopted a strategy to divert organic waste from the landfill through enhanced composting programs in the City (*Measure W-1*). You can support this effort by continuing to divert and reduce your food waste at your business.

Cost: *Free.* In general, reducing waste through strategic business planning and thoughtful purchasing policies not only reduces upfront costs but also reduces waste management costs as well. Commercial waste is generally collected and measured using the number of dumpsters that a facility uses. Reducing the amount of waste generated would reduce the number of trips associated with delivery and waste hauling and therefore reduce GHG emissions and improve local air quality as well.

Links to Resources:

- [Managing food waste at the workplace](#)
- [Managing food waste at your restaurant](#)
- [Learn about food donation programs](#)
- [Donate your left-over food](#)



Edible Food Donations



Practice Sustainable Business

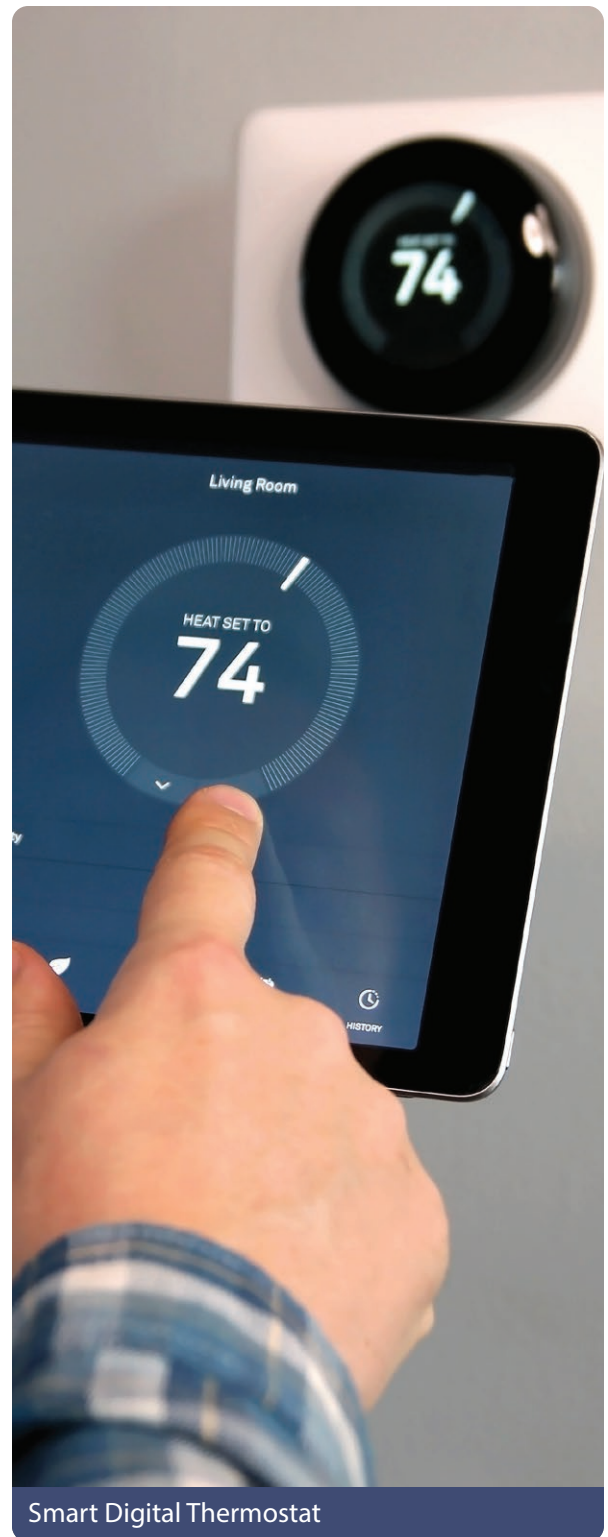
Impact: *Low to moderate.* You can reduce your organization's GHG emissions by procuring sustainable materials and developing other employee-focused sustainability policies.

Cost: *Low.* There may be slight marginal costs associated with practicing sustainable business; however, as noted in [Chapter 8](#), the cost of doing nothing at all is far greater. Shifting business practices may result in minimal upfront costs, which generally will diminish over time when the full life cycle of the operations/actions are compared.

Links to Resources:

- ▶ [Review this business guide to sustainable business practices](#)
- ▶ [Learn more about small businesses and sustainability](#)
- ▶ [Explore rebates and incentives for energy savings](#)
- ▶ [Sacramento County Business Sustainability](#)

In addition to the resources listed above, there are a variety of contractors that design and promote sustainable business practices.



Smart Digital Thermostat

Save Water While Saving Money

Impact: High. Businesses need to do their part in being water wise in the workplace. The City's Water Conservation Team offers several programs to help your business save water, including a rebate program for water-wise upgrades.

Cost: Low. Make improvements to save or reduce water usage and save up to \$50,000 (\$0.50 per 748 gallons saved). Eligible upgrades include:

- High efficiency toilets and urinals
- Equipment and technology for space cooling
- Refrigeration, laundry, cleaning, and flushing
- Air conditioning condensate capture
- Elimination of water intensive phases or industrial processes
- Outdoor rebates including turf conversion, irrigation upgrades, and smart controllers

The Water Conservation Team also provides a customized rebate program to tailor to your business needs.

Links to Resources:

- [Check out the City Water Conservation Team's Business Rebates](#)



Saving Water Saves Money

MUNICIPAL GHG REDUCTION MEASURES



The City of Sacramento has developed its own plan to make substantial progress towards achieving carbon neutrality in all municipal operations by 2045. These measures and actions align with both the Mayors' Commission on Climate Change and the CAAP's ambitious community measures and actions and will allow the City to continue its role as a leader in climate action both within the community and the region. The City has developed a suite of measures and specific actions, identified in this chapter, that will collectively reduce emissions 74% below 1990 levels by 2030, and near zero in 2045. The municipal measures closely mirror the CAAP's community-level strategies with a goal of exceeding community goals

wherever feasible. These measures and actions include electrification of municipal buildings, vehicle fleets, and reductions in energy usage, water, and waste.



Downtown Sacramento

Photo by Carlos Eliason

Municipal GHG Emissions

GHG EMISSIONS INVENTORY

To better understand the progress to date and develop new measures and actions, the City developed a GHG emissions inventory of municipal operations for 2016 (Figure 10-1 and Table 10-1). While municipal emissions are only a small portion of community-wide

emissions – captured as part of the community GHG inventory described in Chapter 2 – they are broken out and analyzed separately to support the development of a municipal operations-specific GHG reduction plan for the City. Municipal GHG emissions are primarily attributed to electricity and natural gas usage in City-owned buildings and facilities (27%), gasoline and diesel usage in the City’s vehicle fleets (28%), electricity usage for streetlights and traffic signals (9%), water and wastewater treatment and conveyance related to water usage in municipal facilities (17%), and landfill process emissions from the City’s waste facilities (19%).

Figure 10-1. Municipal GHG Emissions Inventory by Sector in 2016

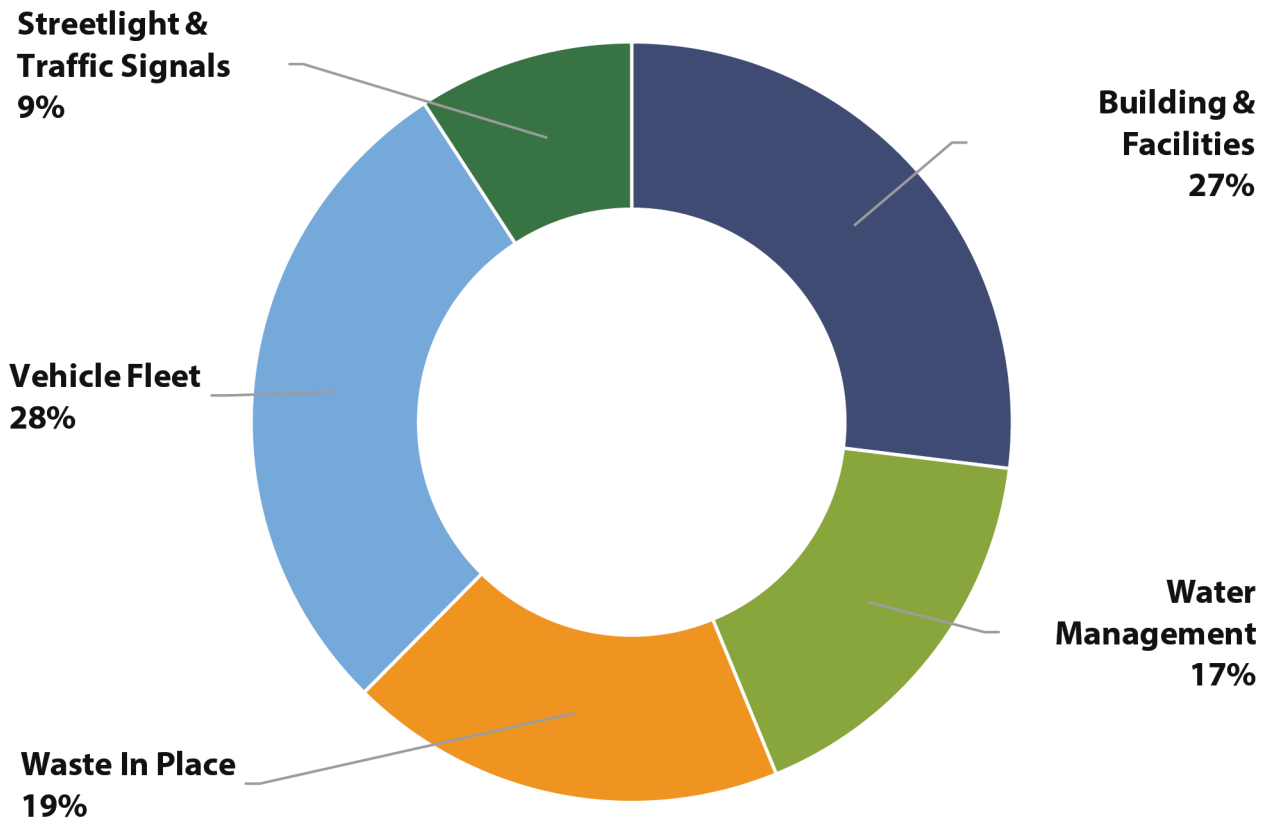




Table 10-1. Municipal GHG Emissions Inventory by Sector (MT CO₂e)

Sector	Emissions
Vehicle Fleet	16,035
Building & Facilities	15,214
Waste-in-Place	10,512
Water Management	9,516
Streetlight & Traffic Signals	5,186
Total	56,463

MUNICIPAL PROGRESS AND SUCCESSES

The City of Sacramento has conducted two previous municipal GHG emissions inventories for the years of 2005 and 2013. Based on these previous inventories, municipal GHG emissions decreased 24% between 2005 and 2013, and 28% between 2005 and 2016 (*Figure 10-2*). Sustainability projects in Sacramento have been driven by aggressive planning efforts, including the City’s 2010 Climate Action Plan for Municipal Operations and subsequent 2016 update to that plan. The 2016 Climate Action Plan for Internal Operations documented a 24 percent reduction in GHG emissions from municipal operations between 2005 to 2013, exceeding the 2010 plan’s 2020 target by 2% and several years ahead of schedule. This CAAP serves to update and build on these efforts.

A number of sustainability projects driven by these past plans have contributed to the emissions reductions since 2005. For example, the

City has completed extensive energy efficiency retrofits throughout its buildings, including replacement of fluorescent lights with light-emitting diodes (LED), installation of solar panels, installation of high efficiency heating, ventilation, and air conditioning (HVAC) replacements, and building envelope improvements that reduced heating and cooling loads. Solar panel systems installed and operated under a Power Purchase Agreement (PPA) generate approximately 4 MWh of on-site solar power for the City each year. The City also procures 31,000 MWh of off-site solar power annually. In addition, energy efficiency projects save another ~8,000 MWh annually, significantly reducing the energy emissions associated with municipal facilities while saving money. To date, the City has also retrofitted approximately one third of the streetlights and most traffic signals in the City to LEDs, significantly reducing electricity usage in another large sector of emissions.

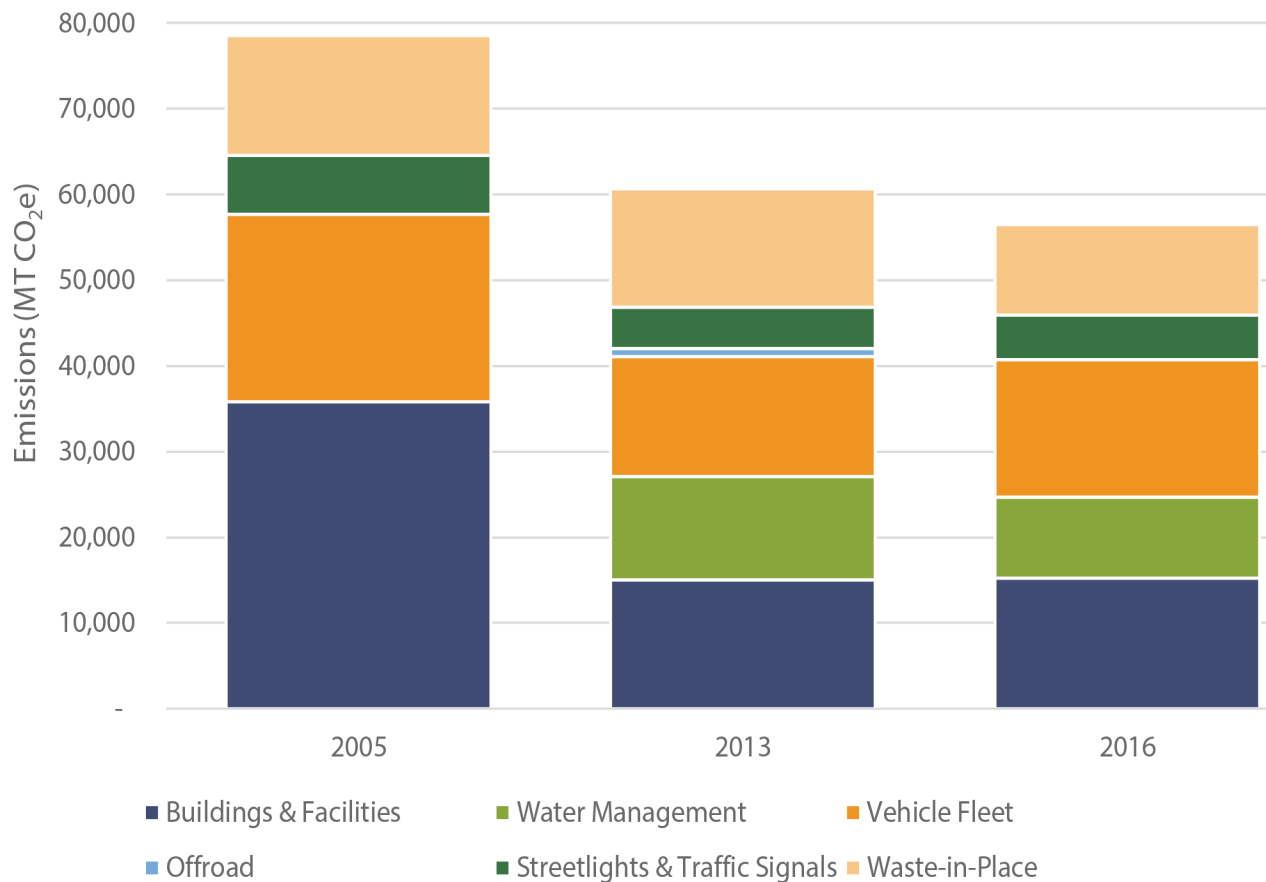
CLIMATE ACTION & ADAPTATION PLAN

As one of the first cities to significantly invest in electric vehicles (EVs), Sacramento has also taken on a variety of EV infrastructure projects including EV charger upgrades at municipal facilities. The City currently operates more than 160 EV chargers at City-owned facilities, over 100 of which are available to the public. The City also offers incentives for EV owners in Sacramento, including preferred parking in City

lots. Efforts are underway to continue growing the number of EV chargers available for both the public and municipal fleet.

Together, these actions have led to a 28% reduction in municipal emissions between 2005 and 2016, which meets the City’s GHG reduction targets for 2020 by exceeding a 22% reduction. In 2020, the City is estimated to have realized a 32% reduction based on the municipal forecast.

Figure 10-2. Municipal GHG Emissions Over Time (MT CO₂e)¹



1. Note that electricity emissions from water management were separated out from the buildings and facilities sector in 2013 and are therefore not shown separately in the 2005 inventory results.

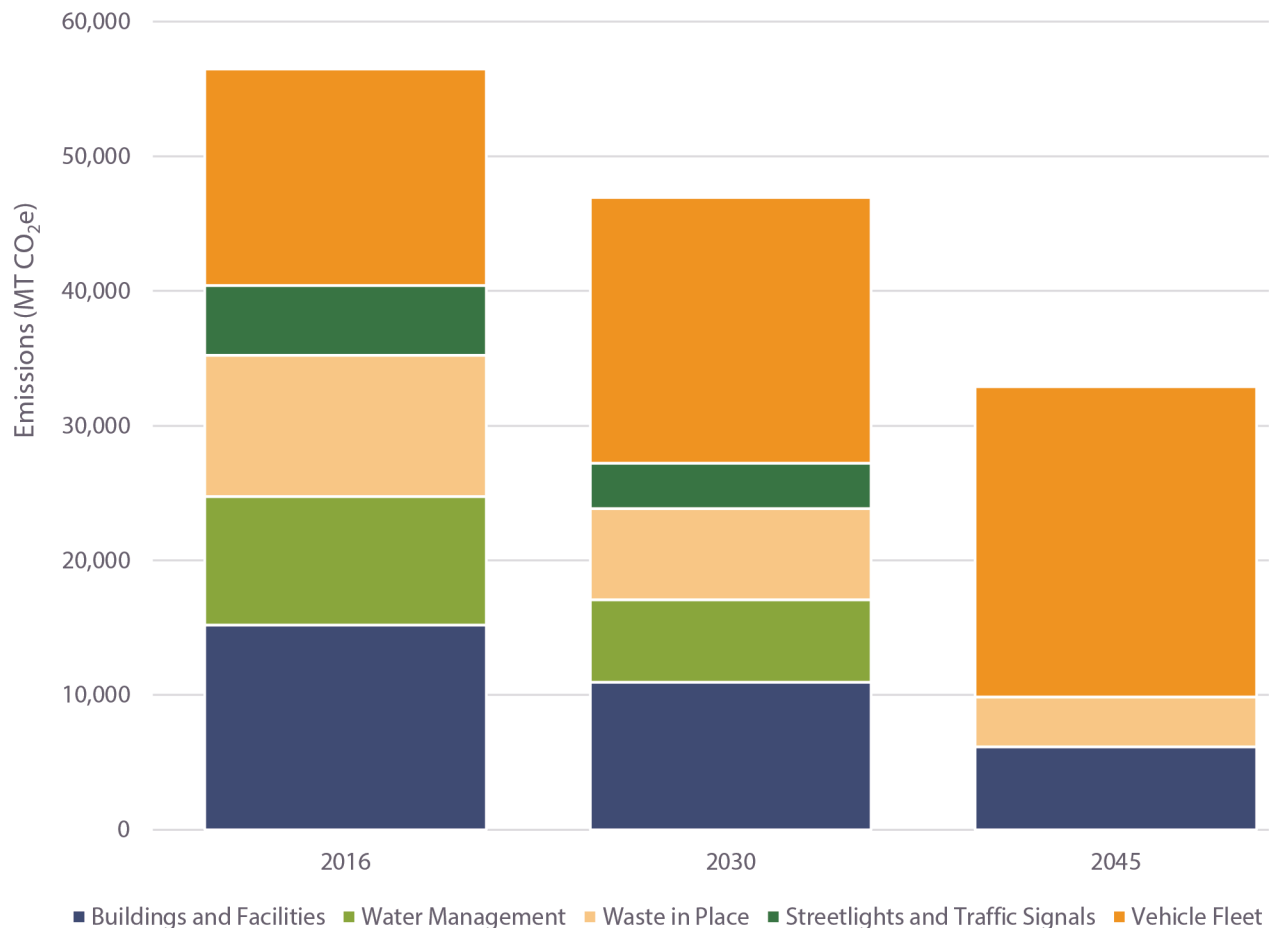


GHG EMISSIONS FORECAST

A GHG emissions forecast (Figure 10-3) was developed based on the inventory, which projects municipal emissions for 2030 and 2045 based on expected municipal operations, and the reduced carbon intensity of SMUD's electricity due to the renewable portfolio standard.² The municipal emissions forecast shows that

without additional action, municipal emissions will decrease 17% by 2030 and 42% by 2045, primarily due to expected decreases in the carbon intensity of electricity emissions required by SB 100. See Appendix F for details on the data and methods used for the municipal GHG emissions inventory and forecast.

Figure 10-3. Municipal GHG Emissions Forecast (MT CO₂e)



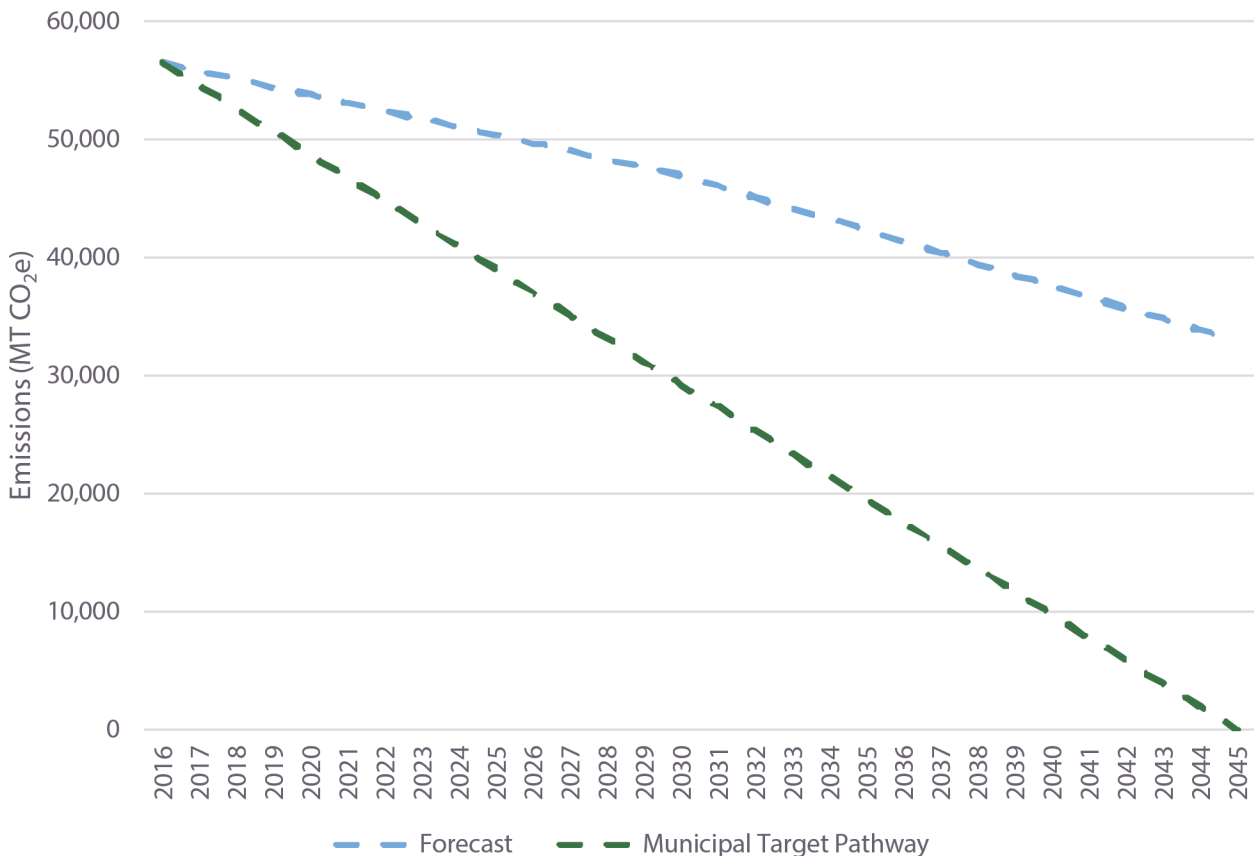
2. The forecast does not include electricity reductions expected from SMUD's Carbon-free 2030 Plan. Instead, the forecast incorporates the less aggressive reductions expected from the renewable portfolio standard, which requires utility providers to procure 100 percent renewable electricity by 2045. The additional reductions associated with SMUD's Carbon-free 2030 Plan are included in the measures and actions.

Municipal Target Pathway

Based on the inventory and forecast, the City developed a GHG emissions target pathway that mirrors the community climate action targets by planning for a linear reduction to carbon neutrality. This pathway would decrease municipal emissions by 63% from 2005 levels

by 2030 and achieve carbon neutrality by 2045.³ These targets are more aggressive than the previous targets established by the City of Sacramento Internal Operations Climate Action Plan.⁴ A comparison of the municipal target pathway and the forecast is shown in *Figure 10-4*. The gap between the target pathway and the forecast in each year is the magnitude of GHG emissions to be reduced by the City’s municipal measures.

Figure 10-4. Municipal Target Pathway (MT CO₂e)



3. While 1990 is used as a baseline for the community, there is no well-defined methodology to backcast to 1990 for municipal emissions. Therefore, a reduction from 2005 levels is commonly used for municipal target setting.

4. Accessed at: <https://www.cityofsacramento.org/Public-Works/Facilities/Sustainability/Climate-Action-Plan-for-Internal-Operations>

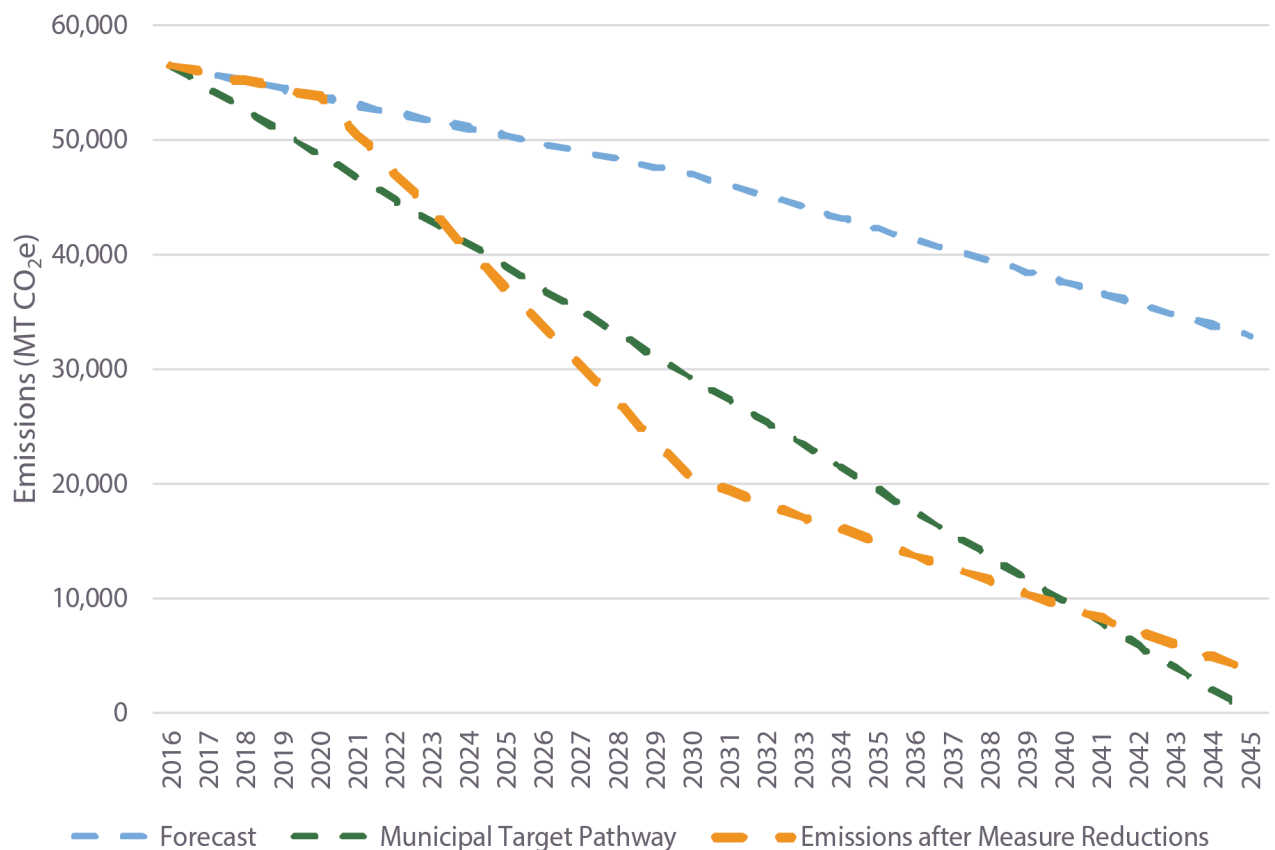


GHG Reduction Measures

The measures and actions to reduce GHG emissions for Sacramento’s municipal operations include reducing natural gas emissions in municipal facilities, transitioning fleet vehicles to EVs, developing programs to incentivize more sustainable employee commutes, encouraging employees to purchase their own EVs, prioritizing teleconferencing and telecommuting over in-person work and meetings, and

analyzing and reducing the waste stream from municipal facilities. Collectively, the municipal measures are expected to achieve a 74% reduction in municipal GHG emissions below 1990 levels by 2030, and near-zero GHG emissions in 2045 (*Figure 10-5*). Importantly, while the GHG emissions reductions from municipal measures were quantified, they were not added to the community-level GHG emissions reductions shown in *Chapter 5* due to potential for double counting. See Appendix G for details on the data and methods used to quantify GHG emissions reductions from municipal measures (MM).

Figure 10-5. GHG Emissions Reductions from Municipal Measures (MT CO₂e)



CLIMATE ACTION & ADAPTATION PLAN

Table 10-2. Municipal GHG Emissions Reductions by Measure

Measure #	Measure Description	2030 Reduction (MT CO ₂ e)	2045 Reduction (MT CO ₂ e)
MM-1	Reduce natural gas consumption 50% below 2016 levels by 2030 and 100% by 2045. Reduce electricity use 25% below 2016 levels by 2030.	3,069	6,130
MM-2	Electrify or decarbonize 100% of light-duty fleet vehicles by 2035 and 100% of municipal fleet by 2045.	9,246	23,009
MM-3	Reduce emissions from trips between City facilities occurring during the workday.	Supportive	Supportive
MM-4	Reduce municipal waste sent to landfills.	Supportive	Supportive
MM-5	Reduce emissions from water usage/conveyance and stormwater drainage (in MT of CO ₂ e per MG delivered) 100% by 2030.	6,093	0 ¹
MM-6	Improve carbon sequestration potential of municipal parks, greenspace at City properties, and street tree planters in the public right-of-way.	Supportive	Supportive
MM-7	Procure carbon-free electricity by 2030, in alignment with SMUD’s 2030 Zero Carbon Plan	8,198	0 ¹
MM-8	Reduce City employee commuter VMT.	Supportive	Supportive
MM-9	Encourage an increase in the number of employee-owned EV and plug-in hybrid electric vehicles 28% by 2030 and 100% by 2045	Supportive	Supportive
Reduction Summary			
Estimated Reductions Achieved from Full Implementation of Measures		26,540	29,139
Total Reduction Needed to Achieve Targets		17,749	32,880
Gap (or Surplus) to Target		-8,791	3,741

1. GHG emissions reductions associated with MM-5 and MM-7 are zero in 2045 because the State has required all electricity providers to procure 100% carbon-free electricity by 2045, making these emissions equal to zero in 2045.



MUNICIPAL MEASURE 1: Reduce natural gas consumption 50% below 2016 levels by 2030 and 100% by 2045. Reduce electricity use 25% below 2016 levels by 2030

Municipal Measure 1 (MM-1) reduces natural gas consumption in municipal buildings and facilities through a commitment to electrification, energy efficiency, and on-site renewable energy. This aligns with the CAAP's electrification strategy for the community and allows the City to lead this effort by demonstrating the feasibility of electrification projects. Currently, about 25% of the 400 plus energy accounts serving Sacramento's municipal buildings, facilities, and infrastructure use natural gas as an energy source. In order for the City to contribute its part in reaching carbon neutrality on a community-wide level, the majority of the City's building stock will need to be carbon neutral. Electrification allows buildings to use the 100% carbon neutral electricity that will be provided by SMUD by 2030 through the 2030 Zero Carbon Plan. Installing on-site renewable energy projects further facilitates electrification by increasing the local grid's resiliency. This measure ensures (1) that new municipal buildings will be built 100% electric so that they will not need to be retrofitted later, (2) that old municipal buildings will be retrofitted on as fast a timeline as possible, and (3) decreases municipal building emissions to the extent feasible while they are not electric to achieve 2030 GHG emission targets.

SUCCESS IN ACTION:

Sacramento's 2035 General Plan committed the City to reducing energy consumption 25% below 2005 levels by 2030. In line with this goal, the City completed lighting retrofits on 21 community centers, club houses, and libraries in 2019. Lighting retrofit projects are estimated to save the City over \$261,000 per year. Due to these and other energy efficiency retrofits, the City achieved a 34% decrease in energy consumption in 2019, far exceeding the 2035 General Plan energy consumption target. This corresponds to a savings of 366,000 therms of natural gas and 54,084 MWh of electricity per year.

Expected GHG Reductions

- **2030:** 3,069 MT CO₂e
- **2045:** 6,130 MT CO₂e

CLIMATE ACTION & ADAPTATION PLAN

Actions and Implementation

Action	Lead	Support
MM-1.1: Electrification – Implement an “electric first” commitment for building projects and major retrofits.	Public Works	
MM-1.2: Building Retrofits – Develop a strategy to transition 100% of existing municipally owned and controlled buildings and facilities to electric by 2045 through expansion of the City’s Energy Efficiency Reinvestment Program. This includes auditing remaining City facilities, establishing a retrofit project pipeline of fundable projects prioritized based on opportunities to reduce energy costs and eliminate natural gas, developing a phase-out plan for each piece of natural gas equipment, and creating an internal revolving loan fund for City facility retrofits.	Public Works	
MM-1.3: SolarShares - Maintain participation in SolarShares for off-site solar photovoltaics to offset at least 35% of municipal power in 2030.	Public Works	Utilities
MM-1.4: Streetlights - Retrofit all post-top streetlights to LED and remaining streetlights as feasible by 2030.	Public Works	
MM-1.5: Municipal Green Building Policy - Update the Municipal Green Building Policy to include all-electric retrofits at time of replacement and prohibit new cogeneration in buildings.	Public Works	
MM-1.6: Generator Phase-out - Evaluate the feasibility of phasing out diesel generators by 2033 by replacing them with solar and storage to provide backup power for buildings. Utilize renewable diesel requirements for existing generators in the short-term if needed.	Public Works	





Action	Lead	Support
MM-1.7: Solar - Expand on-site production of renewable power and develop energy storage technologies for critical operations.	Public Works	
MM-1.8: Battery Storage Pilot Project - Identify a site and construct a battery storage pilot project as well as encourage pairing battery storage systems with all solar PV system installations. Specify that the battery uses GHG emissions for arbitrage rather than rates to increase GHG reduction potential.	Public Works	
MM-1.9: Microgrid Pilot Project - Identify a site and construct a microgrid pilot project preferably for a critical facility like a fire station.	Public Works	Fire Department
MM-1.10: Energy Management - Install and utilize energy management software in existing and new buildings in order to allow for building monitoring, responsive repairs, and assessment of long-term energy trends. Provide trainings on software to facilities management.	Public Works	
MM-1.11: Electrification Study – Conduct an electrification study to identify sources of natural gas and diesel which can be eliminated/switched at time of replacement.	Public Works	
MM-1.12: Additional Resources – Identify additional resources (money and staffing) to assist with implementation of Municipal Measure 1.	Public Works	



Photo by Carlos Eliason

MUNICIPAL MEASURE 2: Electrify or decarbonize 100% of light-duty fleet vehicles by 2035 and 100% of municipal fleet by 2045

MM-2 establishes a plan to transition the City's vehicle fleet to ZEVs. This aligns with the CAAP's electrification strategy for the community and allows the City to lead this effort by demonstration. Electrifying the vehicle fleet will reduce the City's dependence on fossil fuels and reduce and eventually eliminate GHG emissions from vehicles due to SMUD's commitment to provide carbon free electricity by 2030. The City of Sacramento will electrify the vehicle fleet in a phased approach through the City's Fleet Sustainability Policy, which establishes a "ZEV-first commitment." The City will start with light-duty vehicles and will include medium- and heavy-duty vehicles as the technology becomes available. Currently, the City's fleet of 2,433 units is comprised of 2,179 on-road vehicles and 254 off-road vehicles. A total of 1,632 units (roughly 67% of the fleet) are less than 10 years old, while the remainder of the fleet, numbering 801 units (15% of the fleet), is more than 15 years old and could be replaced with ZEVs prior to 2025 where technologies allow.

SUCCESS IN ACTION:

The City of Sacramento received the designation of #1 government green fleet in the nation in 2019, reflecting the City's long-term commitment to ZEV adoption. Currently, 7.1% of the City's light-duty vehicles are ZEVs, including electric and plug-in hybrids, while still more are cleaner fuel alternatives, including renewable diesel, natural gas, hybrid, and ethanol-powered vehicles. The City's fleet size has reduced 18% since 2010 and fleet fuel consumption reduced 3.7% between 2017 and 2018.

Expected GHG Reductions

- **2030:** 9,246 MT CO₂e
- **2045:** 23,009 MT CO₂e



Actions and Implementation

Action	Lead	Support
MM-2.1: ZEV First – Continue to implement the City’s adopted “Zero-emission Vehicle First” policy that directs City departments to purchase ZEVs and develop a plan to convert 100% of all light-duty vehicles in the City’s fleet to ZEVs by 2035 while forging partnerships with manufacturers to pilot medium and heavy-duty ZEVs.	Public Works	All
MM-2.2: Renewable Diesel and Alternatives – Continue to use renewable diesel in all diesel fleet vehicles.	Public Works	
MM-2.3: EV Chargers – Install EV charging infrastructure across City-owned facilities for fleet, motor pool vehicles, and personal vehicle fueling.	Public Works	
MM-2.4: Hybrid Phase-in – Replace all expiring mid-size vehicles and trucks with hybrid models if no all-electric alternative is available.	Public Works	
MM-2.5: Anti-idling Policy – Expand and enforce existing anti-idling policies on all City vehicles.	Public Works	



Amtrack Station

Photo by Carlos Eliason

CLIMATE ACTION & ADAPTATION PLAN

MUNICIPAL MEASURE 3: Reduce emissions from work-related trips by City employees

MM-3 contains strategies for reducing vehicle trips between City facilities, including prioritizing teleconferencing and telecommuting over in-person meetings or on-site office work as feasible and encouraging active and public transportation. Although employee commute trips are not captured in the City’s municipal GHG inventory, these are important supportive measures that model the broader city-wide

workplace shifts that support community reduction measures. The mechanism through which the City plans to avoid unnecessary trips is through incentive programs for employees and by institutionalizing work-from-home as a default option for many employees.

Expected GHG Reductions

- Supportive

Actions and Implementation

Action	Lead	Support
MM-3.1: Teleconferencing and Telecommuting – Promote video conferencing and telecommuting in place of in person meetings or working in the office when possible.	Human Resources	All Departments
MM-3.2: Vehicle Trips – Reduce vehicle trips for City business by encouraging active transportation modes, transit, and carpooling. Award points or have a program to encourage staff to take active and transit modes. Have a prize drawing quarterly to further incentivize adoption.	Human Resources	All Departments
MM-3.3: Bikepools – Expand incorporation of bicycles (including electric bicycles) into City motor pool fleet for employees to use for work-related business.	Public Works	All Departments



MUNICIPAL MEASURE 4: Reduce municipal waste sent to landfills

MM-4 establishes a program to reduce waste and waste-related emissions associated with municipal facilities. MM-4 focuses on organic waste, in alignment with the CAAP’s focus on implementing SB 1383 and community-wide reductions in organic waste. The City will lead the community-wide effort to reduce and divert organic waste through new composting

and recycling programs and employee education programs. The City does not currently track its waste output; however, MM-4.1 directs the City to conduct a waste audit and develop a plan for reducing waste going forward.

Expected GHG Reductions

- Supportive

Actions and Implementation

Action	Lead	Support
MM-4.1: Assess new technologies and the recyclables market periodically to determine the feasibility of reusing or recycling the most challenging portions of the City’s waste stream and developing a zero-waste plan for City facilities.	Public Works	
MM-4.2: Compost and Recycling for Buildings - Ensure organics recycling collection services are available in all owned facilities, as well as ensure its availability in all future occupied facilities.	Finance	
MM-4.3: Employee Outreach – Run online and in person outreach and educational events that encourage waste diversion among City employees, including the creation of a training around compost and recycling in City Facilities to be taken by all new hires during their onboarding process.	Human Resources	All Departments as appropriate
MM-4.4: Centralization – End deskside collection of garbage by custodial, and switch instead to combined organics, recycling and garbage stations.	Finance	

CLIMATE ACTION & ADAPTATION PLAN

Action	Lead	Support
MM-4.5: Update the City’s Sustainable Purchasing Policy which mandates procurement of items which have substantial quantities of recycled or reused content and are recyclable, reusable or compostable themselves.	Finance	
MM-4.6: Develop and implement a plan for procuring compost, mulch, and renewable natural gas in alignment with SB 1383 requirements and using these materials for City facilities and operations.	Finance	Youth, Parks, and Community Enrichment



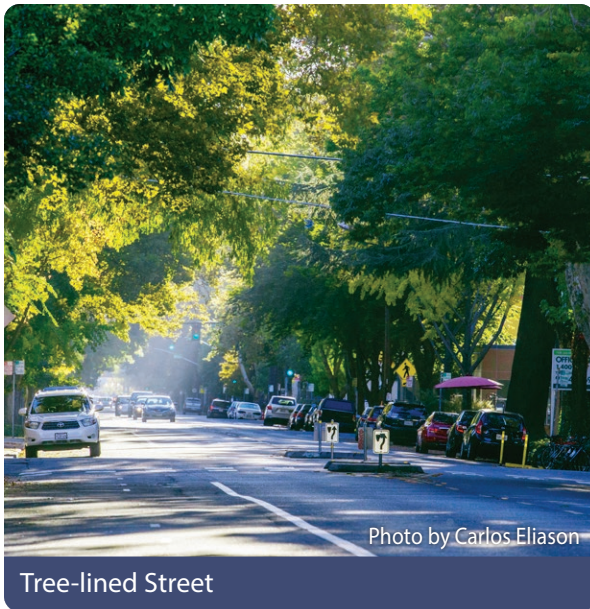
Photo by Carlos Eliason

Farmers Market



MUNICIPAL MEASURE 5: Reduce emissions from water usage/conveyance and stormwater drainage (in MT of CO₂e per MG delivered) 100% by 2030

MM-5 provides a strategy to reduce utility-related emissions associated with water usage at municipal buildings and facilities, including transitioning to 100% carbon-free electricity for water conveyance and stormwater drainage. Because water and wastewater conveyance and stormwater drainage are necessary services that the City will continue to provide through 2045 and beyond, the only way to reduce emissions in this sector is to reduce the carbon intensity of the electricity used, by adding more renewable resources—through purchase or direct construction—to the grid mix. In 2017, water management accounted for almost 20% of overall emissions and is therefore a key emissions sector to address.



SUCCESS IN ACTION:

The City has enacted multiple water conservation best practices over the past decade. 100% of Sacramento residences and businesses are connected to Advanced Metering Infrastructure data, providing real-time water use data online so that building owners and City staff can track water usage and quickly respond to leaks and water waste. In 2019, the Department of Utilities and the Department of Public Works partnered to retrofit toilets and urinals in municipal facilities in 2019, a project that has saved 309,000 gallons of water every year. Additionally, the Department of Utilities, Department of Public Works, and the Department of Youth, Parks, and Community Enrichment are partnering to increase waterwise landscaping on streetscapes.

Expected GHG Reductions

- **2030:** 6,093 MT CO₂e
- **2045:** 0 MT CO₂e

CLIMATE ACTION & ADAPTATION PLAN

Actions and Implementation

Action	Lead	Support
MM-5.1: Purchase 100% carbon-free electricity for water conveyance and stormwater drainage needs.	Utilities	
MM-5.2: Investigate deployment of on-site solar and storage projects to increase resiliency of critical water and stormwater infrastructure.	Utilities	Public Works
MM-5.3: Continue to implement and track low water use landscapes (native and drought tolerant plants) for new park development per YPCE Strategic Plan Policy 2.5d and e, and the Model Water Efficiency Landscape Ordinance.	Youth, Parks, and Community Enrichment	Utilities
MM-5.4: Evaluate the feasibility of converting sports fields to synthetic turf and add new synthetic fields where possible.	Youth, Parks, and Community Enrichment	
MM-5.5: Continue to evaluate the existing watering/irrigation schedule and determine what water reduction strategies can be implemented per YPCE Strategic Plan Policy 2.5d and e. Examples include reducing the number of watering days and watering in the evening to reduce evapotranspiration.	Youth, Parks, and Community Enrichment, Public Works	Utilities





Action	Lead	Support
<p>MM-5.6: Optimize the efficiency of irrigation control systems by training staff how to correctly use them. YPCE will inventory EPA WaterSense certified Smart Irrigation Controllers and host trainings to ensure that the appropriate staff learn how to operate each controller to improve the management, use, reporting, and data analysis of the irrigation control systems.</p>	<p>Youth, Parks, and Community Enrichment</p>	<p>Utilities</p>
<p>MM-5.7: Continue to report for the Model Water Efficient Landscape Ordinance each year. YPCE will work with the Community Development Department and the Department of Utilities to submit the Model Water Efficient Landscape Ordinance Implementation Annual Report every January.</p>	<p>Youth, Parks, and Community Enrichment</p>	
<p>MM-5.8: Continue investigation of energy efficiency improvements of water utility operations and systems and continue to improve the energy efficiency of utility pumps and water treatment plants.</p>	<p>Utilities</p>	
<p>MM-5.9: Water Conservation Inspections for City Facilities: Include landscape irrigation inspections in water conservation inspection and provide educational materials/media for building maintenance staff on how maintain landscape irrigation and track and set leak alerts for buildings.</p>	<p>Utilities</p>	<p>Departments facilities</p>



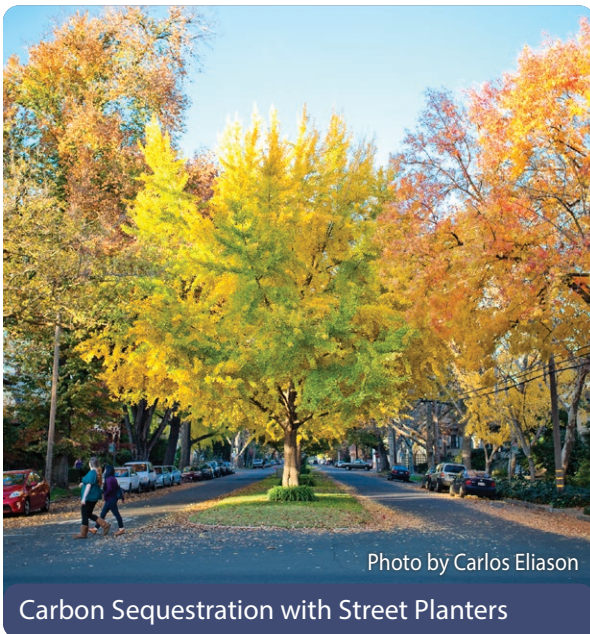
Photo by Carlos Eliason

MUNICIPAL MEASURE 6: Improve carbon sequestration potential of municipal parks, greenspace at City properties, and street tree planters in the public right-of-way

MM-6 provides a strategy to improve the carbon sequestration potential of open space and parks owned or maintained by the City, including the installation of low-water use landscapes, and replacing high-water use species with low water-use species where feasible. This measure is designed to reap the ecological and carbon sequestration benefits of plants, compost, and soils while minimizing increased water usage through water efficient landscaping. As new carbon sequestration opportunities and technologies emerge, such as carbon sequestration in hardscape materials, the City will implement additional actions beyond those identified below.

SUCCESS IN ACTION:

Sacramento is designated as one of the densest human-planted urban forests in the world and one of the best urban forests in the nation. The City currently boasts approximately 19 square miles of tree canopy and maintains approximately 100,000 public trees. Sacramento's tree canopy currently stores more than 1.5 million tons of CO₂ and provides approximately \$4.5 million in annual benefits due to reduced air pollution, reduced stormwater runoff, and sequestered carbon. Since 2018, the Department of Youth, Parks, and Community Enrichment has planted over 2,000 new trees, converted 3.5 acres of turf to low water-use landscaping, and constructed 10 new parks that meet or exceed the State- and City-adopted Model Water Efficient Landscape Ordinance. The City is also an active participant in the Global Cool Cities Coalition.



Expected GHG Reductions

- Supportive



Actions and Implementation

Action	Lead	Support
MM-6.1: Evaluate existing park turf areas for conversion to low water use landscapes using non-irrigated, drought tolerant, or mulched landscaping.	Youth, Parks, and Community Enrichment; Public Works	
MM-6.2: For passive recreation areas, continue to reduce landscape water usage with low-water use plants, compost, and landscape design that emphasizes drought tolerant plants and mulch areas.	Youth, Parks, and Community Enrichment	Public Works
MM-6.3: Investigate and explore options for carbon sequestration at City facilities such as through carbon sequestration in materials for construction and hardscapes or soil health restoration projects.	Youth, Parks, and Community Enrichment	Public Works



McKinley Park

CLIMATE ACTION & ADAPTATION PLAN

MUNICIPAL MEASURE 7: Procure carbon-free electricity by 2030

MM-7 aligns with SMUD’s 2030 Zero Carbon Plan which will provide the City with 100% carbon-free electricity by 2030. While there are no specific municipal actions listed, the City will support SMUD in the implementation of the 2030 Zero Carbon Plan as highlighted in the community actions (*Chapter 6*). This measure directly supports additional GHG emissions reductions from MM-1 by driving to zero the electricity emissions that would otherwise be added from new all-electric equipment.

SUCCESS IN ACTION:

Past efforts to procure carbon-free electricity for Sacramento have included installations of over 4 MW of on-site solar power. About 35% of the City’s municipal power currently comes from on-site solar or community solar through the SolarShares program. The SolarShares program generated 4,190 MWh of community solar power in 2019.

Expected GHG Reductions

- **2030:** 8,198 MT CO₂e
- **2045:** 0 MT CO₂e

Actions and Implementation

Action	Lead	Support
MM-7.1: Procure carbon-free electricity for municipal operations by 2030.	Office of Climate Action & Sustainability	All Departments as appropriate



MUNICIPAL MEASURE 8: Reduce City employee commuter VMT

While employee commute is not included in the municipal GHG emissions inventory, the City chose to establish employee commute VMT reduction goals going forward to set an example for community-wide VMT reduction. MM-8 establishes various incentives, including financial incentives and programs to encourage municipal employees to reduce their commute VMT. This measure ensures the City and its employees are doing their fair share towards reducing VMT in the community, providing leadership through demonstration. A 2021 survey of 600 City employees found that

nearly 90% of respondents drove to work alone before the COVID-19 pandemic and that 77% commuted between 12-20 miles round trip each workday. While the City cannot require employees to choose alternate commuting methods, MM-8 will help promote alternative options and incentives to City employees to choose transportation modes other than single-occupancy vehicles to commute to work and actively reduce their own VMT.

Expected GHG Reductions

- Supportive

Actions and Implementation

Action	Lead	Support
MM-8.1: Establish a Transportation Demand Management program for City employees.	Human Resources	All Departments as appropriate
MM-8.2: Survey City staff to determine baseline commute data. Conduct a new survey every 2 years.	Human Resources, Information Technology	
MM-8.3: Conduct internal outreach to educate staff on available incentives and solicit feedback on which options work best and how to improve incentives/reduce hurdles to implementation.	Human Resources	
MM-8.4: Paid Time Off Rewards Program – Implement a sustainable commute rewards program rewarding employees with time off for using alternative modes of transportation.	Human Resources	
MM-8.5: Pre-Tax Commuter Benefit – Continue providing pre-tax commuter benefits for transit commuters and encourage use of commuter benefits for bicycle commuters as allowed by federal law.	Human Resources	

CLIMATE ACTION & ADAPTATION PLAN

Action	Lead	Support
MM-8.6: Parking Cash-out – Engage with labor partners to explore alternatives to traditional employee commute provisions such as City-provided parking and parking stipends, and instead incentivize carpooling, public transit, and active transportation.	Human Resources	
MM-8.7: Dynamic Ridematch – Promote the regional carpool matching platform that allows employees to request carpool with peers on days and times when they are needed.	Human Resources	
MM-8.8: Remote work – Promote and support working remotely for employees where possible by encouraging it for office employees as appropriate, by providing necessary equipment, training, and encouraging all meetings (when possible) to be set up for web conferencing so that people who aren’t physically in the room can attend. Allow for hybrid work-from-home schedules to increase flexibility for employees.	Human Resources	Information Technology



Photo by Carlos Eliason

Bicycle Commuters



MUNICIPAL MEASURE 9: Encourage an increase in the number of employee-owned EV and plug-in hybrid electric vehicles 28% by 2030 and 100% by 2045

MM-9 establishes financial incentives and a commitment to increased EV infrastructure at municipal facilities to encourage City employees to transition from fossil fuel-powered personal vehicles to EVs. This measure will also help the City to determine the major hurdles to EV adoption among City employees, from which the City can develop additional courses

of action. This measure ensures the City and its employees are doing their fair share towards transitioning to electric vehicles in the community, providing leadership through demonstration.

Expected GHG Reductions

- Supportive

Actions and Implementation

Action	Lead	Support
MM-9.1: EV Chargers – Implement the 2017 EV Strategy directive to meet or exceed CALGreen Tier 2 standards for EV chargers, and transition existing facilities to provide EV charging capacity as feasible.	Public Works	All
MM-9.2: Commuting Surveys – Conduct a survey of City Staff to determine how staff commute to work, what kinds of vehicles they own, and what hurdles they face in purchasing EVs. Conduct a new survey every 2 years.	Human Resources, Information Technology	
MM-9.3: EV Rebates – Provide information to all City staff about local, State, and federal rebates annually. Include lifecycle and maintenance cost information of EV ownership.	Human Resources	



APPENDICES



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SACRAMENTO
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WARNING
GET BEYOND GATE
WHEN BELL RINGS

GATE

EMBASSY SUITES



City of Sacramento Climate Action and Adaptation Plan

Appendix A - Community GHG Emissions Inventory and Forecast

prepared by

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June 2022

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1 Introduction

California considers greenhouse gas emissions (GHG) and the impacts of climate change to be a serious threat to the public health, environment, economic well-being, and natural resources of the State, and has taken an aggressive stance to mitigate the impact on climate change at the State-level through the adoption of legislation and policies. Many cities have developed local climate action plans and aligned goals to correspond with State emissions reduction targets. The two major State GHG-related goals are established by Assembly Bill (AB) 32 and Senate Bill (SB) 32. AB 32 required State agencies reduce State GHG emissions to 1990 levels by 2020 whereas SB 32 requires a 40 percent reduction below 1990 levels by 2030. The goals set by AB 32 were achieved by the State in 2016¹ and many jurisdictions are completing GHG inventories to quantify progress toward their own 2020 goals as well as develop targets to align with the requirements of SB 32.

This technical appendix provides a complete analysis of the previous community-wide GHG emissions inventories completed for the City of Sacramento's 2005 and 2011² emissions as well as details on the methodology used for the 2016 inventory update which is also used as the baseline for the forecasting process. Emissions are forecast for the years 2020, 2025, 2030, 2040, and 2045 to align with State and City targets.

Estimating GHG emissions enables local governments to establish an emissions baseline, track emissions trends, identify the greatest sources of GHG emissions within their jurisdictions, and set targets for future reductions. This inventory is intended to inform completion of a qualified GHG reduction plan for the City of Sacramento and is compliant with the ICLEI – Local Governments for Sustainability (ICLEI) *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions*³ (Community Protocol) as well as California Environmental Quality Act (CEQA) Guidelines Section 15183.5(b) for the requirements of a 'qualified' GHG emissions reduction plan. Methodology for some sections has been updated slightly to conform with the industry standard for California cities as recommended in the Association for Environmental Professionals (AEP) *California Supplement to the United States Community-Wide GHG Emissions Protocol*⁴ (California Supplement). Emissions inventories are an iterative process, and each year must be viewed in the context of other inventories and relative trends of each sector to maintain consistency with the emissions inventory methods and factors.

GHG emissions contained within this inventory include activities under the jurisdictional control or significant influence of the City of Sacramento, as recommended by AEP in preparing Community Protocol and CEQA-compliant inventories.⁴ The municipal operations inventory is a subset of the community-wide inventory, meaning the municipal emissions are included within the community-wide inventory. These municipal emissions calculations and forecast are included in a separate technical appendix.

¹ California Air Resources Board. California Greenhouse Gas Emissions Inventory. Accessed at: <https://ww2.arb.ca.gov/ghg-inventory-data>. Accessed on: July 2019

² Portions of the 2011 inventory were extrapolated based on growth from 2005 levels and therefore all sectors may not be comparable.

³ ICLEI. 2013. U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1

⁴ Association of Environmental Professionals. 2013. The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Protocol.

1.1 Executive Summary

The City of Sacramento has completed a GHG inventory for the 2016 calendar year to measure progress toward its 2020 GHG reduction goals as set in the first City of Sacramento Climate Action Plan⁵ and assist in the development of an updated plan by developing a forecast and gap analysis to identify climate action plan policies that will be needed to achieve longer term targets. SB 32⁶ established 2030 as the next major milestone of GHG reduction targets. The 2016 City of Sacramento inventory was used to develop a forecast to assist the City in setting targets which are consistent with State-level goals and the City of Sacramento General Plan which is currently being updated. Two projections were developed for the City to quantify expected emissions over time: a *business-as-usual scenario* and an *adjusted scenario*.

A summary of the 2016 GHG emissions by sector is provided in Table 1 with a discussion of the inventory methodology and detailed results in Section 3. A summary of the emissions forecast by year through 2045 is provided in Table 4 with further discussion in Section 4.

Table 1 2016 GHG Inventory

Sector	Activity Data	Emission Factors	Units	Emissions (MT CO ₂ e)
Residential Electricity (kWh)	1,423,419,583	0.000224	MT CO ₂ e/kWh	318,275
Residential Gas (therms)	59,977,656	0.00531	MT CO ₂ e/therm	318,304
Industrial and Commercial Electricity (kWh)	2,191,180,705	0.00022	MT CO ₂ e/kWh	489,945
Commercial Gas (therms)	28,980,911	0.00531	MT CO ₂ e/therm	153,803 ¹
District Gas (therms)	3,432,409	0.00531	MT CO ₂ e/therm	18,216 ¹
Transportation (VMT)	4,347,013,534	0.000445	MT CO ₂ e/mile	1,935,870
Generated Waste (tons)	525,968	0.255412	MT CO ₂ e/Ton	134,339
Waste-In-Place	N/A ²	N/A ²	MT CO ₂ e/Ton	26,504
Wastewater (kWh)	N/A ³	N/A ³	MT CO ₂ e/kWh	19,867
Water (kWh)	42,963,998	0.00022	MT CO ₂ e/kWh	9,607
Total Emissions				3,424,729

¹ No natural gas usage was reported for large industrial users due to California Public Utilities Commission privacy rules. The remaining industrial usage is from Pacific Gas & Electric "district" users.

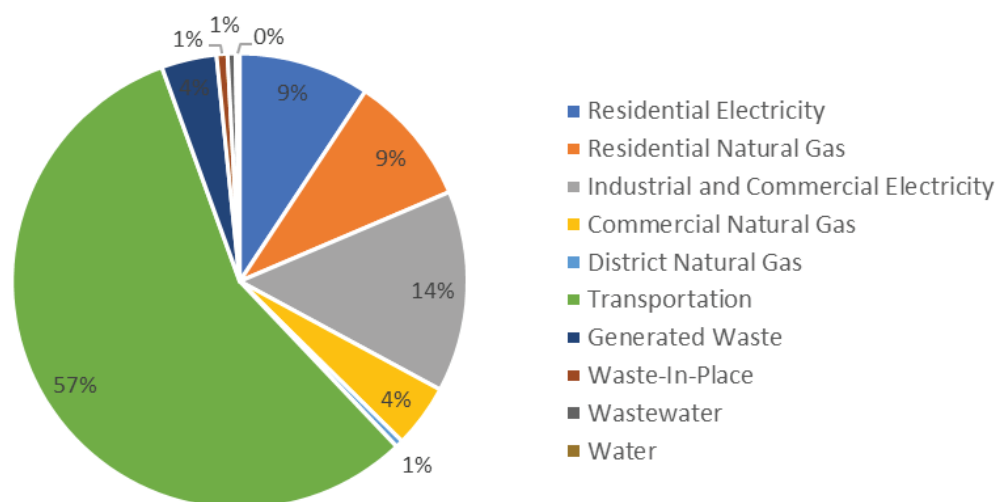
² Waste-in-place is a direct output of a landfill gas modeling system and does not have activity data

³ Wastewater is a combination of stationary and process emissions, further detail is Section 3.3.

MWh = megawatt hours; kWh = kilowatt hours; CO₂e = carbon dioxide equivalent; MT = metric tons; VMT = vehicle miles traveled

⁵ City of Sacramento. 2012. City of Sacramento Climate Action Plan. Accessed at http://www.cityofsacramento.org/~media/Corporate/Files/CDD%20Resources/Online%20Library/CAP%20Climate%20Action%20Plan/3_Chapter_1_Intro%20CAP.pdf Accessed on: June 2019

⁶ Senate Bill 32 requires the State of California to reduce its overall greenhouse gas emissions 40 percent from 1990 levels by 2030.

Figure 1 2016 City of Sacramento Community Emissions by Sector**Table 2 Summary of Emissions Changes from 2005 to 2016**

Sector	2005 Emissions (MT CO ₂ e)	2016 Emissions (MT CO ₂ e)	Percent Change
Residential Electricity	365,319	318,275	-13%
Commercial/Industrial Electricity	624,811	489,945	-22%
Residential Gas	348,859	318,304	-9%
Commercial/District Gas	186,527	172,019	-8%
Waste	455,222	160,843	-65%
Water	12,810	9,607	-25%
Wastewater	57,380	19,867	-65%
Transportation	2,184,617	1,935,870	-11%
Total Emissions	4,235,545	3,424,729	-19%
Per Capita Emissions (MT CO₂e/person)	9.57	7.25	-26%

MT CO₂e = metric tons of carbon dioxide equivalent

Since 2005 the City of Sacramento has reduced overall emissions by 19 percent and has seen emissions reductions in every sector as seen in Table 2. Major reductions were seen in the waste sector and wastewater sectors although these sectors make up smaller proportions of the City's overall emissions. Reductions in the natural gas sector were driven primarily by a reduction in gas consumption whereas emissions reductions in the electricity and transportation sectors were driven entirely by reductions in emission factors and saw increases in activity data as shown in Table 3. During this time the City saw an increase in population of 10 percent which resulted in a 26 percent reduction in per capita emissions from 2005 to 2016. This translated to a 19 percent reduction in total GHG emissions from 2005 to 2016. This reduction exceeds the emission reduction target of 15 percent below 2005 levels by 2020 and therefore, if emissions do not increase over the next four years, the 2020 CAP target is expected to be met.

Table 3 Summary of Activity Data Changes from 2005 to 2016

Raw Activity Data	2005 Activity Data	2016 Activity Data	Percent Change
Population	442,662	472,692	7%
Residential Electricity (kWh)	1,307,301,693	1,423,419,583	9%
Residential Gas (therms)	65,698,581	59,977,656	-9%
Commercial Electricity (kWh)	2,235,898,207	2,191,180,705	-2%
District Industrial Gas (therms)	5,339,537	3,432,409	-36%
Commercial Gas (therms)	29,788,020	28,980,911	-3%
Wastewater (kWh)	N/A	99,541,452	N/A
Water (kWh)	N/A	42,963,997.60	N/A
Waste (tons)	684,088	525,968	-23%
VMT (miles)	4175278800	4,347,013,534	-15%
VMT Emission Factor (MT CO ₂ e/mile)	0.000523	0.000445	-13%
SMUD Emission Factor (MT CO ₂ e/MWh)	0.279	0.224	-20%

MT CO₂e = metric tons of carbon dioxide equivalent; kWh = kilowatt hours; MWh = megawatt hours; VMT = vehicle miles travelled

A *business-as-usual (BAU)* forecast provides a forecast of how GHG emissions would change over time if consumption trends continue as they did in 2016 and growth were to occur as projected in the City's current General Plan, absent any regulations which would reduce local emissions. The results of the (BAU) scenario are shown in Table 4. Additional discussion on the Business-as-Usual Forecast is included in Section 4.2.

A more informative metric for future emissions is the adjusted forecast. An adjusted forecast incorporates State and federal programs which are currently codified and are expected to continue being implemented through 2045, such as SB 100 and California Air Resources Board (CARB) tailpipe emissions standards. This forecast provides a more accurate picture of future emissions growth and the emissions reduction the City and community will be responsible for after State regulations are implemented. Calculating the difference between the adjusted scenario GHG emissions forecast and the reduction targets set by the City determines the gap to be closed through City Climate Action Plan policies. The results of the adjusted scenario forecast are included in Table 5 and Figure 2.

Table 4 Business-as-Usual Forecast Summary by Sector by Year

Sector	2016 Emissions (MT CO ₂ e)	2020 Emissions (MT CO ₂ e)	2025 Emissions (MT CO ₂ e)	2030 Emissions (MT CO ₂ e)	2040 Emissions (MT CO ₂ e)	2045 Emissions (MT CO ₂ e)
Population	472,692	507,587	551,206	594,824	668,786	697,764
Jobs	308,724	324,910	345,142	365,374	403,933	421,435
Residential Electricity	318,275	341,770	371,140	400,509	450,309	469,821
Commercial/Industrial Electricity	489,945	515,632	547,740	579,848	641,041	668,817
Residential Gas	318,304	341,801	371,174	400,546	450,350	469,864
Commercial/District Gas	172,019	181,037	192,310	203,584	225,068	234,820
Waste	160,843	171,357	184,500	197,643	220,803	230,371
Water	9,607	10,235	11,020	11,805	13,188	13,759
Wastewater	19,867	21,166	22,789	24,412	27,273	28,455
Transportation	1,935,870	1,975,873	2,025,876	2,075,879	2,175,885	2,226,350
Total Emissions	3,424,729	3,558,871	3,726,548	3,894,225	4,203,918	4,342,257
Per Capita Emissions (MT CO₂e/person)	7.25	7.01	6.76	6.55	6.29	6.22

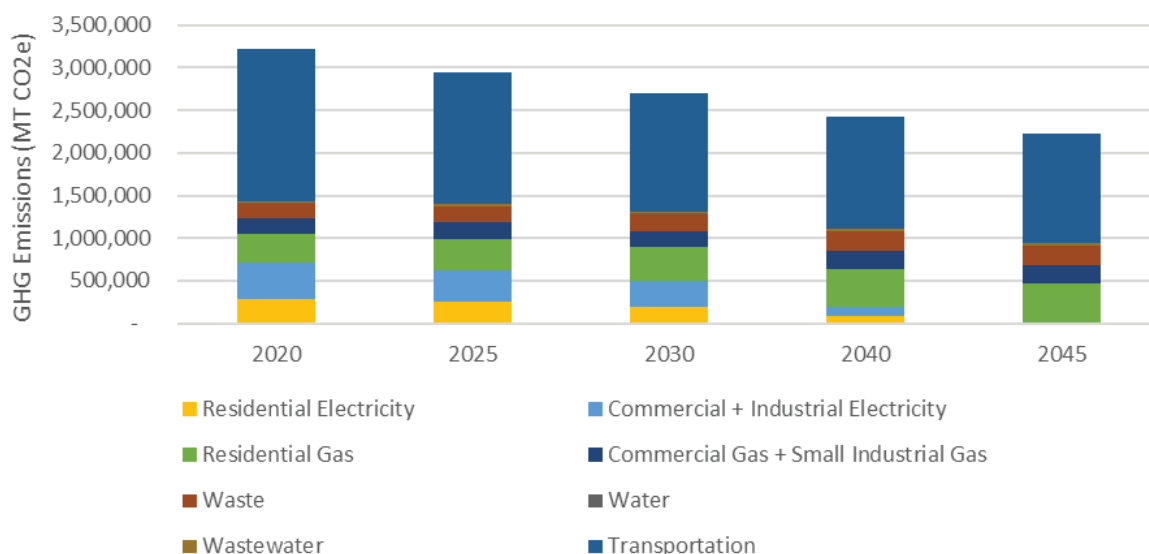
MT CO₂e = metric tons of carbon dioxide equivalent

Table 5 Adjusted Forecast Summary by Sector by Year

Sector	2016 Emissions (MT CO ₂ e)	2020 Emissions (MT CO ₂ e)	2025 Emissions (MT CO ₂ e)	2030 Emissions (MT CO ₂ e)	2040 Emissions (MT CO ₂ e)	2045 Emissions (MT CO ₂ e)
Population	472,692	507,587	551,206	594,824	668,786	697,764
Jobs	308,724	324,910	345,142	365,374	403,933	421,435
Residential Electricity	318,275	283,625	246,723	195,341	77,934	0
Commercial/Industrial Electricity	489,945	430,228	375,327	297,950	120,298	0
Residential Gas	318,304	341,390	368,706	396,022	442,341	460,488
Commercial/District Gas	172,019	180,361	188,252	196,143	211,183	218,009
Waste	160,843	171,357	184,500	197,643	220,803	230,371
Water	9,607	8,572	7,714	6,296	2,638	0
Wastewater	19,867	21,166	22,789	24,412	27,273	28,455
Transportation	1,935,870	1,777,557	1,552,442	1,389,757	1,326,075	1,289,999
Total Emissions	3,424,729	3,214,256	2,946,452	2,703,565	2,428,545	2,227,322
Per Capita Emissions (MT CO₂e/person)	7.25	6.33	5.35	4.55	3.63	3.19

MT CO₂e = metric tons of carbon dioxide equivalent

Figure 2 Adjusted GHG Emissions Forecast Results by Sector and Forecast Year



1.2 Background

The State of California considers GHG emissions and the impacts of global warming to be a serious threat to the public health, environment, economic well-being, and natural resources of California, and has taken an aggressive stance to mitigate the State's impact on climate change through the adoption of legislation and policies, the most relevant of which are summarized below.

- **Executive Order S-3-05**, signed by former Governor Schwarzenegger in 2005, establishes statewide GHG emissions reduction goals to achieve long-term climate stabilization as follows: by 2020, reduce GHG emissions to 1990 levels and by 2050, reduce GHG emissions to 80 percent below 1990 levels. The 2050 goal was accelerated by the 2045 carbon neutral goal established by Executive Order (EO) B-55-18, as discussed below.⁷
- **Assembly Bill 32**, known as the Global Warming Solutions Act of 2006, requires California's GHG emissions be reduced to 1990 levels by the year 2020 (approximately a 15 percent reduction from 2005 to 2008 levels). The AB 32 Climate Change Scoping Plan, first published in 2008, identifies mandatory and voluntary measures to achieve the statewide 2020 emissions limit, and encourages local governments to reduce municipal and community GHG emissions proportionate with State goals.⁸
- **Senate Bill 32**, signed by former Governor Brown in 2016, establishes a statewide mid-term GHG reduction goal of 40 percent below 1990 levels by 2030. CARB formally adopted an updated Climate Change Scoping Plan in December 2017, laying the roadmap to achieve 2030 goals and giving guidance to achieve substantial progress toward 2050 State goals.

⁷ Executive Orders are binding only unto State agencies. Accordingly, EO S-03-05 will guide State agencies' efforts to control and regulate GHG emissions but will have no direct binding effect on local government or private actions.

⁸ Specifically, the AB 32 Climate Change Scoping Plan states CARB, "encourages local governments to adopt a reduction goal for municipal operations emissions and move toward establishing similar goals for community emissions that parallel the State commitment to reduce GHG emissions by approximately 15 percent from current levels by 2020" (p. 27). "Current" as it pertains to the AB 32 Climate Change Scoping Plan is commonly understood as between 2005 and 2008.

- **Executive Order B-55-18**, signed by former Governor Brown in 2018, expanded upon EO S-3-05 by creating a statewide GHG goal of carbon neutrality by 2045. EO S-55-18 identifies CARB as the lead agency to develop a framework for implementation and progress tracking toward this goal in the next Climate Change Scoping Plan Update.

Assembly Bill 1279, signed by Governor Newsom in September of 2022, this legislation codified the target of carbon neutrality by 2045 and established a minimum GHG emissions reduction of 85% below 1990 levels.

The State of California, via CARB, has issued several guidance documents concerning the establishment of GHG emissions reduction targets for local climate action plans to comply with legislated GHG emissions reductions goals and CEQA Guidelines Section 15183.5(b). In the first California *Climate Change Scoping Plan*,⁹ CARB encouraged local governments to adopt a reduction target for community emissions paralleling the State commitment to reduce GHG emissions. In 2016, the State adopted SB 32 mandating a reduction of GHG emissions by 40 percent from 1990 levels by 2030 and in 2017 CARB published *California's 2017 Climate Change Scoping Plan* (hereafter referred to as the Scoping Plan Update) outlining the strategies the State will employ to reach these targets.¹⁰ With the release of the Scoping Plan Update, CARB recognized the need to balance population growth with emissions reductions and in doing so, provided a new methodology for proving consistency with State GHG reduction goals through the use of per capita efficiency targets. These targets are generated by dividing a jurisdiction's GHG emissions for each horizon year by the jurisdiction's total population for that target year and are discussed further in Section 5.

1.3 Greenhouse Gases

The 2016 City of Sacramento Community Inventory was developed using the Community Protocol¹¹ and California Supplement.¹² Emissions were calculated using the principles and methods from these protocols. Emissions from nitrous oxide (N₂O), methane (CH₄), and carbon dioxide (CO₂) are included in this assessment. Each GHG has a different capability of trapping heat in the atmosphere, known as its global warming potential (GWP), which is normalized relative to CO₂ and expressed as carbon dioxide equivalent, or CO₂e. The CO₂e values for these gases are derived from the Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change GWP values for consistency with the yearly CARB GHG inventory, as shown in Table 6.^{13,14}

Table 6 Global Warming Potentials of Greenhouse Gases

Greenhouse Gas	Molecular Formula	Global Warming Potential
Carbon Dioxide	CO ₂	1

⁹ California Air Resources Board. 2008. Climate Change Scoping Plan. Accessed at: https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/document/adopted_scoping_plan.pdf Accessed on: June 20, 2019

¹⁰ California Air Resources Board. California's 2017 Climate Change Scoping Plan. Accessed at: https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/scoping_plan_2017.pdf. Accessed on: June 20, 2019

¹¹ ICLEI. 2012. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions.

¹² Association of Environmental Professionals. 2013. The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Protocol. Accessed at: https://califaep.org/docs/California_Supplement_to_the_National_Protocol.pdf. Accessed on: June 20, 2019

¹³ Intergovernmental Panel on Climate Change. 2007. Fourth Assessment Report: Climate Change. Direct Global Warming Potentials.

¹⁴ All calculations use Intergovernmental Panel on Climate Change Fourth Assessment Report GWP values with the exception of the first order of decay modeling performed for waste-in-place at the 28th Street and L&D landfills, which use a static SAR2 GWP value for methane of 21 and cannot be altered.

Methane	CH ₄	25
Nitrous Oxide	N ₂ O	298

MT CO₂e = metric tons of carbon dioxide equivalent

1.4 Excluded Emissions

The following emissions sectors have been excluded from both the 2005 and 2011 inventories and therefore were also excluded from the 2016 inventory and emissions forecast. Additional updates were also made to the 2005 and 2011 inventories in order to maintain consistency between all inventory years. These changes are summarized in Sections 2.2 and 2.3.

Consumption-based Emissions

GHG emissions from consumption of goods within the city are excluded from the inventory and forecast of City of Sacramento emissions. Currently there exists no widely accepted standard methodology for reporting consumption-based inventories.

Natural and Working Lands

GHG emissions from carbon sinks and sources in natural and working lands are not included in this inventory and forecast due to the lack of granular data and standardized methodology. CARB has included a state-level inventory of natural and working lands in the 2017 Scoping Plan Update¹⁵ greenhouse gas inventory; however, at the time of this City of Sacramento community-wide inventory, sufficient data and tools were not available to conduct a jurisdiction-specific working lands inventory. The Nature Conservancy and California Department of Conservation¹⁶ are exploring options for a tool which may be able to perform these inventories at a more specific geographic level.

Agricultural Emissions

Emissions from agricultural activities are not included in this inventory as the Community Protocol and California Supplement¹⁷ both note agricultural activity is not a required component of Community Protocol inventories and should be included only if relevant to the community conducting the inventory. Regulations exist to encourage urban agriculture within the City boundaries. Many of the emissions from these activities (e.g., energy) are covered under other sectors included in this inventory and no major commercial-scale livestock activity is noted within the city boundaries.

High GWP

High GWP emissions, including chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs) used as substitutes for ozone-depleting substances, are not included in this inventory as it is not a required

¹⁵ California Air Resources Board. 2017. California's Climate Change Scoping Plan.

¹⁶ California Department of Conservation. TerraCount Scenario Planning Tool. Accessed at: <https://maps.conservation.ca.gov/terraaccount/>. Accessed on: May 15, 2019

¹⁷ Association of Environmental Professionals. 2013. *The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Emissions Protocol*. https://califaep.org/docs/California_Supplement_to_the_National_Protocol.pdf

component of the Community Protocol. The California Supplement notes these emissions are not generally included in California inventories, including in Sacramento.

Off-Road Emissions

To maintain consistency with previous inventories (2005 and 2011) off-road emissions were not included in this analysis.

1.5 Forecast and Target Years Summary

Prior to 2016, the City of Sacramento completed two community-wide GHG emissions inventories, one for the year 2005 and an updated inventory for 2011. Portions of the 2011 inventory, including water, waste-in-place, and transportation, allocated emissions based solely on the overall growth of the city and therefore an accurate historical comparison between all inventories may not be feasible without further modifications to previous inventories as discussed in Section 2.

The emissions forecast is based upon the latest available data from City GHG inventories, in this case the 2016 inventory completed by Rincon. This forecast uses benchmark years of 2020, 2025, 2030, 2040 and 2045, consistent with currently codified GHG reduction targets or executive orders which are expected to be codified in future, and a target of carbon neutrality on or before 2045.

The forecast years align with the following targets:

- 2020 (AB 32)
- 2025 (progress evaluation)
- 2030 (SB 32)
- 2040 (General Plan horizon year)
- 2045 (AB 1279)

The 2030 and 2040 targets are required for consistency with SB 32 and the Sacramento 2040 General Plan Update respectively, while the remainder of the targets identify a clear path and milestones of progress toward the long-term State reduction goals.

2020 Progress

The first City of Sacramento Climate Action Plan was adopted in 2012. It identified how the City and broader community can reduce the City of Sacramento's GHGs and included a GHG emissions reduction target of 15 percent reduction below 2005 emissions levels by 2020. The City of Sacramento Climate Action Plan was incorporated into the City's 2035 General Plan¹⁸ and adopted in 2015. Based on the 2016 inventory the City of Sacramento exceeded the 2020 reduction goal by 4.8 percent and four years ahead of schedule by emitting an estimated 3,424,729 MT of CO₂e.

This 2016 inventory and forecast also considered per capita emissions reductions due to the rate at which Sacramento has grown since 2005. In 1990, GHG emissions were an estimated 9.75 MT CO₂e per person. This was calculated by back-casting the 2005 GHG inventory to 1990 (which assumes a 15 percent emission increase from 1990 to 2005) and then dividing by the 1990 population. In 2016, per capita emissions dropped to 7.25 MT CO₂e per person. This equates to an emissions reduction

¹⁸ City of Sacramento. 2035 General Plan. Accessed at: <https://www.cityofsacramento.org/Community-Development/Resources/Online-Library/2035-General-Plan> Accessed on: May 15, 2019

of 26 percent below 2005 levels and 28 percent below 1990 levels. Details and discussion of previous inventories and changes made for consistency as part of this update can be found in Section 2.

2 Previous Inventories

A summary of previous GHG emissions inventories can be found in Table 7. A description of the variability between methodologies used in each of the inventory years is summarized in the following sections.

Table 7 Sacramento GHG Inventories Summary

Sector	1990 Emissions ¹ (MT CO ₂ e)	2005 Emissions ² (MT CO ₂ e)	2011 Emissions ² (MT CO ₂ e)	2016 Emissions (MT CO ₂ e)
Residential Energy	607,052	714,178	656,472	636,578
Commercial & Industrial Energy	689,637	811,337	650,627	661,964
Transportation	1,856,925	2,184,617	2,091,154	1,935,870
Generated Waste	344,506	405,301	113,192	134,339
Waste-in-place	42,432	49,921	25,773	26,504
Wastewater	48,773	57,380	18,719	19,867
Water	10,889	12,810	9,804	9,607
Total Emissions	3,600,213	4,235,545	3,565,741	3,424,729
Per Capita Emissions (MT CO₂e/person)	9.75	9.57	7.58	7.25

¹ All 1990 inventory data calculated as a 15 percent reduction from 2005 inventory levels per California Air Resources Board guidelines.

² Methodology inconsistent, cannot be compared directly to other years

MT CO₂e = metric tons of carbon dioxide equivalent

2.1 1990 Baseline

The State of California uses 1990 as a reference year to remain consistent with AB 32 and SB 32, which codified the State's 2020 and 2030 GHG emissions targets by directing CARB to reduce statewide emissions to 1990 levels by 2020 and 40 percent below 1990 levels by 2030. The City of Sacramento's initial inventory was conducted for the year 2005. The State indicated in the first Climate Change Scoping Plan in 2008 that local governments wishing to remain consistent with State targets could use a 15 percent reduction from 2005-2009 levels as a proxy for a 1990 baseline.¹⁹ The updated 1990 proxy baseline used for target setting by the City of Sacramento is 3,600,213 MT CO₂e.

2.2 2005 Inventory Updates

In 2009, the Sacramento County Department of Environmental Review and Assessment, with guidance from ICF, Jones & Stokes prepared a GHG inventory of 2005 emissions in Sacramento County. This inventory included unincorporated areas as well as the cities of Citrus Heights, Elk Grove, Folsom, Galt, Isleton, Rancho Cordova, and Sacramento.

¹⁹ Due to lack of 1990 inventory data for local governments, page 27 of the 2008 Climate Change Scoping Plan identifies 15 percent below "current" (2005-2009) levels by 2020 as consistent with the State goals of 1990 levels by 2020, allowing local governments to back-cast to develop 1990 baselines for future GHG reduction targets.

Several updates to the 2005 inventory were performed as part of the current inventory and forecast efforts to align the 2005, 2011, and 2016 methodologies. These included removing large industrial natural gas users, updating the transportation emissions calculation methodologies and updating waste emissions methodology to California-specific emissions factors and AR4 GWP. Complete data for water and wastewater was not available, so the original numbers were left as found.

Natural Gas

Because of the California Public Utility Commission (CPUC) 15/15 Rule²⁰, although PG&E reported industrial gas use for 2005, PG&E did not report comparable data in 2016. To allow for a comparison between across all years, the 2005 inventory was updated to remove industrial gas. Large industrial emitters removed from the inventories are under the purview of the CARB Cap-and-Trade Program for emissions reductions and are, therefore, also already accounted for in the 2017 Scoping Plan Update. Attempts were made to estimate industrial natural gas emissions through CAP-and-Trade program data and permits, however, no complete data set could be identified. Therefore, using best available data (utility data provided by PG&E) industrial gas needed to be removed from historical inventories to allow for a consistent comparison of GHG emissions from this sector over time. Because industrial and commercial data was aggregated in the 2005 inventory, an estimate of commercial gas was made by calculating the average of the 2017 and 2016 ratios of commercial gas usage to residential gas usage (0.48207). This ratio was then used to identify the commercial portion of the commercial/industrial aggregated natural gas data. The commercial gas portion was then used to recalculate emissions for 2005 (and 2011) and the estimated industrial portion was dropped.

The ratio of residential to commercial gas use was used to correct for population growth and temperature changes which might have increased or decreased gas use in the city of Sacramento. Natural gas consumption labeled as “district” users, such as fire and school districts, were included in all years. In future years if the California Energy Commission were to change their data aggregation rules, industrial data could be reincorporated.

Waste

In 2005 and 2011, two different waste emission factors were utilized. This caused an increase in emissions from 2005 to 2011 even though the City achieved a 37 percent reduction in overall tonnage. However, neither the 2005 nor 2011 inventory documentation provided clear guidance on the methodologies used to calculate these emission factors. These values also did not make sense as an increase in methane capture occurred during these times. Therefore, to address this problem updated emission factors were derived from a waste characterization study performed by CalRecycle, previously known as the California Integrated Waste Management Board (CIWMB). Factors from the 2004 waste characterization study for the State of California were applied to the 2005 waste tonnage.

Waste-in-place was also assessed for the 2005 inventory. When the waste-in-place inventory was originally completed, it used 2002 as the baseline year for tonnage of waste in the landfills and did not include tonnage added to the landfill from 2002 through 2005. This information was added to the CARB first order decay model and rerun to achieve a more accurate value.

²⁰ The 15/15 rule states no data can be provided if there are less than 15 users in any sector or if one user makes up more than 15 percent of the total usage. This applies to natural gas and electricity consumption.

Transportation

The 2005 inventory data provided in the 2012 City of Sacramento Climate Action Plan includes total transportation emissions as well as the daily vehicle miles traveled (VMT).²¹ However, detailed emissions factors were not cited. Therefore, the EMFAC2017 model was used to re-calculate an emission factor, weighted average emissions per VMT, for 2005. Recalculating the emission factor and updating the 2005 inventory ensures consistency with future inventories and provides transparency for future work if needed. While the methodology used to derive the VMT number was unable to be verified, the VMT values appear to be consistent between inventory years and a note in the previous inventory files indicated that the data was established using the Regional Targets Advisory Committee (RTAC) origin-destination model.

Summary of Inventory Data

Table 8 and Table 9 include all of the activity data, emission factors, and total emissions available for both the original 2005 inventory (Table 8) and the updated inventory (Table 9). The only sectors for which an emission factor and activity data could not be established either through the historical inventory or through the update process were water and wastewater.

Table 8 Original 2005 GHG Inventory Data

Sector	Original Activity Data	Original Emission Factor	Original Emissions (MT CO ₂ e)
Residential Electricity (kWh)	1,307,301,693	0.00028	748,792 ¹
Residential Gas (therms)	65,698,581	0.00531	
Commercial and Industrial Electricity (kWh)	2,235,898,207	0.00028	979,777 ¹
Commercial Gas (therms)	61,791,582	0.00531	
Industrial Gas (therms)	*included in Commercial	0.00531	
District Gas (therms)	5,339,537	0.00531	28,656
On-road Transportation (VMT)	4,175,278,800	0.000482	2,013,962
Waste (tons)	684,088	0.299459	204,856
Waste-in-Place	N/A	N/A	37,006
Wastewater	Unknown	Unknown	57,380
Water (MGY)	Unknown	Unknown	12,810
Total			4,083,239

¹ Data presented as it was provided in the original 2005 inventory.

kWh = kilowatt hours; mgy = million gallons per year; N/A = not applicable; MT CO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled

²¹ Ascent Environmental, January 13, 2012. http://ascentenvironmental.com/files/9714/0537/0505/Sacramento_CAP_Final_Draft.pdf

Table 9 Updated 2005 GHG Inventory Data

Sector	Updated Activity Data	Updated Emission Factor	Updated Emissions (MT CO ₂ e)
Residential Electricity (kWh)	1,307,301,693	0.00028	365,319
Residential Gas (therms)	65,698,581	0.00531	348,859
Commercial and Industrial Electricity (kWh)	2,235,898,207	0.00028	624,811
Commercial Gas (therms)	29,787,868	0.00531	158,174
Industrial Gas (therms)	*Removed from Inventory	0.00531	–
District Gas (therms)	5,339,537	0.00531	28,353
On-Road Transportation (VMT)	4,175,278,800	0.000523	2,184,617
Waste (tons)	684,088	0.59247	405,301
Waste-in-Place	N/A	N/A	49,921
Wastewater	Unknown	Unknown	57,380
Water (mgy)	Unknown	Unknown	12,810
Total			4,235,545

kWh = kilowatt hours; mgy = million gallons per year; N/A = not applicable; MT CO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled

2.3 2011 Inventory Updates

In 2015, the City of Sacramento, with the assistance of Ascent Environmental, conducted a GHG inventory estimate of community-wide emissions for the year 2011. After reviewing the inventory during the 2019 CAP 2.0 process, several inconsistencies were identified between the 2005 inventory, 2011 inventory, and current best practices.

Several updates to the 2011 inventory estimate were performed as part of the current effort to align the 2005, 2011, and 2016 methodologies. These included removing large industrial natural gas users (due to data availability in 2016), updating waste emissions methodology to California-specific emissions factors and AR4 GWP, and updating the transportation emissions calculation methods.

The following section outlines the changes made to the 2011 inventory for consistency with the other inventory years. Although 2011 is less important than 2005 (which derives the baseline 1990 emissions) and 2016 (which informs current progress), it still provides a useful data point for the City of Sacramento's overall emission reduction progress.

Natural Gas

Because of the CPUC 15/15 Rule²², industrial gas was no longer reported in 2016. To allow for a comparison between across all years, the 2011 inventory was updated to remove industrial gas. Large industrial emitters removed from the inventories are under the purview of the CARB Cap-and-Trade Program for emissions reductions and are, therefore, also already accounted for in the 2017 Scoping Plan Update. Because industrial and commercial data was aggregated in the 2011 inventory, an estimate of industrial gas was made and subtracted to isolate the commercial emissions. To accomplish this, the average of the 2017 and 2016 ratios of commercial gas usage to residential gas

²² The 15/15 rule states no data can be provided if there are less than 15 users in any sector or if one user makes up more than 15 percent of the total usage. This applies to natural gas and electricity consumption.

usage (0.48207) was applied to the 2011 inventory. This ratio was then used to identify the industrial emissions portion of the commercial/industrial aggregated natural gas data.

The ratio of residential to commercial gas use was used to correct for population growth and temperature changes which might have increased or decreased gas use in the city of Sacramento. Natural gas consumption labeled as “district” users, such as fire and school districts, was included in all years.

Waste

As noted above, in 2005 and 2011 two different waste emission factors were utilized. This caused an increase in emissions from 2005 to 2011 even though the City achieved a 37 percent reduction in overall tonnage. This was because the original 2005 calculation methodology was not able to be identified during the 2011 inventory. To address this problem, emission factors derived from the CalRecycle (formerly CIWMB) waste characterization study for the State of California for 2008 were applied to the tons of waste generated in 2011.

Waste-in-place was also updated for the 2011 inventory. When the inventory was originally completed, it simply re-used the 2005 data for 2011. However, waste-in-place is a cumulative emissions calculation. Because the landfills in Sacramento are either closed or accepting less waste, this led to an overestimate of emissions. A first order decay model using landfill waste data from 2005 to 2011 was used to update the waste-in-place number.

Transportation

The 2011 inventory data includes total transportation emissions as well as the daily VMT.²³ However, the emissions factor was calculated using older methods no longer considered standard. Therefore, the EMFAC2017 model was used to re-calculate the average emissions per VMT in 2011. While not able to verify the methodology used to derive VMT, the VMT values appear to be consistent between inventory years and a note in the previous inventory workbook suggested the data was provided using the RTAC origin-destination model.

Summary of Inventory Data

Table 10 and Table 11 include all of the activity data, emission factors, and total emissions available for both the original inventory (Table 10) and the updated inventory (Table 11). The only sectors for which an emission factor and activity data could not be established either through the historical inventory or through the update process were water and wastewater.

²³ The documents provided by Ascent in the summary of the 2005/2011 inventories stated that VMT values were derived from the RTAC Origin-Destination model and were provided by Fehr and Peers as well as SACMET.

City of Sacramento
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Table 10 Original 2011 GHG Inventory Data

Sector	Original Activity Data	Original Emission Factor	Original Emissions (MT CO ₂ e)
Residential Electricity (kWh)	1,343,895,669	0.00020	656,472 ¹
Residential Gas (therms)	74,151,520	0.00531	
Commercial and Industrial Electricity (kWh)	2,346,768,051	0.00020	814,087 ¹
Commercial Gas (therms)	66,911,808	0.00531	
Industrial Gas (therms)	*included in Commercial	0.00531	
District Gas (therms)	3,872,204	0.00531	20,561
On-road Transportation (VMT)	4,234,269,734.09	0.000475	2,009,724
Waste (tons)	427,980	0.78300	335,108
Waste-in-Place	N/A	N/A	37,006
Wastewater	Unknown	Unknown	18,719
Water (mgy)	37,149	0.263921	9,804
Total			3,901,481

¹ Numbers presented as they were in the original 2011 GHG inventory.

kWh = kilowatt hours; mgy = million gallons per year; N/A = not applicable; MT CO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled

Table 11 Updated 2011 GHG Inventory Data

Sector	Original Activity Data	Original Emission Factor	Original Emissions (MT CO ₂ e)
Residential Electricity (kWh)	1,343,895,669	0.00020	262,727
Residential Gas (therms)	74,151,520	0.00531	393,745
Commercial and Industrial Electricity (kWh)	2,346,768,051	0.00020	458,786
Commercial Gas (therms)	32,256,175	0.00531	171,280
Industrial Gas (therms)	*included in Commercial	N/A	N/A
District Gas (therms)	3,872,204	0.00531	20,561
On-road Transportation (VMT)	4,234,269,734	0.000494	2,091,154
Waste (tons)	427,980	0.264478517	113,192
Waste-in-Place	N/A	N/A	25,773
Wastewater	Unknown	Unknown	18,719
Water (MGY)	37,149.00	0.263921	9,804
Total			3,565,741

kWh = kilowatt hours; mgy = million gallons per year; N/A = not applicable; MT CO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled

3 2016 Community Inventory

The methodologies, data sources, calculations, and results associated with the 2016 GHG inventory update are included in this section. Information regarding updates to the 2005 and 2011 inventories and information relating to the emissions forecast is located in Section 2.2 and Section 2.3 of the technical appendix, respectively.

The 2016 GHG inventory is structured based on emissions sectors. The ICLEI Community Protocol recommends local governments examine their emissions in the context of the sector responsible for those emissions. Many local governments will find a sector-based analysis more directly relevant to policy making and project management, as it assists in formulating sector-specific reduction measures for climate action planning. The reporting sectors are made up of multiple subsectors to allow for easier identification of sources and targeting of reduction policies.

The 2016 inventory reports all Basic Emissions Generating Activities²⁴ required by the Community Protocol²⁵ by the following main sectors:

- Energy (electricity and natural gas)
- Transportation
- Water and Wastewater
- Solid Waste

The data used to complete this inventory and forecast came from multiple sources, as summarized in Table 12. Data for the 2016 inventory calculations were provided by the City via personal communication with Helen Selph.

²⁴ Required emissions generating activities include use of electricity by the community, use of fuel in residential and commercial stationary combustion equipment, on-road passenger and freight motor vehicle travel, use of energy in potable water and wastewater treatment and distribution, and generation of solid waste by the community.

²⁵ ICLEI. 2012. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions. Section 2.2.

Table 12 Inventory and Forecast Data Sources

Sector	Activity Data	Unit	Source
Inventory			
Energy	Electricity Consumption	kWh	Sacramento Municipal Utilities District
	Natural Gas Consumption	Therms	Pacific Gas and Electric
Transportation	Annual Mileage	VMT	EMFAC2017 Model; Sacramento Area Council of Governments
Water	Water Pumping	AF	Sacramento DOU
	Electricity Usage	kWh	
Wastewater	Electricity Consumption, Water Treated	kWh MGD	Sacramento DOU; Sacramento Regional County Sanitation District; City of Sacramento 2011 Climate Action Plan
Solid Waste	N/A	N/A	CalRecycle; Sacramento Public Works Department United States Environmental Protection Agency Landfill Methane Outreach Program Reporting
Forecast Growth Indicators			
Population	Residents	Persons	City of Sacramento General Plan; California Department of Finance Demographic Projections
Commerce	Jobs	Number of Jobs	City of Sacramento General Plan
Transportation	Annual Mileage, Emissions	N/A	EMFAC2017 Model; Sacramento Area Council of Governments
Building Efficiency	Title 24 Efficiency Increases	Percent	California Energy Commission
Electricity Emissions	Renewable Portfolio Standard	Percent	Renewable Portfolio Standard; Senate Bill 100
<small>kWh; kilowatt hours; VMT = vehicle miles traveled; AF = acre-foot; MGD = million gallons per day; N/A = not applicable; Sacramento DOU = Sacramento Department of Utilities</small>			

3.1 Energy

The energy sector includes GHG emissions resulting from the consumption of electricity and natural gas. Both energy sources are used in residential, commercial, and industrial buildings and for other power needs throughout the City of Sacramento. The following subsections describe the data sources, emission factors and calculation methodologies associated with electricity and natural gas.

Overall, residential and non-residential (commercial and industrial) energy emissions were approximately equal in 2016 at 49 percent and 50 percent respectively (Figure 3). It should be noted that, similar to previous years, this does not include large industrial users' gas use in the analysis. Non-residential electricity was reported in aggregate by Sacramento Municipal Utility District (SMUD) and included both industrial and commercial data. Due to data availability issues, large industrial gas data were not provided by PG&E and not been included in this inventory. Additional information on why this change was made as well as the methodologies used to estimate 2016 commercial gas data are provided in the natural gas section.

Electricity

Emissions resulting from electricity consumption were estimated by multiplying annual electricity consumption by an electricity emission factor representing the average emissions associated with generation of one megawatt hour (MWh) of electricity. Electricity is supplied to the City by SMUD. In its 2016 report to the verification body, The Climate Registry, SMUD reported an electricity carbon intensity factor of 492.95 pounds CO₂e per MWh.²⁶ SMUD also reported to the California Energy Commission, an average of 20 percent renewable energy in its portfolio in 2016.²⁷ From 2005, residential electricity use increased by 116.1 MWh while commercial electricity decreased by 44.7 MWh for a net increase of 71.4 MWh. Therefore, the 181,910 MT CO₂e reduction in GHG emissions from electricity between 2005 and 2016 was due to an approximately 20 percent reduction in the SMUD electricity emission factor.

To calculate emissions from electricity, the total electricity use reported by SMUD was multiplied by the carbon intensity factor to determine MT CO₂e. This value represents all residential, commercial, and industrial electricity use within the city. Prior to performing this calculation, the electricity use associated with in-boundary water sector activities (42,964 MWh) was removed to avoid double counting water emissions. This is discussed further in the water and wastewater section.

In 2016, a total 808,220 MTCO₂e was generated within the community due to residential and commercial electricity use. Table 13 and Table 14 show the breakdown of emissions from electricity by both category (residential, commercial/industrial) and by source.

Natural Gas

In order to calculate emissions from natural gas consumption, the total therms consumed is multiplied by the PG&E reported emissions factor of 11.7 pounds CO₂/therm. Due to CPUC privacy regulations, the majority of 2016 industrial therms were not provided.²⁸ This resulted in a substantial decrease in emissions from industrial natural gas use from the 2005 baseline.

Any remaining reported industrial use is from PG&E “district” users, such as fire and school districts. Industrial emissions removed from the inventories are under the purview of the CARB Cap-and-Trade Program for emissions reductions and are, therefore, already accounted for in the 2017 Scoping Plan Update. The California Supplement does not recommend including these sources unless they are under the direct jurisdictional control of the reporting agency.²⁹ Overall natural gas usage in the commercial sector decreased from 29.8 million therms in 2005 to 29.0 million therms in 2016 while the emission factor remained constant. This means that 100 percent of the 45,063 MT CO₂e reduction was attributed to a decrease in gas use.

In 2016, the commercial, district industrial, and residential categories consumed a total of 92,390,976 therms of natural gas, which, based on the emission factor of 0.00531 MT CO₂/therm, generated 490,323 MTCO₂e. A complete breakdown of natural gas use by category and sector is provided in Table 14.

²⁶ The Climate Registry. 2022 Default Emissions Factors. Accessed at: <https://theclimateregistry.org/wp-content/uploads/2022/11/2022-Default-Emission-Factors-Final.pdf> . Accessed on April 18, 2023

²⁷ California Energy Commission. Sacramento Municipal Utility District 2016 Power Content Label. Accessed at: <https://www.energy.ca.gov/filebrowser/download/526> Accessed April 17, 2023

²⁸ Minor industrial emissions reported through PG&E from the ‘District’ customer class are included in this inventory.

²⁹ Association of Environmental Professionals. 2013. The California Supplement to the United States Community-Wide Greenhouse Gas (GHG) Protocol. Page 9.

Figure 3 Energy Emissions by Category for Year 2016

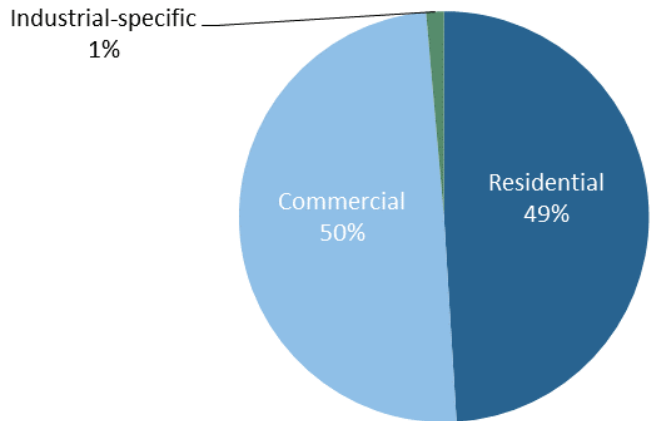


Table 13 Energy Emissions by Category for Year 2016

Source	Activity Data	Emission Factor	Total Emissions (MT CO ₂ e)
Residential			636,578
Natural Gas	59,977,656 therms	0.00531 MT CO ₂ e/therm	318,304
Electricity	1,423,420 MWh	0.2236 MT CO ₂ e/MWh	318,275
Commercial			643,747
Natural Gas	28,980,911 therms	0.00531 MT CO ₂ e/therm	153,803
Commercial and Industrial Electricity	2,191,181 MWh	0.2236 MT CO ₂ e/MWh	489,945
District Industrial			18,216
Natural Gas ¹	3,432,409 therms	0.00531 MT CO ₂ e/therm	18,216
Total			1,298,542

¹ Large industrial natural gas has been removed due to CPUC privacy rules. See Energy Section for discussion.

MWh = megawatt hours; MT CO₂e = metric tons of carbon dioxide equivalent

Table 14 Energy Emissions by Energy Source for Year 2016

Source	Activity Data	Emission Factor	Total Emissions (MT CO ₂ e)
Natural Gas	92,390,976 therms	0.00531 MT CO₂e/therm	490,332
Commercial	28,980,911 therms	0.00531 MT CO ₂ e/therm	153,803
Residential	59,977,656 therms	0.00531 MT CO ₂ e/therm	318,304
District Industrial ¹	3,432,409 therms	0.00531 MT CO ₂ e/therm	18,216
Electricity	3,581,960 MWh	0.2236 MT CO₂e/MWh	808,220
Commercial/Industrial	2,191,181 MWh	0.2236 MT CO ₂ e/MWh	489,945
Residential	1,423,420 MWh	0.2236 MT CO ₂ e/MWh	318,275
Total			1,298,542

¹ Large industrial natural gas has been removed due to CPUC privacy rules. See Energy Section for discussion

MWh = megawatt hours; MT CO₂e = metric tons of carbon dioxide equivalent

3.2 Transportation

Transportation modeling for VMT attributed to the City of Sacramento was completed by Fehr & Peers Transportation Consultants using Sacramento Area Council of Government (SACOG) activity-based model, SACSIM.³⁰ The emissions associated with on-road transportation were then calculated by multiplying the estimated daily VMT and the average vehicle emissions rate established by CARB EMFAC2017 modeling for vehicles within the region. In 2016 on-road transportation attributed to the City of Sacramento resulted in 1,935,870 MT CO₂e, a 248,747 MT CO₂e reduction compared to 2005. During this time VMT increased by 4 percent or 172 million miles traveled. Therefore, the emissions reductions in this sector were driven by an increase in average vehicle efficiency and adoption of electric vehicles which resulted in a 10 percent decrease in average vehicles emissions per mile.

The VMT modeling results allocate VMT derived from the activity-based model to the City of Sacramento using the Origin-Destination (O-D) method. The O-D VMT method is the preferred method recommended by the U.S Community Protocol in on-road methodology TR.1 and TR.2 to estimate miles traveled based on trip start and end locations. Under these recommendations, all trips that start and end within the City are attributed to the City. Additionally, one half of the trips that start internally and end externally and vice versa are attributed to the City. A summary of the VMT results can be found in Table 15.

Table 15 Estimated Transportation Emissions for 2016

Source	Activity Data (VMT) ²	Emission Factor	Total Emissions (MT CO ₂ e)
Internal-Internal Daily VMT	3,588,476	0.000445 MT CO ₂ e per VMT	1,598
½ Internal-External Daily VMT	4,463,016	0.000445 MT CO ₂ e per VMT	1,988
½ External-Internal Daily VMT	4,475,924	0.000445 MT CO ₂ e per VMT	1,993
Total Daily VMT	12,527,417	0.000445 MT CO ₂ e per VMT	5,579
Yearly VMT¹	4,347,013,534	0.000445 MT CO₂e per VMT	1,935,870

1 Weekday to annual conversion of 347 is used per CARB guidance on VMT modeling

2 The origin-destination methodology for VMT calculation attributes 100 percent of internal-to-internal daily trips, 50 percent of internal-external and external-internal daily trips, and excludes all pass-through trips. This sum is then multiplied by 347 to get an annual VMT number.

MT CO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled

Transportation emissions are generated by the community of Sacramento through on-road transportation, including passenger, commercial, and heavy machinery. Emissions factors are established using the latest CARB and EPA-approved emissions modeling software, 2017 State Emissions FACTors (EMFAC) Model. Carbon dioxide, nitrous oxide, and methane emissions from engine combustion are multiplied by their GWP to determine CO₂e per VMT. Emissions for both passenger and commercial vehicles were established using the EMFAC2017 GHG module and weighted by VMT to establish an average emissions factor per VMT for the City. Emissions from electricity used by charging of electric vehicles are captured under the electricity sector. In 2016, the average emissions factor for cars on the road in the County of Sacramento was 0.000445 MTCO₂e

³⁰ Sacramento Area Council of Governments. SACOG Travel Demand Model. Accessed at: <https://www.sacog.org/modeling> Accessed on: October 4, 2019

per VMT as calculated using the EMFAC2017 model.³¹ Technical details on the EMFAC2017 modeling tool can be found on the EMFAC Mobile Source Emissions Inventory Technical Support Documentation Portal.³²

3.3 Water and Wastewater

Water

Water is supplied to Sacramento by the Sacramento Department of Utilities, primarily sourced from the Sacramento and American rivers and from local groundwater reservoirs. The primary water treatment plant facilities for the community are E.A. Fairbairn Water Treatment Plant and Sacramento River Water Treatment Plant, both located within the city boundaries. Water supplied to the community contributes emissions through the use of energy to extract, convey, treat, and deliver water. The amount of energy required for community water usage was calculated following Community Protocol Method WW.14, where the total emissions are equal to the energy used in each of the four phases above. The energy required for each segment of the water cycle was provided by the Sacramento Department of Utilities or based on phase-specific averages where it was unavailable. SMUD provided the annual electricity use for the water extraction, conveyance, and delivery phases (40,101 MWh),³³ while a kWh phase average of 100 kWh/million gallons was used for the treatment phase. As all energy use is in-boundary, total MWh for water transactions has been subtracted from the community energy use total calculated in Section 3.1 to avoid double counting.

SMUD is the electricity provider for the City; therefore, SMUD's energy emissions factor of 492.95 pounds CO₂e/MWh was applied to the calculated electricity used for water consumption in the city. Energy consumption related to water use in the city of Sacramento resulted in the generation of approximately 9,607 MTCO₂e in 2016, or 33 percent of total water and wastewater emissions. In 2016, Sacramento water treatment plants produced 87,811 acre-feet of water. The 2005 water consumption for the City was not recorded in the previous inventory and therefore, a comparison of the methodology was not possible. However, it is likely that emission reductions have been driven in part by a reduced electricity emission factor.

Wastewater

The wastewater generated by community residents and businesses creates GHG emissions during the treatment processes, including process, stationary, and fugitive emissions. The sources and magnitude of emissions depend on the type of wastewater treatment plant and the treatment processes utilized.

Wastewater generated in the city of Sacramento is collected in local sewer lines which ultimately discharge into the Sacramento Regional Wastewater Treatment Plant managed by Regional San in Elk Grove, California. As the wastewater treatment plant treats sewage from multiple jurisdictions, methane and nitrous oxide emissions were allocated to Sacramento on a population basis per Community Protocol Methodology WW.13 shown in Figure 4. Total carbon dioxide emissions from

³¹ EMFAC2017. Base year 2016, County of Sacramento model run. Accessed at: <https://www.arb.ca.gov/emfac/>. Accessed on: July 16, 2019

³² California Air Resources Board. EMFAC Software and Technical Support Documentation. Accessed at: <https://ww2.arb.ca.gov/our-work/programs/mobile-source-emissions-inventory/msei-modeling-tools-emfac-software-and>. Accessed on: October 4, 2019.

³³ D. Vang, personal communication, August 2018.

the Sacramento Regional Wastewater Treatment Plant were unavailable from the USEPA Greenhouse Gas Reporting Program, the ICLEI-recommended data source. Therefore, separate emissions sources (nitrous oxide, methane, electricity use) were calculated based on the population increase from 2011. In 2016, a total of 40 MT N₂O and 32 MT CH₄ were emitted from the effluent discharge and stationary sources at the treatment plant. As shown in Table 16 the total process emissions and electricity usage for Sacramento wastewater treatment and disposal resulted in emissions of 19,867 MT CO₂e per year, or 67 percent of the water and wastewater emissions.

Table 16 Water and Wastewater Emissions for Year 2016

Source	Activity Data	Emission Factor	Total Emissions (MT CO ₂ e)
Water Use	42,963,998 MWh	0.22359 MT CO₂e/MWh	9,607
Supply, Conveyance, Distribution	40,101 MWh	0.22359 MT CO ₂ e/MWh	8,967
Treatment	2,863 MWh	0.22359 MT CO ₂ e/MWh	640
Wastewater Generation	N/A	N/A	19,867
Process Nitrous Oxide Emissions	40 MT N ₂ O	1 N ₂ O to 298 CO ₂ e	11,780
Stationary Methane Emissions	32 MT CH ₄	1 CH ₄ to 25 CO ₂ e	804
Electricity Emissions	32,640 MWh	0.22359 MT CO ₂ e/MWh	7,298
			29,474

MWh = megawatt hours; MT = metric tons; CO₂e = carbon dioxide equivalent; CH₄ = methane; N₂O = nitrous oxide

Figure 4 Wastewater Methodology

Equation WW.13_{CH₄} Attributed CH₄ Emissions		
<i>Attributed CH₄ Emissions = P/P_{tot} * E</i>		
Where:		
Description		Value
Attributed CH₄ Emissions	= Annual CH₄ credited to the community (mtCO₂e)	Result
P	= Population of community served by the given WWTP	User input
P_{tot}	= Total population the WWTP serves	User input
E	= Total CH₄ produced by WWTP (mtCO₂e)	User input
Source: Developed by ICLEI Staff and Wastewater Technical Advisory Committee		

3.4 Solid Waste

GHG emissions result from management and decay of organic material solid waste. The Community Protocol provides multiple accounting methods to address both emissions arising from solid waste generated by a community (regardless of where it is disposed of) as well as emissions arising from solid waste disposed of inside a community’s boundaries (regardless of where it was generated). GHG emissions from the decomposition of organic material in this sector are broken down into two parts:

- Community Waste - Lifetime methane emissions from solid waste generated by the community in the year of the inventory, using Community Protocol method SW.4³⁴. This methodology attributes 100 percent of lifetime GHG emissions from the tonnage reported in the inventory year.
- Waste-in-Place - Methane emissions from existing solid waste-in-place at landfills located within the community limits using Community Protocol method SW.1³⁵. This methodology attributes just the GHG emissions emitted in the inventory year based on the total lifetime tonnage in the landfill.

Due to the slow rate of emissions generation associated with decomposition of solid waste, this two-pronged approach also allows policy makers to target solid waste activity in a particular year, similar to other sectors (e.g., fuel combustion resulting in immediate emissions). Accounting for both of these sources may lead to some double counting in the waste sector as any waste counted in the total tonnage for the year, but also put in the City's in-boundary landfill would be counted twice. However, the City's in-boundary landfills are now closed and both methodologies convey different aspects of the solid waste emissions profile and are included for consistency with previous inventories. All emissions from vehicular transport of solid waste are included in the transportation emissions sector.

Two landfills are located within the city; therefore, solid waste emissions were estimated using both SW.1 to calculate the in-boundary landfill emissions and SW.4 to calculate the full methane commitment of solid waste generated by Sacramento in 2016. A summary of waste emissions is provided in Table 17.

Table 17 Summary of Solid Waste Emissions for Year 2016

Source	Activity Data (tons)	Emission Factor	Total Emissions (MT CO ₂ e)
Waste-in-Place	N/A	N/A	26,504
28th Street Landfill	N/A	N/A	12,027
L & D Landfill	N/A	N/A	14,478
Waste Disposal	525,968	0.2554 MT CO₂e/ton	134,339
Total Waste Emissions			160,843

MT CO₂e = metric tons of carbon dioxide equivalent

Waste-in-Place

As a primary data source for waste-in-place emissions, the Community Protocol recommends utilizing data reported from the United States Environmental Protection Agency (USEPA) in accordance with the GHG Mandatory Reporting Rule (MRR; 40 Code of Federal Regulations [CFR] §98). If the facilities are not subject to the USEPA MRR, then the alternate approach SW.1.1 should be used. Method SW.1.1 estimates emissions based on the first order decay (FOD) model and the waste-in-place in the landfill and is summarized in Figure 5. The FOD model is an exponential equation which estimates the amount of landfill gas generated in a municipal solid waste landfill based upon the amount of municipal solid waste in the landfill (or "waste-in-place") at the point of time for which landfill gas generation is to be estimated, the capacity of that waste to generate

³⁴ <https://icleiusa.org/publications/us-community-protocol/>

³⁵ <https://icleiusa.org/publications/us-community-protocol/>

methane and a methane generation rate constant which describes the rate at which municipal solid waste in the landfill is expected to decay and produce landfill gas.

Figure 5 Waste-in-Place Methodology

Equation SW.1.1 Alternate Method – Methane Emissions from Landfills		
<i>Annual fugitive CH₄ emissions =</i>		
<i>Comprehensive LFG Collection: ((TMMG*LFGE)*(Ox))</i>		
<i>Partial or No LFG Collection: ((TMMG*(1-%LF)*Ox)+((TMMG*%LF*LFGE)*(Ox)))</i>		
Where:		
Term	Description	Value
Annual CH ₄ emissions	= Total annual fugitive landfill CH ₄ emitted (mtCO ₂ e)	Result
TMMG	= Total modeled CH ₄ generated	User Input
OX*	= Account for 10% oxidation rate	(1-.10)
% LF	= Percent of landfill covered by gas collection	User Input
LFGE	= Account for 75% LFG collection efficiency	(1-.75)
Source: 40 CFR 98, Subpart HH, and 40 CFR 60, Subpart WWW		
* If using the California ARB Landfill Emissions Tool oxidation has already been incorporated into landfill outputs therefor you do not have to multiply by 0.9.		

The Community Protocol recommends reviewing the Landfill Methane Outreach Program (LMOP) maintained by the USEPA as the first source of emissions verification for landfills.³⁶ As of 2016, no emissions from the 28th Street Landfill or L&D Landfill were reported to LMOP,³⁷ therefore, a FOD modeling tool developed by CARB and recommended by ICLEI was utilized.³⁸ The FOD model outputs emissions in methane and carbon dioxide. However, only methane emissions were accounted for as the carbon dioxide is considered biogenic in origin and not recommended for inclusion per the Community Protocol. Results of the model runs for both 28th Street Landfill and L&D Landfill can be found in the attached documentation and Table 18. A collection efficiency of 75 percent was applied per the Community Protocol for landfills with methane capture. Fugitive methane emissions from existing waste at the L&D and 28th Street landfills were calculated to be 26,504 MT CO₂e in 2016. Annual waste-in-place emissions decreased by 23,416 MT CO₂e from 2005 to 2016 due to the amount of waste remaining in the now closed landfills as modeled by the FOD modeling tool.

³⁶ United States Environmental Protection Agency. 2016. Landfill Methane Outreach Program. Accessed at: <https://www.epa.gov/lmop/project-and-landfill-data-state> . Accessed on: May 15, 2019

³⁷ United States Environmental Protection Agency. 2016. Greenhouse Gas Reporting Program. Accessed at: <https://www.epa.gov/ghgreporting>. Accessed on: May 15, 2019

³⁸ California Air Resources Board. Local Government Operations Protocol for Greenhouse Gas Assessments. Accessed at: <https://ww2.arb.ca.gov/local-government-operations-protocol-greenhouse-gas-assessments>. Accessed on: May 20, 2019

Table 18 Waste-in-Place Summary for Year 2016

Sector	28th Street Landfill Emissions (MT CO₂e)	L&D Landfill Emissions (MT CO₂e)
Methane generated	48,107	57,910
Methane captured (removed) at landfill	-36,080	-43,432
Subtotal Waste-in-Place Emissions	12,027	14,478
Total Waste-in-Place		26,504

MT CO₂e = metric tons of carbon dioxide equivalent

Community Generated Waste

While communities may want to understand the GHG emissions from landfills located within their boundaries (SW.1.1), they are required to estimate the emissions resulting from waste disposed by the community (SW.4.1), regardless of whether the receiving landfill(s) are located inside or outside of the community boundary.³⁹

Community Protocol Method SW.4.1 is summarized in Figure 6, utilizing mass of waste being disposed, organic content of waste, methane capture ability of the landfill, oxidation rate, and methane GWP. The 2016 emissions factor for generated waste in Sacramento was derived from the 2014 CalRecycle State Waste Characterization Study shown in Table 19.

³⁹ <https://icleiusa.org/publications/us-community-protocol/>

Figure 6 Waste Generation Methodology

Equation SW.4.1 Methane Emissions		
$CH_4 \text{ Emissions} = GWP_{CH_4} * (1 - CE) * (1 - OX) * M * \sum_i P_i * EF_i$		
Where:		
Term	Description	Value
CH ₄ emissions	= Community generated waste emissions from waste M (mtCO ₂ e)	Result
GWP _{CH₄}	= CH ₄ global warming potential	
M	= Total mass of waste entering landfill (wet short ton)	User Input
P _i	= Mass fraction of waste component i	User Input
EF _i	= Emission factor for material i (mtCH ₄ /wet short ton)	Table SW.5
CE	= Default LFG Collection Efficiency	No Collection, 0 Collection, 0.75
OX	= Oxidation rate	0.10
Source: As developed by ICLEI staff and Solid Waste Technical Advisory Committee. Emissions factors from U.S. EPA Municipal Solid Waste Publication (2008) available at http://www.epa.gov/epawaste/nonhaz/municipal/pubs/msw2008data.pdf		

In 2016, Sacramento produced 525,968 tons of waste.⁴⁰ A CO₂e emissions factor for mixed-waste of 0.2554 MT CO₂e/ton was established and multiplied by the total waste disposed of from the community to calculate emissions from waste generated in 2016 of 134,339 MT CO₂e. This emission factor includes the expected lifetime emissions associated with the specified tonnage of waste sent to landfill. The emissions factor was developed using SW 4.1 as well as the relative waste stream percentages of different organic materials as shown in Table 19 to establish a methane emissions factor. The efficiency capture used was 75 percent, which was an update from previous inventories which relied on a regional average (42 percent) from the 2005 inventory. CalRecycle and USEPA LMOP data allow for more precise tracking of waste destination and methane capture ability and the majority of Sacramento’s waste in 2016 was transported to L & D Landfill in Sacramento, Kiefer Landfill in Sloughouse, and Forward Landfill in Manteca, all of which operate landfill gas capture programs.⁴¹ From 2005 to 2016 GHG emissions from community waste decreased by 270,963 MT of CO₂e. This was due to a combination of factors including a reduced emission factor due to installation of methane capture programs at landfills as well as an overall reduction in waste generation of 158,120 tons.

⁴⁰ Waste tonnage and destinations from <https://www2.calrecycle.ca.gov/LGCentral>. Accessed on: May 20, 2019

⁴¹ Landfill gas capture program data verified from <https://www.epa.gov/lmop/project-and-landfill-data-state>. Accessed on: May 20, 2019

Table 19 CalRecycle 2014 Waste Characterization Factor

Waste Type	WIPFRAC	TDOC	DANF	ANDOC	Weighted CH ₄ /ton	Weighted MT CO ₂ e/ton
Newspaper	1.44%	47.09%	15.05%	0.117%	0.000143208	0.003580198
Office Paper	0.73%	38.54%	87.03%	0.617%	0.000344557	0.00861393
Corrugated Boxes	3.13%	44.84%	44.25%	0.952%	0.000872251	0.021806282
Coated Paper	12.10%	33.03%	24.31%	0.721%	0.001366096	0.034152408
Food	18.12%	14.83%	86.52%	1.990%	0.00326912	0.081728001
Grass	1.84%	13.30%	47.36%	0.120%	0.000163279	0.004081975
Leaves	3.52%	29.13%	7.30%	0.069%	0.00010509	0.002627254
Branches	3.27%	44.24%	23.14%	0.200%	0.000470807	0.011770174
Lumber	11.91%	43.00%	23.26%	1.451%	0.00167506	0.041876495
Textiles	5.85%	24.00%	50.00%	0.656%	0.000986758	0.024668962
Diapers	4.29%	24.00%	50.00%	0.520%	0.000723544	0.018088588
Construction/Demolition	2.31%	4.00%	50.00%	0.110%	6.48827E-05	0.001622068
Medical Waste	0.11%	15.00%	50.00%	0.000%	1.19281E-05	0.000298201
Sludge/Manure	0.57%	5.00%	50.00%	0.001%	1.991E-05	0.000497751
MSW Total					0.010216492	0.255412288

WIPFRAC = fraction of waste in waste-in-place; TDOC = total degradable organic carbon; DANF = decomposable anaerobic fraction; ANDOC = anaerobically degradable organic carbon; CH₄ = methane; MT CO₂e = metric ton of carbon dioxide equivalent

4 Forecast

A baseline inventory (i.e., the City of Sacramento’s 2016 inventory) sets a reference point for a single year. However, annual emissions change over time due to external factors such as population and job growth. An emission’s forecast accounts for projected growth and presents an estimate of GHG emissions in a future year. Calculating the difference between the GHG emissions forecast and the reduction targets set by the City determines the gap to be closed through City Climate Action Plan policies. This section quantifies the reduction impact State regulations will have on the City of Sacramento’s forecast and presents the results in an *adjusted scenario* forecast. The *adjusted scenario* incorporates the impact of State regulations which would reduce the City of Sacramento’s GHG emissions to provide a more accurate picture of future emissions growth and the responsibility of the City and community for GHG reductions once State regulations to reduce GHG emissions have been implemented.

Several indicator growth rates were developed and applied to the various emissions sectors to forecast emissions as shown in Table 22. The growth rates were applied to the most recent inventory year (2016) data to obtain projected activity data (e.g., energy use, waste production). Growth rates were developed from the 2035 Sacramento General Plan population and job forecasts, EMFAC Modeling, and Department of Finance population forecasts for Sacramento County. Applicable State and federal regulatory requirements, including Corporate Average Fuel Economy standards, Advanced Clean Car Standards, Renewable Portfolio Standard, and Title 24 efficiencies were then incorporated to accurately reflect expected reductions from State programs.

As the City of Sacramento General Plan Update is completed, population forecasts will shift. Therefore, the forecast presented in Section 4.1 may be updated over the course of the project to be consistent with the General Plan Update. To deal with these changes, a “model” has been developed which allows for these variables to be easily adjusted as changes occur.

4.1 Forecast Results Summary

Overall emissions in Sacramento are forecast to decrease 35 percent by 2045 under existing programs and regulations (Adjusted Forecast) as shown in Table 20. The adjusted forecast emissions reductions are due to SB 100 requiring 100 percent GHG-free electricity in 2045, electricity-related emissions are expected to reduce to zero. Transportation, natural gas, and waste emissions are expected to constitute the majority of emissions by 2045.

Table 20 Summary of BAU Forecast and Legislative Reductions by Year

	2020	2025	2030	2040	2045
Emissions Forecast	Emissions (MT CO ₂ e)	Emissions (MT CO ₂ e)	Emissions (MT CO ₂ e)	Emissions (MT CO ₂ e)	Emissions (MT CO ₂ e)
Business-as-usual forecast	3,558,871	3,726,548	3,894,225	4,203,918	4,342,257
Reduction from State measures	344,615	780,096	1,190,660	1,775,373	2,114,935
Adjusted Forecast	3,214,256	2,946,452	2,703,565	2,428,545	2,227,322

MT CO₂e = metric tons of carbon dioxide equivalent

Waste emissions will likely be lower than the current forecast due to SB 1383 and the requirements for a statewide 75 percent reduction in organic materials being sent to landfill by 2025. Due to the uncertainty of how these requirements will be enacted within the city of Sacramento, the modeling of the change in emissions from SB 1383 was not included and waste-reduction measures identified in the Climate Action Plan will be credited to the City.

As shown in Table 21, State regulations will reduce community GHG emissions substantially by 2045. However, a substantial gap remains between the adjusted scenario and the targets discussed in Section 5. The required reductions to close the gap will come from existing and newly identified GHG reduction measures included in this and future iterations of the Sacramento Climate Action Plan.

Table 21 Adjusted Absolute and Per Capita Emissions Forecast

Year	Population	Absolute Emissions (MT CO ₂ e)	Per Capita Emissions (MT CO ₂ e/person)
2016	472,692	3,424,729	7.2
2020	507,587	3,214,256	6.3
2025	551,206	2,946,452	5.3
2030	594,824	2,703,565	4.5
2040	668,786	2,428,545	3.6
2045	697,764	2,227,322	3.2

MT CO₂e = metric tons of carbon dioxide equivalent

4.2 Business-as-Usual Forecast

The City of Sacramento business-as-usual scenario forecast provides an estimate of how GHG emissions would change in the forecast years if consumption trends continue as in 2016, absent any new regulations which would reduce local emissions. Several indicator growth rates were developed from 2016 activity levels and applied to the various emissions sectors to project future year emissions. Table 22 contains a list of growth factors used to develop the business-as-usual scenario forecast, with a summary of the results in Table 23. The BAU growth factors were then multiplied by the population or service person growth rates to develop the BAU emissions forecast.

Table 22 Business-as-Usual Growth Factors

Sector	Activity Data
Emissions per capita (MT CO ₂ e/capita)	7.25
Residential electricity per capita (kWh/capita)	3,011
Commercial electricity use per job (kWh/employment)	7,098
Residential gas per capita (therm/capita)	127
Commercial gas use per job (therm/job)	93.9
Industrial gas per job (therm/job)	11.1
Per job industrial gas use (therm)	11.1
Waste per service person (tons/SP)	0.67
Per service pop WW GHG (MT CO ₂ e)	0.0254
CO ₂ e per ton waste (MT CO ₂ e/ton)	0.306
Water electricity per service person (kWh/SP)	55.0
Water emissions per capita (MT CO ₂ /capita)	0
Total VMT per service person (VMT/SP)	5,563

kWh = kilowatt hour; SP = service person (sum of population and employment) MT CO₂e = metric tons of carbon dioxide equivalent; VMT = vehicle miles traveled

Under the business-as-usual forecast scenario, the City of Sacramento's GHG emissions are projected to continue increasing through 2045 as shown in Table 23. This increase is led primarily by a strong commercial and residential development trend. After the current General Plan horizon year of 2035, major increases in in emissions are largely attributed to the increased population and vehicular traffic from the greater Sacramento County Area traveling into the city. By 2045, the City is expected to produce 4,393,112 MT CO₂e under business-as-usual projections, an increase of 42 percent over 2016 emissions.

Table 23 Business-as-usual Forecast by Sector

Sector	2020 Emissions (MT CO ₂ e)	2025 Emissions (MT CO ₂ e)	2030 Emissions (MT CO ₂ e)	2040 Emissions (MT CO ₂ e)	2045 Emissions (MT CO ₂ e)
Residential Electricity	341,770	371,140	400,509	450,309	469,821
Commercial & Industrial Electricity	515,632	547,740	579,848	641,041	668,817
Residential Gas	341,801	371,174	400,546	450,350	469,864
Commercial & Small Industrial Gas	181,037	192,310	203,584	225,068	234,820
Waste	171,357	184,500	197,643	220,803	230,371
Water	10,235	11,020	11,805	13,188	13,759
Wastewater	21,166	22,789	24,412	27,273	28,455
Transportation	1,975,873	2,025,876	2,075,879	2,175,885	2,277,215
Total Emissions	3,558,871	3,726,548	3,894,225	4,203,918	4,393,122
Per Capita Emissions (MT CO₂e/person)	7.01	6.76	6.55	6.29	6.30

MT CO₂e = metric tons of carbon dioxide equivalent

4.3 State Legislation

The adjusted scenario estimates future City of Sacramento emissions under codified GHG reduction strategies currently being implemented at the State and federal level. The 2017 Scoping Plan Update identified several existing State programs and targets, or known commitments required by statute which can be assumed to achieve GHG reductions without City action, such as increased fuel efficiency standards of mobile vehicles. The following known commitments are factored into the adjusted scenario projection and a summary of the programs can be found in Table 24.

The largest GHG reductions realized by State programs in Sacramento will occur from the increasing decarbonization of the electricity supply due to SB 100 and the Renewable Portfolio Standard (RPS), avoiding over 1,000,000 MT CO₂e by 2045. The transportation sector will also experience over 975,000 MT CO₂e by 2045 through State and federal fuel efficiency and tailpipe emissions standards.

Table 24 Summary of Legislative Reductions

Legislation	2020 Emissions (MT CO ₂ e)	2025 Emissions (MT CO ₂ e)	2030 Emissions (MT CO ₂ e)	2040 Emissions (MT CO ₂ e)	2045 Emissions (MT CO ₂ e)
Senate Bill 100	140,172	269,898	437,139	803,480	1,033,535
Title 24	6,127	36,764	67,400	122,084	145,049
Transportation (Pavley, etc.)	198,315	473,434	686,121	849,810	936,351
Total	344,615	780,096	1,190,660	1,775,373	2,114,935

MT CO₂e = metric tons of carbon dioxide equivalent

Transportation Legislation

The CARB EMFAC2017 transportation modeling program incorporates legislative requirements and regulations including Advanced Clean Cars program (Low Emissions Vehicles III, Zero Emissions Vehicles program, etc.), and Phase 2 federal GHG Standards. Signed into law in 2002, AB 1493 (Pavley Standards) required vehicle manufactures to reduce GHG emissions from new passenger vehicles and light trucks from 2009 through 2016, with a target of 30 percent reductions by 2016, while simultaneously improving fuel efficiency and reducing motorists' costs.⁴²

Prior to 2012, mobile emissions regulations were implemented on a case-by-case basis for GHG and criteria pollutant emissions separately. In January 2012, CARB approved a new emissions-control program (the Advanced Clean Cars program) combining the control of smog, soot causing pollutants, and GHG emissions into a single coordinated package of requirements for passenger cars and light trucks model years 2017 through 2025. The Advanced Clean Cars program coordinates the goals of the Low Emissions Vehicles, Zero Emissions Vehicles, and Clean Fuels Outlet programs. The new standards will reduce Californian GHG emissions by 34 percent in 2025.⁴³

⁴² California Air Resources Board. Clean Car Standards – Pavley, Assembly Bill 1493. May 2013.

⁴³ California Air Resources Board. Advanced Clean Cars Program About. January 2023. Accessed at: <https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program> Accessed on: April 17, 2023

Reductions in GHG emissions from the above referenced standards were calculated using the CARB EMFAC2017 model for Sacramento County. The EMFAC2017 model integrates the estimated reductions into the mobile source emissions portion of the model.⁴⁴

Title 24

Although it was not originally intended to reduce GHG emissions, California Code of Regulations Title 24, Part 6: California's Energy Efficiency Standards for Residential and Nonresidential Buildings, was adopted in 1978 in response to a legislative mandate to reduce California's energy consumption, which in turn reduces fossil fuel consumption and associated GHG emissions. The standards are updated triennially to allow consideration and possible incorporation of new energy-efficient technologies and methods. Starting in 2020, new residential developments will include on-site solar generation and near-zero net energy use. For projects implemented after January 1, 2020, the California Energy Commission estimates the 2019 standards will reduce consumption by seven percent for residential buildings and 30 percent for commercial buildings, relative to the 2016 standards. These percentage savings relate to heating, cooling, lighting, and water heating only and do not include other appliances, outdoor lighting not attached to buildings, plug loads, or other energy uses. The calculations and GHG emissions forecast assume all growth in the residential and commercial/industrial sectors is from new construction.

The 2017 Scoping Plan Update calls for the continuation of ongoing triennial updates to Title 24 which will yield regular increases in the mandatory energy and water savings for new construction. Future updates to Title 24 standards for residential and non-residential alterations past 2023 are not taken into consideration due to lack of data and certainty about the magnitude of energy savings realized with each subsequent update.

Renewables Portfolio Standard & Senate Bill 100

Established in 2002 under SB 1078, enhanced in 2015 by SB 350, and accelerated in 2018 under SB 100, California's RPS is one of the most ambitious renewable energy standards in the country. The RPS program requires investor-owned utilities, publicly-owned utilities, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources to 50 percent of total procurement by 2026 and 60 percent of total procurement by 2030. The RPS program further requires these entities to increase procurement from GHG-free sources to 100 percent of total procurement by 2045.

SMUD provides electricity in Sacramento and is subject to the RPS requirements. SMUD forecast emissions factors include reductions based on compliance with RPS requirements through 2045. In 2016, SMUD reported an emissions factor of 492.95 pounds CO₂e per MWh.

Assembly Bill 939 & Assembly Bill 341

In 2011, AB 341 set the target of 75 percent recycling, composting, or source reduction of solid waste by 2020 calling for the California Department of Resources Recycling and Recovery (also

⁴⁴ Additional details are provided in the EMFAC2017 Technical Documentation, July 2018. Accessed at: <https://ww2.arb.ca.gov/sites/default/files/2023-01/emfac2017-volume-iii-technical-documentation.pdf>. Accessed on: May 20, 2019. The Low Carbon Fuel Standard (LCFS) regulation is excluded from EMFAC2017 because most of the emissions benefits due to the LCFS come from the production cycle (upstream emissions) of the fuel rather than the combustion cycle (tailpipe). As a result, LCFS is assumed to not have a significant impact on CO₂ emissions from EMFAC's tailpipe emissions estimates.

known as CalRecycle) to take a statewide approach to decreasing California’s reliance on landfills. This target was an update to the former target of 50 percent waste diversion set by AB 939.

As actions under AB 341 are not assigned to specific local jurisdictions, actions beyond the projected waste diversion target of 5.9 pounds per person per day set under AB 939 for the City of Sacramento will be quantified and credited to the City during the Climate Action Plan measure development process. As of 2016, Sacramento is meeting both the 5.9 pounds per person per day and 9.5 pounds per job per day diversion targets set by CalRecycle under AB 341.

Senate Bill 1383

SB 1383 established a methane emissions reduction target for short-lived climate pollutants in various sectors of the economy, including waste. Specifically, SB 1383 establishes targets to achieve a 50 percent reduction in the level of the statewide disposal of organic waste from the 2014 level by 2020 and a 75 percent reduction by 2025.⁴⁵ Additionally, SB 1383 requires a 20 percent reduction in “current” edible food disposal by 2025. Although SB 1383 has been signed into law, compliance at the jurisdiction-level has proven difficult. For example, Santa Clara County suggests the 75 percent reduction in organics is not likely achievable under the current structure; standardized bin colors are impractical; and the general requirement is too prescriptive.⁴⁶ As such, SB 1383 is not included as part of the adjusted forecast. Instead measures addressing compliance with SB 1383 will be addressed through newly identified GHG reduction measures included in the Climate Action Plan.

4.4 Adjusted Scenario Forecast

The adjusted scenario is based on the same information as the business-as-usual scenario but also includes the legislative actions and associated emissions reductions occurring at the State and federal levels. These actions include regulatory requirements to increase vehicle fuel efficiency or standards to reduce the carbon intensity of electricity. The difference between the emissions projected in the adjusted scenario and the GHG reduction targets established for each horizon year is the amount of GHG reductions which are the responsibility of the City. This “gap analysis” provides the City with the total GHG emissions reduction required as well as information on the emissions sectors and sources which have the most GHG reduction opportunities.

The electricity and water/wastewater sectors all experience a strong downward trend, approaching near-zero in 2045 due to extremely stringent RPS from SB 100. Natural gas emissions are expected to continue an upward trajectory until the 2035 due to strong population growth projections in the city. This trend is partially offset due to the increasingly stringent efficiency requirements for new homes in the upcoming Title 24 code cycles. Commercial growth will also lead commercial natural gas emissions on a similar trajectory. Transportation emissions are expected to decrease sharply in the next 10 to 15 years due to existing fuel efficiency requirements and fleet turnover rates. As most current regulations expire in 2025 or 2030, emissions standards will experience diminishing returns while VMT continues to increase, leading to lower rates of emissions reduction in the transportation sector.

⁴⁵ CalRecycle. April 16, 2019. Short-Lived Climate Pollutants (SLCP): Organic Waste Methane Emissions Reductions (General Information). Accessed at: <https://www.calrecycle.ca.gov/climate/slcp>. Accessed on: May 20, 2019

⁴⁶ Santa Clara County. June 20, 2018. SB 1383 Rulemaking Overview. Accessed at: <https://www.sccgov.org/sites/rwr/rwrc/Documents/SB%201383%20PowerPoint.pdf>. Accessed on: May 20, 2019

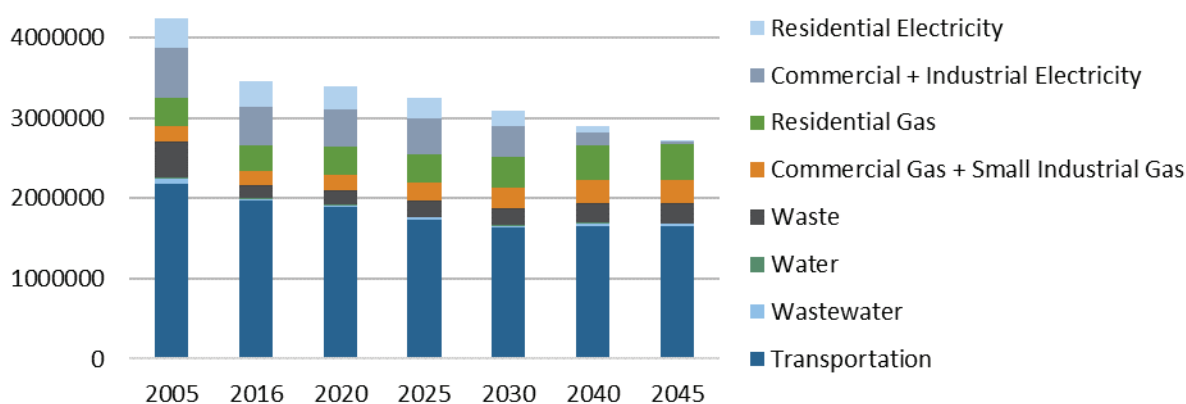
A summary of Sacramento’s projected emissions by sector and year through 2045 can be found in Figure 7 and Table 25. Further details on the growth rates and emissions for each sector can be found in the corresponding discussion sections.

Table 25 Adjusted Scenario Forecast Summary by Sector by Target Year

Sector	2016 Emissions (MT CO ₂ e)	2020 Emissions (MT CO ₂ e)	2025 Emissions (MT CO ₂ e)	2030 Emissions (MT CO ₂ e)	2040 Emissions (MT CO ₂ e)	2045 Emissions (MT CO ₂ e)
Population	472,692	507,587	551,206	594,824	668,786	697,764
Jobs	308,724	324,910	345,142	365,374	403,933	421,435
Residential Electricity	318,275	283,625	246,723	195,341	77,934	0
Commercial/ Industrial Electricity	489,945	430,228	375,327	297,950	120,298	0
Residential Gas	318,304	341,390	368,706	396,022	442,341	460,488
Commercial + District Industrial Gas	172,019	180,361	188,252	196,143	211,183	218,009
Waste	160,843	171,357	184,500	197,643	220,803	230,371
Water	9,607	8,572	7,714	6,296	2,638	0
Wastewater	19,867	21,166	22,789	24,412	27,273	28,455
Transportation	1,935,870	1,777,557	1,552,442	1,389,757	1,326,075	1,319,471
Total Emissions	3,424,729	3,214,256	2,946,452	2,703,565	2,428,545	2,256,794
Per Capita Emissions (MT CO₂e/person)	7.25	6.33	5.35	4.55	3.63	3.23

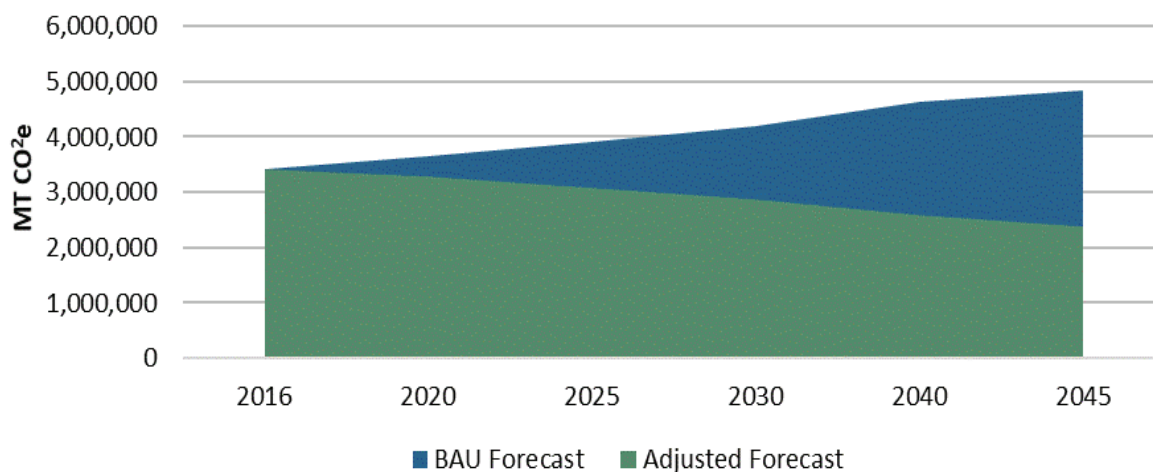
MT CO₂e = metric tons of carbon dioxide equivalent

Figure 7 Summary of Adjusted Scenario Forecast by Sector by Year



As shown in Figure 8, without legislative reductions, the City’s emissions would increase proportionally with population and economic growth. In reality, several existing legislative reductions would limit the City’s emissions growth, causing projected emissions to decrease. This scenario is depicted by the Adjusted Forecast. The legislative reductions for each sector and scaling methods used to project emissions are discussed in detail below.

Figure 8 BAU Scenario and Adjusted Scenario Forecast



4.5 Electricity

Between 2016 and 2045, electricity emissions for commercial, residential, and industrial buildings in the city of Sacramento, together representing the building energy electricity sector, are assumed to decrease from 808,220 MT CO₂e to 0 MT CO₂e, despite steady growth in Sacramento’s population and employment levels due to the adoption of SB 100 and the renewable portfolio standard. SMUD’s current plan to reach carbon neutral electricity includes the use of offsets. These offsets have not been identified fully and future work will need to ensure no double counting occurs between SMUD and Sacramento’s efforts to reach carbon neutral emissions.

Emissions from future electricity use were forecasted by projecting anticipated growth in residential and commercial sectors and multiplying by expected electricity emission factors. Anticipated growth in the residential sector was projected as a function of population growth within the city while commercial sector electricity use was projected as a function of employment projections. Legislative adjustments included in the electricity sector forecast include RPS of 60 percent by 2030 and 100 percent GHG-free by 2045. Additionally, Title 24 building code efficiency increases for the 2019 code cycle were applied to all new growth within the city. The methodologies for the electricity sector which were forecasted in the adjusted scenario are summarized in Table 26 and Table 27.

Table 26 Electricity Sector Adjusted Scenario Forecast Methodology

Source Category	Forecasted Activity Data (Scaling Factor)	Emission Factor	Applied Legislative Reductions
Residential Electricity	Population growth in Sacramento	Assumes an electricity mix of 44 percent, 60 percent, and 100 percent GHG-free by 2025, 2030, and 2045, respectively, for SMUD emission factors per RPS requirements.	Title 24 standards for new construction in 2019 (53 percent residential, 30 percent commercial), RPS requirements
Commercial & Industrial Electricity	Employment growth in Sacramento		

RPS = Renewable Portfolio Standard; GHG = greenhouse gas; SMUD = Sacramento Municipal Utility District

Table 27 Electricity Adjusted Scenario Forecast Results by Target Year

Activity Data	2020	2025	2030	2040	2045
Residential Electricity					
Population	507,587	551,206	594,824	668,786	697,764
BAU per capita kWh	3,011.30	3,011.30	3,011.30	3,011.30	3,011.30
BAU total kWh	1,528,498,898	1,659,848,041	1,791,197,185	2,013,918,450	2,101,180,304
Adjusted kWh (Title 24)	1,514,575,889	1,576,309,986	1,638,044,083	1,742,723,078	1,783,736,149
Emissions factor (MT CO ₂ e/MWh)	0.18726	0.15652	0.11925	0.04472	0.0
Emissions (MT CO₂e)	283,625	246,723	195,341	77,934	0
Commercial Electricity					
Employment	324,910	345,142	365,374	403,933	421,435
BAU per job kWh	7,097.54	7,097.54	7,097.54	7,097.54	7,097.54
BAU total kWh	2,306,059,234	2,449,657,395	2,593,255,556	2,866,927,114	2,991,149,311
Adjusted kWh (Title 24)	2,297,443,344	2,397,962,057	2,498,480,770	2,690,050,860	2,777,006,398
Factor (MT CO ₂ e/MWh)	0.18726	0.15652	0.11925	0.04472	0.00000
Emissions (MT CO₂e)	430,228	375,327	297,950	120,298	0
MT CO ₂ e = metric ton of carbon dioxide equivalent; kWh = kilowatt hour; MWh = megawatt hour; BAU = business-as-usual					

4.6 Natural Gas

Emissions from projected natural gas use were forecast using a similar methodology to the electricity sector. Anticipated natural gas use was projected for the residential and commercial sectors separately using population change and employment increase as growth indicators respectively. These results were multiplied by a natural gas emission factor of 0.00531 MT CO₂e per therm of natural gas.⁴⁷ Unlike electricity, the natural gas emission factor is based on the quality of the gas and remains relatively constant over time. This analysis did not consider any shift to renewable gas which may become more common over time and the use of which may affect future natural gas emission factors. The methodologies and data used to calculate natural gas emissions over time are summarized in Table 28 and Table 29.

Legislative adjustments applied for the natural gas sector include efficiency increases from Title 24 building code updates for new construction after the 2019 code cycle begins. Specific efficiency increases for new buildings over the previous triennial cycle are discussed in Section 4.3.

⁴⁷ The Climate Registry. 2022 Default Emissions Factors. Accessed at: <https://theclimateregistry.org/wp-content/uploads/2022/11/2022-Default-Emission-Factors-Final.pdf>. Accessed on April 18, 2023

Table 28 Natural Gas Adjusted Scenario Forecast Methodology

Source Category	Forecasted Activity Data (Scaling Factor)	Emission Factor	Applied Legislative Reductions
Residential Natural Gas	Population growth in Sacramento	0.00531 MT CO ₂ e/therm	Title 24 standards for efficiency in new construction in 2019 (7 percent residential, 30 percent commercial over 2016 Title 24)
Commercial & District Natural Gas	Employment growth in Sacramento		

MT CO₂e = metric ton of carbon dioxide equivalent

Table 29 Natural Gas Adjusted Scenario Forecast Results by Target Year

Activity Data	2020	2025	2030	2040	2045
Residential Gas					
BAU therms	64,405,311	69,939,880	75,474,449	84,859,102	88,535,995
Title 24 adjusted therms	64,327,827	69,474,976	74,622,125	83,349,853	86,769,363
Factor (MT CO ₂ e/therm)	0.00531	0.00531	0.00531	0.00531	0.00531
Emissions (MT CO₂e)	341,390	368,706	396,022	442,341	460,488
Commercial Gas					
BAU therms	34,112,675	36,236,869	38,361,064	42,409,385	44,246,958
Title 24 adjusted therms	33,985,224	35,472,160	36,959,095	39,792,920	41,079,221
Factor (MT CO ₂ e/therm)	0.00531	0.00531	0.00531	0.00531	0.00531
Emissions (MT CO₂e)	180,361	188,252	196,143	211,183	218,009

MT CO₂e = metric ton of carbon dioxide equivalent; BAU = business-as-usual

4.7 Waste

The forecast used a baseline emissions rate of 0.7458 tons of waste per service population along with projected growth in Sacramento service population to establish the estimated tonnage of waste being disposed yearly through 2045. As the inventoried waste emissions include both waste-in-place and waste generation, an emissions factor of MT CO₂e per ton of waste was used to forecast emissions. An overall 2016 solid waste emissions factor, incorporating both generated waste and waste-in-place emissions, of 0.3058 MT CO₂e per ton of municipal solid waste was used to project emissions consistent with service population growth. Emissions from the waste sector will likely be less than the projected totals due to decreasing rates of organic material in the waste stream and recent legislation such as SB 1383 discussed in previous sections. At this time no mandate exists for individual cities and the waste reductions from these bills are incorporated into the Climate Action Plan through City reduction measures to avoid double counting. A summary of the methodologies and data used to model waste emission over time are provided in Table 30 and Table 31.

Table 30 Solid Waste Adjusted Scenario Forecast Methodology

Forecasted Activity Data (Scaling Factor)	Emission Factor	Applied Legislative Reductions
Service population growth	0.7458 tons per service person, 0.3058 MT CO ₂ e/ton of solid waste	N/A

MT CO₂e = metric ton of carbon dioxide equivalent; N/A = not applicable

Table 31 Waste Emissions Adjusted Scenario Forecast Results by Target Year

Activity Data	2020	2025	2030	2040	2045
Service Population	832,497	896,347	960,198	1,072,719	1,119,199
Ton waste per Service Population	0.6731	0.6731	0.6731	0.6731	0.6731
Total tons waste	560,350	603,328	646,306	722,043	753,328
Waste Factor (MT CO ₂ e/ton)	0.3058	0.3058	0.3058	0.3058	0.3058
Emissions (MT CO₂e)	171,357	184,500	197,643	220,803	230,371

MT CO₂e = metric ton of carbon dioxide equivalent

4.8 Transportation

Transportation emissions forecasts were developed consistent with the inventory methodology, through the determination of on-road annual VMT multiplied by a year-specific weighted emissions factor for emissions per mile travelled. VMT forecasts for the City of Sacramento were provided by Fehr and Peers Transportation Consultants through the use of SACOG SACSIM software. SACSIM was utilized to model VMT through 2040 with projected annual growth in County VMT as a proxy to extrapolate VMT for the years 2040 to 2045. Emissions factors were established for each year through the use of the EMFAC2017 GHG module, which established VMT and total emissions for each vehicle type in the County. These respective emissions factors were applied in each year to establish transportation emissions forecasts as shown in Table 32 and Table 33.

Table 32 Transportation Adjusted Scenario Forecast Methodology

Source Category	Forecasted Scaling Factor	Emissions Factor	Applied Legislative Reductions
On-road Transportation	SACSIM VMT Modeling ¹	EMFAC2017 model analyzing light duty (LDA, LDT1, LDT2, MDV, MCY) and heavy duty (LHD, T6, T7, PTO, MH, SBUS, UBUS, OBUS, Motor Coach, All Other Buses) vehicles.	EMFAC emission factors account for legislative reductions from Advanced Clean Cars, Pavley Clean Car Standards, Tractor-Trailer Greenhouse Gas Regulation, and adopted fuel efficiency standards for medium- and heavy-duty vehicles.

¹ SACSIM incorporates data from many sources, including US Census, travel survey, and highway monitoring information. More information can be found on the SACOG SACSIM website at <https://www.sacog.org/modeling>

MT CO₂e = metric ton of carbon dioxide equivalent; VMT = vehicle miles traveled

Table 33 Transportation Adjusted Scenario Forecast Results by Target Year

Activity Data	2020	2025	2030	2040	2045
Population	507,587	551,206	594,824	668,786	697,764
VMT	4,436,839,519	4,549,121,999	4,661,404,480	4,885,969,442	4,999,288,804
EMFAC (MT CO ₂ e/VMT)	0.000401	0.000341	0.000298	0.000271	0.000258
Emissions (MT CO₂e)	1,777,557	1,552,442	1,389,757	1,326,075	1,289,999

MT CO₂e = metric ton of carbon dioxide equivalent; VMT = vehicle miles traveled

4.9 Water and Wastewater

Due to the increased use of the water system attributed to increases in job and population growth in Sacramento, service population was used as a scaling metric to determine water and wastewater service emissions through 2045. The Sacramento Wastewater Treatment Plant is currently undergoing renovations and upgrades through 2023 to modernize its facilities. As part of the “EchoWater Project”, future wastewater emissions are expected to be lower than quantified here due to ammonia effluent reductions.

Projections for water used a baseline activity factor of 60.92 kWh per service population per year. This emissions factor was multiplied by service population growth through 2045 to find total kWh usage. The RPS for electricity generation was then applied to water emissions, as described in the Legislative Adjustment Section, to determine final MT CO₂e emissions as shown in Table 35 and Table 36.

Wastewater emissions are calculated from both methane as well as stationary and process nitrous oxide emissions, wastewater projections used an emissions factor of 0.028 MT CO₂e per service population per year and a growth indicator of service population to determine future wastewater emissions.

Table 34 Water and Wastewater Adjusted Scenario Forecast Methodology

Forecasted Activity Data (Scaling Factor)	Emissions Factor	Applied Legislative Reductions
Service population (population and employment growth)	SMUD electricity emissions factors, 60.92 kWh per service population per year	Assumes an electricity mix of 44 percent, 60 percent, and 100 percent GHG-free by 2025, 2030, and 2045 respectively for SMUD emission factors per RPS requirements.
Service population (population and employment growth)	0.0282 MT CO ₂ e per service person per year for wastewater	N/A

MT CO₂e = metric ton of carbon dioxide equivalent; kWh = kilowatt hour; SMUD = Sacramento Municipal Utility District; N/A = not applicable

Table 35 Water Adjusted Scenario Forecast Results by Target Year

Activity Data	2020	2025	2030	2040	2045
Service Population	832,497	896,347	960,198	1,072,719	1,119,199
kwh/Service Person	54.98	54.98	54.98	54.98	54.98
Total kWh	45,772,524.85	49,283,183.92	52,793,842.99	58,980,464.53	61,536,051.96
RPS Electricity Factor (MT CO ₂ e/kWh)	0.1872638	0.1565190	0.1192526	0.0447197	0.0000000
Emissions (MT CO₂e)	8,572	7,714	6,296	2,638	0

MT CO₂e = metric ton of carbon dioxide equivalent; kWh = kilowatt hour; RPS = renewable portfolio standard

Table 36 Wastewater Adjusted Scenario Forecast Results by Target Year

Activity Data	2020	2025	2030	2040	2045
Service Population	832,497	896,347	960,198	1,072,719	1,119,199
MT CO ₂ e/Service Population	0.025	0.025	0.025	0.025	0.025
Emissions (MT CO₂e)	21,166	22,789	24,412	27,273	28,455

MT CO₂e = metric ton of carbon dioxide equivalent; kWh = kilowatt hour;

5 Target Setting

Climate action plan GHG-reduction targets can be set as either an efficiency target (MT CO₂e per capita or per service population per year) or as a community wide mass emissions target (total MT CO₂e). With CARB's publication in 2017 of the Scoping Plan Update, the State recommended using efficiency metrics for local targets to incentivize growth in a coordinated manner and not penalize cities which are growing at significant rates.⁴⁸ Throughout this section, targets are discussed in terms of per capita metrics, however, they must occasionally be translated into absolute emissions reductions to quantify reduction measures and identify the magnitude of reductions required.

Target setting is an iterative process which must be informed by the reductions that can realistically be achieved through the development of feasible GHG reduction measures. Furthermore, as mentioned previously, changes to the General Plan Update may impact the forecast results. As such, the targets identified herein should remain provisional until the General Plan Update values are finalized and the quantification and analysis of potential GHG reduction measures completed.

The City of Sacramento has achieved both efficiency and absolute emissions reductions between 2005 and 2016 despite high population growth rates. The purpose of target setting is to develop the trajectory toward achieving the State's 2030 goal and prepare for the deep decarbonization needed by 2045 in a cost-effective manner by setting an incremental path toward achieving the AB 1279 goals. There are several target pathways available to be consistent with State reduction goals, discussed further below.

- **SB 32 Target Pathway** is the pathway toward achieving the minimum reductions required by State law. This will require minimal reductions until 2030 and then steep reductions from 2030 to 2045.
- **Linear Carbon Neutrality Pathway** is an incremental linear pathway from current per capita emissions levels straight to carbon neutrality in 2045. This pathway is also compliant with the 2030 State goal.
- **Mass Emissions Reduction Pathway** is the pathway determined by reducing mass emissions without consideration to population growth. This pathway will require steep reductions to 2030 and then a slightly more gradual reduction to the 2045 carbon neutrality goal. This pathway is also compliant with the 2030 goal.

At this time, the State has codified a goal of reducing emissions to 40 percent below 1990 emissions levels by 2030 (SB 32) and has developed a Scoping Plan to demonstrate how the State will achieve the 2030 goal and make substantial progress toward the State's long-term GHG reduction goals. Sufficient data does not exist to perform a full 1990 inventory, however, as discussed in the Background section, the State has indicated a 15 percent reduction from 2005 GHG emissions levels can be considered equivalent to a 1990 baseline. Consistent with this methodology, a 1990 emissions level of 3,600,213 MT CO₂e, or 9.75 MT CO₂e per capita was established for Sacramento.

The State recommends utilizing a per capita efficiency metric for SB 32 targets to account for changes in population. Therefore, a minimum target of 5.85 MT CO₂e per capita (40 percent reduction from 9.75 MT CO₂e per capita in 1990) would be needed to establish an emissions level compliant with SB 32 target levels.

⁴⁸ California Air Resources Board. 2017. California's Climate Change Scoping Plan, p. 99-102.

While no State plan exists to achieve carbon neutrality by 2045, AB 1279 directs CARB to ensure future Scoping Plan updates identify and recommend measures to achieve the carbon neutrality goal. Executive Orders are binding only unto State agencies and are not binding on local governments or the private sector. However, showing progress toward this goal is expected to be a mandatory component of CEQA analyses upon publication of the next Scoping Plan.

Based on this information, establishing provisional targets for the years 2025 (interim target), 2030 (SB 32 target year), 2040 (General Plan horizon year), and 2045 (AB 1279 target year) is recommended. The 2045 target is intended to be a long-term commitment demonstrating the City's commitment to achieving the long-term goal presented in AB 1279. The City has several potential pathways to show consistency with State targets as shown in Table 37.

Based on the SB32 and AB 1279 State targets, Sacramento has established a 2030 per capita GHG reduction target that exceeds the SB32 minimum and a 2045 target consistent with AB 1279. The City of Sacramento 2030 target of 3.63 MT CO₂e per person exceeds the State minimum of 5.85 and is equivalent to a 63% reduction from 1990 levels by 2030.

Table 37 Per Capita Pathway Targets by Target Year

Year	Forecast (MT CO ₂ e/person)	City of Sacramento Reduction Targets (MT CO ₂ e/person)
2020	6.3	6.0
2025	5.5	4.7
2030	4.8	3.6
2040	3.9	1.0
2045	3.4	0

MT CO₂e = metric ton of carbon dioxide equivalent

The absolute GHG emissions gap in 2030, 2040, and 2045 between each target pathway and the forecast emissions can be found in Table 38. This gap will be bridged by local actions developed in the City of Sacramento Climate Action Plan.

Table 38 Remaining GHG Emissions Gap in 2030 and 2040 by Pathway

Year	Linear Carbon Neutral Pathway (MT CO ₂ e)
2030 Gap	543,437
2040 Gap	1,708,503
2045 Gap	2,227,322

MT CO₂e = metric ton of carbon dioxide equivalent





City of Sacramento Climate Action and Adaptation Plan

Appendix B - CAAP Regulatory Context

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Regulatory Context

As the impacts of climate change are becoming clearer, strategies to address climate change are emerging at all levels of government. This section provides an overview of the regulatory context at the international, state, and local levels relative to Sacramento's actions toward reducing greenhouse gas (GHG) emissions.

International Climate Action Guidance

1992 United Nations Framework Convention on Climate Change

The primary international regulatory framework for GHG reduction is the United Nations Framework Convention on Climate Change (UNFCCC). The UNFCCC is an international treaty adopted in 1992 with the objective of stabilizing atmospheric GHG concentrations to prevent disruptive anthropogenic climate change. The framework established non-binding limits on global GHG emissions and specified a process for negotiating future international climate-related agreements.¹

1997 Kyoto Protocol

The Kyoto Protocol is an international treaty that was adopted in 1997 to extend and operationalize the UNFCCC. The protocol commits industrialized nations to reduce GHG emissions per country-specific targets, recognizing that they hold responsibility for existing atmospheric GHG levels. The Kyoto Protocol involves two commitment periods during which emissions reductions are to occur, the first of which took place between 2008-2012. The second commitment period set new targets and other changes but has not been entered into force (meaning it has not gone into effect).²

2015 The Paris Agreement

The Paris Agreement is the first universal, legally binding global climate agreement that was adopted in 2015 and has been ratified by 191 countries worldwide.³ The Paris Agreement establishes a roadmap to keep the world under 2 degrees Celsius (°C) of warming with a goal of limiting an increase of temperature to 1.5°C. The Paris Agreement does not dictate one specific reduction target, instead relying on individual countries to set nationally determined contributions (NDCs) or reductions based on gross domestic product and other factors. According to the International Panel on Climate Change (IPCC), limiting global warming to 1.5°C will require global emissions to reduce through 2030 and hit carbon neutrality by mid-century.⁴

¹ United Nations Framework Convention on Climate Change (UNFCCC). United Nations Framework Convention on Climate Change. https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf

² UNFCCC. What is the Kyoto Protocol? https://unfccc.int/kyoto_protocol

³ UNFCCC. Paris Agreement - Status of Ratification. <https://unfccc.int/process/the-paris-agreement/status-of-ratification>

⁴ IPCC. Global Warming of 1.5 C. <https://www.ipcc.ch/sr15/>

California Regulations and State GHG Targets

California remains a global leader in the effort to reduce GHG emissions and combat climate change through its mitigation and adaptation strategies. By the early 2000's, California was passing climate change bills including Senate Bill (SB) 1078 and Executive Order (EO) S-3-05 which began to require state agencies and utilities to address climate change. With the passage of Assembly Bill (AB) 32 in 2006, California became the first state in the nation to mandate GHG emission reductions across its entire economy. To support AB 32, California has enacted legislation, regulations, and executive orders (EO) that put it on course to achieve robust emission reductions and address the impacts of a changing climate. The following is a summary of executive and legislative actions most relevant to the Climate Action Plan.

2002 Senate Bill 1078

In 2002, Senate Bill (SB) 1078 established the California Renewables Portfolio Standards (RPS) Program which requires that 20 percent of retail electricity sales be composed of renewable energy sources by 2017 and was accelerated in 2006 by SB 107,⁵ which requires that 20 percent of retail electricity sales be composed of renewable energy sources by 2010, instead of 2017. EO S-14-08 was signed in 2008 to further streamline California's renewable energy project approval process and increase the state's RPS to the most aggressive in the nation requiring 33 percent renewable power by 2020.⁶ SB 350, discussed further below, further accelerated the program which mandated a 50% RPS by 2030.

2002 Assembly Bill 1493

In 2002, AB 1493, also known as the Pavley Regulations, directed the California Air Resources Board (CARB) to establish regulations to reduce GHG emissions from passenger vehicles to the maximum and most cost-effective extent feasible. CARB approved the first set of regulations to reduce GHG emissions from passenger vehicles in 2004, with the regulations initially taking effect with the 2009 model year.

2005 Executive Order S-3-05

EO S-3-05 was signed in 2005, establishing statewide GHG emissions reduction targets for the years 2020 and 2050. The EO calls for the reduction of GHG emissions in California to 2000 levels by 2010, 1990 levels by 2020, and 80 percent below 1990 levels by 2050. The 2050 emission reductions target would put the state's emissions in line with the worldwide reductions needed to reach long-term climate stabilization as concluded by the IPCC 2007 *Fourth Assessment Report*.

2006 Assembly Bill 32

California's major initiative for reducing GHG emissions is outlined in AB 32, the "California Global Warming Solutions Act of 2006," which was signed into law in 2006. AB 32 codifies the statewide goal of reducing GHG emissions to 1990 levels by 2020 and requires CARB to prepare a Scoping Plan that outlines the main state strategies for reducing GHG emissions to meet the 2020 deadline. In addition, AB 32 requires CARB to adopt regulations to require reporting and verification of statewide GHG emissions.

⁵ California Public Utilities Commission. 2021. Renewables Portfolio Standard (RPS) Program. <https://www.cpuc.ca.gov/rps/>

⁶ Executive Order S-14-08. <https://efiling.energy.ca.gov/GetDocument.aspx?tn=50761>

Based on this guidance, CARB approved a 1990 statewide GHG baseline and 2020 emissions limit of 427 million metric tons of CO₂ equivalent (MMT CO₂e). The Scoping Plan was approved by CARB on December 11, 2008 and included measures to address GHG emission reduction strategies related to energy efficiency, water use, and recycling and solid waste, among other measures. Many of the GHG reduction measures included in the Scoping Plan (e.g., Low Carbon Fuel Standard, Advanced Clean Car standards,⁷ and Cap-and-Trade) have been adopted since approval of the Scoping Plan.

In May 2014, CARB approved the first update to the AB 32 Scoping Plan. The 2014 Scoping Plan update defined CARB's climate change priorities for the next five years and set the groundwork to reach post-2020 statewide goals. The update highlighted California's progress toward meeting the "near-term" 2020 GHG emission reduction goals defined in the original Scoping Plan. It also evaluated how to align the state's longer-term GHG reduction strategies with other state policy priorities, including those for water, waste, natural resources, clean energy, transportation, and land use (CARB 2014).

2007 Executive Order S-1-07

Also known as the Low Carbon Fuel Standard, EO S-1-07, issued in 2007, established a statewide goal that requires transportation fuel providers to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020. EO S-1-07 was readopted and amended in 2015 to require a 20 percent reduction in carbon intensity by 2030, the most stringent requirement in the nation. The new requirement aligns with California's overall 2030 target of reducing climate changing emissions 40 percent below 1990 levels by 2030, which was set by SB 32 and signed by the governor in 2016.

2007 Senate Bill 97

Signed in August 2007, SB 97 acknowledges that climate change is an environmental issue that requires analysis in California Environmental Quality Act (CEQA) documents. In March 2010, the California Natural Resources Agency adopted amendments to the State CEQA Guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions. The adopted guidelines give lead agencies the discretion to set quantitative or qualitative thresholds for the assessment and mitigation of GHG and climate change impacts.

2008 Senate Bill 375

SB 375, signed in August 2008, enhances the state's ability to reach AB 32 goals by directing CARB to develop regional GHG emission reduction targets to be achieved from passenger vehicles by 2020 and 2035. In addition, SB 375 directs each of the state's 18 major Metropolitan Planning Organizations (MPOs), to prepare a Sustainable Communities Strategy" that contains a growth strategy to meet these emission targets for inclusion in the MPO's Regional Transportation Plan.

In March 2018, CARB adopted updated regional targets for reducing GHG emissions from 2005 levels by 2020 and 2035. Each region was assigned a target for 2020 and 2035.⁸

⁷ On September 19, 2019, the National Highway Traffic Safety Agency and the U.S. Environmental Protection Agency issued a final action entitled the One National Program on Federal Preemption of State Fuel Economy Standards Rule. This action finalizes Part I of the Safer, Affordable, Fuel-Efficient (SAFE) Vehicles Rule. This rule states that federal law preempts State and local tailpipe GHG emissions standards as well as zero emission vehicle (ZEV) mandates. The SAFE Rule withdraws the Clean Air Act waiver it granted to California in January 2013 as it relates to California's GHG and zero emission vehicle programs.

⁸ https://ww2.arb.ca.gov/sites/default/files/2020-06/SB375_Final_Targets_2018.pdf

2009 California Green Building Code

The California Green Building Standards Code (CALGreen) is Part 11 of the California Building Standards Code or Title 24 and is the first statewide “green” building code in the nation. The purpose of CALGreen is to improve public health, safety, and general welfare by enhancing the design and construction of buildings. Enhancements include higher energy efficiency, better air quality, and improved daylighting. The first CALGreen Code was adopted in 2009 and has been updated in 2013, 2016, and 2019. The CALGreen Code will have subsequent, and continually more stringent, updates every three years.

2009 Senate Bill X7-7

In 2009, SB X7-7, also known as the Water Conservation Act, was signed, requiring all water suppliers to increase water use efficiency. This legislation sets an overall goal of reducing per capita urban water use by 20 percent by 2020.

2011 Senate Bill 2X

In 2011, SB 2X was signed, requiring California energy providers to buy (or generate) 33 percent of their electricity from renewable energy sources by 2020.

2012 Assembly Bill 341

AB 341 directed the California Department of Resources Recycling and Recovery (CalRecycle) to develop and adopt regulations for mandatory commercial recycling. As of July 2012, businesses are required to recycle, and jurisdictions must implement a program that includes education, outreach, and monitoring. AB 341 also set a statewide goal of 75 percent waste diversion from landfill by the year 2020.

2014 Assembly Bill 32 Scoping Plan Update

In 2014, CARB approved the first update to the Scoping Plan. This update defines CARB’s climate change priorities and sets the groundwork to reach the post-2020 targets set forth in EO S-3-05. The update highlights California’s progress toward meeting the near-term 2020 GHG emissions reduction target, defined in the original Scoping Plan. It also evaluates how to align California’s longer-term GHG reduction strategies with other statewide policy priorities, such as water, waste, natural resources, clean energy, transportation, and land use.

2014 Assembly Bill 1826

AB 1826 was signed in 2014 to increase the recycling of organic material. GHG emissions produced by the decomposition of these materials in landfills were identified as a significant source of emissions contributing to climate change. Therefore, reducing organic waste and increasing composting and mulching are goals set out by the AB 32 Scoping Plan. AB 1826 specifically requires jurisdictions to establish organic waste recycling programs by 2016, and phases in mandatory commercial organic waste recycling over time.

2015 Senate Bill 350

SB 350, the Clean Energy and Pollution Reduction Act of 2015, has two objectives: to increase the procurement of electricity from renewable sources from 33 percent to 50 percent by 2030 and to

double the energy efficiency of electricity and natural gas end users through energy efficiency and conservation.

2015 Executive Order B-30-15

EO B-30-15 was signed in 2015, establishing an interim GHG emissions reduction target to reduce emissions to 40 percent below 1990 levels by 2030. The EO also calls for another update to the CARB Scoping Plan to provide a pathway to achieve this goal.

2016 Senate Bill 32

In September 2016, the governor signed SB 32 into law, extending AB 32 by requiring the state to further reduce GHGs to 40 percent below 1990 levels by 2030 (the other provisions of AB 32 remain unchanged).

2016 Senate Bill 1383

Adopted in September 2016, SB 1383 requires CARB to approve and begin implementing a comprehensive strategy to reduce emissions of short-lived climate pollutants. SB 1383 requires achievement of the following reduction targets by 2030:

- Methane – 40 percent below 2013 levels
- Hydrofluorocarbons – 40 percent below 2013 levels
- Anthropogenic black carbon – 50 percent below 2013 levels

SB 1383 also requires CalRecycle, in consultation with CARB, to adopt regulations that achieve specified targets for reducing organic waste in landfills. SB 1383 further requires 20% of edible food disposed of at the time to be recovered by 2025.

2017 Scoping Plan Update

In December 2017, CARB adopted the 2017 Scoping Plan, which provides a framework for achieving the 2030 goal set by SB 32. The 2017 Scoping Plan relies on the continuation and expansion of existing policies and regulations, such as the Cap-and-Trade Program, as well as implementation of recently approved legislation, such as SB 350 and SB 1383.

The 2017 Scoping Plan also puts an increased emphasis on innovation, adoption of existing technology, and strategic investment to support its strategies. As with the 2014 Scoping Plan Update, the 2017 Scoping Plan does not provide project-level thresholds for land use development. Instead, it recommends that local governments adopt policies and locally appropriate quantitative thresholds consistent with statewide per capita goals of six metric tons (MT) CO₂e by 2030 and two MT CO₂e by 2050 (CARB 2017). As stated in the 2017 Scoping Plan, these goals may be appropriate for plan-level analyses (i.e., city, county, subregional, or regional level), but not for specific individual projects because they include all emissions sectors in the state (CARB 2017).

CARB is currently developing the 2022 Scoping Plan Update, which will focus on continuing to work towards the SB 32 target and lay out a path for achieving carbon neutrality by 2045.

2018 Senate Bill 100

Adopted in September 2018, SB 100 supports the reduction of GHG emissions from the electricity sector by accelerating the state's RPS Program, which was last updated by SB 350 in 2015. SB 100

requires electricity providers to increase procurement from eligible renewable energy resources to 33 percent of total retail sales by 2020, 60 percent by 2030, and 100 percent by 2045.

2018 Executive Order B-55-18

In September 2018, the governor issued Executive Order B-55-18, which established a new statewide goal of achieving carbon neutrality by 2045 and maintaining net negative emissions thereafter. This goal is in addition to the existing statewide GHG reduction targets established by SB 375, SB 32, SB 1383, and SB 100.

2022 Assembly Bill 1279

In September 2022, the governor approved AB 1279, which codified the statewide goal of achieving carbon neutrality by 2045 and maintaining net negative emissions thereafter. In addition, AB 1279 established a GHG emissions reduction minimum of 85% below 1990 levels by 2045. The remaining 15% can be addressed with carbon sequestration.

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City of Sacramento Climate Action and Adaptation Plan

Appendix C – Community Measures GHG Emissions Quantification

prepared by

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1 Introduction

The CAAP is aligned and linked to pertinent goals and policies of the 2040 General Plan. As a complementary document, the CAAP is a tool that allows the City to consider community and municipal GHG emissions, establish targets for emissions reductions, and identify and implement specific measures that reduce GHG emissions to achieve established targets and consistent with State law.

The CAAP is structured to serve as a programmatic tiering document for the purposes of CEQA, tiering from the Master Environmental Impact Report (MEIR) developed for the 2040 General Plan. For future projects that the City determines are not exempt from CEQA and are subject to environmental review (e.g., an initial study/negative declaration or an EIR is required) and that seek to streamline the review process for analysis of GHG emissions impacts, projects can achieve streamlining pursuant to the provisions of Section 15183.5 by including all applicable GHG reduction measures in this CAAP in the project designs and/or as mitigation measures in the environmental document, thus demonstrating that the project would have a cumulatively less than significant impact on the environment.

The City will ensure the appropriate use of the CAAP for CEQA streamlining by maintaining the prerogative to use mandatory and voluntary measures as standards for new developments seeking streamlining as part of the CAP consistency review process, as appropriate. The City will work with applicants seeking GHG streamlining on a project-by-project basis regarding the CEQA benefits of the CAAP, identifying measures to integrate into a project's design or mitigation measures. This approach allows the City to ensure that new development projects can benefit from CEQA streamlining while also ensuring that the City is on target to achieve the GHG reduction targets established in the CAAP.

This technical appendix provides the information pursuant to Subsection (D) which requires "measures or a group of measures, including performance standards, that substantial evidence demonstrates, if implemented on a project-by-project basis, would collectively achieve the specified emissions level." This technical appendix is organized around three levels which include:

- **Sectors:** Sectors define where the GHG reductions will take place and include Energy and Electrification, Mobility, Waste, and sequestration
 - **Measures:** Measures are core strategies that will result in substantial reductions in GHG emissions.
 - **Actions:** Each measure is driven by sets of actions that together support and generate the GHG reductions necessary to achieve the City's goal

Measures and actions can be either quantitative or supportive and are defined as follows:

Quantitative: These measures and actions have substantial evidence including case studies, calculations, or other supporting evidence that prove that the implementation of said measure/action will have a measurable GHG reduction when applied to new development projects. These measures/actions have been quantified based on this evidence and the reductions summed to show how Sacramento will meet its 2030 and 2045 goals and exceed the with the State target (SB 32) of 40 percent below 1990 levels by 2030.

Supportive: These measures and actions may also be quantifiable and in most cases have substantial evidence to support their overall contribution to GHG reductions. However, due to one or more factors including low GHG reduction benefits, indirect GHG reduction benefits, potential for double-counting of GHG reductions, or simply a high level of difficulty in quantifying accurate GHG reductions, they have not been quantified and do not contribute directly to the expected GHG reduction goal and consistency with the state targets. However, these measures/actions are critical to the overall success of the CAAP and achieving the established GHG reduction targets.

Together the quantitative and supportive measures and actions listed below will help Sacramento reduce per capita emissions from 9.75 MT CO₂e in 1990¹ to 3.63 MT CO₂e by 2030 and net zero by 2045. This equates to a 63% reduction in per capita GHG emissions by 2030. These goals exceed the minimum requirements of SB 32 (a 40% reduction or 5.85 MT CO₂e per capita in 2030) and meet the intent of AB 1279. The total mass emissions target which corresponds to this per capita goal (based on current population projections) is 2,160,128 MT CO₂e in 2030 and carbon neutrality in 2045. To reach this goal, Sacramento will need to reduce GHG emissions by 543,437 MT CO₂e by 2030. This technical report provides the substantial evidence that CAAP measures can be expected to achieve the 2030 goal, if fully implemented, and provide substantial progress toward achieving long-term reduction targets identified in AB 1279. Making substantial progress toward these long-term state targets is important as these targets have been set at levels that achieve California's fair share of global emissions reduction targets that will stabilize global climate change effects and avoid the adverse environmental consequences described under Section 3.1.3, *Potential Effects of Climate Change* (Executive Order B-55-18).

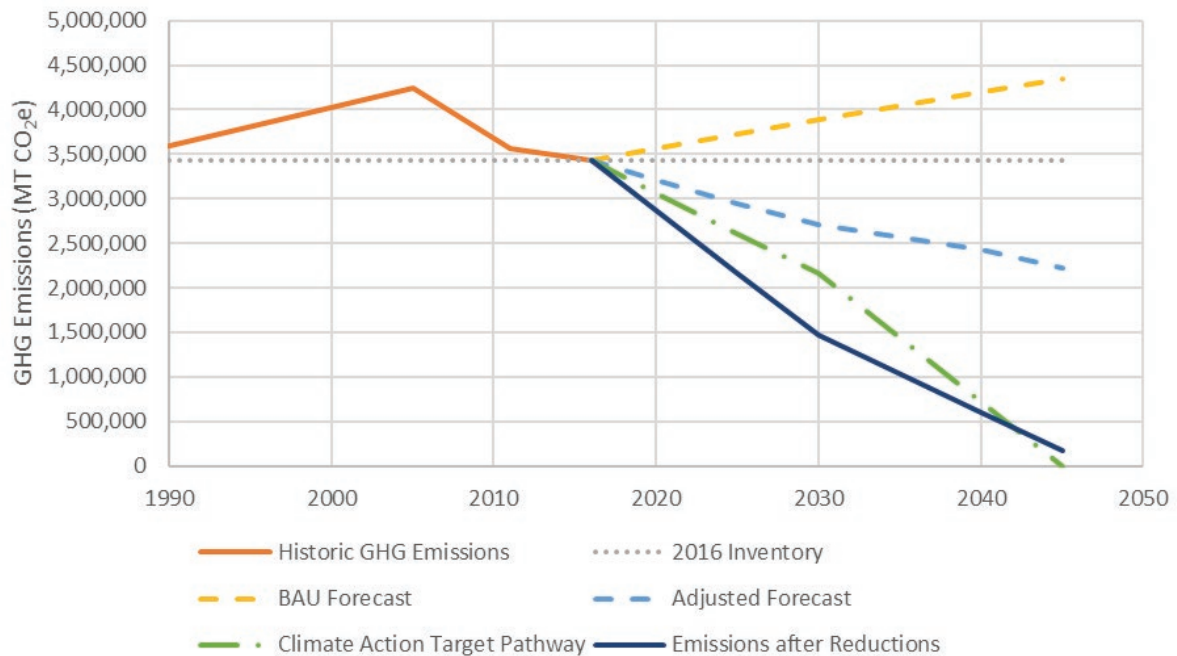
The City has also established a goal consistent with AB 1279 of achieving carbon neutrality by 2045 with at least an 85% reduction in GHG emissions below 1990 levels. The measures identified in this CAAP will lead to a significant reduction in GHG emissions and provide a foundation for achieving net carbon neutrality. However, achieving carbon neutrality will require significant changes to the technology and systems currently in place including the electrification of all buildings and transportation systems, an increased shift to shared and active mobility, achieving carbon neutral electricity, and waste reduction and diversion. The measures and actions developed to meet the 2030 goals are the foundations and establish the trajectory for this long-term transformation. However, the 2045 GHG emissions reductions quantified in this CAAP are not yet enough to meet the long term 2045 goal. As the current measures and actions are implemented, the City will gain more information, new technologies will emerge, and current pilot projects and programs will scale to the size needed to reach carbon neutrality. Furthermore, the state is expected to continue providing updated regulations, resources, and financial support once the 2030 target is achieved. Future CAAP updates will outline new measures needed to reach the ultimate goal of carbon neutrality.

¹ Estimated 1990 levels, equivalent to a 15% reduction below baseline 2005 GHG inventory levels, the most recent year for which a complete inventory is available and consistent with state guidance.

2 GHG Reduction Summary

The City of Sacramento, in coordination with Rincon Consultants, the Mayors’ Commission on Climate Change, the Sacramento Municipal Utility District (SMUD), the Sacramento Regional Transportation Agency (SacRT), and input from the community have developed a suite of measures and specific actions to reduce GHG emissions over time. Based on these measures, the total GHG emissions reduction is expected to be 1,235,043 MT CO₂e by 2030 and 2,060,976 MT CO₂e by 2045. This exceeds the 2030 target but falls short of the 2045 target by 166,345 MT CO₂e. This is illustrated below in Figure 1.

Figure 1: Estimated GHG Reduction and Target Pathway



A summary of the GHG emissions reductions by Measure is included in Table 1. For a complete description of each measure and the contributing actions, please refer to the appropriate sector and measure below.

City of Sacramento
City of Sacramento Climate Action and Adaptation Plan

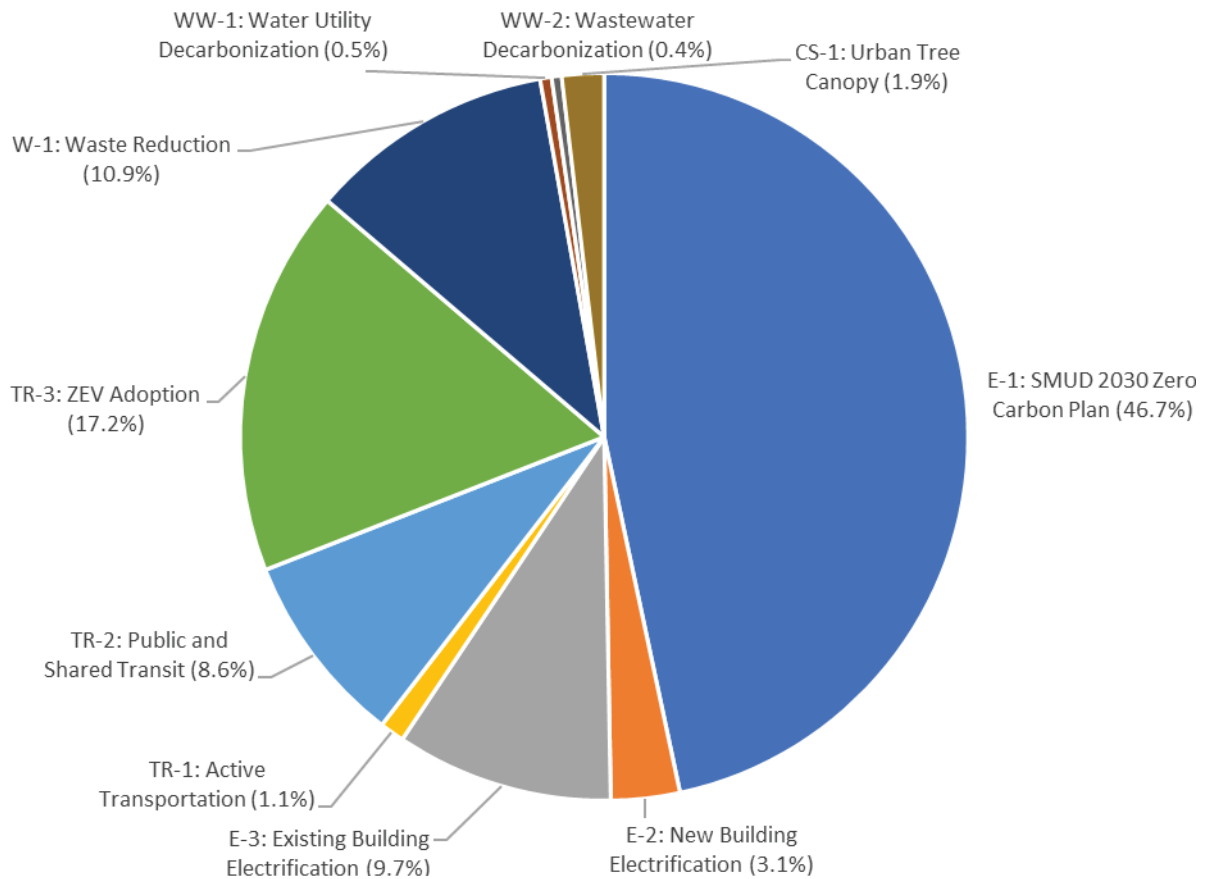
Table 1 Summary of GHG Emissions Reductions by Measure

Measure #	Measure Name	2030 Reduction MT CO ₂ e	2045 Reduction MT CO ₂ e
Built Environment (Energy and Electrification)			
E-1	Support SMUD as it implements the 2030 Zero Carbon Plan.	576,225	0
E-2	Eliminate natural gas in new construction.	37,692	134,621
E-3	Transition natural gas in existing buildings to carbon-free electricity by 2045.	119,289	402,468
E-4	Increase the amount of electricity produced from local resources and work with SMUD to install additional local storage by 2030.	Supportive	Supportive
E-5	Support infill growth with the goal that 90% of growth is in the established and center/corridor communities and 90% small-lot and attached homes by 2040, consistent with the regional Sustainable Communities Strategy. Project-level VMT should be 15% below (or 85% of) the regional average.	Supportive	Supportive
Mobility			
TR-1	Improve active transportation infrastructure to achieve 6% active transportation mode share by 2030 and 12% by 2045.	13,509	30,557
TR-2	Support public transit improvements to achieve 11% public transit mode share by 2030 and maintain through 2045.	106,035	122,371
TR-3	Achieve zero-emission vehicle (ZEV) adoption rates of 28% for passenger vehicles and 22% for commercial vehicles by 2030 and 100% for all vehicles by 2045.	212,451	1,137,071
Waste			
W-1	Work to reduce organic waste disposal 75% below 2014 levels by 2025.	134,991	160,897
Carbon Sequestration			
CS-1	Increase urban tree canopy cover to 25% by 2030 and 35% by 2045.	23,053	61,474
Water and Wastewater			
WW-1	Reduce water utility emissions (in MT of CO ₂ e per MG) by 100% by 2030 and maintain that through 2045.	6,296	0
WW-2	Reduce wastewater emissions by 22% by 2030 and 40% by 2045.	5,495	11,517
Reduction Summary			
Total Reduction Needed		543,437	2,227,322
Estimated Reductions Achieved		1,235,034	2,060,976
Gap		-691,597	166,345
Estimated Reductions Without VMT Reductions		1,115,491	1,908,048
Gap Without VMT Reductions		-572,053	319,273

As shown in Table 1, the measures adopted in this Climate Action & Adaptation Plan (CAAP) have the ability when fully implemented to reduce GHG emissions by approximately 1,235,034 MT CO₂e by 2030. This exceeds the goal reduction by 691,597 MT CO₂e. However, this assumes a very aggressive VMT reduction percentage which currently relies on unfunded transportation infrastructure projects. Furthermore, the State of California has not demonstrated success in achieving VMT reductions historically. Therefore, the most conservative approach to demonstrating

consistency with state reduction targets is to omit VMT reductions from the quantification of the GHG reduction measures when establishing consistency. When omitting the VMT reduction measures the City still exceeds its 2030 target by 572,053 MT CO₂e. There is still a gap of 166,345 MT CO₂e (with VMT reduction) and 319,273 MT CO₂e (without VMT reduction) in 2045. As new technologies develop, and the State pushes further to achieve the 2045 carbon neutrality target, the City of Sacramento will adopt new strategies to achieve this long term goal. Furthermore, the CAAP measures will create the basis for long term carbon neutrality including carbon neutral buildings, electric vehicles, and improved active transportation and transit. The major sectors for GHG reductions are transportation and building energy use. The percent of total reduction generated by each quantifiable measure is shown below in Figure 2.

Figure 2: GHG Reductions in 2030 by Measure



The following section provides the substantial evidence and quantification methodology which provides the reasonable assurance that the GHG reduction strategy adopted by the City of Sacramento will lead to the expected GHG reductions necessary to reach the City’s ambitious GHG reduction goals.

3 Built Environment

<p><i>Measure E-1:</i> Support SMUD as it implements the 2030 Zero Carbon Plan</p>	<p>2030 Target 576,225 MT CO₂e</p> <p>2045 Target 0 MT CO₂e</p>
<p>Performance Metrics:</p> <ul style="list-style-type: none"> ▪ 100% carbon free electricity citywide by 2030 	

Action #	Action	Anticipated Reduction
Quantitative Actions		
E-1.1	Support SMUD in the implementation of the 2030 Zero Carbon Plan.	576,225 MT CO ₂ e (2030) 0 MT CO ₂ e (2045)

3.1 Measure E-1 Quantification

SMUD has adopted the 2030 Zero Carbon Plan which outlines their approach to achieve 100% carbon free electricity by 2030. This is 15 years ahead of the requirements identified by SB 100, which requires all electricity utilities in the state to achieve 100% carbon free electricity by 2030. Therefore, this measure quantifies the GHG reduction benefits to the City of Sacramento by having 100% carbon free electricity in 2030. To avoid double counting this measure also includes the added benefit of reducing the electricity increase caused by measures E-2, E-3, TR-2, and TR-3.

Action E-1.1

Evidence: SMUD has developed a plan to achieve carbon free electricity by 2030.² This plan, when fully implemented, would reduce the emission factor for Sacramento’s electricity to zero. It would also reduce the emissions associated with electrified vehicles and buildings to zero. Therefore, the emissions reductions in this measure are estimated by calculating the GHG emissions associated with electricity in 2030 under the SB 100 scenario compared to the SMUD 2030 Zero Carbon Plan scenario. Conversely, GHG emissions from electricity generation will decrease to zero by 2045, due to SB 100. Therefore, the SMUD 2030 Zero Carbon Plan reduces GHG emissions substantially in 2030 but goes to zero by 2045 when it aligns with SB 100.

Quantification Results Summary

Action E-1.1	2030	2045
Total kWh (without electrification measures)	4,136,524,853	4,681,771,641
MT CO ₂ e/kWh (With SB100)	0.0001193	0.0

² <https://www.smud.org/en/Corporate/Environmental-Leadership/2030-Clean-Energy-Vision#Stay-informed>

Action E-1.1	2030	2045
Emissions (MT CO ₂ e)	493,291	0
MT CO ₂ e/kWh (SMUD Zero Carbon Plan)	0	0
MT CO ₂ e savings (without electrification measures)	493,291	0
E-2 Savings (MT CO ₂ e)	10,597.88	0
E-3 Savings (MT CO ₂ e)	33,540.51	0
TR-2 Savings (MT CO ₂ e)	36.13	0
TR-3 Savings (MT CO ₂ e)	38,758.98	
Total MT CO ₂ e savings (with electrification)	576,225	0

Measure E-2:
Eliminate natural gas in new construction

2030 Target

37,692 MT CO₂e

2045 Target

134,621 MT CO₂e

Performance Metric(s):

- None (completed)

Action #	Action	Anticipated Reduction
Quantitative Measures		
E-2.1	Develop and adopt an electrification ordinance that requires all new construction under four stories to be all-electric by 2023 and all construction to be all-electric by 2026.	37,692 MT CO ₂ e (2030) 134,621 MT CO ₂ e (2045)

3.2 Measure E-2 Quantification

In order for Sacramento to reach carbon neutrality, the large majority of the buildings in the City will need to be carbon neutral. Electrification allows buildings to use 100% carbon neutral electricity that will be provided by SMUD by 2030. To avoid double counting with Measure E-1, emissions reductions associated with this measure were quantified by assuming electricity would be GHG-free by 2045, consistent with SB 100. To ensure new buildings won't need to be retrofitted later, this measure will ensure all new buildings are built to utilize only electricity as an energy source. The emissions savings for this measure were calculated as the difference between the projected therm consumption (based on the 2016 per capita therm usage and Department of Finance population growth) and the expected natural gas use in 2030 and 2045 under baseline conditions and Department of Finance population growth³. The forecast also included expected efficiencies due to upgrades in the Title 24 Energy Efficiency Standards.

Action E-2.1

Evidence: Continuing to allow natural gas use in new buildings would result in an increase of GHG emissions through 2045, due to increases in population and residential construction in the city projected through 2045. Conversely, GHG emissions from electricity generation will decrease to zero by 2045, due to SB 100 (which requires 100% renewable electricity by 2045) and SMUD's 2030 Zero Carbon Plan. The adoption of an electrification ordinance would lead to a mandatory reduction in natural gas consumption compared to baseline projections by replacing natural gas with electricity.

Since the 2023 ordinance would not completely ban natural gas in new buildings, an estimate of the number of 4+ story buildings permitted in Sacramento each year was made. This estimate was developed by looking at the total 4+ story buildings permitted in the 2018 and 2019 calendar year and developing a CalEEMod⁴ model for each construction project. The resulting calculations

³ See Appendix A for complete population projection numbers

⁴ CalEEMod is the State's California Emissions Estimator Model, accessed at: <https://www.caleemod.com/>

estimated that in both 2018 and 2019 ten projects were permitted. This equated to an estimated increase in natural gas demand by 61,078 therms per year from projects completed in 2018 and 64,598 therms per year in 2019. Assuming similar construction trends, an average of 62,838 therms or 333 MT of CO₂e will be added to Sacramento’s total natural gas consumption from new buildings 4 stories or taller from 2023 to 2026 for a total increase in emissions of approximately 1,000 MT CO₂e. It should be noted that emissions from construction between 2020 and 2023 are already included in the calculation by using the forecasted natural gas consumption in 2023 as the basis for the calculation.

Based on the GHG emissions forecast which is predicated on Department of Finance Population Growth and current per capita natural gas consumption, banning gas in new construction under four stories by 2023 will save an estimated 9.1 million therms of natural gas by 2030 and banning all natural gas use in buildings in 2026 will save 25.4 million therms by 2045. However, these ordinances will lead to an increase in electricity consumption because calculations assume natural gas use will be replaced by electric appliances. The conversion also assumes a 300% appliance efficiency increase due to the inclusion of modern heat pump technologies.⁵ By 2045, all emissions from electricity are eliminated by the use of 100% carbon free electricity.⁶ In spring of 2021, the City of Sacramento successfully adopted the new building electrification ordinance in line with Measure E-1. The calculation used to estimate these emissions are included below.

Quantification Results Summary

Action E-2.1	2030	2045
Total therms saved	9,099,205	25,366,596
MT CO ₂ e/therm	0.00531	0.00531
Emissions reductions MT CO ₂ e	48,290	134,621
Emissions from electricity conversion	10,598	0
Net MT CO ₂ e savings	37,692	134,621

⁵ <https://tristate.coop/advantages-heat-pumps-energy-efficiency#:~:text=What's%20the%20efficiency%20performance%20of,coefficient%20of%20performance%2C%20or%20COP.>

⁶ Measure E-2 includes reductions associated with SMUDs accelerated decarbonization schedule.

Measure E-3:
Transition natural gas in existing buildings to carbon-free electricity by 2045

2030 Target
 119,289 MT CO₂e
2045 Target
 402,468 MT CO₂e

Performance Metrics:

- Develop and pass ordinance
- Reduce natural gas use by 28% by 2030
- Reduce natural gas use by 100% by 2045

Action #	Action	Anticipated Reduction
Quantitative Actions		
E-3.1	Develop a comprehensive existing building electrification strategy that identifies associated costs and addresses potential equity impacts prior to implementation of mandatory requirements.	
E-3.2	Develop an electrification ordinance for existing buildings/construction that will be implemented through the building permit process to transition away from fossil fuels to electric at time of replacement following adoption of Measure E3.1. The existing buildings ordinance would include the following elements: <ul style="list-style-type: none"> • No new expansions of fuel gas piping at existing buildings/sites. • Require HVAC system replacements and new water heaters to be all-electric or utilize other low-carbon technologies as the market evolves. 	119,289 MT CO ₂ e (2030) 402,468 MT CO ₂ e (2045)
Supportive Actions		
E-3.3	Work with SMUD to expand existing low-income programs within the City to weatherize and retrofit/electrify existing buildings, with the goal of reducing energy consumption, decreasing utility bills, and converting to carbon-free energy use by 2040.	Supportive
E-3.4	Promote and educate the community about existing programs and expand electrification retrofit incentives for space and water heating to support the electrification ordinances.	Supportive
E-3.5	Provide electrification retrofit incentives and financing for space and water heating.	Supportive

Action #	Action	Anticipated Reduction
E-3.6	Continue to promote and incentivize electrification supportive energy efficiency in existing buildings including lighting, insulation, and air sealing upgrades through programs and financing mechanisms.	Supportive

3.3 Measure E-3 Quantification

SMUD incentives will support the transition of existing buildings away from fossil fuels, including significant rebates on electric appliances and infrastructure. By 2025 the city may need to adopt a mandatory phase out of gas appliances depending on the success of the voluntary program. Action E-3.2 outlines the expected sequence for phasing out gas appliances in existing buildings.

Actions E-3.1 and E-3.2

Evidence: When adopting the new building electrification strategy, Sacramento City Council directed staff to develop an existing building electrification plan to ensure that the transition to a carbon free building stock did not come at the expense of the community, particularly those community members who are most vulnerable. Building electrification has the potential to improve health outcomes, reduce energy burden, and enhance resilience within the City.⁷ However, it also comes with up-front investments that must be financed or funded in an equitable manner to avoid negative impacts. 34% of natural gas use in buildings is from residential and commercial water heating. 40% of natural gas use in buildings is from space heating.⁸ Natural gas hot water heater life expectancy is approximately 10 years.⁹ Therefore, under this ordinance the City should see a 34% decrease in natural gas use from hot water heater electrification in existing buildings by 2035. Natural gas furnace lifecycles are expected to be between 15-20 years with an average of 18 years.¹⁰ Therefore, under this program the City would expect to see an additional 40% reduction in natural gas consumption in existing buildings by 2043. Assuming a linear replacement of existing HVAC and hot water heating equipment starting in 2025, the City should expect to see a 28% decrease in natural gas emissions by 2030 and a 74% decrease by 2045 from this mandatory ordinance. This equates to approximately 25 million therms by 2030 and 72 million therms by 2045, calculated as the corresponding percent reduction from 2016 therm use.

7 <https://berkeleyca.gov/your-government/our-work/adopted-plans/berkeley-existing-buildings-electrification-strategy>

8 <https://www.synapse-energy.com/sites/default/files/Decarbonization-Heating-CA-Buildings-17-092-1.pdf>

9 <https://www.lowes.com/n/how-to/when-to-replace-a-water-heater>

10 <https://www.thisoldhouse.com/21018361/how-long-things-last>

Quantification Results Summary

Action E-3.1 and E-3.2	2030	2045
Total Therm Reduction from Electrification	28,797,447	75,836,692
MT per Therm	0.00531	0.00531
Gas Savings MT CO _{2e}	152,829	402,468
Emissions from electricity conversion (MT CO _{2e})	33,540.51	0
Net MT CO _{2e} Savings	119,289	402,468

3.4 Measure E-3 Supportive Actions

Action E-3.3

Evidence: According to SMUD, the low-income programs are expected to reduce GHG emissions by 33,200 MT¹¹ of CO_{2e} by 2040 by electrifying and upgrading 100% of low-income single-family homes. However, these reductions are not applied to the overall emissions reductions (to eliminate double counting issues) and are considered supportive of the overall community electrification efforts.

Electrification programs that target low-income residents are the most cost-effective and potentially successful approach for equitable decarbonization to combat climate change.¹² For example, the Low-Income Weatherization Program (LIWP) is the state’s first energy efficiency program that targets low-income Californians and has reduced energy bills in participating multifamily buildings by 30 percent and overall energy usage by an average of 40 percent.¹³ A case study on a major energy retrofit in a Lancaster 100-unit low income multifamily complex resulted in a one-third reduction in natural gas use (approximately 145 therms per apartment).¹⁴ SMUD’s programs, which focus on electrification, could be expected to have even more pronounced GHG reduction benefits. The study also showed that such retrofits can result in increased tenant retention, improved health and comfort, and better ability to afford necessities like food, medicine, health care, and rent.

Action E-3.4

Evidence: Electrification of space and water heaters is the best and cheapest way to reduce emissions from California’s existing buildings through 2045 due to SB 100.¹⁵ The largest barrier to implementation of this is high up-front capital costs.¹⁶ Utility-offered incentives to offset these costs for the end-user are therefore among the most promising opportunities for updating this technology.¹⁷

The impacts associated with promotional and educational outreach for electrification have not been well documented due to the cutting-edge nature of the strategy. Electrification has only begun to gain popularity in California mostly due to the implementation of SB 100 and the expansion of community choice aggregations. While it is not clear how the community will respond to

11 Scott Blunk - SMUD

12 http://greenlining.org/wp-content/uploads/2019/10/Greenlining_EquitableElectrification_Report_2019_WEB.pdf

13 California Housing Partnership Corporation and Association for Energy Affordability (2018). California’s Cap-and-Trade-Funded Low Income Weatherization Program Multifamily: Impact Report, 3.

14 <https://www.energy.ca.gov/publications/2018/lancaster-advanced-energy-community>

15 <https://www.mdpi.com/2073-4433/10/8/435/htm>

16 California Center for Sustainable Energy. 2009. Solar Water Heating Pilot Program: Interim Evaluation Report.

17 <https://www.synapse-energy.com/sites/default/files/Decarbonization-Heating-CA-Buildings-17-092-1.pdf>

electrification, energy efficiency outreach has been conducted since as early as the 1970's and some research has been conducted on the effects of outreach and education on energy. One study in New York showed that out of the 8,991 people who participated in informational programs, 69% implemented the recommended practices.¹⁸ Another research meta-analysis reviewed dozens of papers covering various energy efficiency, water efficiency, and waste outreach and found that education-only campaigns could produce between 10-12% energy savings.¹⁹

Electrification is a new idea and not well understood by the community. The education associated with this action as well as the CAAP itself will facilitate adoption of all-electric technologies. The City will conduct a CAAP update between 3 and 5 years to check progress and adopt more voluntary or potentially mandatory measures if necessary.

Action E-3.5

Evidence: This measure is considered supportive to the overall electrification goals. However, using financing programs to fund energy-saving retrofits has demonstrated energy savings results in the past. A meta-analysis on the use of heat pump water heaters found that energy savings significantly increased from installation with notable annual energy use savings of up to 40.2% in cooler regions and 63.7% energy savings in warmer regions of the United States.²⁰

Action E-3.6

Evidence: While the use of carbon neutral electricity by 2045 due to SB100 ensures all-electric buildings have zero energy emissions, there is still a need to reduce energy consumption within Sacramento. Reducing energy consumption will reduce stress on the electricity grid, require less renewable energy generation to meet needs thereby saving resources, and help reduce energy bills within the community.

18 <https://tigerprints.clemson.edu/joe/vol47/iss6/6/>

19 https://aceee.org/files/proceedings/2000/data/papers/SS00_Panel8_Paper10.pdf

20 <https://www.sciencedirect.com/science/article/abs/pii/S0378778817304760>

Measure E-4:

Increase the amount of electricity produced from local resources and work with SMUD to install additional local storage by 2030

2030 Target*Supportive***2045 Target***Supportive***Performance Metrics:**

- Complete a pilot local renewable energy project by 2030

Action #	Action	Anticipated Reduction
E-4.1	Continue to promote and support local energy generation and storage resources.	Supportive
E-4.2	Work with SMUD to site storage and renewable generation at locations in the City which would best support overall grid functionality while electrifying the building stock and maximizing the utilization of existing electrical infrastructure.	Supportive
E-4.3	Work alongside SMUD to promote and further incentivize battery storage as a means to maximize electrification benefits and improve resiliency.	Supportive
E-4.4	Develop a community solar and storage project of at least 1 MW as a pilot project collaboration between SMUD and the City with SMUD leading project development and the City supporting by providing a location and permitting support.	Supportive

3.5 Measure E-4 Supportive Actions

The actions in Measure E-3 have not been quantified but are key strategies in electrifying the City of Sacramento as well as allowing SMUD to reach their 2045 target of carbon neutral electricity. These actions will help SMUD balance the grid, generate more renewable electricity, harness the benefits of distributed battery storage, and create more resiliency around the electricity grid in general. Without these actions, the GHG reductions associated with E-1 and E-2 are more difficult to achieve.

Action E-4.1

Evidence: While difficult to directly quantify the effects of this action on community-wide emissions, on-site energy generation and storage can help local governments and their communities achieve substantial energy, environmental, resilience, and economic benefits.²⁵ For example, the City of Sacramento has already installed 4.9 MW of on-site solar at City owned facilities. This results in the production of over 7,000,000 kWh of electricity per year. The City also offsets an additional 29,000,000 kWh's of electricity through SMUD's SolarShares program. In 2018, the San Francisco airport installed 72 kWh of solar photovoltaic (PV), which became the world's first Zero Net Energy certified facility at an airport, helping campus-wide electricity to decline 4.7% since 2013 and

²⁵ <https://www.energy.gov/sites/prod/files/2017/02/f34/onsiterenewables508.pdf>

supporting their goal of a Zero Net Energy campus by 2021.²⁶ The school district of Spirit Lake, Iowa currently operates and uses two wind turbines to power its elementary, middle, and high schools, and administrative buildings, meeting 46% of the district's needs.²⁷ Projects like these can also indirectly reduce community emissions by creating publicity and awareness around the issue. In 2003, Lenox, Iowa installed a 750-kW wind turbine to produce electricity for its own facilities at about the same time that the town's municipal electric utility began offering customers the option to purchase renewable energy. The opt-in response rate was 13%, almost double the typical opt-in rates seen in other jurisdictions. The success of the program was attributed to the increased public awareness generated by the new turbine.²⁸

Action E-4.2

Evidence: Distributed battery storage and renewables can be used instead of traditional transmission and distribution infrastructure upgrades to help meet the increasing demand that electrification will put on the grid. While this action will not directly reduce GHG emissions, it will support the overall transition to an electrified building stock at the lowest cost and with the most resilience.

Action E-4.3

Evidence: While it's hard to know exactly how effective promotion and incentives for residential battery storage will be, trends across the country indicate that these options are desirable for homeowners. Coupled with renewable energy, battery storage greatly maximizes emissions reductions and enhances community resilience. A recent 2019 study from the University of Michigan found that in California as a whole, adding 60GW of renewables could achieve 72% CO₂ reductions with close to one third curtailment.³¹ Adding energy storage technologies could increase this to 90% reduction and only 9% curtailment, under one modeled scenario.³² While industrial and commercial battery storage will drive these reductions, residential energy storage will also play an important part in the effort to increase battery storage across the state. Residential energy storage is often more flexible and resilient than larger utility-owned systems because the network is well-distributed and has buy-in from both the utility and the owners/residents.³³ Residential energy storage exceeded utility-scale storage installations in the U.S. in 2018, reflecting the high value customers are placing on having their own storage systems.³⁴

Action E-4.4

Evidence: A one megawatt solar array would generate an estimated 1.5 MWh of electricity per year in Sacramento. The GHG emissions reduction from this array would vary depending on the GHG emissions factor of SMUD electricity it was offsetting. In 2030, 1.5 MWh is estimated to reduce GHG emissions by 188 MT CO₂e.³⁵ However, in 2045 when SMUD's electricity would have an emission factor of zero due to SB100, GHG reduction benefit would be zero. However, local solar projects will

26 <https://www.flysfo.com/environment/zero-net-energy>

27 https://siouxcityjournal.com/news/local/spirit-lake-iowa-school-district-honored-for-wind-turbines/article_055c6490-cb1f-51f8-b47e-6681825de968.html

28 <https://www.energy.gov/sites/prod/files/2017/02/f34/onsiterenewables508.pdf>

31 Curtailment occurs when more power is produced than needed at a given time, leading to energy losses

32 <http://css.umich.edu/publication/role-energy-storage-deep-decarbonization-electricity-production>

33 <https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/how-residential-energy-storage-could-help-support-the-power-grid>

34 Ibid

35 <https://pvwatts.nrel.gov/pvwatts.php>

make SB100 a reality and provide additional co-benefits, including cost savings and resiliency, to the community.

In 2012, SMUD completed a 12-month 300kW microgrid demonstration and research project that involved the design, construction, and demonstration of a microgrid that was integrated with SMUD’s central heating and cooling equipment.³⁶ A microgrid can operate while connected to the main utility grid and it can immediately disconnect (“island mode”) if isolated from the utility, providing heightened reliability for users. SMUD’s microgrid was able to successfully power AC, heating, and hot water in “island mode”. According to the report, “successfully deploying microgrids could help...enable the integration of an unlimited quantity of distributed energy resources into the electricity grid. Many of these distributed resources would be renewable energy sources that would reduce the emissions of greenhouse gases.”

³⁶ <https://www.smud.org/-/media/Documents/Corporate/About-Us/Energy-Research-and-Development/research-microgrid-demonstration-project.ashx>

Measure E-5:

Support infill growth with the goal that 90% of growth is in the established and center/corridor communities and 90% small-lot and attached homes by 2040, consistent with the regional Sustainable Communities Strategy. Project-level VMT should be 15% below (or 85% of) the regional average.

2030 Goal

Supportive

2045 Goal

Supportive

Performance Metrics:

- 90% of infill growth occurs in established and center/corridor communities and 90% small lot and attached homes by 2040
- 30% of region’s new living-wage jobs and 30% of region’s new housing units accommodated by 2040

Action #	Action	Anticipated Reduction
Supportive Actions		
E-5.1	Adopt and implement policies, land use designations, and implementation programs which provide a framework to: <ul style="list-style-type: none"> ▪ Accommodate 30% of the region's new living-wage jobs and 30% of the region's new housing units by 2040. ▪ Focus 90% of the city's infill growth into established and center/corridor communities with the goal of achieving 90% small-lot single family and attached homes by 2040. ▪ Prioritize construction of lower-cost workforce and affordable housing through modifications of land-use designations and zoning, offering ministerial/staff-level review of infill housing and continue to reduce fees and the time and expense of planning approval and building permit processes. ▪ Include anti-displacement policies and programs. 	Supportive
E-5.2	Enable development of 29,000 new multi-unit dwellings that are public transit accessible (i.e., within 0.5 mile of public transit) by 2040 through the continuation of the City’s ministerial/staff-level review of infill housing, reduced fees, and identification of local funding sources.	Supportive
E-5.3	Enable the development of 8,700 new missing middle and affordable by design housing types (such as dormitories and smaller units) by 2040 within 0.25 mile of public transit by updating the City Code to allow and reduce barriers to these housing types. Couple with anti-displacement policies and programs.	Supportive

Action #	Action	Anticipated Reduction
E-5.4	Permit a greater array of housing types in existing single-family neighborhoods citywide by allowing missing middle housing types such as accessory dwelling units (ADUs), duplexes, triplexes, and fourplexes, and bungalow courts in single-family and duplex dwelling zones. Develop tools, resources and educational materials to promote and facilitate the development of ADUs in neighborhoods throughout the City.	Supportive

3.6 Measure E-5 Supportive Actions

The City will utilize available regulatory tools to encourage compact infill development, including 2040 General Plan policies and land-use designations, ministerial/staff-level review to streamline ADU's, and reduced fees as appropriate. Encouraging infill development in the City of Sacramento will support overall VMT reduction and energy savings. According to the book *Growing Cooler, The Evidence on Urban Development and Climate Change*, compact development has the potential to reduce the total U.S. VMT by 10 to 14 percent and total U.S. transportation CO₂ emissions by 7 to 10 percent³⁷. Compact development reduces the distance traveled to access jobs and services and shifts travel to active and transit modes. In addition, compared to detached single-unit dwellings, multi-unit dwellings consume 35% less energy for space heating and 21% less energy for space cooling³⁸, decreasing per capita energy use by the built environment.

Action E-5.1 through E-5.4

Evidence: While not easily quantifiable, infill growth that increases density within areas of the community that provide multiple services and better access to jobs can help reduce per capita emissions in those areas due to reduced VMT and energy savings. This is especially effective if paired with affordable housing options such as ADUs, which allow a greater portion of the population to access high density areas and reduce their emissions. Affordable housing can therefore also help reduce suburban sprawl. A Berkeley study on carbon footprint planning suggests that a 10-fold increase in population density in central cities corresponds to 25% lower GHG emissions³⁹ due mostly to decreases in VMT. This can be substantially increased if efforts are additionally made to reduce suburban sprawl. Another study conducted by UC Davis found that a 10% increase in residential density would reduce VMT by 1.9%.⁴⁰ University of Waterloo performed a case study in Toronto to determine how quickly existing areas could be densified to meet minimum transit supportive density thresholds. The study found that 3.8 million additional residents could be residing in transit supportive environments if about 1.2 million units were added with current unit densities between 5 and 20 units per hectare. Given historic growth rates, units could be built within 34 to 95 years. Multi-unit rental units are typically more affordable than detached single-unit dwellings, and the co-benefits include increased access to services for disadvantaged communities.

³⁷ *Growing Cooler: The Evidence on Urban Development and Climate Change* <https://uli.bookstore.ipgbook.com/growing-cooler-products-9780874201789.php>

³⁸ *Growing Cooler: The Evidence on Urban Development and Climate Change* <https://uli.bookstore.ipgbook.com/growing-cooler-products-9780874201789.php>

³⁹ <https://www.cogitatiopress.com/urbanplanning/article/view/1218/1218>

⁴⁰ <https://www.sciencedirect.com/science/article/pii/S0191261510000536>

4 Mobility

Measure TR-1: Improve Active Transportation Infrastructure to Achieve 6% Active Transportation Mode Share by 2030 and 12% by 2045	2030 Target
	13,509 MT CO ₂ e
	2045 Target
	30,557 MT CO ₂ e
Performance Metrics: <ul style="list-style-type: none"> ▪ Achieve 6% active transportation mode share by 2030 and 12% by 2045 ▪ Deploy 30 miles of new bike lane by 2030 ▪ Deploy 20,000 feet of new/repaired pedestrian infrastructure by 2030 ▪ Install or improve at least 70 new pedestrian crossings by 2030 ▪ Implement the 2016 Bicycle Master Plan by constructing 40 miles of bike lanes, 48 miles of bike routes, 40 miles of buffered bike land, 18 miles of separated bikeway, and 127 miles of shared-use paths, by 2045 ▪ Construct the pedestrian network in the 2006 Pedestrian Master Plan by 2045 ▪ Collectively reduce VMT to 6,393 miles per person per year in 2030 (25% below 2016 per capita VMT levels) and to 5,625 miles per person per year in 2045 (34% below 2016 per capita VMT levels) between measure TR-1 and TR-2 	

Action #	Action	Anticipated Reduction
Quantitative Actions		
TR-1.1	Implement the 2016 Bicycle Master Plan by constructing a comprehensive, connected network of safe and accessible (low-stress) bikeways, on- and off-street, within and across neighborhoods totaling 40 miles of bike lanes, 48 miles of bike routes, 40 miles of buffered bike lanes, 18 miles of separated bikeways, and 127 miles of shared-used paths.	13,509 MT CO ₂ e (2030) 30,557 MT CO ₂ e (2045)
Supportive Actions		
TR-1.2	Implement the improvements in the 2006 Pedestrian Master Plan by providing a connected, safe and accessible (low-stress) pedestrian network, prioritized based on High Injury Network (crash data), school access, equity and community needs. Low-stress pedestrian network includes crossings, sidewalks, and other paths.	Supportive
TR-1.3	Conduct a study to identify the physical barriers to active transportation by 2025 and remove them by 2030 to support local partners and community groups.	Supportive
TR-1.4	Conduct a study to identify educational barriers and provide education and outreach to the community on active transportation options in the City including a travel training program and incentivize a spectrum of transportation options that includes public and private shared and active services.	Supportive

Action #	Action	Anticipated Reduction
TR-1.5	Identify and secure ongoing funding for and then implement active transportation programs (open streets, pilot projects, classes, etc.).	Supportive

4.1 Measure TR-1 Quantification

Reducing Vehicle Miles Traveled (VMT) means reducing the number of miles and trips taken by on-road vehicles both intercity and intracity. One-way Sacramento will reduce VMT is by moving from single occupancy vehicles to active transportation, like bicycling and walking. To do this the City must provide low stress and convenient infrastructure and prioritize active transportation movement. Infrastructure needs including bikeways, sidewalk improvements, and expansions of both kinds of infrastructure to all areas of the City. Once the infrastructure is available and stress/comfort is not an issue, comparison with other cities around the world suggest more people will choose active transportation. The following actions outline the infrastructure and supportive actions the City will take to increase bike/ped mode share. Each action is supported by case studies from other cities in California, other US states, and abroad.

Action TR-1.1

Evidence: The Bicycle Master Plan would result in a total of 464 miles of bikeways within 100 square miles for an estimated 500,000 residents. Comparably, the City of Antwerp, in Belgium, had similar bikeway buildout, with 435 miles of bike lanes within 79 square miles serving a population size of approximately 500,000 residents in 2014. The City of Antwerp reported 29% mode share for bicycles in 2014. Assuming that bike lane mileage, density, and city population are directly correlated with bicycle mode share, Sacramento could expect to see a similar level of bicycle mode share that Antwerp saw in 2014. Furthermore, the City of Copenhagen, the gold standard for bicycle use saw a 26% increase between 2012 and 2019 from 36% mode share to 62% as a direct result of a 14-year plan to improve the quality, safety and comfort of cycling.⁴¹ However, it should be noted that these European cities do not just build infrastructure. They also require car drivers to pay their own way with higher parking fees, gas taxes, and excise taxes on new vehicles. These cities also incentivize dense multifamily development. Similarly, the 2040 General Plan and implementing actions will encourage compact infill development. In the US, nearby Davis reports 15.5% of commuters get to work by bike. Santa Cruz, CA, reports 13.2% and Boulder, CO, reports 10.7% according to the Census.⁴² If Sacramento achieves an increase of 4% bicycle mode share (6% total mode share in 2030) the estimated VMT reduction in passenger VMT would be approximately 52 million VMT in 2030. By 2045 a 12% mode share (10% increase over baseline) would decrease 139 million VMT.⁴³

Quantification Results Summary

Action TR-1.1	2030	2045
Total Passenger VMT Decrease	56,188,570	148,448,882
MT CO ₂ e/VMT	0.0002404	0.0002058
Emissions reductions MT CO ₂ e	13,509	30,557

⁴¹ <https://www.latimes.com/world-nation/story/2019-08-07/copenhagen-has-taken-bicycle-commuting-to-a-new-level>

⁴² https://bikeleague.org/sites/default/files/Where_We_Ride_2017_KM_0.pdf

⁴³ VMT savings for increasing bicycle mode share were only taken from internal-internal (trips within the City).

4.2 Measure TR-1 Supportive Actions

Action TR-1.2

Evidence: Improving pedestrian networks is an important part of building Complete Streets – streets that accommodate bikes, cars, shared transit, and pedestrians in an accessible way. Nationally, 16.4% of vehicle trips were one mile or less in 2017, a distance easily travelled by foot or bicycle.⁴⁴ An improved and expanded pedestrian network is the most effective and direct approach for shifting those shorter vehicle trips to walking, and studies show that distance to destinations is one of the strongest predictors of walking as a mode choice.⁴⁵ However, not much research has been conducted to determine quantitatively how improving the pedestrian network translates to increased pedestrian mode share. This is further complicated by the fact that while improved pedestrian networks almost always have a positive correlation with increased walking, that does not always translate to decreased VMT. In other words, increased walking does not mean that walking trips are replacing driving trips. One study from 1993 looked at how improving a pedestrian network affected the number of vehicle miles travelled in Portland, OR in 1985 and found that a 1% increase in the pedestrian network was associated with a 0.14% decrease in number of vehicle trips travelled.⁴⁶

Action TR-1.3

Evidence: By leveraging community groups and local partners to get firsthand feedback from the community the City will be able to better identify and eliminate the hurdles which keep people from walking and biking. The benefits of this action will support overall VMT reduction.

Action TR-1.4

Evidence: Providing education on the benefits of active transportation as well as technical information such as trip planning, incentives and other programs will help generate momentum around active transportation and support overall VMT reduction.

Action TR-1.5

Evidence: The funding to execute Measure TR-1 related actions have not been identified by the City and current public works budget does not allow for these projects. This measure would require the City and its partners to identify and secure funding to implement these actions. A description of funding and financing strategies can be found in Appendix E.

44 <https://nhts.ornl.gov/vehicle-trips>

45 https://ww2.arb.ca.gov/sites/default/files/2020-06/Impacts_of_Pedestrian_Strategies_on_Passenger_Vehicle_Use_and_Greenhouse_Gas_Emissions_Policy_Brief.pdf

46 https://ww2.arb.ca.gov/sites/default/files/2020-06/Impacts_of_Pedestrian_Strategies_on_Passenger_Vehicle_Use_and_Greenhouse_Gas_Emissions_Policy_Brief.pdf

Measure TR-2:**Support Public Transit Improvements to Achieve 11% Public Transit Mode Share by 2030 and Maintain Through 2045****2030 Target**106,035 MT CO₂e**2045 Target**122,371 MT CO₂e**Performance Metrics:**

- Implement new parking minimums and maximums by 2022
- Collaborate with SacRT to achieve an 11% transit mode share by 2030 and maintain this through 2045
- Continue to achieve at least 2 million miles taken by shared transportation
- Collectively reduce passenger VMT to 6,393 miles per person per year in 2030 (25% below 2016 per capita VMT levels) and to 5,625 miles per person per year in 2045 (34% below 2016 per capita VMT levels) between measure TR-1 and TR-2

Action #	Action	Anticipated Reduction
Quantitative Actions		
TR-2.1	Update and implement the City's Transportation System Management Plan (TSMP) ordinance to shift travel behavior away from the single-occupancy vehicle.	
TR-2.2	Eliminate parking minimums Citywide, develop parking maximums and require parking management and transportation demand management plans for all areas of the City based on available transportation options, travel patterns, and land use.	
TR-2.3	Encourage SacRT to provide frequent, reliable transit in the City's priority corridors to reduce VMT and support SacRT in implementing priority transit corridors. Coordinate transit priority corridors with consideration of transportation needs as well as land use planning to provide transit-supportive land uses. Encourage the expansion of frequent, reliable transit services throughout the City.	105,581 MT CO ₂ e (2030) 121,951 MT CO ₂ e (2045)
TR-2.4	Collaborate with SacRT in planning and implementing increased transit services with reduced headways and expanded service lines to support an 11% public transit mode share by 2030.	
TR-2.5	Work with SacRT to identify changes to signals and other technological enhancements for transit prioritization and faster transit travel times.	
TR-2.6	Continue to support electric car sharing options to offset at least 1 million VMT per year in the City through 2030.	454 MT CO ₂ e (2030)
TR-2.7	Continue to support shared rideables (bikes and scooters) to enable a reduction of 1 million VMT per year.	420 MT CO ₂ e (2045)
Supportive Actions		
TR-2.8	Support SacRT efforts to secure funding to support improved service/communications such as interactive service maps, app payments, and real time arrival info.	Supportive

Action #	Action	Anticipated Reduction
TR-2.9	Continue to implement and improve curbside management strategies to better manage and price curb space, manage transportation network companies (TNC) and prepare for autonomous vehicles.	Supportive
TR-2.10	Remove barriers to access transit stops and stations (provide low-stress connectivity) and provide enhanced, comfortable stops and stations.	Supportive
TR-2.11	Implement the City's adopted plans including modal/Citywide plans and corridor/area plans (such as the Bicycle Master Plan, Broadway Complete Streets, and 65th Street Area Plan).	Supportive
TR-2.12	Identify an Employee Transportation Coordinator and establish an employee commute program for City staff that includes provisions for telecommuting and encourage other public and private agencies located within the City to do the same using requirements and/or incentives.	Supportive
TR-2.13	Investigate and lobby for the development of a TNC user tax which would put a small fee on the use of Uber, Lyft, and others and generate funds to pay for transit and transportation infrastructure and related programs.	Supportive

4.3 Measure TR-2 Quantification

Reducing Vehicle Miles Traveled (VMT) means reducing the number of miles and trips taken by on-road vehicles both intercity and intracity. One-way Sacramento will reduce VMT by moving from single occupancy vehicles to shared mobility like trains and buses. To do this the City must work with its partners including the Sacramento Regional Transportation District (SacRT) to expand service lines and increase the convenience of transit by reducing the time it takes to reach a destination via transit as well as reducing wait times (headways) for transit. Some of the changes Sacramento will make to prioritize transit including coordinating with SacRT to plan and implement dedicated transit lanes and setting parking maximums will also make driving single occupancy vehicles less convenient to drive. By making transit more convenient and making decisions to prioritize transit over single occupancy vehicles Sacramento will begin to shift VMT towards shared transit and significantly decreasing GHG emissions. Together these strategies are expected to decrease total VMT by 9.5% by 2030 and 9.5% by 2045. Actions TR-2.1 through TR-2.6 provide quantifiable emissions reductions due to the expected shift to transit based on available information.

Action TR-2.1 through TR-2.5

Evidence: The transportation system management plan (TSMP) is a wholistic look at how mobility is achieved in the City of Sacramento. Through Action TR-2.1, the TSMP will investigate opportunities for shifting demand away from single occupancy vehicles and may include parking pricing and availability strategies, incentives for alternative commutes, requirements for large employers and other approaches.

The Fehr and Peers Transportation Model for Sacramento suggests Action TR-2.2 will yield a 30%-50% reduction in VMT of new development for which the ordinance covers depending on reduction in parking and whether it is a suburban or urban area (or how good the alternative options are). This equates to a 2%-3.1% reduction in citywide passenger vehicle emissions compared to the 2030

forecast and a 4%-6% reduction compared to the 2045 forecast. Conservatively, a citywide VMT reduction of 2% in 2030 and 4% in 2045 is expected due to the implementation of this measure which equates to a VMT reduction of 86,881,896 miles in 2030 and 180,256,184 miles in 2045.

The recent free student ridership program demonstrated that there is an existing strong need for public transportation in Sacramento. Through the program, SacRT student ridership doubled over the course of a few months, including during weekends and after school. SacRT also saw an overall 6% increase in system-wide ridership in 2020. These trends not only suggest that SacRT service improvements would fill a real transportation gap in Sacramento, resulting in actual VMT reductions, but also those VMT reductions would be maximized through the other incentives and programs that SacRT offers.

In general, increases and improvements to public transportation systems reduce a city’s dependence on fossil fuels and reduce VMT. The best ways to improve a transit system and reduce driving is to expand its geographical reach and increase the frequency and reliability of transit service. Each new mile of transit usage replaces VMT on much more than a 1:1 basis. Approximately 1% increase in transit frequency saves 0.5% in VMT.⁴⁷ Bus Rapid Transit can also yield a corridor-level VMT reduction of 1-2%.⁴⁸ Sacramento currently has a transit mode share of 1.5%. Oakland CA, by contrast has achieved a 21% mode share. Oakland also has a low difference in income between transit and non-transit users of 2%.⁴⁹ SacRT has a service area of 400 square miles (1.4 million people) and includes 80 bus routes. In comparison, AC Transit (which serves Oakland) has a service area of 368 miles (1.5 million people) and has nearly double the bus lines with 158. Ridership on AC Transit was 53 million in 2018-2019 compared to 21 million on SACRT. An increase of SACRT service of the magnitude to match AC Transit which serves a similar size and population could reasonably result in a 21% transit mode share. To be conservative, a transit mode share increase of 10% above baseline by 2030 and maintaining that increase through 2045 was estimated for Sacramento. This increase in mode share is expected to reduce VMT by 10% or 399,424,427 miles per year in 2030 and 412,188,607 miles per year in 2045.

Quantification Results Summary

Actions TR-2.1 through TR-2.5	2030	2045
Total Passenger VMT Decrease due to Actions TR-2.1 – TR-2.5	486,306,323	592,444,792
MT CO ₂ e/VMT	0.0002171	0.0002058
Emissions Reductions MT CO ₂ e	105,581	121,951

Actions TR-2.6 and TR-2.7

Evidence: Research from the Transportation Sustainability Research Center at the University of California – Berkeley shows that car share programs like in Action TR-2.6 lower vehicle ownership and overall VMT.⁵⁰ While a majority of car share members use the program to add or replace vehicle trips (leading generally to small VMT increases), a minority of members (2-5%) use car share as a replacement for vehicle ownership (leading generally to larger VMT reductions). The net effect

47 <https://www.ncdot.gov/initiatives-policies/environmental/climate-change/Documents/vehicle-miles-traveled-reduction-study-tool-kit.pdf>

48 <https://www.ncdot.gov/initiatives-policies/environmental/climate-change/Documents/vehicle-miles-traveled-reduction-study-tool-kit.pdf>

49 <https://smartasset.com/mortgage/best-cities-for-public-transportation>

50 http://innovativemobility.org/wp-content/uploads/2016/07/Impactsofcar2go_FiveCities_2016.pdf

is overall decrease in vehicle ownership, VMT, and ultimately GHG emissions. Approximately one car share vehicle replaces seven to eleven cars and VMT is reduced, on average, between 6% to 16% per car share household assuming one-way usage. In approximately one year, Sacramento’s Gig electric car share program hit over 1 million miles driven providing GHG reductions as well as air quality and mobility benefits.

Shared rideables⁵¹ (Action TR-2.7) are also demonstrated to reduce VMT. In 2019, a total of 1,060,405 trips were taken on shared rideables (shared bikes and scooters) in the City of Sacramento. Success of shared rideables in replacing vehicle use is not known in Sacramento, but a 2019 report from the City of Santa Monica found that 49% of shared rideable trips replaced vehicle trips based on answers to survey questions.⁵² A 2014 study from Utrecht University suggests that the car substitution rate of shared rideables is dependent on what proportion of trips are already taken by car in a city.⁵³ In the study, Minneapolis and Melbourne had between 70% and 76% vehicle mode share in 2014 and showed high rates of car mode substitution (19% to 21%) after shared rideables were introduced. On the other hand, London and Washington DC had between 36% and 46% vehicle mode share in 2014 and showed much lower rates of car mode substitution (2% to 7%) after shared rideables were introduced. Sacramento and Santa Monica both had high vehicle mode share (83% and 72% respectively) before shared rideables were introduced, suggesting that Sacramento would see a similar if not higher car substitution rate of shared rideables as Santa Monica. Both studies previously mentioned suggest that average trip duration of shared rideable trips is about 2 miles (this is seen consistently across the six diverse cities mentioned above) and appears to be largely independent of other city metrics. VMT reductions from introduction of shared rideables in 2019 in Sacramento were therefore estimated to be approximately 1 million miles, or 342 MT CO₂e. This assumes an average trip distance of 2 miles and a car substitution rate of 49% along with the total trips recorded in 2019.

Quantification Results Summary

Actions TR-2.6 through TR-2.7	2030	2045
Total VMT reduction from shared mobility	2,039,197	2,039,197
Passenger vehicle emission factor (MT CO ₂ e /VMT)	0.000240	0.000206
Electric car emission factor (kWh/mile)	0.29	0.29
Scooter emission factor (kWh/mile)	0.0125	0.0125
Electric car share kWh used	290,000	290,000
Scooter kWh used	12,990	12,990
SMUD emission factor (MT CO ₂ e /kWh)	0.0001193	0.0000
Emissions avoided (MT CO ₂ e)	490	420
Emissions from electricity (MT CO ₂ e)	36	0.0000
Emissions saved	454	420

⁵¹ Shared rideables generally refer to rentable bicycles and scooters.

⁵² https://www.smgov.net/uploadedFiles/Departments/PCD/Transportation/SantaMonicaSharedMobilityEvaluation_Final_110419.pdf

⁵³ <http://mobility-workspace.eu/wp-content/uploads/Bike-shares-impact-on-car-use-3.pdf>

4.4 Measure TR-2 Supportive Actions

Action TR-2.8

Evidence: This is supportive to Actions TR-2.5 through TR-2.7 and the overall measure. Effective communication, especially communication that takes advantage of new and emerging technologies to accurately and easily disseminate trip planning and real-time status information, is a strong factor in helping customers decide to use transit for business or leisure trips.⁵⁴

Action TR-2.9

Evidence: Curbside management strategies can help shift cities towards sustainable citywide mobility without compromising space and business needs.⁵⁵ Sacramento has already made great strides in curbside management with their innovative dynamic parking program. In San Francisco, a parking pilot program called SFPark instituted dynamic parking pricing for on-street parking and experienced a 30% drop in VMT for the area, 8% drop in traffic volume, and improved meter compliance and parking turnover.⁵⁶ In general, increasing the price to park is one of several related factors that can reduce VMT and promote mode switching.⁵⁷ This approach is more effective when combined with infill development, investments in alternative transportation, and travel demand management programs.

Action TR-2.10

Evidence: Improving transit access has the potential to shift trips from cars to transit, which may reduce vehicle trips, VMT, and greenhouse gas emissions, with time spent getting to a transit stop being the key indicator of transit access.⁵⁸ While difficult to directly quantify, improving access to transit stops and stations can contribute to improved transit access, and is therefore an important component of this strategy to reduce VMT.

Action TR-2.11

Evidence: The City has adopted plans and strategies to increase transit use through planning efforts. These actions will support the overall VMT reduction quantified under Measure TR-2.

Action TR-2.12

Evidence: In light of the recent changes made to combat the spread of COVID-19, telecommuting has proven to be an implementable and effective strategy for reducing VMT. Continuing to leverage the telecommuting and remote work lessons learned during the pandemic will allow the City of Sacramento to reduce VMT well into the future.

Action TR-2.13

Evidence: The City of San Francisco was given a special variance by the State of California to implement a Traffic Congestion Mitigation tax on private transit service vehicles. The revenues of

54 <https://onlinepubs.trb.org/onlinepubs/trnews/trnews303rpo.pdf>

55 <https://nacto.org/wp-content/uploads/2017/11/NACTO-Curb-Appeal-Curbside-Management.pdf>

56 <https://www.ite.org/pub/?id=C2D66E96%2DFF01%2D0BA8%2D68C3%2D65CC9116A5AE>

57 <https://dot.ca.gov/-/media/dot-media/programs/research-innovation-system-information/documents/preliminary-investigations/final-pricing-parking-management-to-reduce-vehicles-miles-traveled-pi-a11y.pdf>

58 [https://ww2.arb.ca.gov/sites/default/files/2020-](https://ww2.arb.ca.gov/sites/default/files/2020-06/Impacts_of_Transit_Access_%28Distance_to_Transit%29_Based_on_a_Review_of_the_Empirical_Literature_Policy_Brief.pdf)

[06/Impacts_of_Transit_Access_%28Distance_to_Transit%29_Based_on_a_Review_of_the_Empirical_Literature_Policy_Brief.pdf](https://ww2.arb.ca.gov/sites/default/files/2020-06/Impacts_of_Transit_Access_%28Distance_to_Transit%29_Based_on_a_Review_of_the_Empirical_Literature_Policy_Brief.pdf)

this tax go to offsetting the emissions from these services through the funding of transit and VMT reducing projects.⁵⁹ The City of Sacramento will pursue a similar tax in order to help offset the impacts of Transportation Network Companies in Sacramento.

⁵⁹ <https://sftreasurer.org/business/taxes-fees/traffic-congestion-mitigation-tax-tcm#:~:text=The%20City%20imposes%20a%20Traffic,or%20private%20transit%20services%20vehicle.>

Measure TR-3:

Achieve Zero-Emission Vehicle (ZEV) adoption rates of 28% for passenger vehicles and 22% for commercial vehicles by 2030 and 100% for all vehicles by 2045

2030 Target
 212,451 MT CO_{2e}
2045 Target
 1,137,071 MT CO_{2e}

Performance Metrics:

- 11% of all vehicles are ZEVs and 3,230 public EV chargers in Sacramento by 2025
- 28% of all vehicles are ZEVs and 8,150 public EV chargers in Sacramento by 2030
- 100% EVs by 2045⁶⁰

Action #	Action	Anticipated Reduction
Quantitative Actions		
TR-3.1	Amend City Building Code to require at least 20% EV-capable charging spaces and at least one installed, operational Level II EV charger in new multifamily and nonresidential development. Amend the Planning and Development Code to incentivize charging in both existing and new developments.	
TR-3.2	Continue to install and provide EV charger access at City-owned facilities and parking garages.	212,451 MT CO _{2e} (2030) 1,137,071 MT CO _{2e} (2045)
TR-3.3	Continue to support a variety of public and public/private partnerships to provide more publicly accessible chargers throughout the City. Examples include public/private partnerships on private property (Electrify America), public/private partnerships on public property (EVgo), and public investment (SMUD).	
Supportive Actions		
TR-3.4	Pursue affordable, zero-emission car share expansions to serve affordable housing, such as the Sacramento Metropolitan Air District’s Our Community Carshare program to more locations, contingent on funding.	Supportive
TR-3.5	Collaborate on e-mobility hub pilot efforts, in partnership with other agencies and local groups, with special consideration for proximity to low-income/disadvantaged communities and multifamily housing.	Supportive
TR-3.6	Continue to maintain a highly streamlined EV infrastructure permit process.	Supportive
TR-3.7	Develop and implement a fee for use of City-owned parking facilities and EV chargers to promote more efficient use and turnover and increase EV availability for people who really need it, including those without access to home charging.	Supportive
TR-3.8	Work and collaborate with major employers including the State of California and Sacramento County to promote ZEV adoption, programs, and improvements to ZEV infrastructure.	Supportive

⁶⁰ The number of chargers needed to meet 100% EV’s is not yet known. New technologies could significantly alter the current landscape by this time. This will be addressed in upcoming CAAPs.

Action #	Action	Anticipated Reduction
TR-3.9	Continue to provide information and education about currently available incentives for expansion of Level II chargers on private property.	Supportive
TR-3.10	Coordinate with community-based organizations, agencies, and non-profits to conduct EV education events with would include information on costs/benefits of owning EVs, steps on how to receive incentives for EV chargers, as well as other benefits. Events will be equitably distributed across the City, focusing on disadvantaged communities.	Supportive
TR-3.11	Because zero-emission technology is improving/changing at a rapid pace, continue to monitor, test, and adapt to new and emerging zero-emission technologies and solutions.	Supportive

4.5 Measure TR-3 Quantification

The State of California has a goal of putting 5 million EVs on the road by 2030. This is approximately 1/3 of the vehicles currently on the road. Forecasting to 2030 given today’s rate of vehicle ownership, 5 million EVs in 2030 would be approximately 30% of the vehicle fleet. Therefore, the level of electrification proposed for this measure is in line with the state’s. The City of Sacramento will support the necessary infrastructure to support a fleet with 28% EV’s by 2030, with a long-term target of 100% EVs by 2045. This is equivalent to approximately 65,000 EVs in Sacramento by 2025 and 163,000 by 2030. As of October 2018, the City had 4,849 EVs registered, with 3.3% of new vehicle sales in Sacramento being EVs.⁶¹ While the City cannot require residents to buy and use ZEVs, the City will take actions to encourage this behavior change and support this level of EV adoption by improving the availability of EV charging infrastructure. The City’s primary target to achieve this measure is to provide one public EV charger for every 20 EVs, or 3,231 EV chargers by 2025 and 8,158 by 2030.⁶² The ratio of one charger per 20 EV’s is in line with the leading Cities in California (San Francisco, Los Angeles, and San Jose) when it comes to EV infrastructure and aligns with recent charging infrastructure studies through 2025. The need for charging infrastructure may change over time depending on new technologies such as smart chargers and trends in personal EV adoption. The City will continue to monitor the most recent research on EV infrastructure needs and update long term goals as necessary. The following actions are a combination of expanded public EV chargers and incentives for EV adoption.

Action TR-3.1

Evidence: This action will account for the majority of the targeted number of EV chargers in 2025 and 2030. EV-ready building codes are one of the most effective and low-cost strategies for states and local governments to encourage consumers to buy or lease electric vehicles, and can save consumers thousands of dollars in installation costs.⁶³ However, new development is not projected to occur at a scale sufficient to meet the City’s charging goals. EV charger installation will therefore need to occur in existing buildings as well. Sacramento is currently 5th in the nation for the number of public chargers per million population (Level II and DCFC), with a total of 682 public EV connectors, including 129 public fast chargers, as of January 2020.⁶⁴ This ordinance would be in

61 Data provided by the City of Sacramento

62 https://theicct.org/sites/default/files/publications/US_charging_Gap_20190124.pdf

63 <https://studylib.net/doc/25931357/cracking-the-code-to-ev-readiness-in-new-buildings>

64 Data provided by the City of Sacramento

addition to Sacramento's substantial ongoing EV programs contained in the 2017 EV Strategy and 2019 EV Blueprint.

Action TR-3.2

Evidence: As of 2020, the City of Sacramento currently operates 120 chargers at City-owned facilities, 48 of which serve the City fleet and 72 of which are available for public or employee charging. Patrons of City parking facilities can currently charge their EV at no additional cost, except when using the DCFC at the Sacramento Valley Station. The City is currently completing replacements of City-owned chargers to upgrade to newer, networked electric vehicle supply equipment (EVSE) and increase charging connector availability at City facilities. This investment will nearly double the number of Level II EVSE connectors in the first phase, going from 61 to 103 at the first seven sites by spring of 2020.⁶⁵ The next phases for City-owned EVSE expansion will support planned EV purchases in the City's fleet and will likely include many public-facing community locations. A key priority for the EVSE expansion plan is to increase charging access in low income and disadvantaged communities. Providing public charging in these communities will help to increase the viability of EV technologies, improve consumer awareness, and ensure charging options for a range of housing types.

Action TR-3.3

Evidence: The City of Sacramento has been a state and national leader in building electric vehicle partnerships and infrastructure since its first EV program in 1994. The City already hosts 682 public EV charging stations and connectors. Volkswagen subsidiary, Electrify America, designated Sacramento as the first Green City in its Zero-Emission Vehicle (ZEV) Investment Plan in 2017. Under this initiative, also known as "Sac-to-Zero", Electrify America invested \$44 million in Sacramento between 2017 and 2020, part of which was allocated to installing new charging infrastructure. In addition, the City launched its first curbside charging pilot in May 2019 in partnership with EVgo, which offers fast charging in the right-of-way at Southside Park. The chargers are owned and operated by EVgo and available to any member of the public. Over 700 vehicles have used the chargers, resulting in an estimated 400,000 EV miles powered and more than 19,000 gallons of gasoline avoided.⁶⁶ The City is currently working with EVgo on a second curbside charging pilot with an anticipated launch date by Fall 2020.

Since 2017, the City's public/private partners have installed or will install by 2025 75 Level II, DC fast chargers, and high-power chargers through Electrify America, three EVgo curbside charging stations, and 42 new Level II connectors through the City itself, for a total of 123 new chargers. Through these existing programs and new opportunities, the City and its partners will continue to install new chargers to meet the 2025 and 2030 targets.

Quantification Results Summary

In order to calculate the GHG reductions associated with achieving a 28% EV adoption level in 2030 and 100% in 2045 the following calculations were conducted. For 2030 the difference in total EV adoption (28%) and projected EV adoption (by EMFAC) was calculated to be 23%. A 23% reduction in 2030 VMT was then calculated and multiplied by the 2030 EMFAC emission factor. For commercial vehicles EMFAC does not project commercial EV adoption, so no adjustment was necessary. Finally, emissions associated with the electricity consumed by the EV's was calculated by

⁶⁵ Data provided by the City of Sacramento

⁶⁶ Data provided by the City of Sacramento

using an estimated EV efficiency.⁶⁷ The resulting kWh estimate was multiplied by the SMUD projected emission factor. The impacts of the SMUD 2030 Zero Carbon Plan are quantified in E-1.

Actions TR-3.1 through TR-3.3	2030	2045
Passenger Vehicles		
Percent Passenger EV's	28%	100%
Forecasted EV's	4.58%	7.25%
Net Increase	23%	100%
VMT driven by EV	890,832,307	3,924,599,639.72
MT CO2e/VMT (Adjusted to include emissions from electric car)	0.0002139	0.0002058
Passenger MT CO2e Savings	190,563	807,854
Commercial Vehicles		
Percent Commercial Vehicle EV's ⁶⁸	22%	100%
Forecasted EV's	0%	0%
VMT driven by EV	69,050,601	331,756,294.30
MT CO2e/VMT (Adjusted to include emissions from electric car)	0.0008783	0.0009923
Commercial MT CO2e Savings	60,647.31	329,216.91
Gross MT CO2 Savings	251,210	1,137,071
Electricity Emissions Adjustment		
MT CO2e/VMT EV (passenger)	0.000027	0.000027
MT CO2e/VMT EV (commercial)	0.000219	0.000219
Emissions from EV's	38,759	0
Total MT CO2 Savings	212,451.08	1,137,070.81

4.6 Measure TR-3 Supportive Actions

Action TR-3.4

Evidence: The City was an early partner for the Sacramento Metropolitan Air Quality Management District's Our Community CarShare program, California's first all-electric carsharing program targeted for low-income communities. Our Community CarShare offers a free membership transportation service located in low-income and affordable housing communities throughout the City of Sacramento. Residents can reserve clean zero emission vehicles to run errands, get to appointments, and take local trips. The program has successfully launched two phases, and as of January 2020 the program offers 14 vehicles at 7 sites that have delivered over 470,000 electric miles driven and more than 19,000 gallons of gasoline avoided (169 MT CO₂e). The project is currently building out its third phase for expanded service at four additional sites.

Other notable car share programs in the City of Sacramento include Envoy and GIG Car Share, both of which received funding in Sacramento from Electrify America's Sac-to-Zero initiative. Envoy is a round-trip ZEV care share service located at 40+ multifamily apartment complexes, with a majority serving low income or disadvantaged residents. GIG Care Share is the nation's largest free-floating

⁶⁷ <https://cleantechnica.com/2018/06/30/what-are-the-most-efficient-electric-cars/>

⁶⁸ Commercial vehicles refers to vehicles in EMFAC classes LHD1, LHD2, T6, T7, PTO, UBUS, Motor Coach, All Other Buses, MH, T7IS, OBUS, MH

ZEV car sharing program, with 260 all-electric vehicles in Sacramento. Recent data from GIG for the Oakland area in 2017 found that GIG cars were used 2.7 times more than privately-owned cars, based on the National Household Travel Survey's estimate that privately-owned cars are idle 94.3 percent of the time.⁶⁹

Action TR-3.5

Evidence: The Sacramento EV Blueprint evaluated examples of e-mobility hubs from other cities and created recommendations for an e-mobility hub in Sacramento, including a preliminary design concept and list of potential locations to consider. This action would take further advantage of the City's work to date and would lead to increased support for EVs within the City of Sacramento. Additionally, data collected from the development of a mobility hub pilot project in the City of Austin in 2018 suggested that mobility hubs can shift mode-share from single-passenger vehicles to walking or biking.⁷⁰ Efforts to evaluate and seek funding for e-mobility hubs are underway in collaboration with the Sacramento Metropolitan Air Quality Management District, the Sacramento Municipal Utility District, and other local partners.

Action TR-3.6

Evidence: In 2016, the City passed ordinance 15.08.190 to expedite the application process for EV charging station installation in accordance with Assembly Bill (AB) 1236. The City of Sacramento is one of only 40 cities and counties to have effectively developed and implemented a streamlined EVCS permitting process in accordance with AB 1236 to date. All application materials and requirements can be found on the City's website, including a simple checklist that applicants use to ensure they have all required materials included in the application. Applications can be submitted via e-mail providing additional convenience to applicants. If all required documents are submitted, applicants can expect to have their expedited EVCS building permits reviewed and approved within 24 hours for residential applications and approximately five business days for non-residential applications – both exceeding the best practices recommended by the Governor's office. Expedited implementation is supported by ongoing collaboration across the departments of Community Development and Public Works. It has further demonstrated the City's dedication to improving local air-quality, achieving community-wide climate and energy goals, and ensuring that zero-emission vehicles can be accessible and utilized by all community members.

Evidence: SMUD has a long history of supporting EV charging infrastructure in the City of Sacramento. SMUD also owns and operates 6 DCFC stations in Sacramento County.⁷¹ SMUD's past and ongoing work to bring public EV chargers to Sacramento will be supplemented by this action to provide substantial incentives for EV owners to install their own chargers at home, where a majority of EV charging occurs. As of 2020, SMUD will offer \$500 for each new electric circuit and up to \$2,500 if a panel upgrade is also required, as well as a free Level II charger⁷². SMUD also offers a \$1,500 incentive for each Level II charger port at businesses, with up to 20 incentives available per business.⁷³

69 <https://www.berkeleyside.org/2017/04/19/bay-areas-first-one-way-car-share-debuts-berkeley-oakland>

70 <https://rmi.org/wp-content/uploads/2018/12/rmi-mobility-hub-report-2018.pdf>

71 http://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Electric-Vehicles/EVStrategy_171212_FINAL_CityOfSacramento.pdf?la=en

72 <https://www.smud.org/en/Rebates-and-Savings-Tips/Improve-Home-Efficiency/Go-Electric-Bonus-Package>

<https://www.smud.org/en/Rebates-and-Savings-Tips/Improve-Home-Efficiency/Go-Electric-Bonus-Package>

73 <https://fundingwizard.arb.ca.gov/web/>

Action TR-3.7

Evidence: While not directly quantifiable, EV charging fees will increase turnover at charging stations, helping to promote equitable access to EV charging infrastructure and encourage widespread EV adoption across a greater demographic range. This will be coupled with increased parking fees for non-EV, encouraging use of both EVs and/or active transit.

Action TR-3.8

Evidence: Curb space is a major resource within the City serving multiple functions relating to mobility. By continuing to price curb space appropriately and preparing for a change to autonomous vehicles, the City of Sacramento can ensure the highest and best use of this limited resource.

Action TR-3.9

Evidence: The State of California is the City's largest employer and has implemented various initiatives to increase its ZEV fleet and available ZEV charging infrastructure for employees.⁷⁴ This action would also benefit other major employers interested in providing workplace charging. Sacramento City Unified School District (SCUSD), for example, has an EV workplace charging program and offers 6 charging stations available for employees.⁷⁵

Action TR-3.10

Evidence: The countywide CALeVIP incentive is anticipated to bring additional public DCFC and L2 workplace or fleet chargers. Rebates are reserved for at least 400 new or replacement L2 chargers, and additional community wide L2 chargers, and 76 new DCFC units.⁷⁶ SMUD incentives are detailed under Action TR-3.6. The City of Sacramento is in the top three of California cities for EV promotion activities. As the City's EV programs continue to expand, outreach surrounding incentives for installing Level II chargers on private property will support the City's targets and this overall measure.

Action TR-3.11

Evidence: Providing information on existing and future programs, incentives, resources, and benefits of electric vehicle adoption to the community will increase adoption and contribute to the overall goal of electrified VMT in the City.

Action TR-3.12

Evidence: City staff are continuously evaluating emerging opportunity areas including:

- Expanded EVSE at City facilities
- Workforce development and job training for emerging ZEV industries
- E-Mobility hubs that connect multiple modes of transportation
- Community incentive programs and resources for low-income and disadvantaged communities
- Education and outreach
- Operationalizing equity & flexibility

⁷⁴ <https://www.green.ca.gov/fleet/about/initiatives/>

⁷⁵ <https://www.scusd.edu/ev-workplace-charging-program>

⁷⁶ Data provided by City of Sacramento

- Public-private partnerships for acceleration of shared mobility programs and transit

While not directly quantifiable, this action will help ensure the City prioritizes the most impactful technologies and solutions as the ZEV landscape changes, maximizing on benefits from other actions and supporting the overall measure.

5 Waste

Measure W-1

Work to reduce organic waste disposal 75% below 2014 levels by 2025

2030 Target

134,991 MT CO₂e

2045 Target

160,897 MT CO₂e

Performance Metrics:

- Compliance with SB 1383 requirements by 2025
- Compost or otherwise divert at least 75% of organic waste in 2025 relative to 2014
- Recover 20% of edible food by 2025
- Maintain or improve these metrics through 2030

Action #	Action	Anticipated Reduction
Quantitative Actions		
W-1.1	Implement the requirements of SB 1383 to compost or otherwise divert 75% of organic waste compared to 2014 levels by: <ul style="list-style-type: none"> ▪ Providing organic waste collection to all residents and businesses. ▪ Establishing an edible food recovery program that recovers edible food from the waste stream and redistributes the food to local community organizations to be used or eaten. ▪ Conducting outreach and education to affected parties, including generators, haulers, facilities, edible food recovery organizations, and city/county departments. ▪ Conducting capacity planning and evaluate your jurisdiction's readiness to implement SB 1383. ▪ Procuring organic waste products like compost, mulch, and RNG. ▪ Inspecting and enforcing compliance with SB 1383. 	134,991 MT CO ₂ e (2030) 160,897 MT CO ₂ e (2045)
Supportive Actions		
W-1.2	Work with regional partners (other municipalities) and the private sector to assess the feasibility of siting long term organics processing facilities in or near Sacramento County.	Supportive
W-1.3	Continue to provide backyard compost education and reduced-cost compost bins as well as kitchen-top food waste containers to participating residents.	Supportive
W-1.4	Implement a food waste diversion program for single-family residential customers by 2022.	Supportive
W-1.5	Enforce new commercial waste code which requires businesses to subscribe to organics recycling collection service through the City's franchised commercial haulers starting July 1, 2021.	Supportive

Action #	Action	Anticipated Reduction
W-1.6	Serve as a regional partner in the development and implementation of an edible food recovery program which connects commercial edible food generators with local food banks, to recover at least 20% of the edible food that is currently disposed of for human consumption, consistent with SB 1383.	Supportive
W-1.7	Explore the feasibility of capital improvement projects for reducing organics in the waste stream, such as organics extraction presses and anaerobic digesters.	Supportive
W-1.8	Consider adopting, if needed, an ordinance that aligns with AB 827, the state law that requires most restaurants to have front-of-house composting.	Supportive

5.1 Measure W-1 Quantification

SB 1383 was adopted in 2016 and is a landmark waste mandate that requires the state to reduce organic waste disposal by 75% by 2025, or by about 20 million tons annually. The law also requires the state to increase edible food recovery by 20 percent by 2025. Since the requirements of SB 1383 fall on the City in many regards, the impacts of SB 1383 were not included in the adjusted forecast. Instead, they are accounted for here as actions for the City to complete as part of the CAAP implementation. CalRecycle describes the requirements of local governments in meeting these targets as follows⁷⁷:

- Provide organic waste collection to all residents and businesses
- Establish an edible food recovery program that recovers edible food from the waste stream
- Conduct outreach and education to affected parties, including generators, haulers, facilities, edible food recovery organizations, and city/county departments
- Capacity Planning: Evaluating your jurisdiction’s readiness to implement SB 1383
- Procure recycled organic waste products like compost, mulch, and renewable natural gas (RNG)
- Inspect and enforce compliance with SB 1383
- Maintain accurate and timely records of SB 1383 compliance

Action W-1.1

The actions listed above for the CAAP are a summary of the complete list of actions required to comply with SB 1383. More information on the requirements of SB1383 which the City would adopt in some form are included below:

Expand local organics collection program: Increase organics collection by offering technical assistance and outreach to commercial and residential accounts and planning for expanded processing capacity.

- Desired Result
 - 50% reduction in landfilled organic waste by 2020
 - 75% reduction in landfilled organic waste by 2025
 - Reduce greenhouse gas emissions by 4 million metric tons statewide by 2030

⁷⁷<https://www.calrecycle.ca.gov/organics/slcp/education#:~:text=The%20SB%201383%20draft%20regulations,and%20other%20food%20recovery%20organizations.>

- Benefits
 - Compliance with SB1383 state regulation
 - Public health benefits
 - Green economy (expanded organics processing facilities and jobs)
- Key Steps
 - As stated in CalRecycle’s SB 1383 regulations⁷⁸, the City of Sacramento must engage in organic waste recycling capacity planning by supporting Sacramento County in executing the following actions:
 - Estimate Sacramento’s disposal of organic waste (tons)
 - Identify and verify amount of available organic waste recycling infrastructure
 - Estimate the amount of new or expanded capacity needed to process organic waste
 - If existing and planned capacity is insufficient based on this process, the City of Sacramento shall support Sacramento County efforts to:
 - Develop and submit an implementation schedule highlighting planning effort to provide enough new or expanded organics capacity, including timelines and relevant milestones, by the end of the report period
 - Identify proposed new or expanded facilities that could be used for additional capacity
 - Expand organic waste collection for all commercial and residential generators
 - Require organics generators to subscribe to organics collection programs or alternatively report organics self-hauling and/or backhauling
 - Work with the City of Sacramento’s Recycling and Solid Waste Division and franchise waste haulers to collect organic waste and verify facility where they will transport organic waste (with exclusions of haulers transporting source-separated organic waste to a community-scale composting site and haulers transporting construction and demolition (C&D) waste in compliance with CALGreen)
 - Allow limited waivers and exemptions to generators for *de minimus* volumes and physical space constraints and maintain records for waivers/exemptions
 - Standardize all colors and labels for carts, dumpsters, debris boxes, compactors for garbage, recycling, and organics based on SB 1383 statewide requirements
 - Develop and implement an education and outreach program that provides compliance assistance to organics generators.
 - Identify percentage of organics generators who are “limited English-Speaking households” or “linguistically isolated.” If more than five percent (5%) of Sacramento’s organics generators are defined as “limited English-speaking households” or linguistically isolated,” provide education and outreach in a language or languages that will assure the information is understood by that community
 - Prior to February 2022 and annually thereafter, provide organics generators the following information:
 - Requirements to properly separate materials
 - Organic waste prevention and on-site recycling

⁷⁸ Key actions are extracted from the second draft of the proposed SB 1383 regulations text.

- Methane reduction benefits
- How to implement organic waste collection services with AVI
- Information related to edible food donation
- Implement inspection and compliance program with defined enforcement mechanisms and penalties by January 31, 2022 and annually thereafter
 - Perform compliance review of all commercial garbage accounts that generate 2 cubic yards or more per week of organics and solid waste
 - Conduct annual contamination inspections and route reviews on randomly selected accounts and waste containers or conduct waste evaluations twice a year that meet the guidelines outlined in Article 3 of SB 1383
 - Enforce penalties for noncompliant entities as required by Article 16 of SB 1383.
- Maintain records, including an initial compliance report, annual report, and implementation record as required by Articles 3, 14, and 16 of SB 1383.

Increase edible food recovery: Develop and implement an edible food recovery program which connects large food generators with local food banks, to recover at least 20% of the edible food that is currently disposed of for human consumption, consistent with SB1383.

- Desired Result
 - 20% increase in recovery of currently disposed edible food from large food generators to food banks and hunger relief organizations
 - Reduction in landfilled organic waste
- Benefits
 - Compliance with SB1383 state regulation.
 - Reduction in food insecurity.
 - New or enhanced community connections via more active and/or extensive donation networks.
 - Support for businesses, which may receive tax incentives for donations.
- Key Action
 - Recover at least 20% of the edible food that is currently disposed of for human consumption by 2025, consistent with SB1383
 - Conduct edible food recovery capacity planning by executing the following actions:
 - Estimate the amount of edible food that will be disposed by organics generators in Sacramento
 - Identify the minimum capacity required to recover 20% of edible food that is estimated to be disposed
 - Work with commercial food generators to reduce excess edible food generation:
 - Connect large food generators to food banks and food recovery organizations
 - Consider the adoption of an edible food recovery ordinance or similarly enforceable mechanism to ensure that large edible food generators connect with local food recovery programs
 - Implement an inspection and compliance program with defined enforcement mechanisms and penalties targeted towards food generators and food recovery agencies as required by SB 1383

- Maintain an initial compliance report, implementation record, and annual report as required SB 1383

Implement organics procurement: Increase municipal procurement of recovered organic waste products and post-consumer fiber products.

- Desired Result
 - Reduction in landfilled organics via bolstering the market for recycled organics products.
- Benefits
 - Carbon sequestration through use of purchased compost
 - Beautified landscapes through application of purchased compost
 - Public health benefits (Reduced particulate emissions from fossil fuels via increased use of clean energy sources)
- Key Actions
 - As stated in CalRecycle’s proposed SB 1383 regulations, the City of Sacramento must procure a quantity of recovered organic waste that meets or exceeds the organic waste product procurement targets for the City of Sacramento. Recovered organic waste products that a jurisdiction may procure to achieve compliance are: 1) compost, 2) renewable natural gas for transportation, electricity, heating applications, 3) pipeline ejection, or 4) electricity from biomass conversion
 - Ensure that at least 75% of City of Sacramento’s annual purchase of paper products, printing paper, and writing paper is paper with a at least 30 percent post-consumer fiber paper. Require paper suppliers to certify minimum percentage of post-consumer material
 - Procure and use compost to meet California Model Water Efficient Landscape Ordinance (WELo) requirement for incorporating compost into new and renovated permitted landscapes (at least four cubic yards per 1,000 sq. ft. to a depth of six inches of compost)
 - Implement an inspection and compliance program with defined enforcement mechanisms and penalties, as required by Article 16 in SB 1383
 - Maintain records, including an initial compliance report, annual report, and implementation record as required by Articles 3, 14, and 16 of SB 1383

Evidence: The requirements and actions associated with SB 1383 have been developed to produce a 75% reduction in organics by the State of California.⁷⁹ Therefore, by taking the actions required, the City of Sacramento can expect to achieve a similar reduction level. The emissions reductions associated with a 75% reduction in organics was calculated using the 2014 waste characterization study for the County of Sacramento pursuant to the SB 1383 guidelines. A 75% reduction was applied in 2025 and continued through 2030 and the reduced amount was multiplied by CARB’s emission factor for mixed organics (.31 MT/short ton).⁸⁰ Total emissions reductions are estimated to be 51,429 MT of CO₂e in 2030.

⁷⁹ https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201520160SB1383

⁸⁰ https://www.epa.gov/sites/production/files/2019-06/documents/warm_v15_organics.pdf

Quantification Results Summary

Action W-1.1	2030	2045
Percentage of waste that is organics	27%	27%
Total Waste (tons) ⁸¹	704,696	839,935
Organic tons	188,506	224,683
Organics reduced by SB 1383 (75%)	141,380	168,512
Organics Emission Factor ⁸²	0.364	0.364
Emissions Saved (MT CO ₂ e)	51,429	61,298

5.2 Measure W-1 Supportive Actions

Action W-1.2

Evidence: Identifying a regional organics processing facility is a key step in diverting the required organics specified by SB 1383. Having a close facility will also reduce VMT compared trucking waste to a less local destination. Permitting is currently a hurdle for facilities in Sacramento County due local quality challenges and standards; however, other nearby regional areas may be identified.

Action W-1.3

Evidence: Sacramento currently provides backyard composting education, reduced-cost compost bins, and kitchen-top food containers to residents.⁸³ Providing compost buckets to residents will remove barriers to composting and allow for more organics to be diverted from the waste stream. Providing free buckets is also an equity benefit.

Action W-1.4

Evidence: The implementation of a food waste diversion program for all residents is a key action in achieving the SB 1383 goals. However, it is only a portion of the SB 1383 strategy and is not quantified here in order to avoid double counting.

Action W-1.5

Evidence: This measure would increase organics diversion and contribute to the overall SB 1383 reduction target.

Action W-1.6

Evidence: This action is required by SB 1383. Diverting edible food waste will both reduce GHG emissions and potentially reduce hunger and improve equity in the City.

Action W-1.7

Evidence: Continuing to explore new technologies in waste diversion may allow Sacramento to better reach its long-term waste goals.

⁸¹ See Community Inventory and Forecast in Appendix A

⁸² <https://ww3.arb.ca.gov/cc/waste/cerffinal.pdf>

⁸³ <http://www.cityofsacramento.org/public-works/rsw/>

Action W-1.8

Evidence: Some cities have introduced ordinances to mandate commercial compost collection, including San Francisco, Portland, Seattle, and Boulder, among others. Boulder approved a Universal Zero Waste Ordinance in 2015, which requires that every home, business, and apartment have recycle and composting services, including front of house composting at restaurants. A waste audit study conducted by Eco-Cycle at food service establishments in Denver found that food establishments of all types can achieve food waste capture rates (57-98%) through FOH collection with minimal contamination rates (1-22%).⁸⁴ This suggests that FOH collection can be a key source of compost material for composting facilities. The study also found that clear signage improved contamination rates for compost collection. FOH composting may also be more successful at establishments that offer compostable service ware or durable service ware.

Composting not only reduces methane emissions from decomposing food scraps in the landfill, but can also increase carbon sequestration when the compost is applied to soil.⁸⁵ Increasing compost added to soil has the additional indirect benefits of decreasing the need for fertilizers (reducing GHGs produced from their production) and improving tillage and workability of soil (reducing GHG produced from working the soil). CARB estimates that approximately 0.69 MT CO₂e is avoided per ton of food waste, arising from decreased methane emissions, soil erosion, and fertilizer usage.⁸⁶ In addition, the US EPA estimates that approximately 183 kg (0.183 MT) of CO₂ is sequestered by one ton of wet compost,⁸⁷ suggesting an overall emissions reduction of 0.873 MT CO₂e per ton of composted waste.

84 https://ecocycle.org/content/uploads/2019/09/Report_how-denver-can-achieve-sustainability-with-composting.pdf

85 sciedirect.com/science/article/pii/S0960852408010572

86 <https://ww3.arb.ca.gov/cc/waste/cerffinal.pdf> (see Table 10)

87 <http://libjournals.unca.edu/ncur/wp-content/uploads/2021/06/1698Deesing-Brittany-FINAL.pdf>

6 Carbon Sequestration

Measure CS-1: Increase urban tree canopy cover to 25% by 2030 and 35% by 2045	2030 Target
	<i>23,053 MT CO₂e (Sequestered)</i>
	2045 Target
	<i>61,474 MT CO₂e (Sequestered)</i>
Performance Metric(s): <ul style="list-style-type: none"> ▪ Achieve 25% urban tree canopy cover by 2030 consistent with the Urban Forest Plan ▪ Achieve 35% urban tree canopy cover by 2045 	

Action #	Action	Anticipated Reduction
Quantitative Actions		
CS-1.1	Implement the Urban Forest Plan with a goal to achieve 25% urban canopy cover by 2030 and 35% by 2045. Prioritize tree planting in areas with the lowest average tree canopy cover and explore strategies to reduce barriers to tree planting in disadvantaged areas and improve tree health.	23,053 MT CO ₂ e (2030) 61,474 MT CO ₂ e (2045)
Supportive Actions		
CS-1.2	Utilize compost and mulch for application to City-owned trees and planters to increase the carbon sequestration potential of tree plantings.	Supportive
CS-1.3	Develop online educational materials about tree species that are adapted to Sacramento’s climate and resilient to drought and climate change.	Supportive
CS-1.4	Continue to support the SMUD/Sacramento Tree Foundation program which provides free shade trees for residents and businesses and support increased plantings on private property in areas that are under-canopied through new partnerships and programs.	Supportive

6.1 Measure CS-1 Quantification

Carbon sequestration is the process by which carbon is taken out of the atmosphere and sequestered in soil, vegetation, or manmade structures. This measure deals with the carbon sequestration achieved by plants through photosynthesis whereby trees and other green plant pull CO₂ out of the atmosphere, use the carbon to grow, and release oxygen. According to the City of Sacramento’s Urban Tree Canopy Assessment the current urban forest sequesters 73,000 MT of CO₂e per year and covers 19% of the City.⁸⁸ Expanding the urban forest to cover 25% of the City would be equivalent to an expansion of 6%.

⁸⁸ <https://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Maintenance-Services/Urban-Forest-Master-Plan/Copy-of-Sacramento-UTC-Assessment-20180515.pdf?la=en>

Action CS-1.1

Evidence: The growth of trees and other vegetation sequesters carbon.⁸⁹ According to the 2018 Urban Tree Canopy Assessment which mapped urban tree canopy using high-resolution aerial imagery and infrared technology to remotely map tree canopy and land cover in the City of Sacramento approximately 19% of the City has tree canopy cover. This vegetation sequesters approximately 73,000 MT of CO₂e per year. If the City were to increase the tree canopy cover to 25% it would increase total sequestration by 32%.

Quantification Results Summary

Action CS-1.1	2030	2045
Total tree canopy coverage in 2018	19%	19%
Total tree canopy coverage goal	25%	35%
Annual sequestration in 2018	73,000	73,000
Percent increase in canopy coverage	6%	16%
Net MT CO ₂ e Savings	23,053	61,474

6.2 Measure CS-1 Supportive Actions

Action CS-1.2

Evidence: This action will help Sacramento meet the compost procurement goals of SB 1383 and increase the carbon sequestration potential of the land in Sacramento. Compost application is associated with increased carbon sequestration.⁹⁰

Action CS-1.3

Evidence: This supportive action will help the community better understand the impacts of climate change as well as identify which tree species will be best suited to Sacramento's future climate.

Action CS-1.4

Evidence: Providing the community with free trees to plant will provide multiple benefits including education on the benefits of trees in Sacramento, increased tree canopy, and increased awareness of climate change and climate adaptation and mitigation actions.

⁸⁹ https://www.parks.ca.gov/?page_id=26107

⁹⁰ <https://www.calrecycle.ca.gov/organics/compostmulch/toolbox/carbonsequest>

7 Water and Wastewater

<p><i>Measure WW-1</i></p> <p><i>Reduce water utility emissions (in MT of CO₂e per million gallon delivered) by 100% by 2030 and maintain that through 2045</i></p>	<p><i>2030 Target</i></p> <p><i>6,296 MT CO₂e</i></p> <p><i>2045 Target</i></p> <p><i>0 MT CO₂e</i></p>
<p>Performance Metrics:</p> <ul style="list-style-type: none"> ▪ Utilize carbon neutral power for 100% of water utility electricity demands by 2030 	

Action #	Action	Anticipated Reduction
Quantitative Actions		
WW-1.1	Reduce GHG emissions associated with the water utility by procuring 100% carbon neutral electricity by 2030.	6,877 MT CO ₂ e (2030) 0 MT CO ₂ e (2045)
Supportive Actions		
WW-1.2	Investigate the feasibility of allowing on-site non potable treatment and distributed water resources in new development.	Supportive
WW-1.3	Continue to implement the Model Water Efficient Landscape Ordinance each year.	Supportive
WW-1.4	Continue to require the use of low impact development (LID) strategies for new construction and development.	Supportive
WW-1.5	Continue to investigate the landscaping/irrigation use of non-potable reclaimed water from regional sanitation at parks.	Supportive
WW-1.6	Increase the use of renewable energy and storage to reduce GHG emissions and increase resiliency for critical infrastructure.	Supportive
WW-1.7	Continue to encourage efficient water use by residents and businesses through expanded education, incentives and assistance services in compliance with Assembly Bill 1668 and Senate Bill 606, which help reduce the City’s water demand and related energy use.	Supportive

7.1 Measure WW-1 Quantification

GHG emissions from water treatment and distribution are 100% attributable to electricity generation. Therefore, the primary measure for reducing GHG emissions is to reduce the emissions associated with electricity used to pump and treat water within the City of Sacramento. By 2030 the water utility will procure 100% carbon free electricity and reduce GHG emission on a per acre foot basis to zero. Additional supportive measures such as water conservation, greywater, and stormwater management will further this goal and reduce the amount of electricity needed by reducing overall water demand as the City continues to grow.

Action WW-1.1

Evidence: Reducing the emission factor of electricity used to pump and treat water to zero would increase the expected reductions from SB 100 by 6,877 MT of CO₂e per year. By 2045, SB 100 will be fully implemented and therefore, procuring carbon neutral electricity will no longer provide a benefit above and beyond the adjusted forecast from which GHG emission reductions are calculated. This measure was not included in Measure E-2 to avoid double counting.

Quantification Results Summary

Action WW-1.1	2030	2045
Projected Electricity Use (kWh)	52,793,843	0
Projected Emission Factor (MT CO ₂ e/kWh)	0.000119	0.0
Projected Emissions (With SB 100)	6,296	0
Emission Factor with Measure E-1 (MT CO ₂ e/kWh)	0.0	0.0
GHG Emissions with Measure E-1 (MT CO ₂ e/kWh)	0	0
GHG Emissions Savings (MT CO ₂ e)	6,296	0

7.2 Measure WW-1 Supportive Actions

Action WW-1.2

Evidence: As part of SB 966, the City of Sacramento is investigating the feasibility of on-site treatment and reuse of non-potable water use in multifamily residential, commercial, and mixed-use buildings. When enacted, a policy of this kind could greatly decrease the amount of potable water consumption.

Action WW-1.3

Evidence: The City will continue to report for the Model Water Efficient Landscape Ordinance on an annual basis and investigate areas for enhanced landscape water conservation.

Action WW-1.4

Evidence: When new projects are permitted in the City of Sacramento, the City will review and encourage applicants to use green infrastructure and low impact development strategies. These strategies can increase stormwater retention and groundwater infiltration.

Action WW-1.5

Evidence: The City will continue to investigate the efficacy of reclaimed water application for non-potable uses at area schools. Reclaimed water use reduces the consumption of potable water both protecting a limited resource and reducing the energy needed to pump and treat potable water.

Action WW-1.6

Evidence: Installing renewable energy and battery storage projects to support the City's water services will improve local grid resiliency and reduce GHG emissions associated with those services.

Action WW-1.7

Evidence: Improving water use efficiency decreases the energy need per person associated with water conveyance and treatment. Reducing energy demand helps reduce associated GHG emissions.

<p>Measure WW-2 Reduce wastewater emissions by 22% by 2030 and 40% by 2045</p>	<p>2030 Target 5,495 MT CO₂e 2045 Target 11,517 MT CO₂e</p>
<p>Performance Metrics:</p> <ul style="list-style-type: none"> ▪ None – projects to reduce wastewater emissions were completed before release of the CAAP 	

Action #	Action	Anticipated Reduction
Quantitative Actions		
WW-2.1	Regional San implements biogas recovery and improvement projects.	993 MT CO ₂ e (2030) 1,171 MT CO ₂ e (2045)
WW-2.2	GHG Emissions Reductions from SB 100 implementation by Regional San.	4,572 MT CO ₂ e (2030) 11,681 MT CO ₂ e (2045)
WW-2.3	Regional San implements solar PV generation project.	389 MT CO ₂ e (2030) 0 MT CO ₂ e (2045)

7.3 Measure WW-2 Quantification

Although GHG emissions from wastewater are generated by the Sacramento Community, operational control of the wastewater treatment facility is covered by Regional San. This means the City of Sacramento has no direct levers to reduce these emissions. However, since the GHG emissions associated with wastewater are included in the GHG emissions inventory, several of the GHG reducing activities which Regional San has undertaken are included here. The City of Sacramento and SMUD will continue to support Regional San in these and future partnerships to further reduce emissions from the wastewater sector.

Action WW-2.1

Evidence: Regional San has operated a biogas recovery project which collects digester gas and utilizes it to generate electricity in a SMUD-owned cogeneration facility. The combustion of the biogas reduces methane emissions, a powerful short-lived climate pollutant able to trap over 25 times more heat in the atmosphere than carbon dioxide does over a 100-year period, meaning that it has a much higher climate change impact. The biogenic CO₂⁹¹ created in the biogas recovery and combustion process has a much smaller impact on global warming. This program has reduced methane emissions from the facility by 96% to 0.454 tons per year.⁹² Sacramento’s GHG inventory estimated methane emissions at 32 tons in 2016. To calculate the expected reduction in methane

⁹¹ Biogenic CO₂ is CO₂ released as the result of the combustion or decomposition of organic material (biomass), as opposed to anthropogenic or fossil CO₂ which results from the combustion of fossil fuels.

⁹² <https://www.regionalsan.com/biogas-recycling>

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emissions from the biogas program into the future, a per service person⁹³ methane value was calculated (0.000040 MT CH₄/person) and the service person forecast for each target year was applied.

Quantification Results Summary

Action WW-2.1	2030	2045
2016 estimated methane production	32	32
Estimated CH ₄ emissions per service person	0.000040	0.000040
MT CH ₄ in target year	38.7	45.1
Estimated BAU emissions	967	1,127
96% reduction in emissions	47	64
GHG Emissions Savings (MT CO ₂ e)	920	1,063

Action WW-2.2

Evidence: Because a majority of emissions associated with wastewater are from process emissions, specifically the generation of CH₄ and N₂O, SB 100 impacts were not included in the adjusted forecast. However, a projected 40,108 MWh of electricity are expected to be used to treat Sacramento's wastewater in 2030 and 46,749 MWh of electricity in 2045.⁹⁴ Emissions associated with this electricity are expected to go to zero by 2045.

Quantification Results Summary

Action WW-2.2	2030	2045
Projected electricity use (MWh)	40,108	46,749
BAU emission factor (MT CO ₂ e/MWh)	0.2236	0.2236
Projected emission factor (MT CO ₂ e/kWh)	0.000119	0.0
Emissions under BAU scenario	8,968	10,453
Emissions with SB 100	4,783	0
GHG emissions savings (MT CO ₂ e)	4,185	10,453

Action WW-2.3

Evidence: In 2018 Regional San installed a 4.2-megawatt solar array which provides an estimated 10% of its operational electricity. In 2016 it was estimated that approximately 32,645 MWh were used to treat wastewater from the City of Sacramento. Offsetting 10% of this usage would reduce GHG emission by approximately 389 MT of CO₂e. However, by 2045, due to SB 100 (calculated in Action 2) reduces the GHG benefit of the solar array to zero to avoid double counting.

⁹³ Service person counts both residents and employees (i.e., population + jobs) to account for activities associated with both. Per service person metrics are calculated as the metric divided by the service population (e.g., community GHG emissions divided by service population).

⁹⁴ See Community Inventory and Forecast in Appendix A.

Quantification Results Summary

Action WW-2.3	2030	2045
Projected offset of electricity use (kWh)	10%	10%
Estimated electricity use attributable to Sacramento in 2016 (kWh)	32,645	32,645
Electricity offset by solar PV (kWh)	3,264.5	3,264.5
Emission Factor from SMUD (MT CO ₂ e/kWh)	0.000119	0.0
GHG emissions savings (MT CO ₂ e)	389	0



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Appendix D – Funding and Financing Strategy Administrative Draft

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1 Introduction

Recognizing the importance of Climate Action and Adaptation Plan (CAAP) implementation, the Sacramento City Council allocated approximately \$4.5 million in one-time money to seed near-term CAAP activities in its 2020-21 budget. However, full implementation will require a substantial long-term commitment on the part of the City and other entities to fund necessary CAAP investments. This appendix presents a summary of the anticipated costs to the City of Sacramento to implement the CAAP and a strategy to approach funding Priority City-led CAAP Measures that require City funding over the next 20 years (i.e., through 2040).

Complete implementation of the CAAP is estimated at a minimum of \$3.2 billion in direct City investments, investments from private citizens, businesses, and other agencies will also be needed, as well as substantial commitment of staff time. Though many of these investments will provide substantial savings to Sacramento and the community over time, full implementation will require the City to consider funding from a wide range of potential sources. This Appendix provides a starting point of the high-level¹ costs associated with the measures and actions in the CAAP, as well as a strategy of how the City could focus its efforts on securing the funding for the approximately \$616 million in primary CAAP actions. These strategies include various new funding options including development impact fees, grant funding from various sources, motor vehicle registration surcharges, and a tax on transportation network company (TNC) operations. Most of these would require voter approval and/or legislative actions.

Section 2 of the document organizes the specific actions in the CAAP into three categories of high, moderate, and low costs. Those actions that are expected to be either moderate or high cost are then provided with a high-level cost estimate and potential funding and financing sources. As actions are further defined and implemented, additional funding options are expected to be identified. Estimates have not been provided for low-level cost actions.

Section 3 provides additional information on the potential funding and financing strategies that the City has access to as it further defines and implements the actions in the CAAP. This guide is a starting point for the City and its partners to identify the resources required to reach its greenhouse gas (GHG) reduction targets. Finally, Section 3 also provides a more detailed financing plan for several core CAAP implementation strategies that have more well-defined project specifics and also provide significant GHG reductions.

¹ This is a high-level estimate which does not include an estimate of low-cost measures.

2 Measure Costs

As part of its updated CAAP, the City has developed a comprehensive strategy for reducing community-wide GHG emissions over time. However, bringing the City to carbon neutrality requires significant, strategic investments into many elements of the community, including new policies, infrastructure, and behavior change on the part of the community. In order to develop transparency around the prioritization of these aforementioned measures, this technical appendix details the estimated cost to the City associated with the implementation of many of the City's most impactful measures.

This document focuses on the cost of implementation to the City and not on the potential costs and savings to the community in general. While the CAAP focused on cost-effective and even cost-saving actions, such as new building electrification (which costs less to both build and operate)² or owning electric vehicles which have lower lifecycle costs than internal combustion vehicles³, the details of upfront costs and lifecycle savings for individual community members will be identified during implementation. One example of this is the Existing Building Electrification Strategy that will provide a deep dive on community costs and savings associated with existing building electrification. Costs associated with many of the other actions in the CAAP, such as new bike lanes and expanded transit, will have major benefits for community members and costs that will ultimately depend on how they are funded and financed.

The measures listed below have been broken down into three cost segments which include:

- 1. Low-Cost.** Low-cost measures are the low-hanging fruit for the City to reduce emissions, generally delineated as measures associated with relatively low-upfront costs. These actions are assumed to be handled through existing resources or through smaller low-cost changes, such as policies and ordinance.
- 2. Moderate-Cost.** This segment includes measures with an intermediate level of costs for implementation. These measures will require additional funding or increase short-term costs to the City and community (e.g., electric vehicle [EV] charging infrastructure and program development)
- 3. High-Cost.** This segment includes longer term projects that require substantial investments over time to reduce emissions, (e.g., new infrastructure and transit). These measures will require significant investment that cannot be paid for by the City alone. Funding and financing will be key to the implementation of these measures.

While many of the low-cost items listed below could be covered by current staff time on an individual basis, the cumulative impact of the CAAP and its many actions will likely necessitate additional sustainability staff. Hiring additional staff results in long-term costs that are not covered by grants. In addition to the need for additional staff resources, one potential opportunity that is not tied to any single CAAP action is to apply to host a Civic Spark Fellow who could work under the direction of the City's sustainability staff to help with CAAP implementation activities. Civic Spark Fellows are provided through an AmeriCorps program that places Fellows with local governments and other entities that are engaged in sustainability projects. Most of the cost of the Fellows is

² <https://explorer.localenergycodes.com/jurisdiction/sacramento-city/summary>

³ <https://advocacy.consumerreports.org/wp-content/uploads/2020/10/EV-Ownership-Cost-Final-Report-1.pdf>

covered by the Civic Spark program, meaning that a General Fund allocation to cover the City's required local fiscal contribution could leverage the Civic Spark program to secure more staffing than the City could otherwise afford to support.

Table 1 below includes each measure and the corresponding cost bucket. For measures falling into the moderate or high-cost bucket, costs have been estimated, and funding and financing strategies have been provided. A more detailed funding analysis has been completed for a subset of key CAAP measures and is included in Section 3 - Funding Strategy.

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Table 1 Measure Cost and Funding Strategies

Sector	Measure + Action #	Action(s) Required	Potential Funding Sources	Confirmed Funding Source	What Funding Source Program Can Fund	Cost to City Operations	Estimated Cost (Cost to City \$ millions)	References and Assumptions
Built Environment	E-1.1	Support SMUD in the implementation of the 2030 Zero Carbon Plan.		SMUD Zero Carbon Plan	Carbon free electricity through SMUD by 2030.	1	Low (through rates)	https://www.smud.org/en/Corporate/Environmental-Leadership/2030-Clean-Energy-Vision
Built Environment	E-2.1	Develop and adopt an electrification ordinance that requires all new construction under four stories to be all-electric by 2023 and all construction to be all-electric by 2026.		SMUD Advanced Commercial Solutions Program	SMUD Advanced Commercial Solutions currently provides assistance and incentives of up to \$5,000 per unit to private individuals and the building industry for new buildings (electrification and energy efficiency).	1	No/Low Upfront Costs to Developers, Cost Savings Over Lifecycle	In-kind staff time to develop and adopt Ordinance. Assumes that SMUD will continue to provide incentives for new development to incorporate electric appliances. https://explorer.localenergycodes.com
				SMUD All Electric Smart Home Program	Currently SMUD provides incentives up to \$5,000 per unit.			
Built Environment	E-3.1	Develop a comprehensive existing building electrification strategy that identifies associated costs and addresses potential equity impacts prior to implementation of mandatory requirements.	City	City	–	1	One time consulting fee budget of \$130,000 established with existing funding allocations.	Cost of implementing existing building electrification strategy is TBD.
Built Environment	E-3.2	Develop an electrification ordinance for existing buildings/construction that will be implemented through the building permit process to transition away from fossil fuels to electric at time of replacement following adoption of Measure E3.1. The existing buildings ordinance would include the following elements: <ul style="list-style-type: none"> No new expansions of fuel gas piping at existing buildings/sites. Require HVAC system replacements and new water heaters to be all-electric or utilize other low-carbon technologies as the market evolves. 	City Building Permit/Plan Check/Inspection Fees	SMUD Residential and commercial rebates/incentives	Rebates and incentives for energy efficient equipment. Recoup the cost of reviewing and approving construction plans and conducting inspections to ensure compliance.	1-2	Stage 1: Low Cost (See E-1-1) Stage 2: Low Cost	Assumes that stages 1 & 2 are ordinances. FTE for enforcement program depends on what it is. Permit compliance would require ~seven administrative staff. SMUD Rebates and Incentives: https://www.smud.org/Rebates-and-Savings-Tips/Rebates-for-My-Home/#Home-Rebates
Built Environment	E-3.3	Work with SMUD to expand existing low-income programs within the City to weatherize and retrofit/electrify existing buildings, with the goal of reducing energy consumption, decreasing utility bills, and converting to carbon-free energy use by 2040.	Potential in-kind city staff time	SMUD Energy Assistance Program Rate (EAPR)	SMUD currently funds weatherization and energy efficiency and electrification for qualifying low-income households.	2	TBD based on results of existing building electrification strategy.	Assumes that SMUD continue to implement low-income retrofits, with support from the City with implementation and locating additional grant funding to expand programs.
				Home Energy Assistance Program (HEAP)	Provides financial assistance to qualified low-income residents as a credit on their utility bills.			Community Resource Project, Inc
				Low-Income Weatherization Program	Free energy efficiency and weatherization services and equipment for low-income households.			Community Resource Project, Inc and Grid Alternatives are SMUD's contracted service providers.
Built Environment	E-3.4	Promote and educate the community about existing programs and expand electrification retrofit	TECH Switch is On	SMUD Residential and commercial rebates/incentives	SMUD Rebates and incentives for energy efficient equipment.	1	Low cost to City	Assumes that most of additional outreach and education will be by SMUD, and that any additional

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Sector	Measure + Action #	Action(s) Required	Potential Funding Sources	Confirmed Funding Source	What Funding Source Program Can Fund	Cost to City Operations	Estimated Cost (Cost to City \$ millions)	References and Assumptions
		incentives for space and water heating to support the electrification ordinances.	Existing City resources	CDD operating budget	Links to SMUD educational materials on City websites, or inclusion of SMUD staff at City events when appropriate,		Low cost to the City	outreach and education can be done on an as-needed basis by existing City staff. Assumes that the City will leverage existing City resources when appropriate to raise public awareness about the existence of SMUD incentives. Assumes that City staff will not advise the public about the specifics of SMUD programs or create educational content.
Built Environment	E-3.5	Provide electrification retrofit incentives and financing for space and water heating.		SMUD's Advanced Homes Program	Central air conditioner, heat pumps and induction cooking.	1	Low cost to City	Assumes that this will continue to be implemented by SMUD and that City staff will get involved when SMUD makes a specific request.
Built Environment	E-3.6	Continue to promote and incentivize electrification supportive energy efficiency in existing buildings including lighting, insulation, and air sealing upgrades through programs and financing mechanisms.		Multiple SMUD programs: Express Energy Solutions, Complete Energy Solutions, Custom Retrofit, Integrated Design Solutions	lighting, refrigeration, food service equipment, HVAC, industrial equipment, retro-commissioning, etc.	1	Low cost to City	Assumes that incentives and promotion of incentives will continue to be implemented primarily by SMUD and that City staff will get involved when SMUD makes a specific request. SMUD Rebates and Incentives: https://www.smud.org/en/Rebates-and-Savings-Tips
Built Environment	E-4.1	Continue to promote and support local energy generation and storage resources.	Potential in-kind city staff time	SMUD Solar and Battery Storage Incentives		1	Low cost to City	Assumes that SMUD will promote and support local on-site energy storage and implement SMUD's IRP, but that SMUD may request in-kind staff time. SMUD Solar and Battery Storage Incentives: https://www.smud.org/en/Going-Green/Solar-for-Your-Home
Built Environment	E-4.2	Work with SMUD to site storage and renewable generation at locations in the City that would best support overall grid functionality while electrifying the building stock and maximizing the utilization of existing electrical infrastructure.	Potential in-kind city staff time	SMUD Solar and Battery Storage Incentives		1	Low cost to City	Assumes SMUD will fund and lead the development of this plan and request in-kind staff time from the City if needed. SMUD Solar and Battery Storage Incentives: https://www.smud.org/en/Going-Green/Solar-for-Your-Home
Built Environment	E-4.3	Work alongside SMUD to promote and further incentivize battery storage as a means to maximize electrification benefits and improve resiliency.	Potential in-kind City staff time	SMUD Solar and Battery Storage Incentives	SMUD incentives for new My Energy Optimizer program	1	Low cost to City	Assumes that SMUD will fund and implement programs and the Building Division will support with streamlined permit processing and provide related educational materials to customers.
Built Environment	E-4.4	Develop a community solar and storage project of at least 1 MW as a pilot project collaboration between SMUD and the City with SMUD leading project development and the City supporting by providing a location and permitting support.	Potential in-kind staff time, Potential General Fund money allocated to solar and storage project			1	Low cost to City	Assumes that SMUD will determine criteria for a potential site for a 1 MW pilot project, and Public Works Department will provide in-kind staff time to identify a list or map of suitable City-owned properties, and

Sector	Measure + Action #	Action(s) Required	Potential Funding Sources	Confirmed Funding Source	What Funding Source Program Can Fund	Cost to City Operations	Estimated Cost (Cost to City \$ millions)	References and Assumptions
Built Environment	E-5.1	<p>Adopt and implement policies, land use designations, and implementation programs which provide a framework to:</p> <ul style="list-style-type: none"> Accommodate 30% of the region's new living-wage jobs and 30% of the region's new housing units by 2040. Focus 90% of the city's infill growth into established and center/corridor communities with the goal of achieving 90% small-lot single family and attached homes by 2040. Prioritize construction of lower-cost workforce and affordable housing through modifications of land-use designations and zoning, offering ministerial/staff-level review of infill housing and continue to reduce fees and the time and expense of planning approval and building permit processes. Include anti-displacement policies and programs. 	CA Housing and Community Development Infill Infrastructure Grant Program	In-kind staff time	Infill Infrastructure Grant Program could potentially provide funding for capital improvement projects.	1	No/Low cost to City	<p>that SMUD will support project development.</p> <p>Assumes in-kind staff time to develop policies and changes to City Code and that new development will be funded by private businesses and private sector housing producers.</p>
Energy	E-5.2	<p>Enable development of 29,000 new multi-unit dwellings that are public transit accessible (i.e., within 0.5 mile of public transit) by 2040 through the continuation of the City's ministerial/staff-level review of infill housing, reduced fees, and identification of local funding sources.</p>		In-kind staff time	Planning activities	1	Low cost to City	<p>Assumes in-kind staff time to develop policies and changes to City Code, and that new development will be funded by private sector housing producers.</p>

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Energy	E-5.3	Enable the development of 8,700 new missing middle and affordable by design housing types (such as dormitories and smaller units) by 2040 within 0.25 mile of public transit by updating the City Code to allow and reduce barriers to these housing types. Couple with anti-displacement policies and programs.		CA Housing and Community Development; SB2 Formula Funds	Technical assistance to local governments	1	Low cost to City	Assumes in-kind staff time to develop policies and changes to City Code, and that new affordable dwellings will be funded by private sector housing developers and individual landowners.
Energy	E-5.4	Permit a greater array of housing types in existing single-family neighborhoods citywide by allowing missing middle housing types such as accessory dwelling units (ADUs), duplexes, triplexes, and fourplexes, and bungalow courts in single-family and duplex dwelling zones. Develop tools, resources and educational materials to promote and facilitate the development of ADUs in neighborhoods throughout the City.		CA Housing and Community Development SB2 Formula Funds	Technical assistance to local governments	1	Low cost to City	Assumes in-kind staff time to develop policies and changes to City Code and that new affordable dwellings will be funded by private sector housing developers and individual landowners.
Transportation	TR-1.1	Implement the 2016 Bicycle Master Plan by constructing a comprehensive, connected network of safe and accessible (low-stress) bike paths, on- and off-street, within and across neighborhoods totaling 40 miles of bike lanes, 48 miles of bike routes, 40 miles of buffered bike lane, 18 miles of separated bikeway, and 127 miles of shared-used paths.	New transportation funding sources TBD; and grants.			3	\$510	Public Works Cost Estimate New transportation funding sources will be necessary for CAAP implementation. City staff evaluating options, and direction to be confirmed with the City Manager
Transportation	TR-1.2	Implement the improvements in the 2006 Pedestrian Master Plan by providing a connected, safe and accessible (low-stress) pedestrian network, prioritized based on High Injury Network (crash data), school access, equity and community needs. Low-stress pedestrian network includes crossings, sidewalks, and other paths.	Improvements made as part of new development projects New transportation funding sources TBD; and grants.			3	\$300	Public Works Cost Estimate New transportation funding sources will be necessary for CAAP implementation. City staff evaluating options, and direction to be confirmed with the City Manager.
Transportation	TR-1.3	Conduct a study to identify the physical barriers to active transportation by 2025 and remove them by 2030 to support local partners and community groups.	New transportation funding sources TBD; and grants.			2	\$510	Public Works Cost Estimate to study and remove barriers. Final costs will be identified after study. New transportation funding sources will be necessary for CAAP implementation. City staff evaluating options, and direction to be confirmed with the City Manager.

Sector	Measure + Action #	Action(s) Required	Potential Funding Sources	Confirmed Funding Source	What Funding Source Program Can Fund	Cost to City Operations	Estimated Cost (Cost to City \$ millions)	References and Assumptions
Transportation	TR-1.4	Conduct a study to identify educational barriers and provide education and outreach to the community on active transportation options in the City including a travel training program and incentivize a spectrum of transportation options that includes public and private shared and active services.	New transportation funding sources TBD; and grants.			1	\$0.25	New transportation funding sources will be necessary for CAAP implementation. City staff evaluating options, and direction to be confirmed with the City Manager.
Transportation	TR-1.5	Identify and secure ongoing funding for and then implement active transportation programs (open streets, pilot projects, classes, etc.) quality and healthy opportunities for parts of the community workforce most impacted by climate change.	New transportation funding sources TBD; and grants.			1	\$0.2 (recurring, per year)	
Transportation	TR-2.1	Update and implement the City's Transportation System Management Plan (TSMP) ordinance to shift travel behavior away from the single-occupancy vehicle.	Public Works Funding	Public Works Funding		2	\$0.2	
Transportation	TR-2.2	Eliminate parking minimums citywide, develop parking maximums and require parking management and transportation demand management plans for all areas of the City based on available transportation options, travel patterns, and land use.	In-kind city staff time Parking Demand Management Program		Mini-grants to fund pilot projects that change travel behavior.	1		Assumes that in-kind city staff time will support making changes to City Code.
Transportation	TR-2.3	Encourage SacRT to provide frequent, reliable transit in the City's priority corridors to reduce VMT and support SacRT in implementing priority transit corridors. Coordinate transit priority corridors with consideration of transportation needs as well as land use planning to provide transit-supportive land uses. Encourage the expansion of frequent, reliable transit services throughout the City.	Sacramento Transportation Authority		Transportation improvement projects. Specific projects and programs to be determined.	3	\$1-\$2 million per mile	
Transportation	TR-2.4	Collaborate with SacRT in planning and implementing increased transit services with reduced headways and expanded service lines to support an 11% public transit mode share by 2030.	New transportation funding sources TBD and grants			3	Approximately \$1 Billion - 3\$ Billion (City's portion of costs only to fund signal prioritization, bus lanes, bus bulbs, and light rail enhancement in City ROW.)	New transportation funding sources will be necessary for CAAP implementation. City staff evaluating options, and direction to be confirmed with the City Manager.
Transportation	TR-2.5	The City will work with SacRT to identify changes to signals and other technological enhancements for transit prioritization and faster transit travel times.	New transportation funding sources TBD and grants			1		New transportation funding sources will be necessary for CAAP implementation. City staff are evaluating options, to be confirmed with the City Manager for direction from the City Council.

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Transportation	TR-2.6	Continue to support electric car sharing options to offset at least 1 million VMT per year in the City through 2030.	Regulatory fees for service providers; see Action TR-2-13			1		
Transportation	TR-2.7	Continue to support shared rideables (bikes and scooters) to enable a reduction of 1 million VMT per year.	Regulatory fees for service providers; see Action TR-2-13			1		This assumes the ongoing service of shared-mobility services in the City through partnerships with private mobility providers.
Transportation	TR-2.8	Encourage SacRT to secure funding to support improved service/communications such as interactive service maps, app payments, and real time arrival info.	In-kind staff time			1		
Transportation	TR-2.9	Continue to implement and improve curbside management strategy to better manage and price curb space, manage transportation network companies (TNC) and prepare for autonomous vehicles.	General Fund or fees on service providers; see action TR-2-13			1		
Transportation	TR-2.10	Work with SacRT to remove barriers to access transit stops and stations (provide low-stress connectivity) and provide enhanced, comfortable stops and stations.	State Funding	Transit Stop Improvement Program		3	\$50	
Transportation	TR-2.11	Implement the City's adopted plans including modal/Citywide plans and corridor/area plans (such as the Bicycle Master Plan, Broadway Complete Streets, and 65th Street Area Plan).	Impact fees/VMT mitigation bank fees and other local funds			3	Covered in other measures	
Human Resources	TR-2.12	Identify an Employee Transportation Coordinator and establish an employee commute program for City staff that includes provisions for telecommuting and encourage other public and private agencies located within the City to do the same using requirements and/or incentives.	General Fund – In-kind staff time			1		
Transportation	TR-2.13	Investigate and lobby for the development of a TNC user tax which would put a small fee on the use of Uber, Lyft, and others and generate funds to pay for transit and transportation infrastructure and related programs.	In-kind staff time			1		

Sector	Measure + Action #	Action(s) Required	Potential Funding Sources	Confirmed Funding Source	What Funding Source Program Can Fund	Cost to City Operations	Estimated Cost (Cost to City \$ millions)	References and Assumptions
Transportation	TR-3.1	Amend City Building Code to require at least 20% EV-capable charging spaces and at least one installed, operational Level II EV charger in new multifamily and nonresidential development. Amend the Planning and Development Code to incentivize charging in both existing and new developments.	In-kind staff time	SMUD Commercial charging incentives	Incentives for the purchase and installation of EV charging infrastructure. Incentives range from up to \$6,500 per connector for a Level 2 charger and up to \$80,000 per DC Fast Charger	1		SMUD's Commercial EV Charging Incentives: https://www.smud.org/en/Going-Green/Electric-Vehicles/Business
			SMAQMD, Carl Moyer Program and Community Air Quality Incentive Program		Funding for hydrogen fueling and electric charging stations; may be combined with SMUD funding.			
Transportation	TR-3.2	Continue to support a variety of public and public/private partnerships to provide more publicly accessible chargers throughout the City. Examples include public/private partnerships on private property (Electrify America), public/private partnerships on public property (EVgo), and public investment (SMUD).		SMUD/Cal eVIP Electric Vehicle Supply Equipment Rebates	Installation of chargers at workplaces.	2	\$4.4	Based on recent construction and installation costs for installation in existing parking lots, to complete the remaining ~200 connectors to achieve the EV Strategy goal for City facilities of 300 ports
Transportation	TR-3.3	Continue to install and provide EV charger access at City-owned facilities and parking garages.		SMUD/Cal eVIP Electric Vehicle Supply Equipment Rebates		1		The City already provides multiple EV charging stations at City-owned facilities and parking garages.
Transportation	TR-3.4	Pursue affordable, zero-emission car share expansions to serve affordable housing, such as the Sacramento Metropolitan Air District's Our Community Carshare program to more locations, contingent on funding.	In-kind staff support			1		
Transportation	TR-3.5	Collaborate on e-mobility hub pilot efforts, in partnership with other agencies and local groups, with special consideration for proximity to low-income/disadvantaged communities and multifamily housing.	In-kind staff support; regional funding - See Action TR-2-13.			1		
Transportation	TR-3.6	Continue to maintain a highly streamlined EV infrastructure permit process.	In-kind staff support; potential support from regulatory fees - See Action TR-2.13.			1		
Transportation	TR-3.7	Develop and implement a fee for use of City-owned parking facilities and EV chargers to promote more efficient use and turnover and increase EV availability for people who really need it, including those without access to home charging.	User Fees			1		

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Transportation	TR-3.8	Continue to implement and improve curbside management strategy to better manage and price curb space, manage TNC, and prepare for autonomous vehicles.	General Fund – In-kind staff support to establish; program could be self-supporting from user fees.			1		
Transportation	TR-3.9	Work and collaborate with major employers including the State of California and Sacramento County to promote ZEV adoption, programs, and improvements to ZEV infrastructure.	Regulatory fees - See Action TR-2.13			1		
Transportation	TR-3.10	Continue to provide information and education about currently available incentives for expansion of Level II chargers on private property.	In-kind staff support			1		Partnership will be needed to continue to significantly expand EVSE in places like downtown, where existing parking garages are maxed out for electrical capacity. To be tackled in partnership with state and SMUD, with existing City staff time, and state grants/rebates.
Transportation	TR-3.11	Coordinate with community-based organizations, agencies, and non-profits to conduct EV education events with would include information on costs/benefits of owning EVs, steps on how to receive incentives for EV chargers, as well as other benefits. Events will be equitably distributed across the City, focusing on disadvantaged communities.	In-kind staff support			1		
Transportation	TR-3.12	Because zero-emission technology is improving/changing at a rapid pace, continue to monitor, test, and adapt to new and emerging zero-emission technologies and solutions.	In-kind staff support			1		
Waste	W-1.1	Implement the requirements of SB 1383 to compost or otherwise divert 75% of organic waste compared to 2014 levels by: <ul style="list-style-type: none"> Providing organic waste collection to all residents and businesses. Establishing an edible food recovery program that recovers edible food from the waste stream and redistributes the food to local community organizations to be used or eaten. Conducting outreach and education to affected parties, including generators, haulers, facilities, edible food recovery 	Recycling and Solid Waste User fees and City Franchise Fees and charges			2	\$3-5 Per Month (Residential) \$70-\$90 Per Month (Commercial)	https://www2.calrecycle.ca.gov/Docs/Web/115980

Sector	Measure + Action #	Action(s) Required	Potential Funding Sources	Confirmed Funding Source	What Funding Source Program Can Fund	Cost to City Operations	Estimated Cost (Cost to City \$ millions)	References and Assumptions
		<p>organizations, and city/county NC waste products like compost, mulch, and RNG.</p> <ul style="list-style-type: none"> Inspecting and enforce compliance with SB 1383. 						
Waste	W-1.2	Work with regional partners (other municipalities) and the private sector to assess the feasibility of siting long-term organics processing facilities in or near Sacramento County.	User Fees - Solid waste program fees	Recycling and Solid Waste User Fees and City Commercial Franchise Fees and Charges		2		
Waste	W-1.3	Continue to provide backyard compost education and reduced-cost compost bins, as well as kitchen-top food waste containers to participating residents.		Recycling and Solid Waste User Fees		2	See W-1-1	
Waste	W-1.4	Implement a food waste diversion program for single-family residential customers by 2022.		Recycling and Solid Waste User Fees		2	See W-1-1	
Waste	W-1.5	Enforce new commercial waste code which requires businesses to subscribe to organics recycling collection service through the City's franchised commercial haulers starting July 1, 2021.		City Commercial Franchise Fees and Charges		2	See W-1-1	
Waste	W-1.6	Serve as a regional partner in the development and implementation of an edible food recovery program that connects commercial edible food generators with local food banks, to recover at least 20% of the edible food that is currently disposed of for human consumption, consistent with SB 1383.	CalRecycle Food Waste Prevention and Rescue Grant Program	Food Waste Prevention and Rescue Grant Program and City Commercial Franchise Fees and Charges	Supports new or expanding existing food waste prevention projects (source reduction or food rescue for people) in California to reduce the amount of food being disposed in landfills.	2	See W-1-1	
Waste	W-1.7	Explore the feasibility of capital improvement projects for reducing organics in the waste stream, such as organics extraction presses and anaerobic digesters.	CalRecycle Grant Programs, Public-Private Partnership	Recycling and Solid Waste User Fees				Development of new capital improvement projects to support organic waste diversion will be pursued as needed, primarily through the City's contract services for the provision of organic waste diversion.
Waste	W-1.8	Consider adopting, if needed, an ordinance that aligns with AB 827, the state law that requires most restaurants to have front-of-house composting.	Recycling and Solid Waste Fees and Charges, Grants	City Commercial Franchise Fees and charges		2		

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Carbon Sequestration	CS-1.1	Implement the Sacramento Urban Forest Plan with a goal to achieve 25% urban canopy cover by 2030 and 35% by 2045. Prioritize tree planting in areas with the lowest average tree canopy cover and explore strategies to reduce barriers to tree planting in disadvantaged areas and improve tree health.	CalFire's Urban and Community Forestry Grant Programs City Statewide Park Development and Community Revitalization Program Urban Greening Grant Sacramento Tree Foundation; in-kind tree donations New funding streams – to be determined	City Department of Youth, Parks, & Community Enrichment	Urban forest expansion and improvement; urban forest management activities; all must include tree planting component. Create, expand, or improve parks in under-served communities as part of a capital improvement project; Participate in tree planting projects at park sites with community partners and consider tree acquisition, planting, and irrigation (including hand-watering). New funding sources are needed to support ongoing maintenance and irrigation of trees, overcome barriers to planting in low-income areas and support expanded tree canopy on private property Continue to enforce zoning standards for shading in private parking lots to protect trees in existing parking lots	2	\$6-\$10 million additional annual cost for annual maintenance of city-managed trees.	There is not nearly enough space to achieve 35% tree canopy coverage on City-owned/controlled land alone. Tree planting on private property will need to double. New funding sources for urban forest expansion and management are TBD, including but not limited to grants funding. City staff are evaluating options, and direction is to be confirmed with the City Manager
Carbon Sequestration	CS-1.2	Utilize compost and mulch for application to City-owned trees and planters to increase the carbon sequestration potential of tree plantings.	CalRecycle			1		See Measure W-1.1 for SB1383 requirements
Carbon Sequestration	CS-1.3	Develop online educational materials about tree species that are adapted to Sacramento's climate and resilient to drought and climate change.	City CalFire's Urban and Community Forestry Grant Programs		Urban forest expansion and improvement; urban forest management activities; all must include tree planting component.	1		
Carbon Sequestration	CS-1.4	Continue to support the SMUD/Sacramento Tree Foundation program, which provides free shade trees for residents and businesses and support increased plantings on private property in areas that are under-canopied through new partnerships and programs.	SMUD CalFire Urban and Community Forestry Grant Programs		Urban forest expansion and improvement; urban forest management activities; all must include tree planting component.	1	-	
Water and Wastewater	WW-1.1	Reduce GHG emissions associated with the water utility by procuring 100% carbon-free electricity by 2030.				1		Assumes that electricity from SMUD will be carbon-free (2030 Zero Carbon Plan)
Water and Wastewater	WW-1.2	Investigate the feasibility of allowing on-site non potable treatment and distributed water resources in new development.		In-kind staff time and consultant services		1		On-site non-potable water reuse study has been funded, Standards for on-site non-potable treatment will be incorporated into City Code if feasible.
Water and Wastewater	WW-1.3	Continue to implement the Model Water Efficient Landscape Ordinance each year.		In-kind staff time		1		

Sector	Measure + Action #	Action(s) Required	Potential Funding Sources	Confirmed Funding Source	What Funding Source Program Can Fund	Cost to City Operations	Estimated Cost (Cost to City \$ millions)	References and Assumptions
Water and Wastewater	WW-1.4	Continue to require the use of low impact development (LID) strategies for new construction and development.		Utilities operating budget		1		Assumes that this action is a continuation of the City's regulatory role that will be implemented by existing staff. Installation of LID in new construction and redevelopment will be paid for by developers. New LID infrastructure does, however, increase maintenance costs for the City.
Water and Wastewater	WW-1.5	Continue to investigate the landscaping/irrigation use of non-potable reclaimed water from regional sanitation at parks.	A source of funding would be needed to conduct a pilot	In-kind staff time.		1		Assumes that service provider is Regional Sanitation District if implemented.
Water and Wastewater	WW-1.6	Increase the use of renewable energy and storage to reduce GHG emissions and increase resiliency for critical infrastructure.	California Public Utilities Commission's Self-Generation Incentive Program (SGIP)		SGIP provides incentives for new and emerging distributed energy resources.	2	\$1-5M	https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/demand-side-management/self-generation-incentive-program
Water and Wastewater	WW-1.7	Continue to encourage efficient water use by residents and businesses through expanded education, incentives and assistance services in compliance with Assembly Bill 1668 and Senate Bill 606, which help reduce the City's water demand and related energy use.	Additional funding will be required for expansion.	Utilities operating budget	City Water Conservation Office	1		www.sacwaterwise.com Confirmed funding is for ongoing education. Newer state regulations on water conservation are under development and will require additional funding sources.

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3 Funding and Financing Strategy

Full implementation of the CAAP will require significant investments on the part of the City of Sacramento, other governmental agencies, local households and businesses, and property owners. This Appendix outlines the estimated capital costs for actions to be taken by the City of Sacramento itself, which are approximately \$3.2 billion. Other costs associated with key CAAP actions will be covered by SMUD, Sacramento Regional Transit (Sacramento RT), and private businesses and households.

The CAAP is an ambitious project and will require substantial commitment of City staff time to implement. City staff have reviewed the CAAP measures listed in Table 1 and estimated new ongoing City staff requirements for implementation. City staff estimate the need for approximately six new full-time staff. Considering salary, benefits, City overhead, etc., the approximate annual costs to the City would be around \$960,000, or about \$19.2 million over 20 years. This does not include additional staff who would be required to implement a building electrification monitoring and enforcement program (see Energy Measure E-2-1). This is because user fees, such as building permit fees charged to program participants, would be designed to recover costs, so these additional staff would not have a net impact on the City's budget.⁴ This would be in addition to existing City staff positions that are already funded to support CAAP implementation in the normal course of operations.

In addition, the above estimates do not include capital costs for Sacramento Regional Transit to improve transit services, nor do they include maintenance costs for new public infrastructure, or costs to businesses and households to make changes to buildings and vehicles that are envisioned in the CAAP. Some expenditures will not represent net cost increases but instead will involve substituting investments that would otherwise have been made on less climate-friendly options into climate-friendly equipment, materials, and technologies for expenditures. Furthermore, the City and local partners such as SMUD can help households and businesses make these transitions by promoting available low-cost financing programs or providing incentives.

In some cases, expenditures may represent net cost increases compared to a "status quo" approach to climate change. As such, these costs represent an accounting for the costs to address the negative externalities⁵ associated with current practices that are now recognized as not sustainable.

Below are general descriptions of principles that will guide the City's approach to funding the CAAP measures that require an outlay of City funds and descriptions of key funding sources that the City may use. A more detailed matching of specific CAAP actions with potential funding sources and tools is included in Table 1 with columns identifying potential funding sources, programs, and what items can be funded.

3.1 Priority City-Led CAAP Measures

As previously mentioned, this Appendix provides an estimate of high-cost CAAP measures and actions but does not provide cost estimates for low- and moderate-cost actions. Given the

⁴ Based on City staff estimate of \$160,000 per year average cost, including salary and benefits, per full-time equivalent employee.

⁵ "A negative externality is a cost that is suffered by a third party as a result of an economic transaction. In a transaction, the producer and consumer are the first and second parties, and third parties include any individual, organization, property owner, or resource that is indirectly affected." Accessed 6/13/19 at: https://www.economicsonline.co.uk/Market_failures/Externalities.html

magnitude of the costs, the City will likely struggle to identify all the necessary funding for timely implementation of the CAAP. Recognizing this, it will be important for the City to direct its available financial resources to low- and moderate-cost CAAP actions and those high-cost CAAP actions that are most critical to achieving community goals and most effective in contributing to GHG reductions. As shown in Table 2 below, City staff have reviewed the list of high-cost CAAP measures that require direct City investment and identified those that are most critical to achieving the overall community and CAAP goals (Priority City-Led CAAP Measures), not including ongoing annual staffing costs. It is important to remember that this is a short-term priority list of only high-cost measures, many other moderate- and low-cost measures will also be implemented in the short term.

Table 2 Estimated Costs for Short-Term Priority City-Led CAAP Measures

Measure/ Action # -	Description	Estimated Cost
TR-1.1	2045 Implement 2016 Bicycle Master Plan	\$510,000,000
TR-2.1	2025 Update and Implement Transportation System Management Plan	\$200,000
TR-3.2	Ongoing EV chargers at City-owned buildings	\$4,400,000
CS-1.1	Ongoing Implement Sacramento Urban Forest Plan ⁶	\$130,000,000
TOTAL COSTS, PRIORITY CITY-LED CAAP MEASURES		\$644,600,000

The short-term priority City-led CAAP measures represent a more manageable 19 percent of the total estimated CAAP Measures but still total to approximately \$645 million, not including required staff time (see Table 3). This listing of Priority City-led CAAP Measures provides important direction for prioritization of available City funding to invest in CAAP implementation. Other projects that do not involve direct City funding for capital costs, primarily investments in improving the public transit system, will also need to move forward, along with these Priority City-led CAAP Measures over the next 20 years.

In many cases, the expenditures will not only help to reduce GHG emissions but will bring other valuable co-benefits, such as cleaner air, water conservation, savings on energy and utility costs, more robust and flexible transportation systems, improved public health, greater resiliency to climate change, and enhanced local quality of life.

Some investments will not represent net cost increases, but instead will involve substituting expenditures on climate-friendly equipment, materials, and technologies for expenditures that would otherwise have been made on less climate-friendly options. For example, when a building owner, such as the City, a household, or a business, makes investments in building electrification, the initial expenditure on the improvements may be offset by long-term savings from reduced energy usage. Replacing a less-efficient central air conditioning and gas furnace system that it is at the end of its useful life with a new energy-efficient electric heat pump, should produce long-term savings in energy costs compared to replacing the system with conventional but less efficient equipment. Furthermore, the City and local partners, such as SMUD, can help households and businesses make these transitions by promoting available low-cost financing programs or providing incentives.

Some CAAP expenditures may represent net cost increases compared to a “status quo” approach to climate change. As such, these costs represent an accounting for the costs to address the negative

⁶ This assumes City costs growing to an additional \$6.5 million annually over 20 years to maintain and irrigate beyond current levels of \$6.5 million per year. It does not include the costs for trees on private property.

externalities⁷ associated with current practices that are now recognized as not sustainable. Following below are general descriptions of principles that will guide the City's approach to funding the CAAP measures that require outlay of City funds and descriptions of key funding sources that the City may use. A more detailed matching of specific CAAP Measures with potential funding sources and tools is included in Table 1, with columns identifying the CAAP Measures, potential funding sources, estimated costs to the City, and estimated requirements for new City staff.

3.2 Funding Principles

The CAAP is targeted for implementation over the next 20 years. Funding sources for some actions can be identified at the outset, while the best means to fund other actions will be determined at the time the City is ready to implement them, depending on the resources available at the time. Several principles will help the City to determine the best approach to funding various actions, as follows.

Equity

The costs of implementing the CAAP should be spread as equitably as possible, taking care to limit the imposition of new costs on the segments of the community that have the least ability to shoulder increased costs. Where certain segments of the community will benefit disproportionately from an action, the costs should be spread accordingly. Where funding options involve establishing new local taxes, the discussion of funding options in Section 4 identifies those that are more or less equitable.

Leveraging City Resources

Leveraging will involve using outside sources of funding to augment City resources to fund implementation of the CAAP. General Fund resources are extremely limited, so the City will leverage in-kind staff time and local matching funds that can be provided by impact fee programs to aggressively seek grants (e.g., state and federal transportation infrastructure grants), in-kind contributions from partners such as SMUD, and other resources from state, federal, and philanthropic sources (e.g., Sacramento Tree Foundation) to help pay for actions and limit the cost to the City, local residents, and businesses. The CAAP also includes actions through which City staff will monitor and publicize grants and incentives that will help households and businesses make the necessary climate-friendly investments.

Long-Term Cost Savings

While some actions may require initial capital outlays, whenever possible these actions should generate long-term cost savings that will repay and even generate a return on investment (ROI). For example, Measure E-2-5 promotes private investments in energy efficiency that will yield property owners long-term savings on energy costs and offset initial capital costs.

⁷ "A negative externality is a cost that is suffered by a third party as a result of an economic transaction. In a transaction, the producer and consumer are the first and second parties, and third parties include any individual, organization, property owner, or resource that is indirectly affected." Accessed 6/13/19 at: https://www.economicsonline.co.uk/Market_failures/Externalities.html

3.3 Prioritization Strategy for Available City Funds

The City of Sacramento can consider two primary strategies for the prioritization of funds available to implement the CAAP. The first strategy is to focus available funds on those CAAP actions that will have the greatest impact on GHG reductions. The second strategy is to strategically utilize funds that the City of Sacramento controls to leverage other sources of funding that may be available from other sources.

Prioritization of Funds Towards Actions with the Greatest GHG Impacts

Whenever possible, the City should try to direct funds that become available for CAAP implementation towards low- and moderate-cost measures and actions and the Priority CAAP Actions listed in Table 2.

Prioritization of Funds to Leverage Outside Sources

The City should also be alert to opportunities to include priority CAAP projects in any new funding programs that may be developed, such as a regional VMT-mitigation bank (provided the City can eventually obtain regional support), or newly authorized local funding programs such as congestion management fees, curbside management fees, and/or sources that would be overseen at a statewide level, such as proceeds from a surcharge on property hazard insurance.

3.4 Conceptual Funding Approach for Priority City-Led CAAP Implementation Actions

With an overall City cost likely in excess of \$3.2 billion for implementation of all City-led CAAP measures, it is clear that full implementation will require that the City of Sacramento consider funding from a wide range of potential sources. This is made more challenging by the fact that the City of Sacramento's tax base is constrained because of the substantial amount of property in the city that is owned by the State of California, which does not pay property taxes and certain other taxes and fees that private property owners, households, and businesses pay.

New funding sources will be needed to implement the CAAP. Below is a high-level overview of potential new funding sources. City staff are evaluating options that will be confirmed with the City Manager for direction from the City Council.

Development Impact Fees – Consistent with the priority of using local funds to leverage outside funding sources, the City may be able to modify its TDIF (Transportation Development Impact Fee) program to include Priority City-Led CAAP Measures in the list of eligible TDIF expenditures.

Grant Funding – City staff estimate that based on historic grant funding, it may be feasible to obtain approximately \$5 million per year in transportation infrastructure grant funding that could be used to help implement Priority City-Led CAAP Measures, or approximately \$100 million over the next 20 years. State and federal transportation infrastructure grant programs typically require between 11.5 percent and 50 percent of project costs come from local matching funds, and this match is currently unfunded.

Motor Vehicle Registration Surcharge – State law allows a countywide transportation planning agency to place a ballot measure before the voters of the county to authorize an annual fee increase of up to \$10 on each motor vehicle registered in that county, to fund transportation related

projects. Through a potential Sacramento County motor vehicle registration fee, motor vehicle owners could contribute to helping the City reach its GHG reduction targets.

Tax on Transportation Network Company Trips – A new tax on TNCs such as Uber and Lyft trips would require local voter approval. If the City was successful in obtaining voter approval, this new funding source could generate revenues for multiple years.

Local Parcel Tax – Combined, the above sources could potentially fund about \$266 million in costs through 2040. This would leave about \$368 million that would need to be covered from other sources. In addition, the City would also need to consider the cost of debt service payments. This amount translates to the need for about \$20 million in annual debt service payments. Roughly translated, this would equate to an annual cost of about \$63 per household and a cost to non-residential properties of about \$12 per employee per year. As a new parcel tax would be needed to repay the green bond, this strategy to fill the funding gap would require voter approval.

A voter-approved parcel tax is another method to raise funding for implementation of the CAAP and could be used for a bonding or grant match.

3.5 Summary

The magnitude of costs in Table 2 illustrates that the City of Sacramento will need to seriously consider establishment of new funding sources to enable implementation of the CAAP. While the City may not be able to afford the full benefits of a plan that requires nearly \$3.2 billion, a minimum level of commitment of an estimated \$664 million (which includes \$19 million in ongoing staff time) to fund the Primary CAAP Measures, has potential to be funded. If \$100 million in grant funding can be obtained, the funding gap is about \$564 million. Success in funding this gap will likely require considerable political leadership and broad-based public support for the City’s CAAP goals. This would require a collective willingness of the Sacramento community to tax itself in various new forms in order to generate the funds necessary to cover even the priority City-led projects and staff support for CAAP implementation.

Table 3 Funding Gap for Priority City-Led CAAP Measures

Cost of Priority City-Led CAAP Measures	\$644,600,000
Cost of Ongoing Staffing to Support CAAP Implementation (a)	\$19,200,000
Total Cost for priority City-Led CAAP Measures	\$663,800,000
Likely grant funding over 20 years	\$100,000,000
Funding Gap*	\$563,800,000

*Table does not include the cost of debt service

The City of Austin’s Project Connect Measure A provides a case study to help put the CAAP funding challenge facing the City of Sacramento into perspective and suggests that it could be achievable. In 2020, voters in the city of Austin, Texas approved property tax increases that will fund a \$7 billion transit system and \$460 million in new bicycle and pedestrian infrastructure. This success came after two previous failed attempts at similar transportation funding initiatives. Like Sacramento, Austin is another state capitol city; however, it is approximately twice the population of Sacramento. Although aspirational, local funding needed to support Sacramento’s CAAP does not appear disproportionately high in comparison to Austin’s funding measure.

The Austin measure expected federal transportation grants to cover 45 percent of the transit capital costs and the approved property tax increase would provide the remaining capital costs, as well as necessary funding for operations and maintenance of the transit system once built. Voters approved the property tax increase, which the City of Austin estimated would cost the owner of a home valued at \$325,000 approximately \$284 per year in additional taxes. The City of Austin indicated that the median taxable home value in Austin was \$326,368.⁸ An analysis of Sacramento's needs and funding potential will be conducted.

3.6 Other Actions Critical to CAAP Success

In addition to the priority City-led CAAP measures, the expansion of the RT transit system is a critical component of the CAAP. The City of Sacramento will need to work closely with RT to lobby and secure the necessary funding to increase transit service and reduce headways in the city. The total funding that RT would need to make the service and system expansions necessary to achieve an 11 percent mode share is not known, because RT has not yet designed the system expansions nor estimated the costs. City staff, however, have estimated that the City's related costs would be between \$1 billion and \$3 billion.

⁸ <https://austintexas.gov/2020PropA#:~:text=The%20City%20of%20Austin%20is,fund%20implementation%20of%20Project%20Connect>.

4 Types of Funding Sources

The CAAP will rely on a variety of funding sources for implementation. Following are general descriptions of some key funding sources identified that can be used to pay for climate-friendly actions.

4.1 Grants

From time to time, the City is able to secure funds for specific projects through grant programs provided by state and federal agencies. This includes various grant programs funded through the State of California's Cap and Trade program, which generates money for the State's Greenhouse Gas Reduction Fund, some of which is granted to local governments. Moving forward, state and federal grants may be a useful source of funding to pay for the portion of mitigation programs or actions that is attributable to the City's existing residential and non-residential development, which cannot be funded through impact fees collected on new development. State and federal grants can also be used to fund climate-friendly actions and programs that have broad community benefits, or to help defray costs that might otherwise have been too burdensome for lower-income households or small businesses. From time to time, utility companies also provide grants in their service areas through various programs designed to incentivize energy conservation.

Grants are beneficial, because they represent an opportunity to reduce the cost burden for implementation programs and projects on the City itself and the burden on local residents and businesses. Grants are one funding source that the City can use to pay existing development's share of project costs when the costs must be split between new development and existing development. The primary disadvantages of grants are that funds availability is not certain due to competition for limited funds, timing of funds availability may not match with necessary implementation timelines, and grants are not always available for the types of projects that need funding. Typically, grants require local matching funds for which the City would need to identify new or redirected sources of funds. In addition, preparation of grant applications and grant administration is very time-consuming and costly, so funding will need to be reserved for staff or consultants to prepare such grant applications.

4.2 City General Fund Monies

The City's General Fund receives the revenues over which the City Council exercises discretionary funding authority. The General Fund receives major funding sources including sales tax revenues, property tax revenues, property tax in-lieu of vehicle license fees, and many other smaller revenue streams. The City Council spends these monies on public services that broadly benefit the community at large. While balancing all of its budgetary needs, the City Council may elect to spend some General Fund money on CAAP implementation. It is most important that the City utilize General Fund money to support staffing required to implement and administer the CAAP, including preparing and submitting grant applications for CAAP projects and working to foster partnerships that will support CAAP implementation. This would include working with key outside agencies and organizations such as Sacramento RT, SMUD, and SACOG that will support the City's efforts by providing grant funding and in-kind support for City of Sacramento actions and undertaking other actions that support the City's CAAP. Given the many competing demands for General Fund monies,

it should not be anticipated that the General Fund will be a major source of capital funding for CAAP projects.

The CAAP contains numerous actions that are likely to be implemented through in-kind City staff efforts. However, it is not likely that existing City staff will have adequate capacity to take on all the responsibilities of CAAP implementation that are identified in as “Staff In-Kind”. To leverage the available staff resources, the City often partners with other agencies and/or contracts out certain services, such as using consultants for specialized studies, when that is more cost-effective. One such opportunity the City is already using is partnership through the CivicSpark Program, operated by the Local Government Commission, to host CivicSpark Fellows who work under the direction of the City’s sustainability staff to help with CAAP implementation activities. Civic Spark Fellows are provided through an Americorps program that places fellows with local governments and other entities that are engaged in sustainability projects. The cost of the Fellows is comparatively affordable. The City’s fiscal contribution could leverage the Civic Spark program to aid and support with climate programs and help build staff capacity.

A benefit of using General Fund monies to fund climate-friendly actions is that the City Council already has control and the authority to allocate General Fund monies to implement climate-friendly actions, meaning implementation of items to be funded with General Fund dollars does not have to wait for funding decisions from other governmental or private entities. However, it must also be recognized that the General Fund supports many other critical public services, such as law enforcement and fire protection, as well as parks and roadway maintenance. The City likely has little ability to allocate General Fund monies to new programs without impacting existing programs.

4.3 Restricted Funds

Restricted funds are monies that the City receives but which can only be used for specified purposes. This is often the case with funds that are passed through to the City from other governmental entities, such as state or federal agencies. Relevant examples of such restricted funds are money allocated to the City projects from Sacramento County Measure A (sales tax measure for transportation projects), Transportation Development Act (TDA) pedestrian and bicycle facilities funds, and development impact fees.

A benefit of restricted funds is that they could help pay for projects that otherwise might require General Fund support. The challenge with using these funds is that they are typically fully allocated and directing funds towards CAAP projects will require prioritizing CAAP projects over other potentially worthy uses of the funds. In the case of development impact fees, it may be possible to add certain new projects to the capital projects list that forms the basis for the fee program and then adjust the impact fee schedule to capture the additional costs.

A limitation of impact fees is that they are only paid by new development and thus can only be used to pay for new development’s “fair share” of project costs. Another limitation is the legal requirement for a “rational nexus” between the fee and the needs created by new development and the benefits incurred by new development. Development impact fees can only be used to support the needs created by the new development. Thus, they are spent only in the areas where new development is occurring and cannot provide source of funding for infrastructure or projects to support existing developed areas.

The City is sensitive to the need to not overly burden new development with costs that may create feasibility challenges for desirable projects.

City staff indicate that the City of Sacramento has among the lowest impact fee rates in the region. While comparatively low impact fee rates may indicate that there may be some room to increase fees to help pay for some CAAP project costs, impact fees typically can only fund a small share of the cost of capital projects that support the need created by new development in the city.

4.4 Fees for Service/User Fees

The City operates some services on a cost recovery basis. The City collects funds in the form of user fees to provide specific services to various user groups, and the fees charged are designed to offset the cost of the services provided. An example of user fees that support services provided to a specific segment of the community includes building permit fees, which are charged to cover the cost of reviewing plans and conducting inspections to verify that buildings are constructed properly. To the extent that these types of services incorporate climate-friendly actions, the costs of these actions can be recovered through user fees. User fees and ratepayer charges can also be applicable to utilities such as SMUD, water and sewer system operators, and the City's solid waste program. For example, the City's costs for overseeing the implementation of CAAP Measure E-3-2 (Building Electrification) might be re-couped through building permit and/or inspection fees charged to contractors or property owners. In addition, the City currently collects regulatory fees from car share companies and from companies providing "shared rideables" (e.g., bike share, scooter share). According to City staff, these fees cover only a small part of the overall costs of overseeing these programs. There may be an opportunity for the City to build more costs of supporting these private businesses that rely on city roadways (see CAAP Measures TR-3.8 and TR-2-13) by establishing a TNC (such as Uber and Lyft) trip tax. Another opportunity to fund CAAP improvements would be to charge users of EV chargers installed at City-owned facilities a fee (see Measure TR-3-2).

These types of fees/surcharges may represent an opportunity for the City to help fund staff time needed for work on CAAP implementation, and City staff indicate that Sacramento is typically understaffed relative to other cities. At the same time, the City will also be mindful that implementation projects and actions that are funded via fees for service, user fees, or ratepayer charges are similar to actions that are funded directly via household or business income and a disadvantage is that they could disproportionately burden lower income households or small and disadvantaged businesses that have more limited resources. The City will want to be particularly careful where users of affected services have limited ability to change their behavior to limit their exposure to increased costs. For example, some utility incentive programs can be structured to provide relatively low rates for "baseline" consumption but to charge higher rates for consumption above baseline levels that would be considered discretionary, as an incentive to minimize consumption.

4.5 Financing Tools

Financing tools are not funding sources per se; however, while many climate-friendly actions may generate long-term cost savings, they may also require significant up-front expenditures that could be a challenge for the City, households, or businesses to finance. There are various financing tools that can be used to essentially borrow the funds needed "up front" for CAAP implementation and paid back over time using one or more funding sources that will generate money over time.

Examples of such tools that could be used by homeowners or businesses include:

- Home mortgages and equity lines

- Property Assessed Clean Energy (PACE) programs, which the City has already established
- On-bill financing and similar programs sponsored by utilities, which are not currently offered by SMUD or PG&E, but could be considered
- Private financing innovations, such as the Metered Energy Efficiency Transaction Structure (MEETS)⁹ pioneered in Seattle

The City may be able to use a range of tools to help finance investments in public buildings and infrastructure. Various federal and state programs provide financing to public agencies for capital investments when funds are not provided as grants.

A financing option that the City currently uses is “interfund borrowing” whereby the City self-finances certain improvements by using money from idle fund balances, and then repaying those funds over time with other revenue streams. The City’s current program is called the Energy Efficiency Reinvestment Program. According to City staff, the program is relatively modest and is providing about \$62,000 per year in repayments that will be diminishing over time. This program is suitable for smaller municipal capital projects.

Other financing tools available to the City of Sacramento include Mello-Roos Community Facilities Districts (CFD) and Enhanced Infrastructure Financing Districts (EIFD), which are both discussed briefly in the section below regarding potential new funding sources and tools. In particular, the City should consider using financing mechanisms to pay for up-front costs of large capital projects that will yield long-term annual budget savings that can offset the annual debt service from the financings.

The City could consider the possibility of undertaking a “green bond” issuance using its authority to take on municipal debt in various forms to finance a package of capital investments included in the CAAP. Any green bond would need to be considered in the context of the City’s available remaining bonding capacity, considering other City Council priorities and commitments. If bonding capacity is available, green bonds could be an option to provide the City with revenue to fund investments to be repaid using annual budget expenditures that otherwise would have been spent in the absence of the cost savings created by the investments. In this way, the City can benefit from long-term cost savings from investments in CAAP projects. For example, if the City issued a green bond to finance the development of solar power generation facilities on City property, this would reduce the City’s energy costs and the savings on energy costs could be used to repay the bonds. Other types of cost-saving projects could include electrification of City buildings and/or energy conservation improvements in City buildings and infrastructure operations (e.g., water and sewer).

As described above, various financing tools can be beneficial, because they can help make large expenditures achievable by providing funds up front and then allowing the cost to be repaid over an extended period of time. The disadvantage of most financing programs is that the cost of financing (e.g., interest charged on the outstanding balance while the financing is being repaid), adds to overall project costs. It will be preferable for the City to fund its CAAP implementation activities on a pay-as-you-go basis whenever practical, reserving financing techniques for those situations where funds are needed up front, but not available without using financing tools, or where long-term annual operational cost savings are sufficient to offset the necessary debt service payments.

⁹ See: <http://www.meetscoalition.org/>

4.6 Potential New Funding Sources and Tools

Even if the City of Sacramento is able to maximize the use of all existing funding sources, full implementation of the CAAP will require establishing new funding sources, particularly for the long-term buildout of large public works projects that have price tags in the tens or hundreds of millions of dollars featured in the transportation sector of CAAP measures. A characteristic that is common to many of these projects is that they are public infrastructure projects, and it will be difficult and/or politically infeasible to charge user fees to the general public for access/use of these facilities. Given their broad public use, and the fact that in most cases it will not be desirable to create a financial disincentive for the public to use these facilities, it may be most appropriate to fund them using revenues from sources that are more broadly based.

Funding Measures Requiring Local or Regional Actions

There are some funding options available to the City of Sacramento that can be enacted under the authority of the City Council.

Development Impact Fee Updates/VMT Mitigation Bank

The City can review the capital improvement lists for its development impact fee program to consider if new CAAP implementation projects have a rational nexus for inclusion. CAAP projects in the Transportation Sector that involve public transportation infrastructure improvements such as new pedestrian, bicycle, and transit capital projects, are the most likely candidates to be included in development impact fee updates.

It should be noted that, according to City staff, the City's existing transportation impact fees are currently set about 10 percent of the maximum justifiable amount out of concern for the financial feasibility of new development projects. Updating the City's transportation impact fees to collect the maximum justifiable amount for CAAP projects would require a major City policy shift and could also have a significant impact on the economic feasibility of development projects. Modifications to the impact fee schedule would need to be considered in relation to other City goals as well, such as mitigating impediments to housing development.

A funding opportunity that is related to development impact fees is a VMT mitigation bank. Currently, regional support for a VMT mitigation bank does not exist. If support can be obtained in the future, a VMT mitigation bank would identify a series of projects and programs that would help regional goals for VMT reduction under SB 743 and new development projects that create excess VMT would have the option to pay into a VMT mitigation bank to provide funds that the City would spend on projects that would mitigate those impacts. Examples would primarily include projects listed under the Transportation Sector of the CAAP that would help to increase bicycle, pedestrian, and transit mode shares and reduce auto usage.

If a VMT mitigation bank is implemented at a regional scale, some projects in the Sacramento CAAP might be eligible for funding from the VMT bank. Project costs that are included in a local impact fee program, a local VMT mitigation bank, or a regional VMT mitigation bank should not be included in any of the other of these related programs, to ensure against "double dipping".

The concept of a VMT mitigation bank is similar to the Emissions Banking Program operated by the Bay Area Air Quality Management District, which facilitates the exchange of emissions credits between businesses that are awarded credits for emission reduction projects and businesses that need credits to offset impacts of new or expanded activities that generate increased emissions. In

this case the City would be delivering GHG-reducing projects through implementation of the CAAP that receive credits and the City would receive payment from other organizations that undertake projects that increase emissions.

Parking Fees

Increasing parking fees to help pay for GHG-reduction projects may be another locally available but limited option to raise funds. (For example, see Measure TR-3-7, which calls for developing and implementing a fee for use of City-owned parking facilities and EV chargers to encourage more efficient use and turnover and increase EV availability.) It should be noted however, that parking fees are driven by market demand and are constantly monitored and adjusted to maximize revenue within the limits that the market will bear. Increasing fees above the market risks loss of customers and revenue. Furthermore, the City uses existing parking fees to cover General Fund obligations, such as payment on the bonds for the Golden 1 Arena, so certain levels of growth in fees are already assumed and obligated.

CFD/EIFD Financing

As mentioned above, the City has the authority to utilize state law that allows formation of Mello-Roos Community Facilities Districts (CFD) and Enhanced Infrastructure Financing Districts (EIFD) to generate funding that could be used to support CAAP project implementation and to provide financing tools to help spread the costs over time. Bond financing supported by revenues from a CFD or EIFD would be most appropriately used to pay for large public capital improvement projects that have useful lives that would match or exceed the term of the bonds issued; most likely involving projects in the CAAP Transportation Sector.

Most likely, a CFD would involve establishing a new special tax on properties located within the district, requiring authorization by a 2/3 super-majority vote. A CFD special tax would be collected annually, and the City could bond against the annual tax levies. Because a CFD is approved by a 2/3 vote, it is considered a special tax. If approved, the City would have flexibility to use the funds for a broad range of voter-authorized purposes, and the City would not be held to the same strict standards of proportionate benefit that apply with property assessments that are approved by a simple majority.

An EIFD does not require voter approval unless it is used for a bond issue. To generate revenues that would help to fund CAAP implementation, the City Council would need to agree to divert a portion of the City's future property tax increment generated within the district that would have otherwise accrued to the City General Fund. Both CFDs and EIFDs are able to issue bonds to be repaid by future revenues collected by the district, so the mechanisms can both provide a potentially useful mechanism to finance CAAP investments. There are challenges for EIFDs that include the need for 55 percent voter approval, high-administrative costs, and the potential need for a Joint Powers Authority.

Other Voter-Approved Funding Measures

There are a variety of other types of voter-approved funding measures that could generate funds to support CAAP implementation by creating new taxes in the City. Funding measures that would specifically earmark new tax revenues for CAAP projects would most likely constitute new special taxes, requiring 2/3 super-majority voter approval.

Motor Vehicle Registration Surcharge

Another possibility of a voter-approved funding measure that aligns well with CAAP goals is a motor vehicle registration surcharge. A number of California air quality management districts have approved these surcharges. State law enacted in 1990 (AB 2766) authorizes local agencies to assess annual motor vehicle registration fee surcharges of up to \$5 per vehicle to generate funds to "to reduce air pollution from motor vehicles and for related planning, monitoring, enforcement, and technical studies necessary for the implementation of the California Clean Air Act of 1988. This would be viewed as a special tax, requiring approval by a 2/3 super-majority of the voters. In addition, this authority expires January 1, 2025, unless it is extended by state law. This funding option would need to be coordinated with the Sacramento Metropolitan Air Quality Management District to ensure coordination of efforts to ensure a collaborative and mutually beneficial approach.

According to the City of Sacramento's EV Implementation Blueprint Study, approximately half of the 1.1 million vehicles registered in Sacramento County were registered in the City of Sacramento. If City of Sacramento voters approved a \$5 per vehicle surcharge, this would raise approximately \$2,750,000 per year in annual revenues (assuming extension of the surcharge authority beyond January 2025).

Parcel Tax

In addition to other tax measure examples discussed above, a parcel tax charged to owners of real estate in the city of Sacramento is another example of a funding opportunity that would require voter approval, either majority or 2/3, depending on how structured. Because the revenues from a parcel tax are secured by liens on the property in the area subject to the parcel tax, the annual revenue flow from a parcel tax approved to provide CAAP funding would be bondable, creating the opportunity to finance CAAP projects over time.

In 2020, voters in the city of Austin, Texas, approved property tax increases that will fund a \$7 billion transit system and \$460 million in new bicycle and pedestrian infrastructure. Like Sacramento, Austin is another state capitol city; however, it is approximately twice the population of Sacramento. Thus, if Sacramento sets its sights on a parcel tax to fund similar GHG-reducing projects, it may be appropriate for the City to target more modest dollar amounts.

In the California context, depending on the way the parcel tax is structured, it could require either a majority or 2/3 voter approval. If the ballot measure names specific allowable uses of the funds, it would be considered a special tax requiring 2/3 voter approval. Some jurisdictions choose to structure a ballot measure as a general tax that does not name specific allowable uses for the funds, and then the ballot measure is accompanied by a second advisory ballot measure that outlines recommended, but not required, uses of the parcel tax proceeds.

4.7 Funding Measures Requiring State Legislation/Action

The Sacramento/West Sacramento Mayors' Commission on Climate Change identified and discussed a range of potential funding options for climate mitigation investments, including many of those discussed above. In addition, the Commission identified some "big idea" funding options that would require not only support at the local level but also enable state legislation as well. Two such examples were:

- a tax/surcharge on property hazard insurance premiums on property in the local area that could be used to fund climate resiliency projects; and
- congestion management fees that would be charged to drivers using specified local roadways at certain times as a way to manage demand for roadway facilities and reduce associated congestion and pollution.

Another example of a potential local funding measure that would require state authorization is taxes on TNC users. In 2018, California Assembly Bill 1184 confirmed that the City of San Francisco (only) had authority to place Measure D on its November 2019 ballot, and it was subsequently narrowly approved by the voters. This measure assesses a tax on ride share companies (car, bike, scooter, etc.) to raise funds for transit, pedestrian, and bicycle services. The rate is 1.5 percent for rides in zero emission vehicles and 3.25 percent on private rides, such as Uber and Lyft. The City of San Francisco expects to generate from \$30 million to \$35 million per year from this program. Along these lines, Measure TR-2-13 calls for the City to investigate and lobby for the development of a TNC user tax.

If the City of Sacramento sought and gained approval for such a program, it could provide a useful source of annual revenue to support CAAP projects. This funding source would most appropriately be used to fund projects that support TNC functioning in the City, including providing space for TNCs to use for parking of shared bicycles and scooters, providing bike lanes for bicycles and scooters, providing curb space and parking space for TNC vehicle parking, waiting, and pick-up/drop-off, and related signage and other infrastructure.

City staff estimate that the process of obtaining enabling legislation at the state level, placing a local measure on the ballot, and then implementing the program would take a minimum of approximately 5 years. Thus, if successful, this would represent a medium- to long-term funding opportunity.

After adjusting for the City of Sacramento's smaller population and a generally lower market share for TNCs versus San Francisco, an equivalent tax level in Sacramento might raise around \$6 million per year. Although this is a modest amount of money in comparison to San Francisco's estimate, a steady, predictable stream of revenues that is at least partially generated by visitors as opposed to residents and local property owners and businesses can be an important piece of the total revenue package for CAAP implementation.

Carbon Offset Credits

The California Air Resources Board administers the State of California's carbon Cap and Trade program. To date, the program has provided limited opportunities for entities that undertake GHG-reduction actions to monetize carbon offset credits. However, in the future, there may be opportunities to do so.

With GHG reduction as a central focus, many of Sacramento's CAAP actions, such as its aggressive plan to expand the urban forest, could potentially qualify for carbon credits which, if sold, could provide funding for additional CAAP investments. However, the ability to do so would depend on the particular carbon offset protocols that are established and a determination as to whether the GHG reductions represent net new reductions that would not have happened in absence of the ability to sell the credits.

As mentioned previously, the Bay Area Air Quality Management District administers a regional Emissions Banking Program. One potential advantage of a program administered by the Air

Resources Board would be a much larger (potentially statewide) pool of potential buyers who need to obtain emissions credits. This could support higher values for emissions credits than if the buyers were limited to those in the Sacramento area.

4.8 Federal Funding

From time to time, the federal government appropriates funds to be distributed to states and local governments to fund various types of infrastructure investments. Although unpredictable, it is possible that some such funds could be utilized to help implement certain CAAP projects that align with the federal program criteria. Depending on the priorities of the administration following from the 2020 presidential and congressional elections, there may be renewed focus on investments in climate change-related programs and projects and/or investments in infrastructure as a component of stimulus programs to aid in recovery from the COVID-19 epidemic. These funds would most likely flow to the local level through programs administered by federal agencies that pass grant funding through to state, regional, and local governments, such as the Department of Transportation and the Department of Housing and Urban Development.



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City of Sacramento Climate Action and Adaptation Plan

Appendix E – Municipal Inventory and Forecast Methodology

prepared for

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1 Introduction

California considers greenhouse gas (GHG) emissions and the impacts of climate change to be a serious threat to public health, the environment, economic well-being, and natural resources of the State, and has taken an aggressive stance to mitigate the impact on climate change at the State-level through the adoption of legislation and policies. Many cities have developed local climate action plans and aligned goals to correspond with State emissions reduction targets. The two major State GHG-related goals are established by Assembly Bill (AB) 32 and Senate Bill (SB) 32. AB 32 required State agencies to reduce State GHG emissions to 1990 levels by 2020; SB 32 requires a 40 percent reduction below 1990 levels by 2030. The goals set by AB 32 were achieved by the State in 2016¹ and many local jurisdictions are completing GHG inventories to quantify progress toward their own 2020 goals as well as develop targets to align with the requirements of SB 32.

GHG inventories and targets are generally established at the community-level, to capture the full picture of GHG emissions for the jurisdiction. To this end, a 2016 community-wide GHG inventory and forecast was completed for the City of Sacramento and methodologies and results of that inventory are contained in a separate technical appendix (Appendix A). This document by contrast contains methods and results of a municipal-level GHG inventory for the City of Sacramento. The municipal inventory complements the community-wide inventory, with a narrower focus on GHG emissions for City programs, buildings, and staff. While the municipal inventory is a subset of the community inventory, the increased resolution at the municipal level allows the City to take exemplary action in reducing its own GHG emissions and act as a leader for the much larger community-wide effort to achieve substantial GHG reduction targets. Emissions contained within the municipal inventory include activities under direct control of the City of Sacramento.

This technical appendix provides a complete analysis of the previous municipal inventories completed for the City of Sacramento in 2005 and 2013 as well as details on the methodology used by Rincon for the 2016 inventory update, which is also used as the baseline for GHG forecast. Municipal emissions are forecast for the years 2020, 2030, and 2045 to align with State and City targets.

Emissions inventories are an iterative process and each year must be viewed in the context of other inventories and relative trends of each sector to maintain consistency with the emissions inventory methods and factors.

¹ California Air Resources Board. California Greenhouse Gas Emissions Inventory. Accessed at: <https://ww3.arb.ca.gov/cc/inventory/inventory.htm>. Accessed on: July 2019

2 Municipal Inventory

The methodologies, data sources, calculations, and results associated with the 2016 municipal GHG inventory are included in this section. The municipal inventory is considered a subset of the community inventory (see Appendix A) and has therefore already largely been accounted for in the community inventory.² The GHG emissions below are included in this appendix to inform the development of climate action plan strategies that will reduce emissions in internal government operations.

The ICLEI Local Government Operations Protocol³ (referred to hereafter as ICLEI LGOP) recommends local governments examine their emission sources in the context of operational control when determining whether to include in their inventory. The 2016 municipal GHG inventory is based on this recommendation and for consistency with previous GHG inventory methods and reporting (2005 and 2013).

The 2016 inventory reports the following emission sectors as recommended by ICLEI LGOP:

- City-owned buildings and facilities
- Streetlights and traffic signals
- Water and wastewater treatment and conveyance
- Vehicle fleet
- Solid waste facilities (waste-in-place)

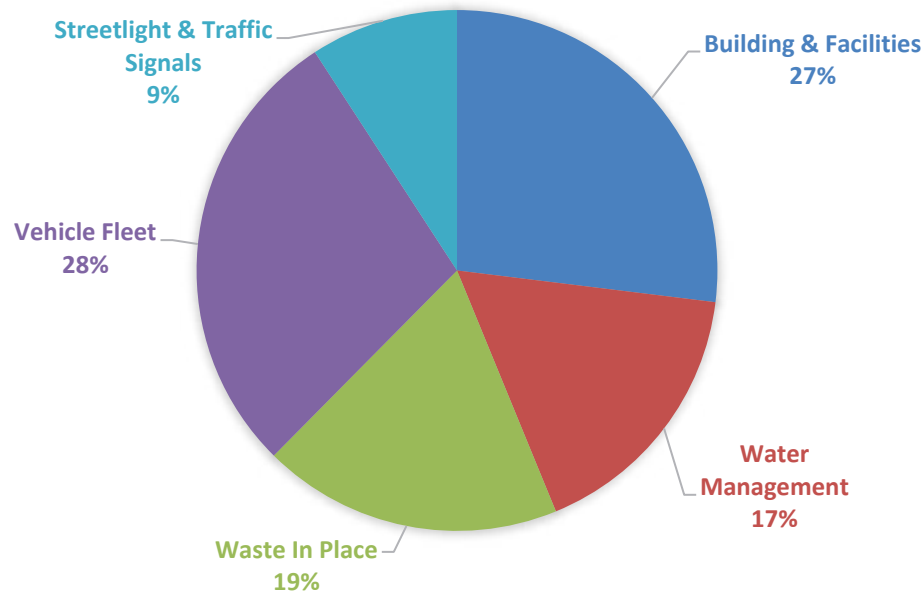
In 2016, municipal operations resulted in 56,463 metric tons of carbon dioxide equivalent (MT CO₂e). The largest emissions sector was vehicle fleet (28 percent) followed by buildings and facilities (27 percent) and waste-in-place (19 percent) emissions. Detailed results can be found in Table 1 and Figure 1. The following sections discuss each emissions sector of the municipal inventory.

Table 1 2016 Municipal Emissions by Sector

Sector	Emissions (MT CO ₂ e)
Vehicle Fleet	16,035
Building & Facilities	15,214
Waste-in-Place	10,512
Water Management	9,516
Streetlight & Traffic Signals	5,186
Total	56,463

² The municipal inventory captures a small amount of GHG emissions that are not captured in the community inventory. This includes GHG emissions from off-road equipment (e.g., from heavy-duty equipment used at City parks or other City land) and fuel use for building needs not supplied by the grid (e.g., fuel in emergency generators or backup equipment). However, all other GHG emission sources captured by the municipal inventory are already captured in the community inventory. The municipal inventory is therefore considered, effectively, to be a subset of the community inventory and the two inventories should not be “added” together.

³ <https://icleiusa.org/resources/local-government-operations-lgo-protocol/>

Figure 1 2016 Municipal GHG Emissions (MTCO₂e)

2.1 Previous Inventories and Emissions Reduction Progress

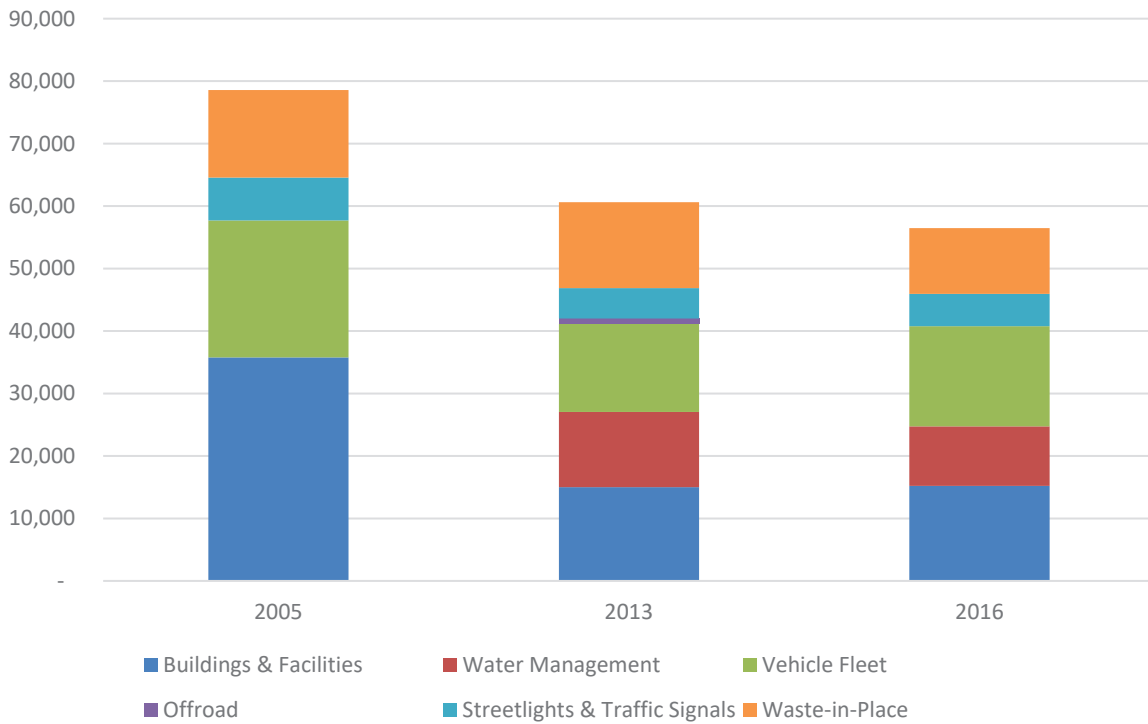
The City of Sacramento has conducted two previous GHG inventories for internal government operations, one for the calendar year 2005 and another for the calendar year 2013. Since 2005, overall GHG emissions have decreased by 22,121 MT CO₂e or 28 percent. An accounting of the methodological changes between each inventory is included in the following section. The building and water management sectors and the waste sector decreased each year from 2005 to 2016. The transportation sector decreased from 2005 to 2013 but increased again in 2016 by 1,092 MT CO₂e. Streetlights and traffic signals followed a similar trajectory, decreasing from 2005 to 2013 but seeing a slight rise in 2016. However, changes to streetlight calculation methodologies could be the cause of this change. A summary of each inventory year are included below in Table 2 and Figure 2.

Table 2 Municipal Inventory Comparison

Sector	2005 (MT CO ₂ e)	2013 (MT CO ₂ e)	2016 (MT CO ₂ e)
Building & Facilities	35,773	15,011	15,214
Water Management		12,043	9,516
Vehicle Fleet	21,927	14,081	16,035
Off-road	N/A	862	
Streetlights & Traffic Signals	6,872	4,870	5,186
Waste	14,012	13,750	10,512
Total Emissions	78,584	60,617	56,463

MTCO₂e: metric tons of carbon dioxide equivalent

Figure 2 Municipal Inventory Comparison (MTCO_{2e})



Methodology Changes

The data sources and emissions factors used for the 2005, 2013, and 2016 inventories are summarized in Table 3. Several minor changes are apparent between each year as methods evolved. One minor change made in the 2013 inventory was the breakout of water management emissions from overall building and facilities use. Notable changes to methods in the 2016 inventory include electricity data for all libraries, inclusion of regional pumping electricity data not included in 2013, and a better breakdown of energy data by building/facility.

Table 3 Municipal Data Sources and Emissions Factors by Year and Sector

Data	2005	2013	2016
Data Sources			
Building and Facilities	City energy use from Keith Roberts, included water management energy use. Streetlight and Traffic Signals not included. Included propane but not diesel.	Energy use from EnergyCAP, excludes propane and Library electricity from Pocket-Greenhaven and North Sacramento libraries. Includes diesel generator. May not include all City-operated buildings.	Energy use from EnergyCAP, excludes propane. Includes gasoline and diesel generators.
Water Management		Electricity use by water management system (water, sewer, drainage) from EnergyCAP. Excludes electricity from regional pumping.	Electricity use by water management system (water, sewer, drainage) from EnergyCAP.
Vehicle Fleet	Vehicle fuel use by vehicle type and fuel type. Reported four vehicle types.	Detailed data by vehicle mileage, fuel consumption, and model year. Includes 14 vehicle types.	Utilimarc detailed data by fuel consumption, vehicle mileage, and model year. Includes 31 vehicle types.
Off-road Fleet	Data included in vehicle fleet data from City.	Data broken out from vehicle fleet and reported separately.	Data included in vehicle fleet data from City.
Streetlights and Traffic Signals	Total energy use from SMUD.	Streetlight and traffic signal energy totals from EnergyCAP, extrapolated by light type.	SMUD-owned streetlight and traffic signal energy totals from EnergyCAP, extrapolated by average light use. City-owned streetlight energy totals based on number of streetlights and estimated 4,000 hours of nighttime operation. ¹
Waste-in-Place	Waste in-place tonnage.	Total CH ₄ captured at 28th Street Landfill	Total CH ₄ captured at 28th Street Landfill.
Emissions Factors			
Building and Facilities	SMUD ² 2005	SMUD 2013	SMUD 2016, PG&E 2016, EPA eGRID 2016, TCR 2016 (generators)
Water Management		SMUD and PG&E 2013	SMUD 2016, EPA eGRID 2016
Vehicle Fleet	Fuel-based	Fleet fuel consumption, EMFAC 2014 ³ , TCR 2013 for non-gasoline fuel	Fleet fuel consumption, mileage and TCR ⁴ 2016 for CH ₄ , N ₂ O, non-gasoline fuel
Off-road Fleet	N/A	Fuel-based	Fuel-based (TCR 2016)
Streetlights and Traffic Signals	SMUD 2005	SMUD 2013	SMUD 2016, EPA eGRID 2016

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Data	2005	2013	2016
Waste-in-Place	ARB FOD	ICLEI LGOP 9.1	ICLEI LGOP 9.1
GWP	IPCC SAR (21, 310)	IPCC SAR (21,310)	IPCC AR4 (25, 298)

¹https://www.smud.org/-/media/Documents/Rate-Information/Rates/01_SLS.ashx

²Sacramento Municipal Utilities District

³https://www.arb.ca.gov/emfac/2014/?_ga=2.188515880.1044032860.1584991585-988399991.1554499524

⁴2016 The Climate Registry Emissions Factors, <https://www.theclimateregistry.org/wp-content/uploads/2014/11/2016-Climate-Registry-Default-Emission-Factors.pdf>

As noted earlier, the internal operations emissions data presented above are a subset of the communitywide inventory (see Appendix A). These emissions are not added to the community inventory and therefore, no “double-counting” is occurring between community-wide and internal operations. Additional information regarding the 2005 and 2011 Sacramento GHG inventories can be found in the previous 2016 IO CAP Update.⁴

2.2 Inventory Data Sources

The data used to complete the 2016 GHG inventory and forecast came from multiple sources, as summarized in greater detail in Table 4. Data for the 2016 municipal GHG inventory calculations were provided by City staff via personal communication with Helen Selph, Jennifer Venema, John Febbo, and Mark Stevens⁵.

⁴ City of Sacramento. Climate Action Plan for Internal Operations, 2016 Update. https://www.cityofsacramento.org/-/media/Corporate/Files/Public-Works/Facilities/CityOfSacramento_1606_ClimateActionPlan_InternalOps_FINAL.pdf?la=en Accessed: November 2019.

⁵ Helen Selph, Associate Planner; Jennifer Venema, Sustainability Manager; John Febbo, Integrated Waste Planning Superintendent, Mark Stevens, Fleet Manager.

Table 4 Inventory and GHG Emission Factors Sources

Sector	Data	Unit	Source
Activity Data			
Building Energy	Electricity Consumption	kWh	EnergyCAP
	Natural Gas Consumption	Therms	EnergyCAP
Transportation	Fuel Usage, Annual Mileage	Gallon, GGE, VMT	Utilimarc
Streetlights	Electricity Consumption	kWh	EnergyCAP City of Sacramento
Water	Electricity Usage	kWh	EnergyCAP
Solid Waste	Landfill Gas, Methane Content	cf	Sacramento Public Works Department
Emission Factors			
Electricity	SMUD, PG&E, and eGRID electricity emissions factors	CO ₂ /MWh, CH ₄ MWh, N ₂ O/MWh	The Climate Registry 2016 Reported Emissions Factors, EPA eGRID
Natural Gas	PG&E natural gas emissions factor	CO ₂ /therm, CH ₄ /therm, N ₂ O/therm	The Climate Registry 2016 Reported Emissions Factors
Transportation Fuels	Diesel, Gasoline, CNG, LNG, E85, and Propane emission factors	CO ₂ /gal or mi, CH ₄ /gal or mi, N ₂ O/gal or mi	The Climate Registry 2016 Default Emissions Factors
Streetlights and Traffic Signals	SMUD and EGRID electricity emissions factors	CO ₂ /MWh, CH ₄ MWh, N ₂ O/MWh	The Climate Registry 2016 Emissions Factors, EPA eGRID
Water Management	SMUD and EGRID electricity emissions factors	CO ₂ /MWh, CH ₄ MWh, N ₂ O/MWh	The Climate Registry 2016 Reported Emissions Factors, EPA eGRID
Waste	N/A (constants)	N/A	N/A

cf: cubic feet; CO₂: carbon dioxide; CH₄: methane; CNG: compressed natural gas; EPA: Environmental Protection Agency; kWh: kilowatt hours; gal: GGE: gasoline gallon equivalent; LNG: liquid natural gas; MWh: megawatt hour; N₂O: nitrous oxide; PG&E: Pacific Gas & Electric; SMUD: Sacramento Municipal Utility District; VMT: vehicle miles traveled; N/A: not applicable

2.3 Building and Facilities

In 2016, municipal building and facility energy use resulted in 15,214 MT CO₂e, comprising the second largest emissions source after the vehicle fleet. Energy use consisted primarily of electricity and natural gas, as well as diesel and gasoline which is used to power emergency generators.

Electricity, natural gas, and generator fuel for building and facilities were provided by SMUD, Tesla/Solar City (on-site solar), Public Works Department fuel contracts, and PG&E. Grid-supplied building and facility energy data were collected by the City of Sacramento staff using EnergyCAP software, run through internal analysis, and provided to Rincon (as summarized in Table 5).

Table 5 Municipal Building and Facilities Energy Use

Emission Source	Energy Usage	Unit	Emissions Factor	Emissions (MT CO ₂ e) ¹	Percent (%) of Total
SMUD Purchased Electricity (except H2O management)	40,323.72	MWh	0.2236 MT CO ₂ /MWh	9,053	59%
PG&E Purchased Electricity ²	86	MWh	0.1332 MT CO ₂ /MWh	12	0.08%
Solar City Purchased Electricity	4,353	MWh	0.0 MT CO ₂ /MWh	0	0%
PG&E Natural Gas Use	900,788	therms	0.0053 MT CO ₂ /therm	6,130	40%
Gasoline Generators	44	gallons	0.0088 MT CO ₂ /gal gasoline	0.4	0.0025%
Diesel Generators	1,661	gallons	0.0102 MT CO ₂ /gal diesel	19	0.13%
Total Emissions	–	–	–	15,214	–

¹ MT CO₂e: metric tons of carbon dioxide equivalent

² PG&E electricity provided for Camp Sacramento operations only.

Buildings and facilities in this sector include City-owned and operated offices, corporation yards, parking lot facilities, and irrigation systems at City-owned facilities. Electricity use includes lighting, appliances, and equipment in City buildings and facilities.⁶ Natural gas was most often used for space heating and water heating. Diesel and gasoline fuel were used for City-operated back-up generators, which are used intermittently during power outages and for regular testing. Generator fuel use was provided by the City of Sacramento's Utilimarc program for tracking fuel purchases. Electricity use for water supply and management by the Department of Utilities is included in a separate section and has been removed from the Buildings and Facilities category. Electricity for vehicle charging has not been broken out and is included in overall building electricity.⁷ A detailed breakdown of building energy use by emission source and building type can be found in Table 6.

The 2016 inventory likely includes more buildings than the 2013 inventory. At a minimum, the 2016 inventory includes the Pocket-Greenhaven Library electricity consumption which was not included in the 2013 inventory (approximately 523,823 kWh or 117 MT CO₂e). The 2013 inventory noted that data from this library was not available at the time of inventory creation. Additional buildings may also be an addition to the 2016 inventory. However, because the 2013 inventory does not include a detailed list of buildings accounted for in the analysis, it is not possible to identify if the library was accounted for in a different portion of the building inventory. However, all future inventories will provide a complete list of building-by-building end uses to avoid this issue.

Table 6 Municipal Buildings and Facilities Emissions

Facility Type	Energy Consumption	CO ₂ (MT)	CH ₄ (MT)	N ₂ O (MT)	CO ₂ e (MT)	Fuel Type
Electricity (kWh)						
Camp Sac	85,960	11.45	0.00	0.00	12	Electricity
Solar City (Purchased)	4,353,000	0.00	0.00	0.00	0	Electricity
Police	6,319,471	1,413.03	0.09	0.01	1419	Electricity

⁶ Electricity use for streetlights and traffic signals is accounted for in a separate sector. Refer to Section 2.7.

⁷ At the time of report preparation, data was unavailable for all electricity related to EV charging; as of late 2019, only one City facility had a separate submeter for EV charging, City Hall Parking Garage.

Facility Type	Energy Consumption	CO ₂ (MT)	CH ₄ (MT)	N ₂ O (MT)	CO ₂ e (MT)	Fuel Type
Fire	2,147,681	480.22	0.03	0.00	482	Electricity
Public Works	10,495,687	2,346.82	0.16	0.02	2356	Electricity
Libraries ¹	3,331,210	744.85	0.05	0.01	748	Electricity
Parks & Recreation	5,890,602	1,317.13	0.09	0.01	1323	Electricity
Cultural and Community Services	11,075,055	2,476.37	0.17	0.02	2487	Electricity
Youth Parks and Community Enrichment	34,862	7.80	0.00	0.00	8	Electricity
Community Development Department	356,474	79.71	0.01	0.00	80	Electricity
Other-City-Related-Accounts	300,243	67.13	0.00	0.00	67	Electricity
Unknown Accounts	3,366	0.75	0.00	0.00	1	Electricity
Downtown Plaza- Central Garage (Lot U)	136,758	30.58	0.00	0.00	31	Electricity
Old Sac Waterfront	111,726	24.98	0.00	0.00	25	Electricity
1109 2nd St. Building	37,154	8.31	0.00	0.00	8	Electricity
1115 2nd St. Building	3,791	0.85	0.00	0.00	1	Electricity
Old Sac Promenade	48,342	10.81	0.00	0.00	11	Electricity
1012 2nd St. Building	31,298	7.00	0.00	0.00	7	Electricity
Total	44,762,680	9,027.8	0.60	0.07	9,065²	--
Diesel and Gasoline (Gallons)						
Generators	1,661	16.96	0.0009	0.0069	19	Diesel
Generators	44	0.39	0.0000	0.0000	0	Gasoline
Total	1,705	17.35	0.00095	0.0069	19	--
Natural Gas (Therms)						
Police	78,736	417.85	3.78	0.079	536	Natural Gas
Fire	75,832	402.44	3.64	0.076	516	Natural Gas
Utilities	205,861	1,092.51	9.88	0.206	1401	Natural Gas
Public Works	141,931	753.23	6.81	0.142	966	Natural Gas
Libraries ¹	68,891	365.61	3.31	0.069	469	Natural Gas
Parks & Recreation	54,074	286.97	2.60	0.054	368	Natural Gas
Convention and Cultural Services	249,902	1,326.24	12.00	0.250	1701	Natural Gas
Community Development Department	25,389	134.74	1.22	0.025	173	Natural Gas
Old Sac Waterfront	172	0.91	0.01	0.000	1	Natural Gas
Total	900,788	4,780.5	43.2	0.9	6,130	-
¹ Includes activity data for all libraries in City limits that are City-owned buildings.						
² Numbers may not sum due to rounding						
MT = metric tons						

Approximately 60 percent of building and facility emissions occurred from electricity usage, while 40 percent were attributable to natural gas and generator emissions. Overall, buildings and facilities were 27 percent of total municipal operations emissions.

2.4 Water Management

The City provides water-related utility services to residents and businesses in the form of water intake, treatment, and distribution; wastewater collection and conveyance; and stormwater drainage. In 2016, pumping and other activities associated with these water-related services (referred to hereafter as the “water management” sector) produced 87,811 acre-feet of water. This sector comprised 17 percent of the City’s total municipal GHG emissions in 2016. Water management activity represented the fourth largest sector of emissions in the city after the vehicle fleet emissions, building and facility energy use, and waste. More detail on the sector is available in Table 7.

Table 7 Municipal Water Management Emissions

Activity	Electricity (kWh)	CO ₂ (MT)	CH ₄ (MT)	N ₂ O (MT)	Emissions (MT CO ₂ e)
Water Supply Conveyance	35,190,068	7,868.45	0.527	0.064	7,901
Wastewater Conveyance	2,551,344	570.48	0.038	0.005	573
Stormwater Drainage	4,645,541	1,038.74	0.070	0.008	1,043
Total	42,386,953	9,477.66	0.63	0.08	9,516

2.5 Vehicle Fleet

The City’s 2016 vehicle fleet consisted of a variety of vehicle types using both conventional and alternative fuels. Fuel consumption from vehicle fleet operations contributed to approximately 16,035 MT CO₂e in 2016, comprising 28 percent of the City’s annual operational GHG emissions (Table 8). This sector captures fuel usage for both on-road and off-road vehicle activities. All fuel use is presented by fuel type for this sector.

Table 8 Municipal Fleet Emissions

Fuel Type	Units (Gallons)	CO ₂ Factor	CO ₂ (MT)	CH ₄ (MT)	N ₂ O (MT)	Total (MT CO ₂ e)
Gasoline	1,146,935	0.00878	10,070	0.12	0.2	10,125
Diesel	5,173	0.01021	53	0.003	0.022	59
Biodiesel	512,081	N/A	0	0.29	2.1	643
CNG	67,880	0.006896	468	0.53	0.05	495
RNG	18,228.30	N/A	0	0.14	0.05	18
Propane	7,538	0.00568	43	0.02	0.0	44
LNG	945,258	0.00446	4,216	1.86	0.17	4,312
E-85	53,808	0.0062651	337	0.01	0.0	340
Total	–	–	15,187	2.97	2.60	16,035

In 2016, the City operated 2,330 vehicles including maintenance trucks, vans, solid waste collection vehicles, police and fire vehicles, and light duty passenger vehicles. This included 38 CNG, 461 diesel, 222 E85, 90 LNG, 45 propane, and 1,474 unleaded gasoline vehicles.

Fleet emissions were calculated using the LGOP recommended methodologies 7.1.1 and 7.1.3 for CO₂, CH₄, and N₂O in mobile combustion. The LGOP recommends quantifying CO₂ levels through total annual fuel consumption by fuel type and appropriate emissions factors for each. Annual fuel use was provided by the City of Sacramento while emissions factors utilized were identified by The Climate Registry (TCR)⁸, an industry-standard independent third-party verifier for reporting GHG emissions. CH₄ and N₂O levels were calculated either by using the same methodology when emissions per gallon emission factors were available (Gasoline, Diesel, and Propane) or by mileage of each vehicle type when mileage-based emission factors were available (CNG, RNG, LNG, and Ethanol). This method was used for all fleet fuel consumption, both on-road and off-road.

2.6 Waste-in-Place

Waste-in-place emissions are inventoried under LGOP recommended Calculation 9.1 for landfills with landfill gas collection systems. In 2016, the 28th Street Landfill collected 243,718,413 cubic feet of gas with an average methane content of 29.10 percent. Total emissions from the 28th Street Landfill were 10,512 MT CO₂e. This value differs from the community-wide inventory for the same year because it includes only the 28th street landfill which is under the City's direct control. The method for calculation is also different and leverages actual measures CH₄ emissions at the site as well as several assumptions defined by Calculation 9.1 of the LGOP.

GHG emissions in the waste category are attributed to waste-in-place emissions at the City-owned-and-operated 28th Street Landfill. Waste-in-place emissions are the result of anaerobic decomposition of organic material from the existing accumulated waste in a landfill. The anaerobic decomposition occurs at covered landfills where the deposited waste is not exposed to the oxygen in the atmosphere. Previously, the 28th Street Landfill served as the disposal location for solid waste generated within the City between 1968 and 1994. Since the 28th Street Landfill's permanent closure in 1997, a methane gas recovery system was installed and operated by a third-party contractor that collects and disposes of much of the gas that is generated from the closed landfill. From the early 1990s until 2010, the City sold a portion of the captured landfill gas to Blue Diamond Almond for their industrial operations, flaring the remaining captured CH₄. However, in 2013, due partially to the declining quality of landfill gas, the landfill flared all CH₄ that was captured through its landfill gas (LFG) collection system, rather than sell it for combustion. Fugitive CH₄ emissions which were not flaring in 2016 resulted in an estimated 10,512 MTCO₂e. The IPCC considers any CO₂ (non-methane) emissions from flaring or fugitive emissions from landfills to be of biogenic origin and not significant to overall solid waste emissions.

2.7 Streetlights and Traffic Signals

Electricity in this sector falls into three categories, traffic signals, City-owned streetlights (metered and non-metered), and SMUD-owned streetlights. Electricity usage for traffic signals and SMUD owned streetlights was provided by with the EnergyCAP data. Electricity data for unmetered

⁸ The Climate Registry. 2016 Default Emission Factors. <https://www.theclimateregistry.org/wp-content/uploads/2014/11/2016-Climate-Registry-Default-Emission-Factors.pdf> Accessed: Oct. 2019

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streetlights was not available through EnergyCAP. Instead, the City provided a comprehensive list of all City-owned streetlights and wattage estimates. This information along with a SMUD-provided operational assumption of approximately 4,000 hours of streetlight use per year was used to estimate unmetered streetlight electricity use.⁹

In 2016, the operation of streetlights and traffic signals in the City required approximately 23,097,333 kWh of electricity and resulted in 5,186 MTCO₂e, contributing 9 percent of the City's total annual GHG emissions (Table 9). In 2016 the City operated 41,591 streetlights and at least 631 traffic signals.¹⁰ This sector captures electricity for all streetlights and traffic signals operated by the City, including both City-owned and SMUD-owned streetlights.

Table 9 Streetlight and Traffic Signal Emissions

Source (Number)	Electricity (kWh)	CO ₂ (MT)	CH ₄ (MT)	N ₂ O (MT)	Emissions (MT CO ₂ e)
Traffic Signals (631)	1,995,276	446.1	0.0299	0.0036	448
City-Owned Streetlights (38,135)	19,348,584	4326.3	0.2896	0.0351	4,344
SMUD-Owned Streetlights (3,456)	1,753,473	392.07	0.0262	0.0032	394
Total	23,097,333	5164.5	0.35	0.0419	5,186

⁹ https://www.smud.org/-/media/Documents/Rate-Information/Rates/01_SLS.ashx

¹⁰ 630 traffic signal accounts were registered with SMUD with one additional Master Account with an unknown number of associated signals. 631 is used here as the minimum value.

3 Municipal Forecast

A baseline municipal GHG emissions inventory (i.e., the City of Sacramento’s 2016 municipal inventory) sets a reference point for municipal emissions for a single year. As the demographics of the City change, municipal emissions may change as well, such that municipal emissions in the future may be quite different. A municipal GHG emissions forecast attempts to quantitatively capture these future changes and is based primarily on projected population growth within the City, as well as existing programs and regulations at the City and State level as of the 2016 inventory. The projections from the municipal emissions forecast provides the basis for determining the City’s Climate Action Plan policies on a municipal level. Municipal policies are developed based on the difference or gap between the municipal forecast and the municipal reduction targets set by the City.

This section quantifies the projected municipal GHG emissions for the City of Sacramento in the horizon years 2030 and 2045. The forecast additionally includes reductions from State regulations in order to provide a more accurate picture of future emissions growth and highlight the City’s responsibility for achieving further reductions necessary for attainment of municipal GHG emissions targets. This “gap analysis” provides the City with the total municipal emissions reductions that would be necessary to achieve goals, as well as information on the emissions sectors and sources which have the most GHG reduction opportunities. Further details on State regulations and programs aimed at reducing GHG emissions are provided in Appendix B.

3.1 Forecast Methods and Results Summary

The driving factor for the municipal forecast was population growth, as an increasing population is anticipated to lead to increased municipal staff and increased usage of municipal facilities and services. Population projections were obtained from the 2035 Sacramento General plan population forecast. While it is not known if the City will build or acquire new buildings or facilities by 2045, it was conservatively assumed that any newly constructed or acquired building or facility would be at least as energy-intensive as the building or facility it replaced. Therefore, building and facility energy use projected into 2030 and 2045 is the same as energy use in 2016. Waste-in-place emissions are expected to decrease, as the 28th St. Landfill is no longer operating which will decrease overall emissions from off-gassing. All other sectors – water management, streetlights and traffic signals, and vehicle fleet – represent services for the general population and should therefore increase with the population. For simplicity, growth in these service sectors were assumed to increase linearly with population. The exception is electricity usage for stormwater drainage under the water management sector, which will vary from year to year based on total precipitation in each year and was carried forward unchanged from 2016 to 2030 and 2045 for reasons further discussed in Section 3.3.

Overall municipal GHG emissions in the City of Sacramento are forecast to decrease 42 percent by 2045 under existing programs and regulations (Table 10). Due to SB 100 requiring 100 percent GHG-free electricity in 2045, electricity-related emissions from buildings and facilities, streetlights and traffic signals, and water management are expected to reduce to zero by 2045. Emissions from natural gas, waste, and fuel usage from the vehicle fleet are expected to constitute the majority of emissions by 2045.

Table 10 Municipal Forecast Summary

Year	2005	2016	2030	2045
Population	369,365	487,758	600,231	699,903
Projected Population Increase (%)	–	–	23.1 (17% per year)	16.6 00.1% per year
Buildings and Facilities		15,214	10,965	6,149
Water Management	35,773	9,516	6,093	0
Waste-in-Place	14,021	10,512	6,775	3,722
Streetlights and Traffic Signals	6,872	5,186	3,390	0
Vehicle Fleet	21,927	16,035	19,732	23,009
Municipal Emissions (MT CO₂e)	78,584	56,463	46,954	32,880
Municipal Emissions per Capita (MT CO₂e/person)		0.116	0.078	0.047
Reduction from 2016 (%)	–	–	17%	42%

MT CO₂e: metric tons of carbon dioxide equivalent

SB 100 is the only state regulation included in the municipal forecast. Although, it will reduce municipal GHG emissions substantially by 2045 as shown in Table 11. However, a gap remains between the municipal forecast and the City's municipal targets. The reductions to close the gap will come from existing and newly identified municipal measures included in this and future iterations of the Sacramento Climate Action Plan.

Table 11 Estimated GHG Emissions Savings from SB100

Year	2016	2030	2045
Projected Electricity Use (kWh)	40,409,680	40,409,680	40,409,680
BAU Emissions (MT CO ₂ e)	9,065	9,065	9,065
Emissions with SB100 (MT CO ₂ e)	9,065	4,816	0
Savings (MT CO ₂ e)	0	4,249	9,065

3.2 Buildings and Facilities

As described in Section 3.1, it was conservatively assumed that building and facility energy use projected into 2030 and 2045 will be the same as energy use in 2016. That is, the City will use roughly the same amount of electricity, natural gas, gasoline, and diesel each year through 2045. However, while municipal building and facility energy use is expected to remain the same, GHG emissions from electricity in general are expected to decrease each year, due to the Renewable Portfolio Standard (RPS) and SB 100. The RPS program requires investor-owned utilities, publicly owned utilities, electric service providers, and community choice aggregators to increase procurement from eligible renewable energy resources to 50 percent of total procurement by 2026 and 60 percent of total procurement by 2030. The RPS program further requires these entities to increase procurement from GHG-free sources to 100 percent of total procurement by 2045. Further details on the RPS program are contained in Appendix A. After factoring in emissions reductions from the RPS program, overall GHG emissions from municipal buildings and facilities will therefore

decrease through 2045, from 15,214 MT CO₂e in 2016 to 10,965 MT CO₂e in 2030 to 6,149 MT CO₂e in 2045 (Table 12).

Table 12 Activity and Emissions Data for Municipal Buildings and Facilities

	2016	2030	2045
Activity Data			
Purchased Electricity – SMUD (kWh)	40,323,720	40,323,720	40,323,720
Purchased Electricity – PG&E (kWh)	85,960	85,960	85,960
Purchased Electricity – Solar City (kWh)	4,353,000	4,353,000	4,353,000
Natural Gas Use – PG&E (therms)	900,788	900,788	900,788
Gasoline Use (gallons)	44	44	44
Diesel Use (gallons)	1,661	1,661	1,661
Emissions Factors			
SMUD Electricity (MT CO ₂ e/kWh)	0.00022	0.00012	0.0
PG&E Electricity (MT CO ₂ e/kWh)	0.00013	0.00008	0.0
Solar City Electricity (MT CO ₂ e/kWh)	0.00000	0.00000	0.0
PG&E Natural Gas (MT CO ₂ e/therm)	0.00681	0.00681	0.00681
Gasoline (MT CO ₂ e/gallon)	0.00883	0.00883	0.008823
Diesel (MT CO ₂ e/gallon)	0.01147	0.01147	0.01147
Emissions (MT CO₂e)			
Electricity – SMUD	9,053	4,809	0
Electricity – PG&E	12	7	0
Electricity – Solar City	0	0	0
Natural Gas – PG&E	6,130	6,130	6,130
Gasoline	0.4	0.4	0.4
Diesel	19	19	19
Total	15,214	10,965	6,149
MT CO ₂ e: metric ton of carbon dioxide equivalent; kWh: kilowatt hour			

3.3 Water Management

Electricity used for water management attributable to water supply conveyance and wastewater conveyance will increase each year as the population grows, to service more people and meet projected demand. As mentioned above, electricity usage attributable to stormwater drainage varies from year to year based on precipitation levels, independent of population growth. Inventory year 2016 was the ninth wettest year on record in Sacramento, suggesting that electricity usage for stormwater drainage was particularly high in 2016. This forecast made the conservative assumption that 2030 and 2045 may also be particularly wet years, especially considering that climate change is expected to bring more intense rainfall to Northern California. The electricity usage for stormwater drainage from 2016 was therefore carried forward into 2030 and 2045. Emissions totals for electricity usage from water management factored in anticipated changes to emissions factors due to the RPS program (Table 13)

Table 13 Water Management Activity and Emissions Data

	2016	2030	2045
Activity Data			
Water Supply Conveyance (kWh)	35,190,068	43,304,613	50,495,600
Wastewater Conveyance (kWh)	2,551,344	3,139,663	3,661,023
Stormwater Drainage (kWh)	4,645,541	4,645,541	4,645,541
Emissions Factors			
SMUD Electricity (MT CO ₂ e/kWh)	0.00022	0.00012	0.0
Emissions (MT CO₂e)			
Water Supply Conveyance	7,901	5,164	0
Wastewater Conveyance	573	374	0
Stormwater Drainage	1,043	554	0
Total	9,516	6,093	0

MT CO₂e: metric ton of carbon dioxide equivalent; kWh: kilowatt hour

3.4 Waste-in-Place

Waste-in-Place emissions are expected to decrease over time due to no new organic material being added to the 28th Street landfill. As described in Section 2.6, waste-in-place emissions are entirely attributed to flaring of off-gassed CH₄ from the permanently closed 28th Street Landfill. To estimate how emissions may decrease over time the annual percent reduction (4 percent) was calculated for the period between 2013 and 2016. In 2016, the landfill collected and flared 243,718,413 cubic feet of gas with an average methane content of 29.10 percent. Emissions from gas flaring at the landfill were 10,512 MT CO₂e. The estimated gas capture based on historic subsidence and associated emissions based on Equation 9.1 of the LGOP protocol are included below in Table 14.

Table 14 Waste-in-Place Collected Gas and Emissions Estimates

	2016	2030	2045
Data			
Collected Gas	243,718,413	157,070,840	86,282,675
Emissions (MT CO₂e)	10,512	6,775	3,722

3.5 Streetlights and Traffic Signals

Emissions from streetlights and traffic signals are based on electricity usage. Electricity usage associated with streetlights and traffic signals will increase as population increases (Table 15).

Table 15 Streetlights and Traffic Signals Activity and Emissions Data

	2016	2030	2045
Activity Data (kWh)			
Traffic Signals	1,995,276	2,455,371	2,863,099
City-owned streetlights	19,348,584	23,810,211	27,764,037
SMUD-owned streetlights	1,753,473	2,157,810	2,516,127
Emissions Factors			
SMUD Electricity (MT CO ₂ e/kWh)	0.00022	0.00012	0.0
Emissions (MT CO₂e)			
Traffic Signals	448	293	0
City-owned streetlights	4,344	2,839	0
SMUD-owned streetlights	394	257	0
Total	5,186	3,390	0

MT CO₂e: metric ton of carbon dioxide equivalent; kWh: kilowatt hour

3.6 Vehicle Fleet

Emissions from the City's vehicle fleet were calculated based on total fuel usage in the year 2016. To project these numbers forward into 2030 and 2045, all fuel usage was assumed to increase at the same rate of population, as vehicle usage increases to provide services to more people every year (Table 16). Because vehicle fleet emissions are calculated using fuel specific factors (MT CO₂e per gallon of fuel) these emission factors will not change over time as they are tied to the direct properties of the fuel. However, the efficiency of the fleet may increase over time lowering the total fuel combusted. This efficiency increase is difficult to calculate for several reasons. The first is that a large portion of the fuel combusted was in heavy duty vehicles which are not covered under current legislation. Furthermore, the estimates in the EMFAC model tool which is used to calculate future vehicle emissions is based on the countywide fleet. It is not clear that the City fleet (which is already made up of generally newer and more efficient vehicles) would have the same impact due to current legislation like Pavley. Therefore, to be conservative no adjustments were made to the City fleet. Emissions reductions will be calculated as part of the GHG reduction measures.

Table 16 Activity and Emissions Data for Municipal Vehicle Fleet

	2016	2030	2045
Activity Data (gallons)			
Gasoline	1,146,935	1,411,409	1,645,782
Diesel	5,173	6,365	7,422
Biodiesel (99%)	512,081	630,163	734,806
CNG	67,880	83,532	97,403
RNG	18,228	22,432	26,156
Propane	7,538	9,276	10,816
LNG	945,258	1,163,227	1,356,388
Ethanol	53,808	66,216	77,212
Emissions Factors (MT CO₂/gallon)			
Gasoline		0.00886	
Diesel		0.01147	
Biodiesel (99%)		0.00126	
CNG		0.00732	
RNG		0.00097	
Propane		0.00577	
Emissions (MT CO₂e)			
Gasoline	10,125	12,459	14,528
Diesel	59	73	85
Biodiesel (99%)	643	791	922
CNG	495	610	711
RNG	18	22	25
Propane	44	54	62
LNG	4,312	5,306	6,187
Ethanol	340	418	487
Total	16,035	19,732	23,009

4 Municipal Target Setting

Municipal emissions reduction targets can be set the same way as community-wide reduction targets: as either an efficiency target (MT CO₂e per capita or per service population per year) or as a community wide mass emissions target (total MT CO₂e). Target setting is an iterative process which must be informed by the reductions that can realistically be achieved through the development of feasible GHG reduction measures. Furthermore, the General Plan Update may impact the forecast results. As such, the targets identified herein should remain provisional until the General Plan Update values are finalized and the quantification and analysis of potential GHG reduction measures completed.

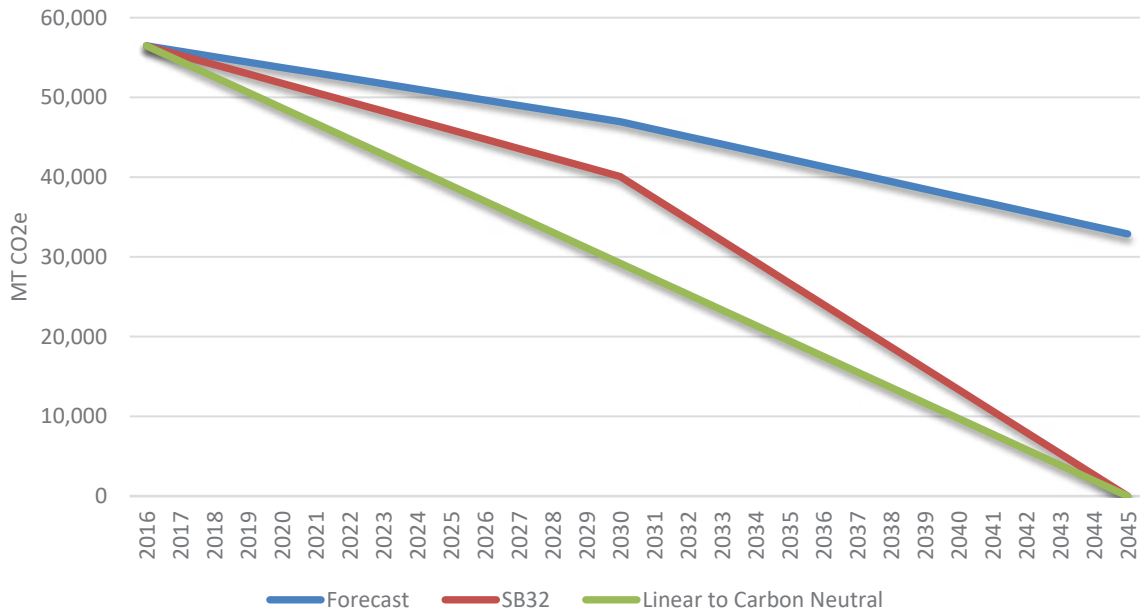
The City of Sacramento has achieved both efficiency and absolute emissions reductions in municipal operations between 2005 and 2016. The purpose of target setting is to develop the trajectory toward achieving the State's 2030 goal and prepare for the deep decarbonization needed by 2045 in a cost-effective manner by setting an incremental path toward achieving the EO B-55-18 goals. There are two primary target pathways available to be consistent with State reduction goals:

- **SB 32 Target Pathway (red)** is the pathway toward achieving the minimum reductions required by State law. This will require minimal reductions until 2030 and then steep reductions from 2030 to 2045.
- **Linear Carbon Neutrality Pathway (green)** is an incremental linear pathway from current per capita emissions levels straight to carbon neutrality in 2045. This pathway is also compliant with the 2030 State goal.

At this time Rincon suggests setting a municipal target that meets or exceeds the targets set for the community. The City has already set a reduction target of 33 percent below 2005 levels by 2020 which is more aggressive than the AB32 requirement of a return to 1990 levels or approximately a 15 percent reduction below 2005 levels by 2020. The two suggested reduction pathways are shown graphically in Figure 2.

Per Capita based municipal emissions targets were not included in this analysis. While a per capita target works well for the community, it is not recommended for the City since municipal emissions are not as directly tied to population growth. Therefore, Rincon suggests setting a mass emissions reduction target of at least 55 percent below 2005 levels by 2030 and carbon neutrality by 2045 and thereafter. This pathway would be consistent with SB32 and Executive Order B-55-18 and is shown in Figure 3 (in red). However, a more aggressive target such as a linear reduction to carbon neutrality in 2045, shown in green in Figure 3, could also be considered. In order to achieve the SB32 compliant pathway (red), the City would need to reduce 48 percent below 2005 levels, 29 percent below 2016 levels, or an estimated 15 percent below 2030 forecast levels by 2030. To reach the linear to carbon neutral target shown in green, the City would need to reduce 60 percent below 2005 levels, 48 percent below 2016 or 38 percent below 2030 forecast levels by 2030. Emission levels for each target pathway, relative to historical actuals and the forecast, are presented in Table 17.

Figure 3 Municipal Target Reduction Pathways



Based on the results of the community target setting and the municipal measure quantification process, the City may choose either of these targets for consistency with state targets.

Table 17 Municipal Target Reduction Pathways

Target Pathway	2005 (MT CO ₂ e)	2016 (MT CO ₂ e)	2030 (MT CO ₂ e)	2045 (MT CO ₂ e)
Historical Actual & Forecast	78,584	56,463	46,954	32,880
SB 32	-	-	40,078	0
Linear to Carbon Neutral	-	-	29,205	0

MT CO₂e: metric tons of carbon dioxide equivalent

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Appendix F - Municipal Measures GHG Emissions Quantification

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1 Introduction

This technical appendix contains a detailed description of each measure the City will take to reduce its municipal-level greenhouse gas (GHG) emissions, as well as quantification of the reductions expected from the measures wherever possible. This technical appendix is organized around two levels which include:

- **Municipal Measures (MM):** Municipal measures define core strategies that will result in reductions in GHG emissions at the municipal level
 - **Actions:** Each measure is driven by sets of actions that together support and generate the GHG reductions necessary to achieve the City’s municipal-level goals

Municipal measures and actions can be either quantitative or supportive and are defined as follows:

- **Quantitative:** These measures and actions have substantial evidence including case studies, calculations, or other substantial evidence that prove that the implementation of said measure/action will have a measurable GHG reduction when implemented. These measures/actions have been quantified based on this substantial evidence and the reductions summed to show how the City will meet its 2030 and 2045 municipal goals and exceed the state target (SB 32) of 40 percent below 1990 GHG levels by 2030.
- **Supportive:** These measures and actions may also be quantifiable and in most cases have substantial evidence to support their overall contribution to GHG reduction. However, due to one of several factors including a low GHG reduction benefit, indirect GHG reduction benefit, lack of the necessary data, or simply a high level of difficulty in quantifying accurate GHG reductions, they have not been quantified and do not contribute directly to the expected municipal GHG reduction goal. However, these measures/actions are critical to the overall success of the CAP.

2 Reduction Target

Without additional action, municipal emissions are currently forecast to decrease from 56,463 MT CO₂e in 2016 to 46,954 MT CO₂e in 2030, and to 32,880 in 2045. The City has established a goal of reducing municipal emissions on a linear path to carbon neutrality in 2045. This equates to 29,205 MT CO₂e in 2030 (17,749 MT CO₂e below the 2030 forecast) and net zero in 2045 (32,880 MT CO₂e below the 2045 forecast). Together the quantitative and supportive measures and actions listed in this document will help the City achieve its 2030 and 2045 emission reduction goals. These goals align with the City's community CAP goals as well as the State goals, including the requirements of SB 32 (a 40 percent reduction from 1990 levels in 2030), and the intent of Assembly Bill (AB) 1279. A linear reduction to carbon neutrality exceeds the State target by establishing a target of 56 percent below 1990 levels by 2030.

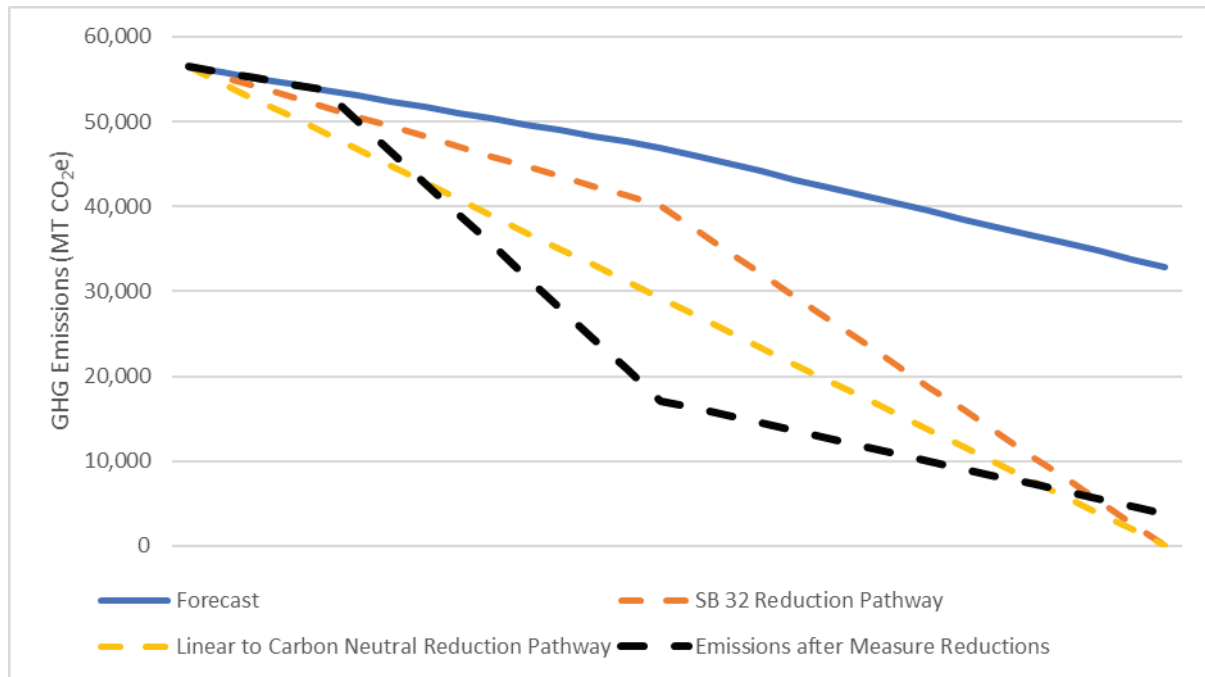
This technical report provides the emission reduction calculations and evidence that the municipal measures adopted in the CAP will allow the City to reach its 2030 goal and will provide substantial foundation for and progress toward achieving the 2045 goal and AB 1279.

Achieving carbon neutrality, on both a municipal and community level, will require significant changes to the technology and systems currently in place. These changes include carbon neutral electricity, complete electrification of buildings and the transportation system, a shift to shared and active mobility, and waste reduction and diversion. The measures and actions developed to meet the 2030 goals are the foundations for this long-term transformation. However, the emissions reductions quantified for 2045 in this document are not yet enough to meet the long term 2045 goal. As the current measures and actions are implemented, the City will gain more information, new technologies will emerge, and current pilot projects and programs will scale to the size needed to reach carbon neutrality. Furthermore, the State is expected to continue providing updated regulations and support once the 2030 target is achieved. Future CAP updates will outline new measures needed to reach the 2045 goal of carbon neutrality.

3 GHG Reduction Summary

The City of Sacramento, in coordination with Rincon Consultants has developed a suite of measures and specific actions to reduce municipal GHG emissions over time. Based on these measures, emissions are expected to exceed the 2030 reduction target but fall short of the 2045 target by 3,741 MT CO₂e. This is illustrated below in Figure 1. The 3,741 MT CO₂e remaining in 2045 is entirely attributed to waste-in-place emissions which are caused by the degradation of waste already located in the closed municipal landfill, as well as some remaining gasoline and diesel usage for municipal generators. This waste sector is not usually considered in most GHG inventories, and the City is already capturing methane from this facility, greatly reducing GHG emissions. These remaining sources of GHG emissions will likely need to be mitigated through carbon sequestration taking place at the larger community scale.

Figure 1 Estimated Municipal GHG Reductions and Target Pathway



A summary of the GHG emissions reduction by Measure is included in Table 1. For a complete description of each measure and the contributing actions, please refer to the individual measure descriptions below.

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Table 1 Summary of GHG Emissions Reductions by Measure

Measure #	Measure Description	2030 Reduction (MT CO₂e)	2045 Reduction (MT CO₂e)
MM-1	Reduce natural gas consumption 50% below 2016 levels by 2030 and 100% by 2045.	3,068	6,130
MM-2	Electrify or decarbonize 100% of light-duty fleet vehicles by 2035 and 100% of municipal fleet by 2045.	9,246	23,009
MM-3	Reduce emissions from trips between City facilities occurring during the workday.	Supportive	Supportive
MM-4	Reduce municipal waste sent to landfills.	Supportive	Supportive
MM-5	Reduce emissions from water usage/conveyance and stormwater drainage (in MT of CO ₂ e per MG delivered) 100% by 2030.	6,093	0
MM-6	Improve carbon sequestration potential of municipal parks, greenspace at City properties, and street tree planters in the public right-of-way.	Supportive	Supportive
MM-7	Procure carbon free electricity by 2030, in alignment with SMUD's 2030 Zero Carbon Plan.	8,198	0
MM-8	Reduce City employee commuter VMT.	Supportive	Supportive
MM-9	Encourage an increase in the number of employee-owned EV and plug-in hybrid electric vehicles 28% by 2030 and 100% by 2045	Supportive	Supportive
Reduction Summary			
Estimated Reductions Achieved from Full Implementation of Measures		26,604	29,139
Total Reduction Needed		17,749	32,880
Gap		-8,855	3,741
Notes: MM = municipal measure, numbers may not sum due to rounding.			

4 Municipal Measures Detail

Measure MM-1:

Reduce natural gas consumption 50% below 2016 by 2030 and 100% by 2045.

2030 Target

3,068 MT CO₂e

2045 Target

6,130 MT CO₂e

Performance Metric(s):

- 50% all-electric building stock by 2030
- 100% all-electric building stock by 2045

Action #	Action	Anticipated Reduction
Quantitative Measures		
MM-1.1	Electrification – Implement an “electric first” commitment for building projects and major retrofits.	
MM-1.2	Building Retrofits - Develop a strategy to transition 100% of existing municipally owned and controlled buildings and facilities to electric by 2045 through expansion of the City’s Energy Efficiency Reinvestment Program. This includes auditing remaining City facilities, establishing a retrofit project pipeline of fundable projects prioritized based on opportunities to reduce energy costs and eliminate natural gas, developing a phase-out plan for each piece of natural gas equipment, and creating an internal revolving loan fund for City facility retrofits.	3,065 MT CO ₂ e (2030) 6,130 MT CO ₂ e (2045)
MM-1.3	SolarShares - Maintain participation in SolarShares for off-site solar photovoltaics to offset at least 35% of municipal power in 2030.	3 (2030)
Supportive Measures		
MM-1.4	Streetlights – Retrofit all post-top streetlights to LED and remaining streetlights as feasible by 2030.	Supportive
MM-1.5	Municipal Green Building Policy – Develop a Municipal Green Building Policy to include all-electric retrofits at time of replacement for major retrofits or building replacements, when feasible.	Supportive
MM-1.6	Generator Phase-out – Evaluate the feasibility of phasing out diesel generators by 2033, by replacing them with solar and storage to provide backup power for buildings. Utilize renewable diesel requirements for existing generators in the short-term if needed.	Supportive
MM-1.7	Solar – Expand on-site production of renewable power and develop energy storage technologies for critical operations.	Supportive

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MM-1.8	Battery Storage Pilot Project: Identify a site and construct a battery storage pilot project as well as encourage pairing battery storage systems with all solar PV system installation.	Supportive
MM-1.9	Microgrid Pilot Project - Identify a site and construct a microgrid pilot project preferably for a critical facility like a fire station.	Supportive
MM-1.10	Energy Management – Install and utilize energy management software in existing and new buildings in order to allow for building monitoring, responsive repairs, and assessment of long-term energy trends. Provide trainings on software to facilities management.	Supportive
MM-1.11	Electrification Study – Conduct an electrification study to identify sources of natural gas and diesel which can be eliminated/switched at time of replacement.	Supportive
MM-1.12	Additional Resources – Identify additional resources (money and staffing) to assist with implementation of Municipal Measure 1.	Supportive

MM-1 Quantification

In order for the City to contribute its part in reaching carbon neutrality on a community-wide level, the majority of the City’s building stock will need to be carbon neutral. Electrification allows buildings to use the 100% carbon neutral electricity that will be provided by SMUD by 2030. This measure ensures (1) that new buildings will be built 100% electric so that they won’t need to be retrofitted later, (2) that old buildings will be retrofitted on as fast a timeline as possible, and (3) decreases building emissions to the extent feasible while they are not electric. The municipal forecast also included expected efficiencies through 2045 due to Title 24 and SB 100. Actions 1.1 and 1.2 are quantified together. Supportive Actions 1.4 through 1.12 are not directly quantifiable but will help the City achieve the overall measure.

Evidence for Actions 1.1 and 1.2: These two measures ensure electrification of the municipal building stock. By 2030, electricity will be carbon neutral (i.e., 0 MT CO₂e per kWh) and 100% electrification of the building stock would result in 100% reduction in building emissions from natural gas. In addition to the electrification efforts, retrofits to increase energy efficiency in municipal buildings is well underway, and the City aims to reduce electricity use in buildings 25% by 2030. Between 2016 and 2019, the City has decreased electricity.

Table 2 Quantification Results for MM-1.1 and MM-1.2

Actions 1.1 and 1.2	2030	2045
Natural Gas Saved (therms)	450,394	900,788
MT CO ₂ e/therm	0.00681	0.00681
Emissions reductions (MT CO ₂ e)	3,067	6,130
Emissions from electricity conversion	0	0
Electricity saved from retrofits (kWh)	10,102,420	10,102,420
Net MT CO ₂ e Savings	3,068	6,130

Evidence for Action 1.3: The City of Sacramento participates in the SolarShares program, which has offset 28,979,195 kWh since 2016 (about 35% of electricity usage year-to-year). By continuing to participate in the program, the City expects to continue offsetting approximately 35% of electricity usage each year, resulting in savings through 2030, until electricity is carbon-neutral.

Table 3 Quantification Results for MM-1.3

Action 1.3	2030	2045
Electricity Offset (kWh)	10,607,541	0
Net MT CO ₂ e Savings	3 ¹	0

¹ Emissions reductions are small due to SMUD electricity reaching carbon neutrality by 2030 as part of the SMUD 2030 Plan. The reductions are therefore attributed only to the PG&E electricity which is a small portion of overall City consumption and will also be much lower emissions by 2030.

<p>Measure MM-2: Electrify or decarbonize 100% of light-duty fleet vehicles by 2035 and 100% of municipal fleet by 2045</p>	<p>2030 Target 9,246 MT CO₂e</p> <p>2045 Target 23,009 MT CO₂e</p>
<p>Performance Metrics:</p> <ul style="list-style-type: none"> 74% of light-duty fleet vehicles are EVs by 2030 100% of light-duty fleet vehicles are EVs by 2035 100% of municipal fleet is EV by 2045 	

Action #	Action	Anticipated Reduction
Quantitative Actions		
MM-2.1	ZEV First – Continue to implement the City’s adopted “Zero-emission Vehicle First” policy that directs City departments to purchase ZEVs and develop a plan to convert 100% of all light-duty vehicles in the City’s fleet to ZEVs by 2035 while forging partnerships with manufacturers to pilot medium and heavy-duty ZEVs.	9,181 MT CO ₂ e (2030) 23,009 MT CO ₂ e (2045)
MM-2.2	Renewable Diesel and Alternatives – Continue to use renewable diesel in all diesel fleet vehicles.	65 MT CO ₂ e (2030)
Supportive Actions		
MM-2.3	EV Chargers – Install EV charging infrastructure across City-owned facilities for motor pool vehicles and personal vehicle fueling	Supportive
MM-2.4	Hybrid Phase-in – Replace all expiring mid-size vehicles and trucks with hybrid models if no all-electric alternative is available.	Supportive
MM-2.5	Anti-idling Policy – Expand and enforce existing anti-idling policies on all City vehicles	Supportive

MM-2 Quantification

Electrifying the vehicle fleet will reduce the City’s dependence on fossil fuels and enable emissions from vehicles replaced by EVs to go to zero in 2045, due to SB 100 making electricity carbon neutral in 2045. The City of Sacramento will electrify the vehicle fleet in a phased approach that starts with light-duty vehicles and will include medium and heavy-duty vehicles as the technology becomes available. Currently, the City’s fleet of 2,433 units is comprised of 2,179 on-road vehicles and 254 off-road vehicles. A total of 1,632 units (roughly 67% of the fleet) are less than 10 years old, while the remained of the fleet, numbering 801 units (15% of the fleet) is more than 15 years old and

could be replaced with EVs prior to 2025. Actions 2.1 and 2.2 are quantified below. Actions 2.3 through 2.5 are not directly quantifiable but will help the City to achieve the overall measure.

Evidence for Action 2.1: This measure ensures electrification of light-duty vehicles that are expected to use about 1.4 million gallons of gasoline in 2030, the equivalent of 12,459 MT CO₂e. By 2040, the City's vehicle fleet is projected to produce approximately 23,009 MT CO₂e. The conversion of light-duty vehicles to all-electric by 2030 will replace the projected gasoline usage with electricity usage, with a much lower emissions factor than gasoline. By 2045, the emissions factor for electricity will be 0 MT CO₂e/kWh, making all electric vehicles carbon neutral, saving all vehicle fleet emissions otherwise projected.

Table 4 Quantification Results for MM-2.1

Action 2.1	2030	2045
Gallons of gasoline saved	1,411,409	1,645,782
MT CO ₂ e/gallon	0.00883	0.00883
Emissions Reductions (MT CO ₂ e)	12,459	14,528
Emissions from other fuels saved	0	8480
Emissions from electricity conversion	0	0
Net MT CO ₂ e Savings	9,181	23,009

Evidence for Action 2.2: This measure replaces the vehicle fleet's diesel usage in 2030 and 2045 with renewable or biodiesel, reducing associated GHG emissions to zero.

Table 5 Quantification Results for MM-2.2

Action 2.2	2030	2045
Emissions from diesel usage in fleet in 2030 - after Action 2.1 (MT CO ₂ e)	73	0
Diesel usage by fleet in 2030 (gallons)	6,365	0
Renewable diesel emission factor (MT CO ₂ e/gallon)	0.001	0.001
Net MT CO ₂ e Savings	65	0

Measure MM-3

Reduce emissions from work-related trips by City employees

2030 Target

Supportive

2045 Target

Supportive

Performance Metrics:

- Number of actions/programs completed or in place.
- Annual survey of City employees on work-related trips and telecommuting.

Action #	Action	Anticipated Reduction
MM-3.1	Teleconferencing and Telecommuting – Promote video conferencing and telecommuting in place of in person meetings or working in the office when possible	Supportive
MM-3.2	Vehicle Trips – Reduce vehicle trips for City business by encouraging active transportation modes, transit, and carpooling. Award points or have a program to encourage staff to take active and transit modes. Have a prize drawing quarterly to further incentivize adoption.	Supportive
MM-3.3	Bikepools – Expand incorporation of bicycles (including electric bicycles) into City motor pool fleet for employees to use for work-related business.	Supportive

MM-3 Background

One way the City will reduce VMT and overall emissions in the transportation sector, for its employees during the workday will include reducing emissions from trips between City facilities. The City plans to do this by providing alternatives if driving is avoidable (such as telecommuting and teleconferencing) and making an electric car share program available when driving is unavoidable. The mechanism through which the City plans to avoid unnecessary trips is through incentive programs for employees and by institutionalizing work-from-home as a default option for many employees.

Measure MM-4

Reduce municipal waste sent to landfills

2030 Target

Supportive

2045 Target

Supportive

Performance Metrics:

- No waste sent to landfill from municipal buildings in 2045

Action #	Action	Anticipated Reduction
MM-4.1	Develop a set of internal policies for city facilities and departments to increase diversion of solid waste from city operations away from landfills.	Supportive
MM-4.2	Compost and Recycling for Buildings - Ensure organics recycling collection services are available in all owned facilities, as well as ensure its availability in all future occupied facilities, by 2023.	Supportive
MM-4.3	Employee Outreach – Run online and in person outreach and educational events that encourage waste diversion among City employees, including the creation of a training around compost and recycling in City Facilities to be taken by all new hires during their onboarding process.	Supportive
MM-4.4	Centralization - End deskside collection of garbage by custodial, and switch instead to combined organics, recycling and garbage stations.	Supportive
MM-4.5	Update the City's Sustainable Purchasing Policy which mandates procurement of items which have substantial quantities of recycled or reused content and are recyclable, reusable or compostable themselves.	Supportive
MM-4.6	Develop and implement a plan for procuring compost, mulch, and renewable natural gas in alignment with SB 1383 requirements and using these materials for City facilities and operations, community benefit, and/or carbon sequestration.	Supportive

MM-4 Background

While this measure is not directly quantified (and not included in the GHG inventory), the City plans to take multiple steps to drastically reduce its waste output. The City will lead community-wide efforts to reduce and divert organic waste through new programs, and employee education. Action

4.1 directs the city to conduct a waste reduction plan and audit, establishing a baseline for future actions.

The City's control over supplies and services such solid waste collection and janitorial services is largely decentralized. For example, nearly all City facilities contract for their own solid waste services through Waste Management Inc. under an Agreement administered by the Procurement Division. Implementation of MM-4 will require involvement of an array of groups and service providers, from the Facilities Division of Public Works to the Procurement Division of Finance, to align solid waste collection and janitorial services with MM-4 and supporting actions. City will need to develop a set of policies and a strategies to engage and work across multiple departments, divisions, and services providers to divert solid waste from the City's operations away from landfills.

<p>Measure MM-5 Reduce emissions from water usage/conveyance and stormwater drainage (in MT of CO₂e per MG delivered) 100% by 2030</p>	<p>2030 Target 6,093 MT CO₂e</p> <p>2045 Target 0 MT CO₂e</p>
<p>Performance Metrics:</p> <ul style="list-style-type: none"> Water utility emissions associated with electricity decreased 100% by 2030 	

Action #	Action	Anticipated Reduction
Quantitative Actions		
MM-5.1	Purchase 100% carbon-free electricity for water conveyance and stormwater drainage needs.	6,093 MT CO ₂ e (2030) 0 MT CO ₂ e (2045)
Supportive Actions		
MM-5.2	Investigate deployment of on-site solar and storage projects to increase resiliency of critical water and stormwater infrastructure.	Supportive
MM-5.3	Continue to implement and track low water use landscapes (native and drought tolerant plants) for new park development per YPCE Strategic Plan Policy 2.5d and e, and the Model Water Efficiency Landscape Ordinance.	Supportive
MM-5.4	Evaluate the feasibility of converting sports fields to synthetic turf and add new synthetic fields where possible.	Supportive
MM-5.5	Continue to evaluate the existing watering/irrigation schedule and determine what water reduction strategies can be implemented per YPCE Strategic Plan Policy 2.5d and e. Examples include reducing the number of watering days and watering in the evening to reduce evapotranspiration.	Supportive
MM-5.6	Optimize the efficiency of irrigation control systems by training staff how to correctly use them. YPCE will inventory EPA WaterSense certified Smart Irrigation Controllers and host trainings to ensure that the appropriate staff learn how to operate each controller to improve the management, use, reporting, and data analysis of the irrigation control systems.	Supportive

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MM-5.7	Continue to report for the Model Water Efficient Landscape Ordinance each year. YPCE will work with the Community Development Department and the Department of Utilities to submit the Model Water Efficient Landscape Ordinance Implementation Annual Report every January.	Supportive
MM-5.8	Continue investigation of energy efficiency improvements of water utility operations and systems and continue to improve the energy efficiency of utility pumps and water treatment plants.	Supportive
MM-5.9	Water Conservation Inspections for City Facilities: Include landscape irrigation inspections in water conservation inspection and provide educational materials/media for building maintenance staff on how maintain landscape irrigation and track and set leak alerts for buildings.	Supportive

MM-5 Quantification

Emissions from utilities are directly attributable to the electricity, natural gas and diesel used for water and wastewater conveyance and stormwater drainage, with the majority of those emissions from electricity use. By 2045, electricity in California is required to be carbon neutral, with an emissions factor of 0, due to SB 100. However, prior to 2045, there is opportunity for the City to utilize electricity that is carbon neutral or lower carbon than what is offered by the current electricity providers within the City. Because water and wastewater conveyance and stormwater drainage are necessary services that the City will continue to provide through 2045 and beyond, the only way to reduce emissions in this sector is to reduce the emissions factor for the electricity used, by adding more renewable resources—through purchase or direct construction—to the grid mix. In 2017, water management accounted for almost 20% of overall emissions, and is therefore a key emissions sector to address.

Evidence for Action 5.1: The overall measure aims to achieve a 100% carbon free electricity by 2030, and to become carbon neutral by 2045. Emissions from utilities are expected to be approximately 6,000 MT CO₂e in 2030 and, due to electricity being carbon neutral in 2045, 0 MT CO₂e in 2045.

Table 6 Quantification Results for MM-5.1

Action 5.1	2030	2045
Emissions from water utilities	6,093	0
Emission Reduction	100%	100%
Total MT CO ₂ e Savings	6,093	0

<p><i>Measure MM-6</i></p> <p>Improve carbon sequestration potential of municipal parks, greenspace at City properties, and street tree planters in the public right-of-way</p>	<p>2030 Target Supportive</p> <p>2045 Target Supportive</p>
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Action #	Action	Anticipated Reduction
MM-6.1	Evaluate existing park turf areas for conversion to low water use landscapes using non-irrigated, drought tolerant, or mulched landscaping.	Supportive
MM-6.2	For passive recreation areas, continue to reduce landscape water usage with low-water use plants, compost, and landscape design that emphasizes drought tolerant plants and mulch areas.	Supportive
MM-6.3	Investigate and explore options for carbon sequestration at City facilities such as through carbon sequestration in materials for construction and hardscapes or soil health restoration projects.	Supportive

MM-6 Background

Measure MM-6 focuses on carbon sequestration in municipal greenspaces as a long-term strategy for reducing municipal GHG emissions. Trees, plants, and other green materials have natural carbon sequestration capabilities. The City manages many open and green spaces around Sacramento, including street trees, parks, and other landscaped areas. Managing these spaces for higher carbon sequestration potential includes integrating low-water use landscapes. The City also plans to explore ways to utilize building materials which have been created through a process that stores carbon in the material.

Measure MM-7 Procure carbon-free electricity by 2030	2030 Target <i>8,198 MT CO₂e</i> 2045 Target <i>0 MT CO₂e</i>
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Action #	Action	Anticipated Reduction
MM-7.1	Procure carbon-free electricity for municipal operations by 2030.	8,198 MT CO ₂ e (2030) 0 MT CO ₂ e (2045)

MM-7 Quantification

MM-7 Aligns with SMUDs 2030 Zero Carbon Plan which will provide the City with 100% carbon free electricity by 2030. While there are no specific municipal measures listed, the City will support SMUD in the implementation of the 2030 Zero Carbon Plan as highlighted in the community actions.

Table 7 Quantification Results for MM-7.1

Measure MM-7.1	2030	2045
Emissions from Electricity	8,198	0
Total MT CO₂e Savings	8,198	0

<p>Measure MM-8</p> <p>Reduce City employee commuter VMT</p>	<p>2030 Target Supportive</p> <p>2045 Target Supportive</p>
<p>Performance Metrics:</p> <ul style="list-style-type: none"> Employee VMT reduced 20% by 2030 Employee VMT reduced 30% by 2045 	

Action #	Action	Anticipated Reduction
MM-8.1	Establish a Transportation Demand Management program for City employees	Supportive
MM-8.2	Survey City staff to determine baseline commute data. Conduct a new survey every 2 years.	Supportive
MM-8.3	Conduct internal outreach to educate staff on available incentives and solicit feedback on which options work best and how to improve incentives/reduce hurdles to implementation.	Supportive
MM-8.4	Paid Time Off Rewards Program – Implement a sustainable commute rewards program rewarding employees with time off for using alternative modes of transportation.	Supportive
MM-8.5	Pre-Tax Commuter Benefit – Continue providing pre-tax commuter benefits for transit commuters and encourage use of commuter benefits for bicycle commuters as allowed by federal law.	Supportive
MM-8.6	Parking Cash-out – Engage with labor partners to explore alternatives to traditional employee commute provisions such as City-provided parking and parking stipends, and instead incentivize carpooling, public transit, and active transportation.	Supportive
MM-8.7	Dynamic Ridematch – Promote the regional carpool matching platform that allows employees to request carpool with peers on days and times when they are needed.	Supportive
MM-8.8	Remote work – Promote and support working remotely for employees where possible by encouraging it for office employees as appropriate, by providing necessary equipment, training, and encouraging all meetings (when possible) to be set up for web conferencing so that people who aren’t physically in the room can attend. Allow for hybrid work-from-home schedules to increase flexibility for employees.	Supportive

MM-8 Background

The actions in Measure MM-8 have not been quantified but are key strategies in reducing VMT at the municipal level within Sacramento, as well as helping to reduce overall VMT within the community. As VMT is a large share of the municipal and community emissions, reducing VMT will result in important emissions reductions. While the City cannot require employees to choose alternate commuting methods, these actions will help provide options and incentives to City employees to choose transportation modes other than single-passenger vehicles to commute to work, thereby creating the opportunity for employees to actively reduce their own VMT.

<p>Measure MM-9</p> <p>Encourage an increase in the number of employee-owned EV and plug-in hybrid electric vehicles 28% by 2030 and 100% by 2045</p> <p>Performance Metrics:</p> <ul style="list-style-type: none"> • 28% of employee-owned vehicles are EV/plug-in hybrid by 2030 • 100% of employee-owned vehicles are EV/plug-in hybrid by 2030 	<p>2030 Target <i>Supportive</i></p> <p>2045 Target <i>Supportive</i></p>
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Action #	Action	Anticipated Reduction
MM-9.1	EV Chargers – Implement the 2017 EV Strategy directive to meet or exceed CALGreen Tier 2 standards for EV chargers, and transition existing facilities to provide EV charging capacity as feasible.	Supportive
MM-9.2	Commuting Surveys – Conduct a survey of City Staff to determine how staff commute to work, what kinds of vehicles they own, and what hurdles they face in purchasing EVs. Conduct a new survey every 2 years.	Supportive
MM-9.3	EV Rebates – Provide information to all City staff about local, State, and federal rebates annually. Include lifecycle and maintenance cost information of EV ownership.	Supportive

MM-9 Background

The actions in Measure MM-9 have not been quantified but are key strategies in decarbonizing the work commutes of Sacramento City employees. While the City does not currently track employee commute distances and methods in order to determine associated GHG emissions, these actions will help the City start to track these metrics, as well as incentivize employees to choose EVs or plug-in vehicles where feasible. The EV adoption goals associated with this measure track with the communitywide EV adoption goals of the CAAP.





City of Sacramento Climate Action and Adaptation Plan

Appendix G - Climate Change Vulnerability Assessment

PUBLIC REVIEW DRAFT

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Executive Summary

This Vulnerability Assessment provides a foundation for the City's policies and actions to adapt to climate change impacts, by assessing the key climate change impacts that are likely to affect Sacramento, including those that have potential to put residents and critical infrastructure at risk. The City's ability to build adaptive capacity to respond to climate change requires an understanding of the ways in which climate change impacts will be felt in Sacramento. This report details those findings, which are summarized below.

CLIMATE CHANGE EFFECTS

The primary climate change impacts that are expected for Sacramento include increases in average temperature and changes in precipitation patterns such as reduced snow pack, increases in extreme weather such as heat waves and extreme precipitation events, and air quality impacts from increased wildfires.

- **Temperature.** Temperatures are projected to increase by about five to six degrees Fahrenheit (°F) throughout Sacramento by mid-century (2035-2064). Under these conditions, Sacramento could experience hotter and significantly drier conditions. The effects of temperature increase are likely to be felt throughout Sacramento, especially in more densely developed areas with relatively less green space and tree canopy. Overall temperature increase can also lead to an increase in the number of extreme heat days and heat waves, the intensification of the urban heat island effect, heat-related illnesses such as heat stroke and exhaustion, reduced air quality, and stress to infrastructure.
- **Increased Variability, Extreme Weather and Changes in Precipitation.** Annual precipitation is expected to increase in the Sacramento region. Sacramento has historically experienced about 18.9 inches of precipitation per year, which could increase to about 27.8 inches per year at the end of the century. This increase, however, will not occur at a uniform rate throughout the year. Rainfall will become more concentrated in the winter months and occur in fewer, higher-intensity events. These storms may produce higher volumes of runoff, contribute to increased flood risk, damage infrastructure, increase burden on the City's internal drainage system, and threaten the stability of levees. In addition, warmer temperatures will cause more precipitation to fall primarily as rain rather than snow, leading to less winter snowpack. This is especially true for the Northern Sierras, which are a primary water source for the Sacramento Valley region and are expected to have almost no annual snowpack by the end of the century.¹ Meanwhile, the spring and summer

¹ Benjamin Houlton and Jay Lund, California's Fourth Climate Change Assessment - Sacramento Summary Report (University of California, Davis: 2018), Publication number: SUM-CCCA4-2018-002,

months are expected to see reductions in rainfall, and lesser volumes of snowpack will melt earlier in the year – which could lead to flooding, increased challenges in operating water storage facilities, drought, increased wildfire risk, changes in streamflow, vulnerability to local habitats, and strain to health, energy, and infrastructure systems.

- **Air Quality Impacts from Wildfires.** Wildfire risk and intensity will continue to increase as further development occurs along urban-wildland interface accompanied by shifts in forest management, and invasive species such as bark beetles. While wildfire is unlikely within the City limits, Sacramento will be impacted by wildfires occurring throughout the region via impacts on air and water quality; damage to energy infrastructure and roads; and strain on local firefighting resources as the fire department is called to respond to fires across the region and state.
- **Flood Risk and Sea Level Rise.** While Sacramento is not a coastal city, the Sacramento and American Rivers drain into the Sacramento-San Joaquin Delta, which in turn drains into the San Francisco Bay and the Pacific Ocean. As such, sea level rise may exacerbate flood risk in Sacramento by raising river levels during major storm events. Sea level rise is expected to increase saltwater intrusion in the Sacramento-San Joaquin Delta, impacting freshwater quality and the wellbeing of aquatic species. However, the risk that saltwater intrusion could reach the City’s surface water intakes is low.

VULNERABILITY

Climate change impacts will affect key community features and services provided by the City of Sacramento. These key features include critical infrastructure and facilities, the damage or disruption of which may interfere with the operation of key transportation, power, communication, health, and safety systems, or expose residents to significant health and safety risks. Many critical facilities, infrastructure, and services are at risk of flooding hazards, including industrial facilities, public safety facilities, and transportation facilities shown in Maps 25, 26, 27, and 28. While areas with a higher probability of annual flooding may be unsuitable locations for existing critical facilities and may require relocations in the future, facilities in areas with lower probabilities of annual flooding may be good candidates for green infrastructure interventions to mitigate the extent and duration of flood impacts.

In addition, the health and economic impacts of climate change are not experienced equally, or in the same way, by all members of the population. Climate change effects manifest on top of a dynamic and complex socio-cultural landscape in which various groups already experience different levels of access to economic, health, and political resources. Historically, many of these resources have been out of reach to the socially marginalized. Thus, the inequitable impacts of climate change produce unique individual and community levels of exposure, degrees of sensitivity, and adaptive capacities to climate change hazards. One important element of understanding and addressing climate change vulnerability is understanding how and why this vulnerability is disproportionately distributed among different subsets of the population.

https://www.energy.ca.gov/sites/default/files/2019-11/Reg_Report-SUM-CCCA4-2018-002_SacramentoValley_ADA.pdf.

It is important to understand where vulnerable populations are prevalent in Sacramento in order to provide targeted services and infrastructure that improves responses to climate-related hazards and thus increases climate resilience and equity within the city. Populations that are particularly vulnerable to climate change include children, older adults, individuals with disabilities, low-income individuals and households, outdoor and seasonal workers, households in substandard housing, cost-burdened households, renters, homeless individuals, linguistically isolated individuals, and communities of color. Identifying where concentrations of such populations overlap with areas of high risk can help prioritize future public investments that bolster the City's adaptive capacity.

ADAPTIVE CAPACITY

Climate change adaptation is the process of adjusting to current or anticipated effects of climate change, in order to reduce harm and improve livability. Adaptive capacity can be improved in a variety of ways, including emergency response and hazard response services, the collection and distribution of climate-relevant information, and strategic infrastructure investments and maintenance. Prioritizing adaptation actions is a multi-step process that involves identifying which climate impacts are most likely to impact Sacramento, when these impacts will be felt, how severe these impacts will be, and which City services and communities are most likely to be affected. Ideally, the most pressing climate change impacts should be given priority when considering adaptation, with special consideration given to areas with the most vulnerable populations.

In addition to the existing climate change readiness landscape in California and the Sacramento region, the City of Sacramento has already taken preliminary steps to establish adaptive capacity in response to the climate risks that affect the city. This includes plans, programs, and services that are continually updated and maintained to respond to environmental and community changes, as well as ongoing projects to mitigate known hazards. The synergies between these efforts such as Local Hazard Mitigation Plans and the General Plan Safety Element help bolster the City's adaptive capacity. This Vulnerability Assessment builds on those plans and identifies additional actions that can be taken to more specifically address the climate change vulnerabilities identified in this document as well as leverage other opportunities to efficiently and effectively build resilience in Sacramento's communities.

1 Introduction

From flooding to drought, extreme heat, and wildfires, the Sacramento region has a long history of confronting natural hazards. Understanding how climate change might exacerbate the region's risks and vulnerabilities to extreme weather is fundamental to formulate strategic priorities to enhance public health, resilience, and sustainability. The purpose of this Climate Change Vulnerability Assessment is to assist the City and its residents in planning for the future by identifying the climatic changes that are likely to influence life and wellbeing in Sacramento over the next several decades, especially for the populations and community services that these changes are most likely to affect. This document was prepared in parallel with the City's 2040 General Plan Update to comply with California Senate Bill 379 (Stats. 2015, codified at Government Code section 65302(g)), which requires all cities and counties in California to address climate adaptation and resiliency in their General Plans, and is part of the City's Climate Action and Adaptation Plan (CAAP).

A climate change vulnerability assessment is a document that identifies and summarizes the risks that climate change poses to a local area, highlighting specific locations and communities that are most likely to be severely impacted by climate change. This Vulnerability Assessment synthesizes climate change projections created by Cal-Adapt (a statewide climate change assessment tool, further discussed in Section 2.1: Broad Changes in the Climate System), historical data pertaining to natural events and hazards, and sociodemographic information collected by the United States Census Bureau to determine which climate impacts are most likely to affect the City of Sacramento, where these impacts may manifest, who will be affected, and how severely. The assessment considers existing and planned development in identified at-risk areas, including structures, roads, utilities, and essential public facilities. The assessment identifies the federal, state, regional, and local agencies with responsibility for the provision of public health, safety, transportation, and environmental services, including special districts and local offices of emergency services.

- **Chapter 1** of this document provides context for this document and introduces the concept of climate vulnerability.
- **Chapter 2** outlines key climate change impacts that are likely to affect the Sacramento region such as temperature increase, increased flood risk and drought based on changes in precipitation patterns, air quality impacts from wildfire, and possible late-century flooding related to sea level rise. This chapter discusses the origin of these impacts, their projected severity, permanence, and rate of increase, as well as key secondary disruptions to the climate, weather, the environment, infrastructure, and health and safety that may result.
- **Chapter 3** identifies vulnerable areas and populations at risk to climate change hazard events. Critical facilities and infrastructures potentially at risk to climate hazards are also identified.
- **Chapter 4** describes actions currently being taken within the state and Sacramento region to address climate change and identifies existing federal, state, regional, and local agencies implementing adaptation and mitigation strategies. This includes an assessment of the capacity of public agencies and the community to adapt and respond to climate hazards.
- **Chapter 5** provides a risk assessment and identifies potential gaps in existing adaptation strategies and recommendations for future improvements.

1.1 What is Climate Vulnerability?

Climate change vulnerability refers to the extent to which individuals, communities, or infrastructure are exposed to, susceptible to, and/or unable to cope with or adapt to the effects of climate change, including climate variability and extremes.² Climate change vulnerability emerges across time and space from the interaction of several related components of both the climate system and surrounding social, physical, and political environment. These components include exposure, sensitivity, and adaptive capacity.³

Exposure describes whether and to what degree a community or individual will experience a stress or hazard due to climate change.⁴ A low-lying coastal community, for example, has a higher degree of exposure to sea level rise than a community that is located in the mountains far above sea level. If sea level rise does occur in a community, the community may be more or less affected depending on such factors as the location of housing developments and roads. A community that locates major housing developments or critical healthcare or utility services within a coastal, low-lying area will be more severely affected by sea level rise than a community that preserves or restores wetlands in this location instead. This degree to which a community, system, or individual is affected by a climate change impact is referred to as its **sensitivity**.

Adaptive capacity refers to the ability to respond to climate change impacts. If a community has the ability to construct levees, flood walls or natural landscaping buffers, flood-proof homes, and educate residents and home developers about the potential risk associated with living and building in an area likely to be exposed to sea level rise, then these resources are referred to as the adaptive capacity of the community to address sea level rise. Factors influencing adaptive capacity include levels of economic resources, technological capacity, education and awareness, and equity in access and distribution of resources. All else being equal, those individuals, communities, and cities with a greater degree of adaptive capacity will suffer less harm from exposure to climate impacts and will recover more quickly from the impact.⁵

The concept of **resilience** is closely related to that of adaptive capacity. Resilience has been described as the ability of a system, community, structure, or individual to withstand and recover from distress or perturbation while maintaining its core functions or meeting the core needs of community members. Resilience involves the ability to be responsive to change while simultaneously preserving core structure and function.⁶ Citywide resilience-building features can take many forms, including strong and supportive social ties within a community, redundancies in key infrastructural systems that prevent service interruptions, and responsive governance. Climate resilience is a specific subtype of resilience that deals with the ability to anticipate, prepare for, and

² Cal-Adapt, “Frequently Asked Questions,” 2018. Accessed October 29, 2019: <https://cal-adapt.org/help/faqs/>.

³ Thomas, K., Hardy RD., Lazrus H., Mendez M., Orlove B., Rivera-Collazo, I., Roberts JT., Rockman M., Warner BP., Winthrop R., Explaining differential vulnerability to climate change: A social science review (December 2018). Oct 29 2019: <https://onlinelibrary.wiley.com/doi/full/10.1002/wcc.565>.

⁴ Nutters, H., Addressing Social Vulnerability and Equity in Climate Change Adaptation Planning, June 2012, Oct 29 2019: http://www.adaptingtorisingtides.org/wp-content/uploads/2015/04/ART_Equity_WhitePaper.pdf.

⁵ Nutters, H., 2012.

⁶ Nutters, H., 2012.

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respond to hazardous events, trends, or disturbances related to climate change. This assessment is designed to improve the City's understanding of climate-related risks as a first step to enhancing Sacramento's climate resilience.

Exposure is often an inherent feature of the climate system—the underlying probability that a given climate change impact will occur in a particular location. Knowing a community's changing exposure level is a critical piece of understanding vulnerability and thus of making well-informed growth and development decisions that minimize long-term risk. Exposure, however, is not something that a community will likely be able to significantly change on its own. In contrast, making well-informed development and investment decisions can help a community improve its sensitivity and adaptive capacity.

Measures of a community's sensitivity and adaptive capacity can also be highly subjective. Different members of the community will see different community features as being worthy of protection, will be affected by climate change impacts in different ways or to different degrees, and will see relatively more or fewer benefits from a given adaptive capacity-building strategy. For that reason, it is important to take stock of a variety of voices and experiences throughout the vulnerability assessment process, highlighting Sacramento's rich diversity both in terms of how different groups of people may experience climate change differently and in terms of the wide range of response and resilience strategies that different communities are able to employ.

Likewise, it is important to remember that vulnerability is not an inherent and unchallengeable characteristic of an individual, community, or city. Vulnerability emerges from a dynamic and interacting web of physical, environmental, and social factors such as environmental exposure, infrastructural integrity, and historical and present-day decisions regarding development patterns, allocation of key resources, and distribution of political power.⁷ It is the cumulative unequal distribution of exposure, sensitivity, and adaptive capacity that creates an unequal distribution of climate change vulnerability, and this distribution often reflects patterns of structural inequality present in society. Climate change is likely to amplify pre-existing disparities in health and wealth on the global, regional, and municipal scales. This makes the work of analyzing and responding to vulnerability all the more urgent. If created early and leveraged often, information about the distribution of climate change vulnerability within a community can be used to promote more equitable social and health outcomes.

⁷Thomas, K., et. al, 2018.

2 Climate Change Effects

This chapter provides an overview of how climate change impacts are likely to manifest in the City of Sacramento. It begins with a brief discussion of the nature of climate modeling, then discusses the nature of the effects that temperature increase, change in precipitation, wildfire, and sea level rise are predicted to have on the city.

2.1 Broad Changes in the Climate System

Climate change represents more than a mere short-term extreme weather event, but rather a long-term, large-scale shift in the entire climate system. Everything in the climate system is connected. This means that climate change manifests not only in discrete, observable weather events, but a host of other climatic and geophysical states and processes such as air quality, erosion rates, water quality, soil composition, and growing seasons. Each of these secondary climate change impacts manifest at different rates, in different ways, and may have more severe impacts on some community members than others.

The primary climate change impacts that are expected to be experienced in California include:

- Increased wildfire frequency and intensity
- Shifts in the water cycle
- Increases in average temperature and number of extreme heat days
- Sea level rise and flooding

Some climate change impacts are more frequent, such as heat, drought, and smoke from wildfires, and others may be more episodic, such as extreme storms and major floods. Between 2000 and 2022, the average maximum temperature in Sacramento was about 75.0°F, with maximum temperatures during summer months (May to September) averaging a maximum of about 88.6°F.⁸ Average temperatures from baseline levels (1961-1990) are expected to increase by between 5.4 and 9.7°F by the end of this century,⁹ while the average annual number of extreme heat days (when the maximum temperature is above 103.8°F¹⁰) is projected to increase by between 19 and 48 days per

⁸ National Oceanic and Atmospheric Administration National Centers for Environmental information, Climate at a Glance: City Time Series, published January 2023, retrieved on January 11, 2023 from <https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/city/time-series>.

⁹ Cal-Adapt, Annual Average Maximum Temperature for Sacramento, California [Place (Incorporated and Census Designated, 2015)], RCP 4.5 and RCP 8.5, Global Climate Model CanESM2, 2018. [Cal-Adapt website developed by University of California at Berkeley's Geospatial Innovation Facility under contract with the California Energy Commission.] Retrieved January 11, 2023: <https://cal-adapt.org/tools/extreme-heat/>.

¹⁰ This threshold is determined as the 98th percentile maximum daily temperature over a historical baseline period of April to October from 1961 to 1990. This value is used to better account for the local ecosystem.

year.¹¹ These temperature increases will be accompanied by intense heat waves, a reduction in the number of cool nights, and decreased air quality. These changes pose health risks – especially for those unable to seek shelter from heat and those whose physiology makes it difficult to regulate body temperature. Changes in temperature regimes will also impact regional snowmelt and wildfire patterns and increase warm season electrical load.

From 1972 through 2018, California experienced a fivefold increase in annual burned area, due to more than an eightfold increase in summer forest-fire extent.¹² Annual frequency and intensity of wildfires are expected to continue to increase, often exacerbated by hotter temperatures. Statewide, total annual hectares burned by wildfire is projected to almost double by the end of the century. Changes in wildfire regimes can give rise to a host of secondary social and environmental consequences, including changes in forest composition, impacts to transmission lines, safety threats to those living in high-exposure areas, and reductions in air quality due to the presence of smoke. Health problems related to wildfire smoke exposure can be as mild as eye and respiratory tract irritation and as serious as worsening of heart and lung disease, including asthma, and even premature death.

Mediterranean climates such as California are characterized by warm, wet winters and hot, dry summers. In addition to annual swings in precipitation, historical and paleoclimatic evidence points to California as a land of hydrological extremes, including mega-droughts and episodic but infrequent extreme storm sequences giving rise to great mega-floods.

Using data from the Community Earth System Model Large Ensemble, scientists found that climate change has already doubled the likelihood of an extreme storm event capable of producing catastrophic flooding, and that larger future increases are likely due to continued warming. Furthermore, they found that runoff in the future extreme storm scenario may be 200 to 400 percent greater than historical values in the Sierra Nevada because of increased precipitation rates and decreased snow fraction. In addition, between 2012 and 2021, California experienced two historically severe droughts, one of which may have been the most intense in the past millennium.¹³

As global temperatures continue to rise, precipitation patterns in California are expected to continue to change, which has direct implications for flood and emergency management as well as water supply management.

The Northern Sierras, which are a primary water source for the Sacramento Valley, are expected to have virtually no annual snowpack by the end of the century.¹⁴ Unless mitigated, reduced winter snowpack will negatively impact local water availability, particularly during drought periods, because less snow means less water is temporarily stored in the form of snow and metered into

¹¹ Cal-Adapt, Number of Extreme Heat Days per Year for Sacramento, California [Place (Incorporated and Census Designated, 2015)], RCP 4.5 and RCP 8.5, Global Climate Model CanESM2, 2018. [Cal-Adapt website developed by University of California at Berkeley's Geospatial Innovation Facility under contract with the California Energy Commission.] Retrieved January 11, 2023: <https://cal-adapt.org/tools/extreme-heat/>.

¹² Williams, A. P., Abatzoglou, J. T., Gershunov, A., et al. 2019. Observed impacts of anthropogenic climate change on wildfire in California. *Earth's Future*, 7, 892– 910. <https://doi.org/10.1029/2019EF001210>.

¹³ [Climate Change is Increasing the Risk of a California Megaflood](#), *Science Advances*, Vol. 8, No. 32.

¹⁴ Houlton and Lund, 2018.

water reservoirs as snow melts. Additionally, smaller bodies of snowpack will have less resistances to changes in temperature, leading to greater and more concentrated volumes of surface runoff. Water storage capacities will need to account for this pattern of runoff by releasing reservoirs for flood control, potentially leaving less water supply in the summer. Further, intermittent, intense episodes of rain may become the norm, which will strain local stormwater management systems, increase flood risk, and exacerbate erosion. Warmer water also negatively affects water treatment and the ecosystem. Temperature management in the Lower American River often drives operational decisions in storage reservoirs to protect aquatic species.

Sea level rise can expose coastal areas to inundation and flooding, impact water quality, and increase rates of coastal erosion. Since Sacramento is not a coastal community, it is not as vulnerable to the direct impacts of sea level rise as some other California cities. However, eventually, higher sea level will push saltwater from the ocean into the freshwater systems of the Sacramento-San Joaquin Delta.¹⁵ Sea level rise may also exacerbate flood risk in Sacramento during extreme storm events by raising river levels within the Sacramento River channel during major storm events. As saltwater pushes into river systems, it may also affect the health of freshwater aquatic ecosystems.

INTERPRETING CLIMATE CHANGE PREDICTIONS

The summaries of the extent, severity, rate of onset, and duration of the climate change impacts discussed in this document draw from climate change projections provided by Cal-Adapt. Cal-Adapt is the result of a partnership between the California Energy Commission, California Natural Resources Agency, and the Public Interest Energy Research Program, which provides an online climate data visualization tool that allows users to explore a wealth of climate data pertaining to climate change impacts in California. Cal-Adapt data contributors include the Pacific Institute, Santa Clara University, Scripps Institution of Oceanography, UC Berkeley, UC Merced, and the U.S. Geological Survey.

In order to understand the descriptions and visualizations of projected climate change impacts that appear in this document, it is important to understand the types of data provided through Cal-Adapt, its strengths, and limitations.

Cal-Adapt provides projections of different future climate scenarios. Climate projections are not definitive statements about what types of weather patterns or climate impacts are guaranteed to occur in a particular year but provide general guidance on how climatic conditions might be expected to change over time. Climate projections are the output of global climate models—sophisticated computer modeling tools that simulate how the global climate system works. Scientists can input certain assumptions about how this global climate system works, as well as different predicted patterns of greenhouse gas emissions, to obtain a prediction for climatic conditions.

Despite the sophistication of these computer programs, the complexity of the global climate system and the significant uncertainty regarding long-term greenhouse gas emissions means that the

¹⁵ California's Fourth Climate Change Assessment, Sacramento Valley Region Report, [Publication number: SUM-CCCA4-2018-002](#)

results of different climate projections can look quite different. Cal-Adapt helps demonstrate this variability in modeling results by allowing users to work with different emissions scenarios and different climate models. Each tool in Cal-Adapt shows possible outcomes for two different greenhouse gas emission scenarios: a high-emissions scenario, in which greenhouse gas emissions continue to rise over the 21st century (representative concentration pathway [RCP] 8.5), and a medium-emissions scenario, in which greenhouse gas emissions level off around the middle of the 21st century and are lower than 1990 levels by the end of the century (RCP 4.5).¹⁶ This assessment uses the high-emissions scenario as the basis for Map 6: Snowpack Mid-Century, Map 7: Snowpack End-of-Century, Map 9: Annual Average of Area Burned by Wildfires Mid-Century, Map 10: Annual Average of Area Burned by Wildfires End-of-Century, Map 13: Extreme Sea Level Rise Average Model 2040 to 2060 and FEMA Flood Zone, and Map 14: Extreme Sea Level Rise Average Model 2060 to 2080 and FEMA Flood Zone. However, results from both medium and high emissions scenarios are discussed in the text. This was done in order to help decision-makers prepare for worst case climate scenarios, while also providing an indication of the scale of future climate variability. However, it is important to keep in mind that both the medium and high emissions scenarios are based on assumptions of likely—not guaranteed—future emissions patterns; future greenhouse gas emissions may not adhere to either of these scenarios.

As a default, Cal-Adapt allows users to compare the results produced by four different climate models: CanESM2 (Average), HadGEM2-ES (Warm/Drier), CNRM-CM5 (Cooler/Wetter), and MIROC5 (Complement). These results each represent the average values from a variety of models. This document uses the CanESM2 model because it represents an average primary climate model. For additional details regarding the emissions scenarios and climate models, see Section 6: Understanding Cal-Adapt and Key Scenario Assumptions at the end of this document.

Rather than discussing only current (e.g., 2023) conditions, which would reflect a point-in-time snapshot, the best practice in climate science analyzes long-term trends. Cal-Adapt uses three 30-year ranges—historical baseline, mid-century, and end of century—to assess climatic changes over time. These time frames span 30 years to control for variability by establishing a stable average that helps ensure that climate change analysis is not skewed by singular, anomalous events that significantly differ from typical values.

The default historical baseline is defined as 1961 to 1990 and represents the period when the majority of California’s critical infrastructure was developed and when anthropogenic climate change signals were beginning to be felt. Use of the terms “historical” or “historically” in this document refers to this historical baseline period defined by Cal-Adapt unless otherwise stated. In some cases, additional data sources have been used to extend observed data to the most recent date available. For example, temperature data from the National Oceanic and Atmospheric Administration’s (NOAA’s) National Centers for Environmental Information Climate Data Online tool is used to report recent temperature trends between 2000 and 2022.

Cal-Adapt uses climate model projections for mid-century (2035 to 2064) and end of century (2070-2099) to analyze patterns of climate change in the near-term and long-term, respectively. When speaking of projections of climate conditions, mid-century and end-of-century conditions

¹⁶ Cal-Adapt, “About climate projections and models,” 2023. Accessed April 24, 2023: <https://cal-adapt.org/help/get-started/about-climate-projections-and-models/>.

are averages of the projected conditions occurring in these windows unless otherwise noted. Both of these periods are also 30-year ranges for the same reasons as the historical baseline, in addition to ensuring that the assessed values are valid comparisons. It is noted that the mid-century period most closely coincides with the projected build out date of the City of Sacramento's General Plan Update (2040).

2.2 Primary and Secondary Impacts

This work begins with an assessment of the primary and secondary climate change impacts most likely to affect the City of Sacramento. Primary and secondary impacts are identified in accordance with the California Adaptation Planning Guide: Planning for Adaptive Communities and via consultation with City of Sacramento staff, where a primary impact can be understood as a major disruption to the weather or environment that results from climate change, and a secondary impact is a shift in the weather or environment that occurs as a result of the primary impact. Primary and secondary climate impacts are organized as outlined in the Table 2-1.

Potential effects on human health and critical infrastructures are discussed under secondary impacts where appropriate. Each primary impact contains an assessment of that impact's temporal and spatial scale, as well as its level of uncertainty and estimated level of disruption to community function.

TEMPERATURE INCREASE

Climate models consistently report rising average temperatures across California.¹⁷ The average annual maximum temperature in the City of Sacramento has already increased from the historical baseline average of 74.1°F¹⁸ to about 75.0°F between 2000 and 2022.¹⁹ Average annual maximum temperatures are projected to continue increasing to between 78.9°F and 79.9°F by mid-century, and to between 79.9°F and 83.8°F by the end of the century (Figure 2-1).²⁰ Increasing average daytime temperatures are expected to be accompanied by higher nighttime temperatures. Historically, the average annual minimum temperature has been 49.3°F, but these minimums are also projected to increase to between 53.6°F and 54.8°F by mid-century and to between 54.5°F and 58.8°F by the end of the century (Figure 2-1).²¹ Overall temperature increase is associated with several secondary impacts, including increased incidence of extreme heat days, warm nights, heat waves, urban heat islands, heat-related health impacts, and heat-related damage to infrastructure (Table 2-2), as discussed below.

¹⁷ Sacramento Municipal Utility District, Climate Readiness Assessment and Action Plan, 2016.

¹⁸ Cal-Adapt, Annual Average Maximum Temperature for Sacramento, California, RCP 4.5 and RCP 8.5, Global Climate Model CanESM2, 2018.

¹⁹ National Centers for Environmental Information, Climate Data Online - Global Historical Climatology Network, accessed October 3, 2022.

²⁰ Cal-Adapt, Annual Average Maximum Temperature for Sacramento, California, RCP 4.5 and RCP 8.5, Global Climate Model CanESM2, 2018.

²¹ Cal-Adapt, Annual Average Minimum Temperature for Sacramento, California, RCP 4.5 and RCP 8.5, Global Climate Model CanESM2, 2018.

Table 2-1: Primary and Secondary Climate Change Impacts in Sacramento

<i>Impacts¹</i>	<i>Temporal Extent</i>	<i>Spatial Extent</i>	<i>Permanence</i>	<i>Level of Disruption</i>	<i>Level of Uncertainty</i>
<p>Temperature Increase</p> <ul style="list-style-type: none"> • Increased Heat waves • Increased Urban heat island effects • Warmer average temperatures 	<p>Moderate. Effects will be most extreme in July and August, but may be felt anytime between May and October</p>	<p>High. Effects will be felt throughout the City, but will be most extreme in and around urban heat islands</p>	<p>High. The most extreme effects will be seasonal, but average ambient temperatures will increase steadily over the century</p>	<p>High. Increased strain and potential physical damage to energy, utility, and transportation infrastructure from extreme heat; risk of blackouts; and heat-related illness/death. Higher source water temperature create need for additional water treatment technologies.</p>	<p>Low.</p>
<p>Precipitation Changes</p> <ul style="list-style-type: none"> • Extreme Storms • Flooding • Snowpack reduction • Drought • Reduced groundwater recharge • Increased water temperature • Deteriorated water quality 	<p>High. Increased likelihood of riverine flooding in winter/early spring. Reduced surface water supply in summer due to reductions in winter snowpack</p>	<p>High. Nearly all of the city is low-lying and dependent on levee protection and a system of pumping stations, pipes, ditches, and channels, but areas already susceptible to localized, riverine, and flash flooding and/or that have limited stormwater infrastructure will be most affected by increased winter rain and flows. Drought will affect most areas and</p>	<p>High. The most extreme effects will be seasonal, with continued changes expected over the century</p>	<p>High. A large storm could cause significant health and infrastructure impacts over potentially large portions of the City. Increased water temperature is harmful to water treatment, reservoir and hydroelectric operation, and ecological health.</p>	<p>Moderate. While impacts vary year to year, climate change is increasing the likelihood of a storm event capable of significant flooding; drought frequency is projected to increase in California.</p>

<i>Impacts¹</i>	<i>Temporal Extent</i>	<i>Spatial Extent</i>	<i>Permanence</i>	<i>Level of Disruption</i>	<i>Level of Uncertainty</i>
		increase demand for groundwater use.			
Wildfire <ul style="list-style-type: none"> Declines in air quality 	Moderate. Projected wildfire extent/severity is highly variable but will generally increase over the century. Future fire seasons may become longer.	High. A wildfire is unlikely to break out within City limits, but wildfire smoke will affect the entire city.	Moderate. Wildfire intensity is expected to gradually increase, with significant year-to-year variability.	Moderate. The wildfire impact most likely to have a significant impact on the city is reduced air quality from wildfire smoke.	Moderate.
Sea Level Rise <ul style="list-style-type: none"> Higher river levels during major storm events 	Low. Sea level rise is projected to occur gradually over the course of the century.	Low. Areas within or near the Delta are most at risk.	High. In the longer term, sea level rise may exacerbate flood risk associated with major storm events.	Low. Effects may be significant when coinciding with riverine or flash flooding. Increasing salinity of water may increase burden on upper watershed resources.	Moderate.

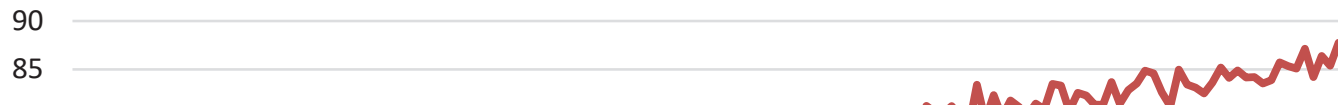
1. Primary impacts are shown in **bold** and secondary impacts are listed by bullets (●) in the first column.

City of Sacramento
City of Sacramento Climate Action and Adaptation Plan

Table 2-2: Temperature Increase

Temporal Extent	<ul style="list-style-type: none"> • Effects will be felt most acutely in July and August, but excessive heat may occur May through October
Spatial Extent	<ul style="list-style-type: none"> • The entire City of Sacramento is likely to be affected • Effects will be felt most acutely in highly urbanized areas with limited tree canopy, where the urban heat island effect is most likely to occur
Permanence	<ul style="list-style-type: none"> • Annual average temperatures are projected to continue to increase through the end of the century, though the projected rate of increase is higher under a high emissions scenario
Level of Disruption	<ul style="list-style-type: none"> • High
Nature of Disruption	<ul style="list-style-type: none"> • Increased heat strains the electrical service sector by reducing the efficiency of electrical transmission and increasing demand for air conditioning • Greater incidence of heat-related illnesses and deaths may increase hospital visits and demand for medical services • High temperatures can physically damage utility and transportation infrastructure, disrupting services and increasing discomfort associated with active and public transportation • Increased water temperature affects drinking water treatment and quality, can lead to algal blooms, and is harmful to spawning anadromous fish and reservoir operations
Level of Uncertainty	<ul style="list-style-type: none"> • Low

Figure 2-1: Average Annual Temperatures



Secondary Impacts

Extreme Heat Days

Cal-Adapt defines an extreme heat day as a day falling between April and October where the maximum daily temperature exceeds the 98th percentile of daily maximum temperature, based on historical data from between 1961 and 1990 (for the City of Sacramento, 103.8°F). Historically, the City of Sacramento has experienced about four extreme heat days per year. By mid-century, the city is projected to experience between 21 and 26 extreme days per year. At the end of the century, this number is anticipated to be between 23 and 52 extreme heat days per year (Figure 2-2 through 2-3).²²

July and August are likely to be the most critical months for increased temperature effects. Historically, these months have experienced the highest temperatures; they are also projected to experience the highest temperature increases during the 21st century.²³ By the end of the century, about one of every two days in the month of July may be an extreme heat day (Figure 2-4). However, the effects of extreme heat days will likely be felt throughout spring and summer. Historically, extreme heat days in May, September, and October have been rare (on average, one or fewer high heat days every two years). By the end of the century, May and September are projected to experience an average of at least one extreme heat day per year, and these extreme heat days may extend into October (Figure 2-4). Dynamic weather patterns over the past two years have brought late summer heat waves to the region, with record-setting temperatures reached in 2022. Most concerning, the late season heat wave in 2022 did not appear on long-range forecasts until a week prior, adding to the uncertainty of what future dynamic extreme heat events may bring.

The average temperature of extreme heat days is projected to gradually increase over the course of the century. Historically, the average temperature of a high heat day has been about 105.3°F. By the end of this century, this value may increase to 108.2°F (Figure 2-5).

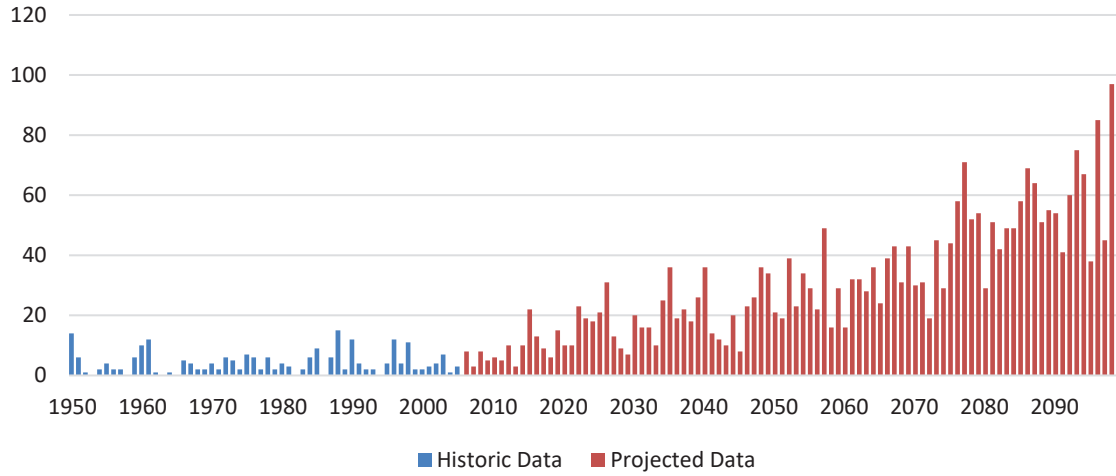
Urban Heat Islands

Increases in urban temperature may be felt particularly acutely by those living in urban heat islands. Urban heat islands are pockets of the urban environment where temperatures can dramatically exceed those in neighboring areas with fuller tree canopies and more parks and open space. Urban heat islands are associated with a number of negative environmental and health effects, as well as increased demands for energy.

²² Cal-Adapt, Number of Extreme Heat Days per Year for Sacramento, California [Place (Incorporated and Census Designated, 2015)], RCP 4.5 and RCP 8.5, Global Climate Model CanESM2, 2018.

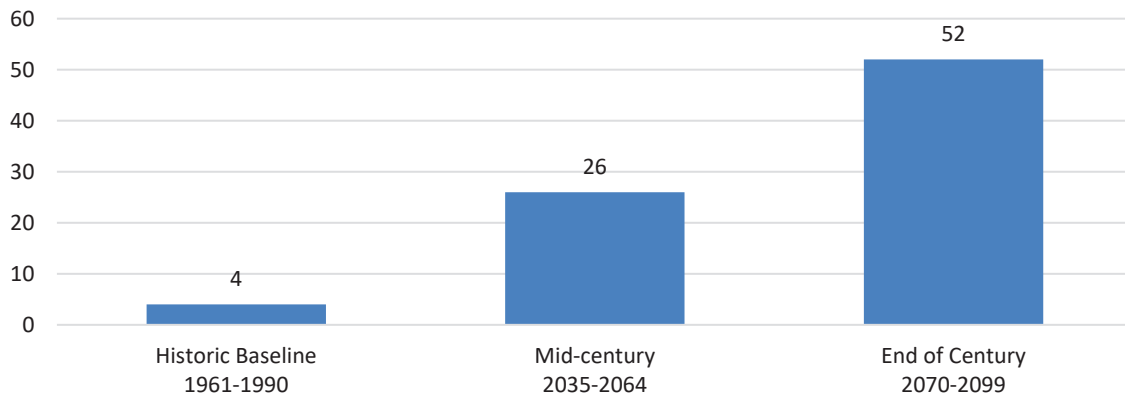
²³ Sacramento Area Council of Governments, Sacramento Region Transportation Climate Adaptation Plan, 2015. Accessed August 25, 2022: <https://www.sacog.org/sites/main/files/file-attachments/fullplanwithappendices.pdf>.

Figure 2-2: Annual Number of Extreme Heat Days



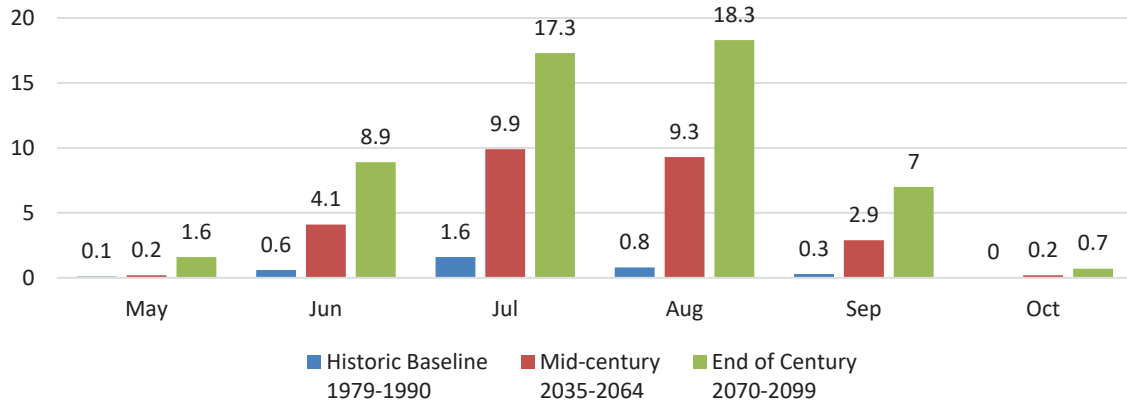
Created using Cal-Adapt’s Extreme Heat Days & Warm Nights climate data tool. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. Historical data (modeled and observed) is capped to 2005. While some variability in the annual number of extreme heat days is projected to occur in the future, there is a clear upwards trend in the number of extreme days that occur per year. By the end of the century, the annual number of extreme heat days is projected to be significantly higher than anything that has been observed historically.

Figure 2-3: Average Number of Extreme Heat Days per Year



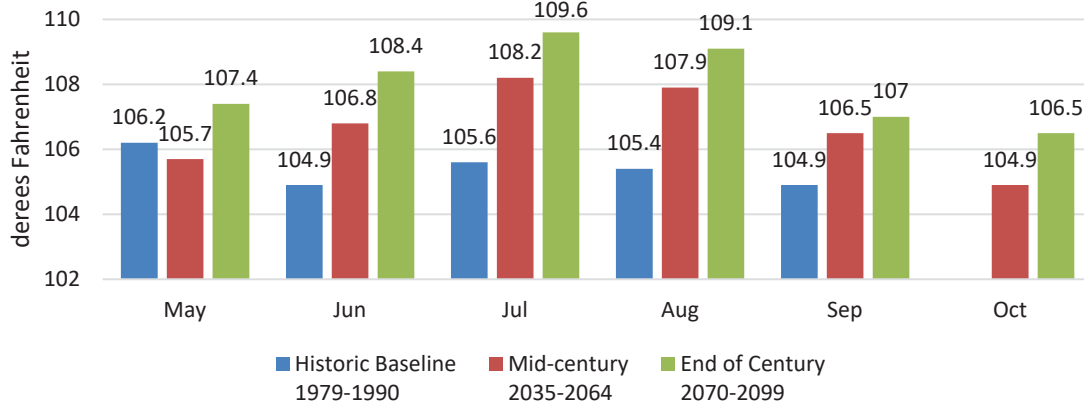
Created using historical and projected annual temperature data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. This chart shows the number of extreme heat events either observed or projected to occur, averaged over the time period indicated.

Figure 2-4: Average Number of Extreme Heat Events per Month



Created using gridMET observed daily maximum temperatures for 1979 to 1990 and projected daily maximum temperature data from Cal-Adapt under the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. Observed daily maximum temperature is not available for 1961 to 1978. The number of extreme heat events occurring per month are projected to increase dramatically by the end of the century, particularly in the months of June, July, and August.

Figure 2-5: Monthly Average Maximum Temperature of Extreme Heat Days



Created using gridMET observed daily maximum temperatures for 1979 to 1990 and projected daily maximum temperature data from Cal-Adapt under the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. Observed daily maximum temperature is not available for 1961 to 1978. Dramatic increases in the average daily high of extreme heat days are projected to occur, particularly in July in August and, by the end of the century, June. Mid- and end-of-century projections indicate that extreme heat days will begin to occur in October at least by 2040, a phenomenon that was not observed during the historical period.

Urban heat islands form where high levels of development intersect with limited landscape vegetation. Natural elements such as trees and green spaces provide cooling via evapotranspiration and shade.²⁴ In contrast, the materials that constitute the built environment, such as asphalt and concrete, absorb heat. These materials re-radiate absorbed heat and can raise nearby temperatures by several degrees.²⁵ Other anthropogenic activities such as running air conditioners and operating internal combustion engines can also raise urban temperatures.²⁶ The location of urban heat islands can also shift with changes in atmospheric conditions such as prevailing wind patterns.²⁷

The pockets of high temperature created by urban heat islands facilitate the formation of ozone and smog.²⁸ Additionally, high pavement and rooftop surface temperatures can heat stormwater runoff. This heated runoff can enter local rivers and lakes, where it may upset the metabolism and reproduction of aquatic species.²⁹

Increased daytime temperatures, reduced nighttime cooling, and higher air pollution levels associated with urban heat islands can exacerbate the health effects associated with excessive heat, warm nights, and air pollution. Potential health complaints include general discomfort, dehydration, respiratory difficulties, heat cramps and exhaustion, heat stroke, and heat-related mortality.³⁰ Seeking relief from excess heat, many urban residents may turn to air conditioning. While air conditioning can alleviate some of the most immediate health impacts of urban heat islands, air conditioning use also increases energy use³¹, straining the electrical grid and potentially releasing both greenhouse gases and excess heat into the environment.

The impact of urban heat islands is particularly pronounced during the summer months and heat waves³², when maximum temperatures reach their peaks, but hotter temperatures can also extend

²⁴ Golden JS, “The Built Environment Induced Urban Heat Island Effect in Rapidly Urbanizing Arid Regions – A Sustainable Urban Engineering Complexity,” *Environmental Sciences*, 2004. May 1, 2020: <https://www.tandfonline.com/doi/abs/10.1080/15693430412331291698>.

²⁵ Golden JS, 2004; United States Environmental Protection Agency, “Learn About Heat Islands,” last updated September 2, 2022. Accessed October 27, 2022: <https://www.epa.gov/heatislands/learn-about-heat-islands>.

²⁶ Memon RA, Leung DY, Chunho L, “A review on the generation, determination and mitigation of urban heat island,” *Journal of Environmental Sciences*, 2008. May 1, 2020: <https://www.ncbi.nlm.nih.gov/pubmed/18572534>; Salamanca F, Georgescu M, Mahalov A, Moustauoi M, Wang M. “Anthropogenic heating of the urban environment due to air conditioning.” *Advancing Earth and Space Science*, May 9, 2014. May 1, 2020: <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2013JD021225>.

²⁷ Wilby, RL. “A Review of Climate Change Impacts on the Built Environment.” *Built Environment*, Mar 13 2007. May 4 2020: <https://www.ingentaconnect.com/content/alex/benv/2007/00000033/00000001/art00003>

²⁸ Akbari, H. “Energy Saving Potentials and Air Quality Benefits of Urban Heat Island Mitigation.” (2001). May 1, 2020: <https://www.osti.gov/servlets/purl/860475>.

²⁹ United States Environmental Protection Agency, “Heat Island Impacts,” last updated September 2, 2022. Accessed October 27, 2022: <https://www.epa.gov/heatislands/heat-island-impacts>

³⁰ United States Environmental Protection Agency, “Heat Island Impacts,” 2022; Laaidi K, Zeghnoun A, Dousset B, Bretin P, Vandentorren S, Giraudet E, Beaudeau P. “The Impact of Heat Islands on Mortality in Paris during the August 2003 Heat Wave.” *Environmental Health Perspectives*, Feb 1, 2012. May 1, 2020: <https://ehp.niehs.nih.gov/doi/full/10.1289/ehp.1103532>; Memon RA, Leung DY, Chunho L, 2008.

³¹ United States Environmental Protection Agency, “Heat Island Impacts,” 2022.

³² Sacramento Municipal Utility District, 2016.

into early morning and night.³³ This is significant because these cooler periods typically provide relief, especially for people who reside in or around urban heat islands and cannot afford or lack access to air conditioning, but latent heat accumulated throughout the day can severely dampen this effect and lead to prolonged heat exposure and health effects. Similarly, warmer nights will also increase energy costs and demand for air conditioning.

This heat island map, created using urban heat island index (UHII) data produced by the Sacramento Metropolitan Air Quality Management District's Capital Region Urban Heat Island Mitigation Project, calculated UHIIs using air temperatures at human height levels, as opposed to the surface temperatures of roads or buildings. This focus on air-temperature data provides a more accurate reflection of temperatures as experienced by Sacramento residents. UHII expresses the cumulative temperature difference between an urban location and a non-urban reference point summed over a certain time interval. The units of UHII are degree-hours or degree-days and represent the total urban heat island effect added up over a period of time. The UHII illustrated in Map 1 was computed for the May to September period for years 2013 through 2016 and was calculated for all hours (24-hour day), specific hours (6:00 a.m., 1:00 p.m., and 3:00 p.m.), and for ranges of hours representing peak periods for the electricity system.³⁴

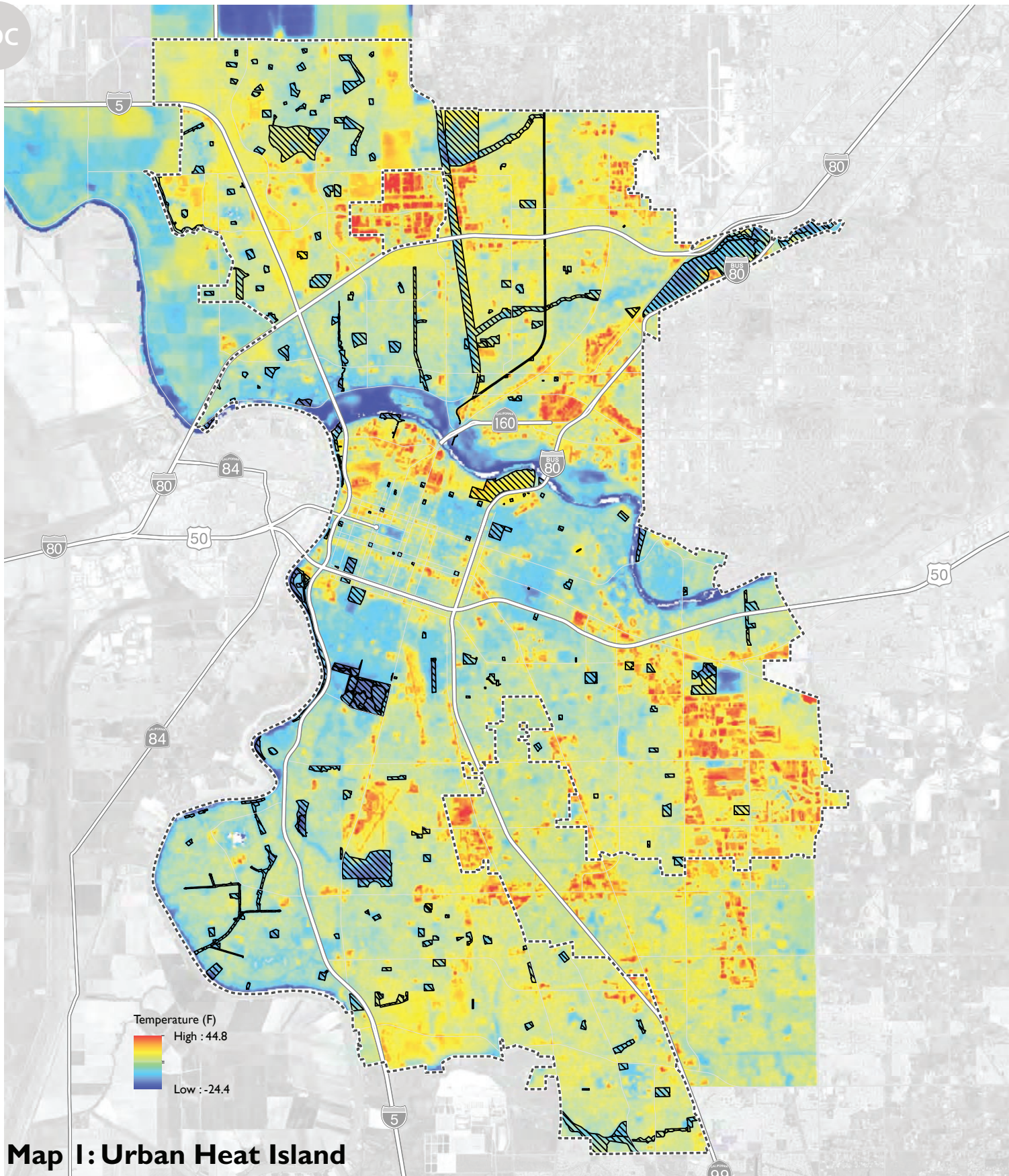
The urban heat island effect is currently prevalent throughout Sacramento, particularly in areas adjacent to major roadways and in the northeast quadrant of the city. Over the course of the next several decades, UHII is expected to increase. In areas that are already urbanized, local climate change will be the primary contributor to future changes in UHII. In areas that will be urbanizing between now and 2050, the impacts on air temperature will result from both changes in land use type and changes in climate.

One feature of the natural and built environment that can both reduce intensity of the urban heat island effect and improve air quality is the presence of trees and other forms of vegetation. As seen in Map 2: Tree Canopy, Sacramento's tree canopy is typically the densest in areas neighboring—but not immediately within—downtown. Tree cover is highest in wealthy historic neighborhoods and tends to decrease in areas that lie along the borders of the city. Trees will be more vulnerable to patterns of increased heat, drought, and storms, which will in turn cause them to be more vulnerable to stress and disease.

It is important to note that there may be tradeoffs in adaptation strategies. For instance, water conservation and drought resilience efforts could have a negative impact on urban heat islands due to removal of vegetation and use of heat-absorbent materials such as rock or artificial turf. These unintended consequences will need to be weighed alongside potential co-benefits when prioritizing adaptation measures.

³³ Memon RA, Leung DY, Chunho L, 2008; Golden JS, 2004.

³⁴ Sacramento Metropolitan Air Quality Management District, Summary Report: Capital Region Urban Heat Island Mitigation Project (2020).

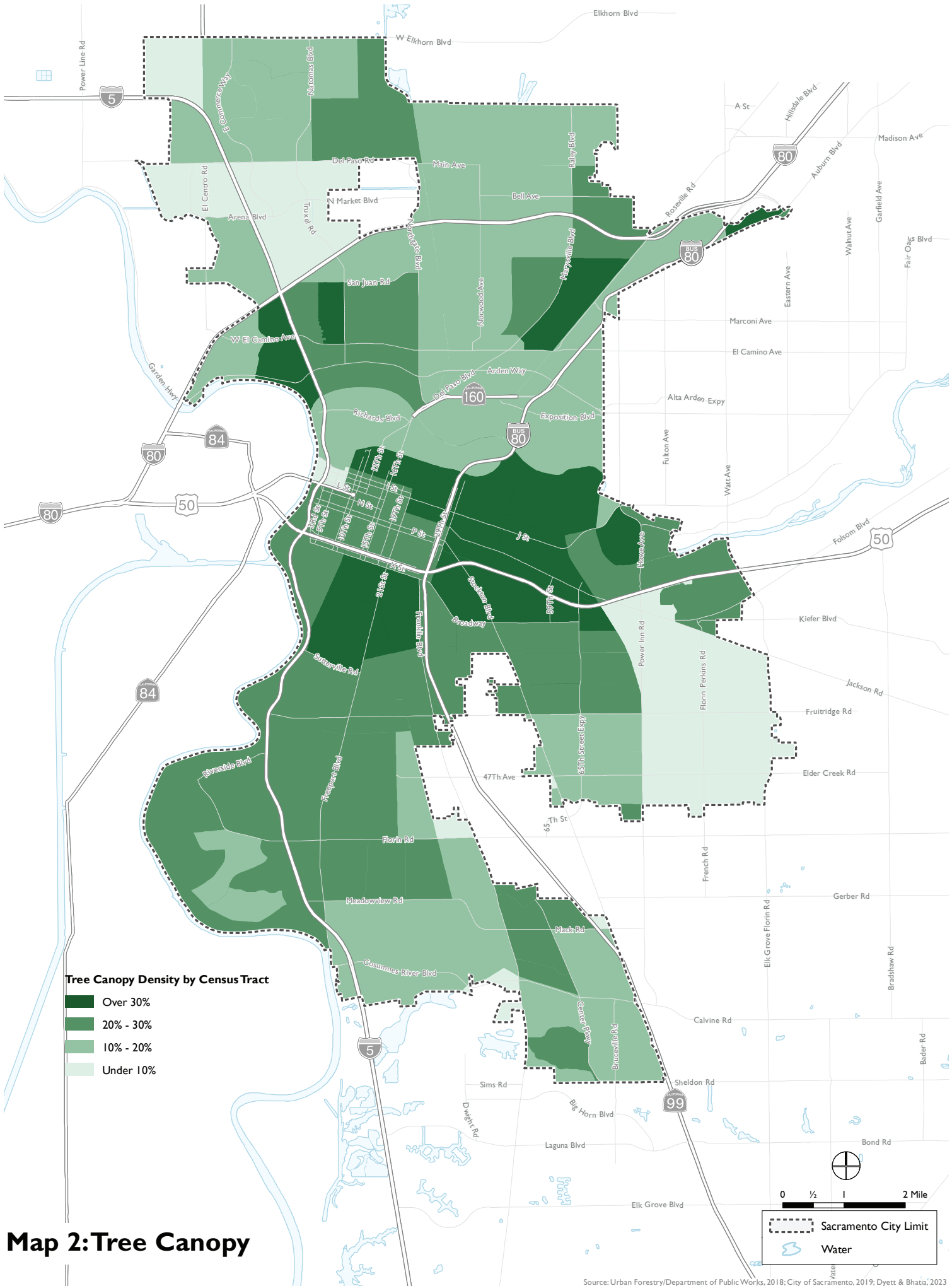


Map 1: Urban Heat Island

Map 1: Urban Heat Island, illustrates the incidence of urban heat islands in the City of Sacramento. Darker red and orange colors indicate locations where the average urban temperature exceeds that of associated rural areas. Urban heat island effects are most prevalent in the northeast quadrant of the city, including neighborhoods such as Northpointe, Glenwood Meadows, Raley Industrial Park, and Del Paso Heights, as well as the Central City.

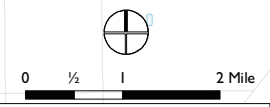
0 1/2 1 2 Mile

Source: NASA, 2020; County of Sacramento, 2018; City of Sacramento, 2018; Dyett & Bhatia, 2021



Tree Canopy Density by Census Tract

- Over 30%
- 20% - 30%
- 10% - 20%
- Under 10%



Sacramento City Limit
~ Water

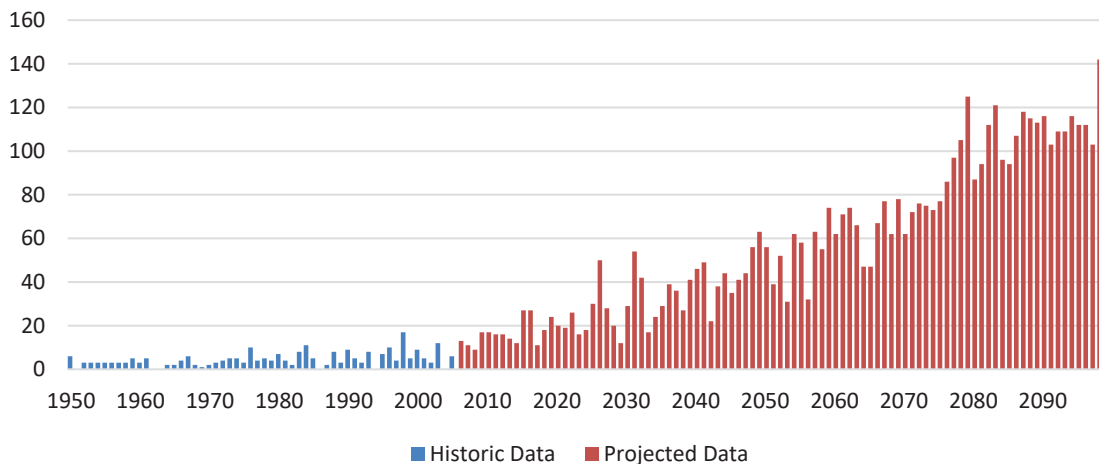
Map 2: Tree Canopy

Source: Urban Forestry/Department of Public Works, 2018; City of Sacramento, 2019; Dyett & Bhatta, 2023

Warm Nights

Cal-Adapt defines a warm night as a night falling between April and October when the daily minimum temperature exceeds the 98th historical percentile of daily minimum temperatures observed from 1961 to 1990³⁵ (for the City of Sacramento, 66.6°F). Both the frequency and intensity of warm nights are projected to increase in the future. Historically, the City of Sacramento experienced an average of three warm nights per year. By mid-century, the city is predicted to experience approximately 35 to 48 warm nights per year. By the end of the century, this figure could climb as high as 101 warm nights per year (Figure 2-6 and 2-7). The majority of these warm nights are projected to occur between June and September. By the end of the century, almost every night in July and August may be a warm night. Warm nights may also become a larger concern in May and October, months in which warm nights have historically been rare (Figure 2-8).

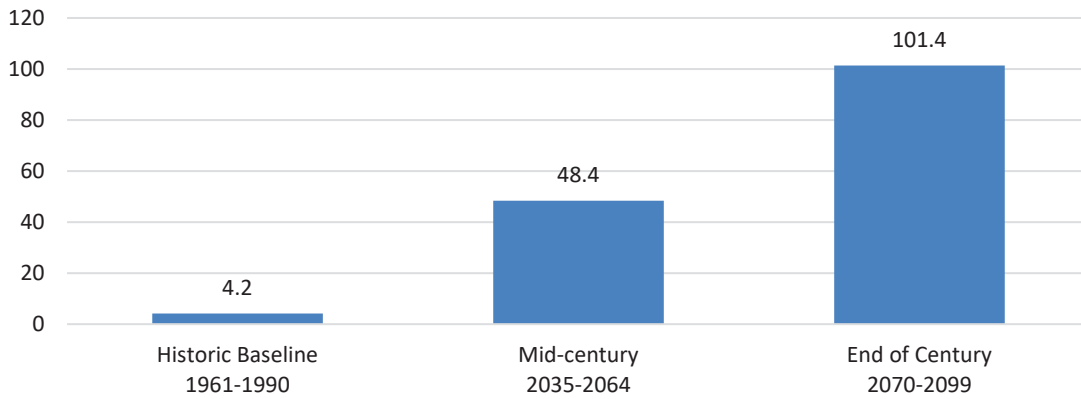
Figure 2-6: Annual Number of Warm Nights



Created using historical and projected warm night data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. Historical data (modeled and observed) is capped at 2005. While some degree of variability in the annual number of warm nights that occur per year is projected to continue into the future, projections demonstrate a steadily increasing trend through the end of the century. By the end of the century, the annual number of warm nights is projected to far exceed anything that has been observed between 1950 and 2005.

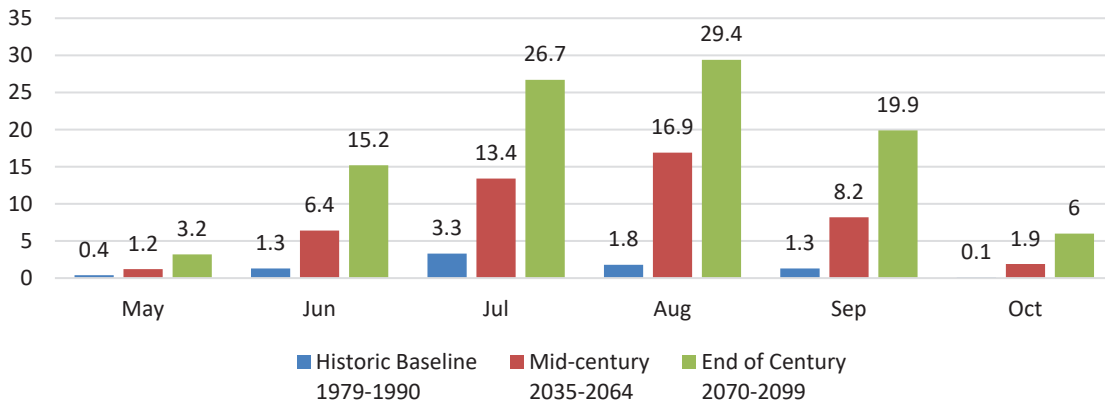
³⁵ Cal-Adapt, “Extreme Heat Days & Warm Nights,” 2018.

Figure 2-7: Annual Number of Warm Nights



Created using historical and projected warm night data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento.

Figure 2-8: Average Number of Warm Nights Per Month



Created using gridMET observed daily minimum temperatures for 1979 to 1990 and projected daily minimum temperature data from Cal-Adapt under the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. Observed daily minimum temperature is not available for 1961 to 1978. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. The average number of warm nights is projected to increase most dramatically in the summer months. However, temperature projections also illustrate increase in the number of warm nights that occur in the Spring and Fall.

Historically, the average warm night temperature has been about 68.9°F. By mid-century, average warm night temperature is projected to increase to 70.1°F. By the end of the century, average warm night temperature is projected to further increase to 71.6°F. The most dramatic increases in nighttime temperature are projected to occur in July and August (Figure 2-9).

Stretches of consecutive warm nights are also expected to increase in length. Historically, it has been unusual to see significantly more than two warm nights in a row. By mid-century, consecutive stretches of warm nights may be between 9 and 13 nights long. At the end of the century, the length of the average stretch of consecutive warm nights may climb up to 71 nights in a row (Figure 2-10, 2-11).

Elevated nighttime temperatures limit the body's opportunity to offload excess heat acquired during the day, increase mortality risk³⁶, and can disrupt sleep.³⁷ Within the city, the effects of warm nights may be felt most acutely in heavily built-up areas with limited vegetation. These areas can become very warm during the day and continue to radiate heat at night.³⁸ Nighttime air conditioner use, while providing relief to residents, may actually exacerbate these effects by releasing waste heat into the environment.³⁹ Additionally, should air conditioner systems fail, those who had come to rely on them may have few other options for relieving heat.⁴⁰

Just as cool nights help the body recover from high daytime temperatures, firefighters have traditionally relied on cooler evening and nighttime temperatures to slow wildfire growth. Higher nighttime temperatures enable wildfires to blaze through the night.^{41, 42}

³⁶ Laaidi K, et.al, 2012; Murage P, Hajat S, Kovats S. "Effect of night-time temperatures on cause and age-specific mortality in London." *Environmental Epidemiology*, Dec 13, 2017. May 1, 2020: https://journals.lww.com/enviroepidem/FullText/2017/12000/Effect_of_night_time_temperatures_on_cause_and.1.aspx.

³⁷ Obradovich N, Migliorini R, Mednick SC, Fowler JH. "Nighttime temperature and human sleep loss in a changing climate." *Science Advances*, May 26, 2017. May 1, 2020: <https://advances.sciencemag.org/content/3/5/e1601555>.

³⁸ Lenart M, Guido Z. "Rising temperatures bump up risk of wildfires." *Southwest Climate Outlook*, March 2011. May 1, 2020: <https://climas.arizona.edu/sites/climas.arizona.edu/files/pdf2011marrisingtempfirerisk.pdf>.

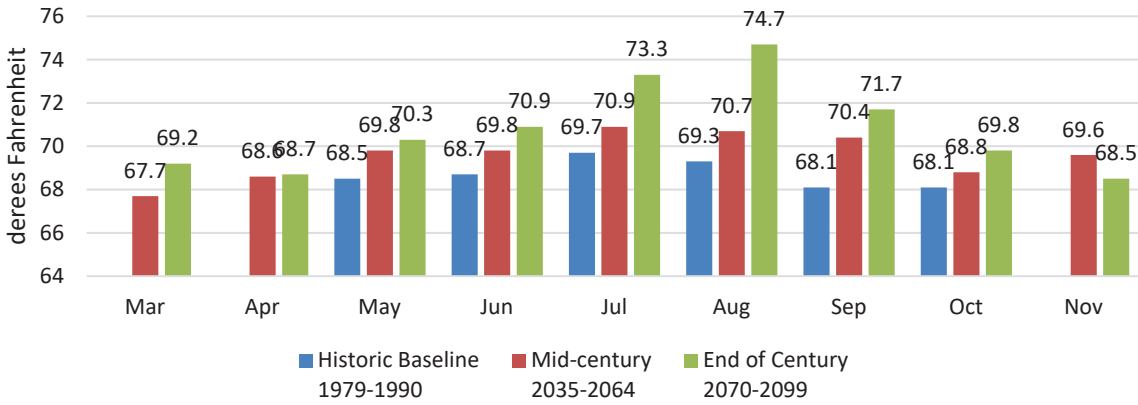
³⁹ Salamanca F., et.al., 2014.

⁴⁰ Gronlund CJ. "Racial and Socioeconomic Disparities in Heat-Related Health Effects and Their Mechanisms: s Review." *Current Epidemiology Reports*, 2014. May 3 2020: <https://link.springer.com/article/10.1007/s40471-014-0014-4>.

⁴¹ McCann H, Mount J. "Managing Wildfires Requires New Strategies." *Public Policy Institute of California*, Sep 23, 2015. May 1, 2020: <https://www.ppic.org/blog/managing-wildfires-requires-new-strategies/>; Lenart M, Guido Z.

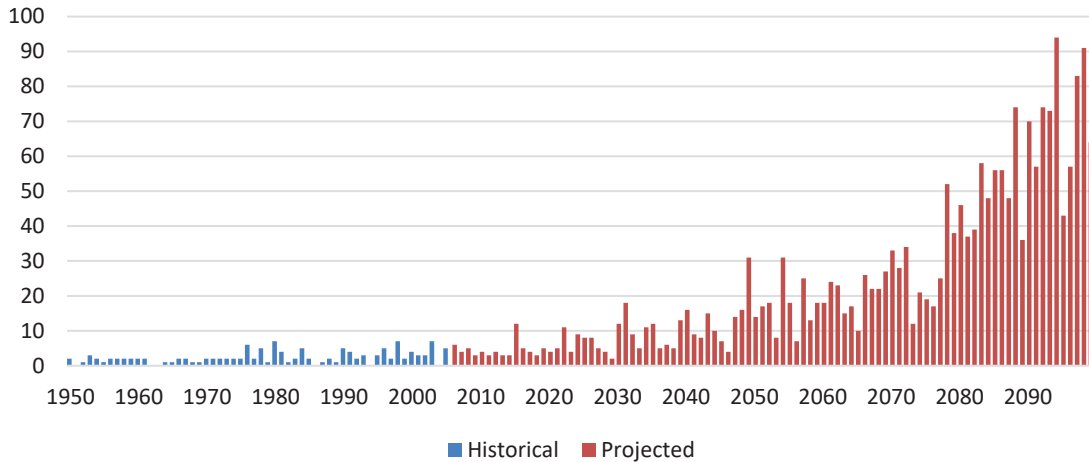
⁴² Lenart M, Guido Z. "Rising temperatures bump up risk of wildfires." *Southwest Climate Outlook*, March 2011. May 1, 2020: <https://climas.arizona.edu/sites/climas.arizona.edu/files/pdf2011marrisingtempfirerisk.pdf>.

Figure 2-9: Monthly Average Temperature of Warm Nights



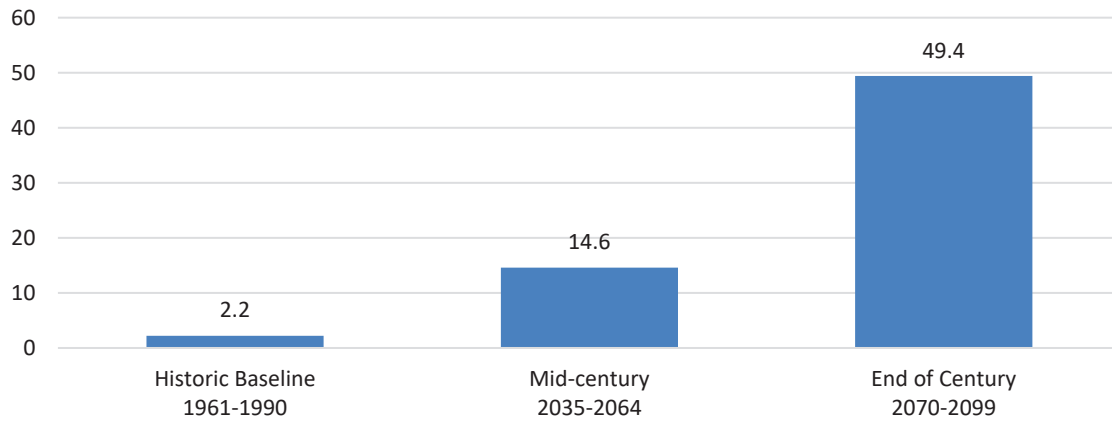
Warm nights refer to nights between April and October when the daily minimum temperature exceeds the 98th historical percentile of daily minimum temperatures observed from 1961 to 1990 (for the City of Sacramento, 66.6°F). Created using gridMET observed daily minimum temperatures for 1979 to 1990 and projected daily minimum temperature data from Cal-Adapt under the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. Observed daily minimum temperature is not available for 1961 to 1978. Average minimum temperature is projected to increase most dramatically in July and August. However, warm nights are also projected to occur in March, April, and November by the end of the century, a phenomenon that has not been observed historically.

Figure 2-10: Longest Stretch of Consecutive Warm Nights



Created using historical and projected warm night data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. Historical data (modeled and observed) is capped at 2005. While considerable variability is projected to remain in the typical length of a nighttime heat wave up through the end of the century, nighttime temperature projections do demonstrate a clear upward trend in nighttime heatwave length. This increase may occur somewhat gradually up through the middle of the century but then begin to increase rapidly thereafter.

Figure 2-11: Average Longest Stretch of Consecutive Warm Nights



Created using historical and projected warm night data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. The chart above displays the historical and projected longest stretch of consecutive warm nights, averaged over the years indicated.

Heat Waves

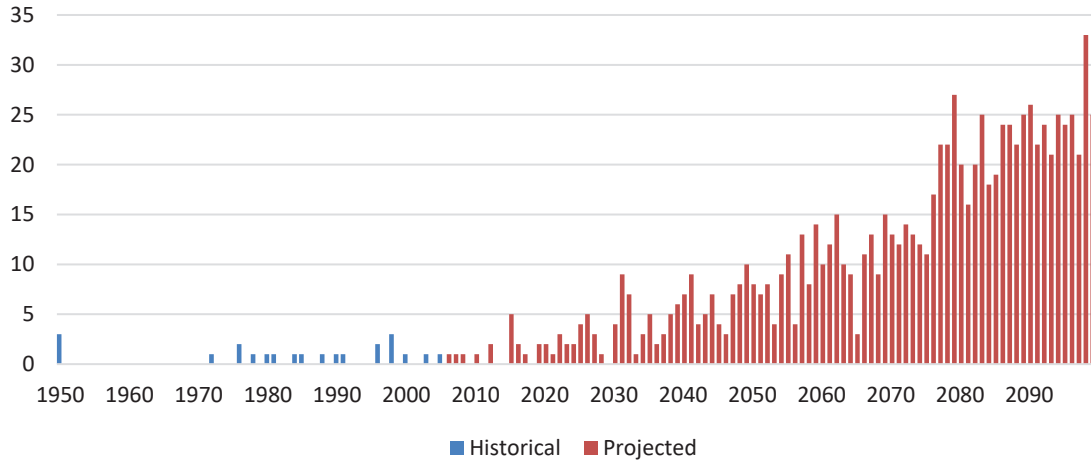
Cal-Adapt defines a heat wave as a period of four consecutive extreme heat days or warm nights.⁴³ Between 1961 and 1990, the Sacramento region experienced about one to two heat waves per decade.⁴⁴ Heat waves are projected to increase in intensity and duration.⁴⁵ By mid-century, the City of Sacramento may experience about three to eight four-day heat waves per year. At the end of the century, this range is predicted to rise to between three and 21 four-day heat waves per year (figures 2-12a and 2-12b). The typical heat wave duration is predicted to grow to between seven and 15 days by mid-century and up to 49 days by the end of the century (Figure 2-13 through 2-14).

⁴³ Cal-Adapt defines warm nights as those with daily minimum temperatures above the 98th percentile of historical daily minimum temperatures for a place, computed using data from April through October for 1961 to 1990. For the City of Sacramento, this is 66.6°F.

⁴⁴ Ascent Environmental, Climate Change Vulnerability Assessment for the Sacramento County Climate Action Plan: Communitywide Greenhouse Gas Reduction and Climate Change Adaptation (2017).

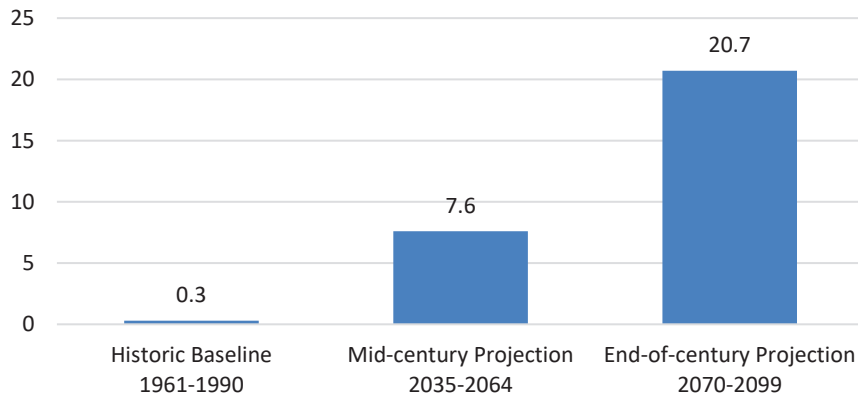
⁴⁵ Sacramento Municipal Utility District, SMUD 2018 Local Hazard Mitigation Plan (2018). Oct 28 2019: <https://www.smud.org/-/media/Documents/Corporate/About-Us/Company-Information/Reports-and-Documents/2014-2021/2020/20190124-Local-Hazard-Mitigation-Plan-re-Submittal.ashx>.

Figure 2-12a: Number of Heat Waves Per Year



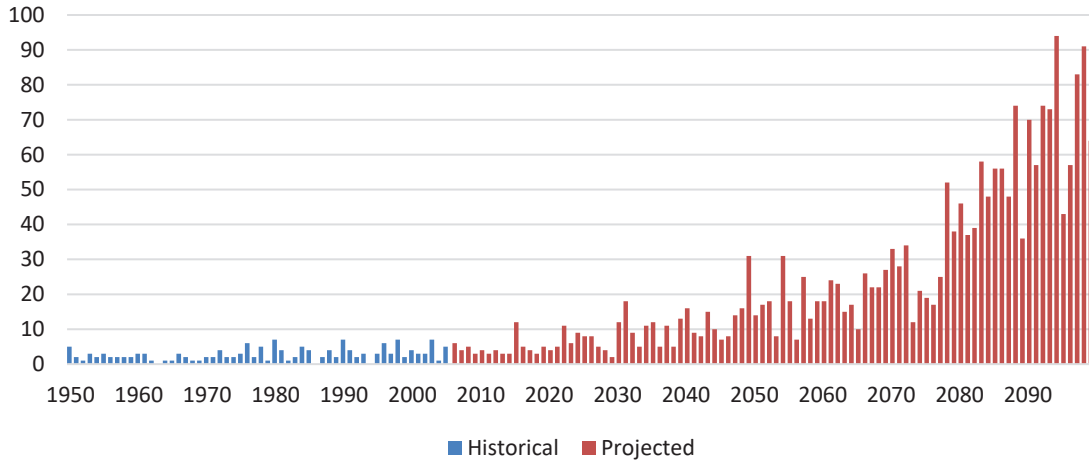
Created using historical and projected heat wave (both extreme heat days and warm nights) data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. Historical data (modeled and observed) is capped at 2005. While considerable variability in the annual number of heat waves is projected to continue, the number of heat waves projected to occur per year does increase dramatically by the end of the century.

Figure 2-12b: Average Number of Heat Waves Per Year



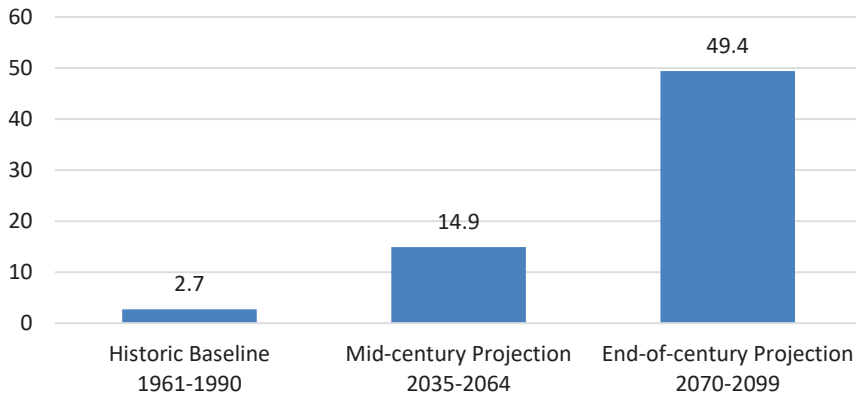
Created using historical and projected heat wave (both extreme heat days and warm nights) data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. While considerable variability in the annual number of heat waves is projected to continue, the number of heat waves projected to occur per year does increase dramatically by the end of the century.

Figure 2-13: Maximum Heat Wave Duration



Created using historical and projected heat wave (both extreme heat days and warm nights) data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. Historical data (modeled and observed) is capped at 2005. The length of the longest heat wave is projected to gradually increase over the course of the century.

Figure 2-14: Average Maximum Heat Wave Duration



Created using historical and projected heat wave (both extreme heat days and warm nights) data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento.

Sensitivity

Heat-Related Illness

Heat waves and sustained high heat days directly harm human health through heat-related illness such as heat cramps, heat exhaustion, and heat stroke.⁴⁶ Heat also intensifies the photochemical reactions that produce smog, ground level ozone, and fine particulates, which exacerbate respiratory diseases in children, the elderly, and people with pre-existing cardiovascular, respiratory, and cerebrovascular disease and diabetes-related conditions.⁴⁷ Prolonged exposure to high temperatures is associated with increased hospital admissions for cardiovascular, kidney, and respiratory disorders.⁴⁸ On especially hot days, cooler nights have typically provided a period of respite. Increases in nighttime temperature prevent people from being able to adequately cool down at night, further increasing their risk of suffering heat-related illness.⁴⁹

Most people find it relatively easy to take measures, such as locating to a cooler environment, that reduce their exposure to excessive heat. However, opportunities to reduce heat exposure are not evenly distributed throughout the population. Segments of the population who face especially high levels of heat exposure include those experiencing homelessness, outdoor workers, individuals that depend on medical equipment, individuals with impaired mobility,⁵⁰ and those without access to adequate home insulation, air conditioning, or ventilation.⁵¹

Survey data collected from residents of the greater Sacramento region revealed that heat-related discomfort at home tends to be more prevalent among lower-income households. The proportion of respondents with household incomes under \$40,000 who reported feeling the most heat-related discomfort at home was nearly 2.8 times greater than those with household incomes over \$100,000 (about 33 percent compared to 12 percent, respectively). Similarly, the proportion of respondents from households with incomes of over \$100,000 who reported that their greatest source of heat-related discomfort came from outdoor activity was 2.6 times greater than households earning \$40,000 or less (37 percent compared to 14 percent, respectively). A majority (about 60 percent) of those who reporting feeling no discomfort due to heat at all were respondents earning \$60,000 or more. Only six percent of those earning \$40,000 or less said they felt no heat impacts, compared to 14 percent of those earning over \$100,000. Survey results also show race contributing to experiences

⁴⁶ Sari Kovats R, Hajat S. “Heat Stress and Public Health: A Critical Review.” *Annual Review of Public Health*, Nov 21 2007. May 3 2020: <https://www.annualreviews.org/doi/full/10.1146/annurev.publhealth.29.020907.090843>.

⁴⁷ Maizlish N, English D, Chan J, Devin K, English P, Climate Change and Health Profile Report: Sacramento County (Sacramento, CA, 2017). Oct 28 2019: https://www.cdph.ca.gov/Programs/OHE/CDPH%20Document%20Library/CHPRs/CHPR067Sacramento_County2-23-17.pdf; U.S. Climate Resilience Toolkit, Extreme Heat—NIHHIS. Oct 28 2019: <https://toolkit.climate.gov/topics/human-health/extreme-heat>.

⁴⁸ U.S. Global Change Research Program, Climate and Health Assessment (Washington D.C., 2016). Oct 28 2019: <https://health2016.globalchange.gov/temperature-related-death-and-illness>; Gronlund CJ, 2014.

⁴⁹ U.S. Climate Resilience Toolkit, Extreme Heat—NIHHIS; U.S. Global Change Research Program, 2016.

⁵⁰ Sacramento Municipal Utility District, 2018.

⁵¹ Maxwell, K., Julius S., Grambsch A., Kosmal A., Larson L., Sonti, N., Built Environment, Urban Systems, and Cities. In *Impacts, Risks, and Adaptation in the United States: Fourth National Climate Assessment, Volume II* (Washington D.C., 2018). Oct 28 2019: <https://nca2018.globalchange.gov/chapter/11/>; Gronlund CJ, 2014.

of heat. Higher percentages of American and Alaskan Native (36 percent), Latinx (26 percent), Asian (27 percent), and Middle Eastern or North African (44 percent) respondents reporting feeling their highest heat stress at home, as opposed to 19 percent of white respondents. Black respondents were more likely to report feeling heat-related discomfort during their commute (15 percent) and at work (19 percent) compared to white respondents (6 percent and 12 percent, respectively).⁵²

Personal perceptions regarding heat risk and safety can also influence responses to heat. Those who fear exposure to crime may hesitate to open windows or travel to cooler locations, while some may not be aware of the dangers posed by high heat or may not think of themselves as susceptible.⁵³

Studies have shown that cooling of the body is achieved through increased blood flow to the skin and sweating, cooling mechanisms that rely heavily on the cardiovascular system, as well as the endocrine, urinary, and integumentary processes.⁵⁴ Certain segments of the population whose natural cooling systems are inhibited are thus more sensitive to the health effects of heat. These groups include the elderly, those taking certain types of medication (anticholinergic, antihypertensive, and antipsychotic drugs), and children.⁵⁵ Conditions such as dementia and Parkinson's have also been found to be important risk factors for heat mortality. Additionally, social, cultural, and linguistic isolation have also been shown to contribute to heat's adverse health effects.⁵⁶ Sometimes limited transportation options for the elderly can also make it more difficult to relocate to cooler locations when local temperatures become extreme.

Just as cool nights help the body recover from high daytime temperatures, firefighters have traditionally relied on cooler evening and nighttime temperatures to slow wildfire growth. Higher nighttime temperatures enable wildfires to blaze through the night.⁵⁷

Heat-Related Infrastructure Impacts

High temperatures can have detrimental impacts on key infrastructures including energy generation and distribution and transportation. High temperatures decrease the efficiency of power lines while increasing the demand for energy-intensive uses such as air conditioning and cooling equipment⁵⁸. This results in a higher risk of energy blackouts⁵⁹ and increases energy bills.⁶⁰ These

⁵² Sacramento Metropolitan Air Quality Management District, 2020.

⁵³ Gronlund CJ, 2014.

⁵⁴ Gronlund CJ, 2014.

⁵⁵ Sari Kovats R and Hajat S, 2007; U.S. Global Change Research Program, 2016; Gronlund CJ, 2014.

⁵⁶ Gronlund CJ, 2014.

⁵⁷ McCann H, Mount J. "Managing Wildfires Requires New Strategies." *Public Policy Institute of California*, Sep 23, 2015. May 1, 2020: <https://www.ppic.org/blog/managing-wildfires-requires-new-strategies/>; Lenart M, Guido Z. "Rising temperatures bump up risk of wildfires." *Southwest Climate Outlook*, March 2011. May 1, 2020: <https://climas.arizona.edu/sites/climas.arizona.edu/files/pdf2006aprrisingtempfirerisk.pdf>

⁵⁸ Sacramento Municipal Utility District, 2016.

⁵⁹ Sacramento Area Council of Governments, 2015; U.S. Climate Resilience Toolkit, Extreme Heat—NIHHIS.

⁶⁰ Maxwell, K., et. al., 2018.

impacts can strain household budgets, increase exposure to heat, and negatively impact the provision of medical and social services.⁶¹

Extremely high temperatures can damage roadways, railways, and bridges, as well as reduce the comfort and feasibility of walking, biking, and taking public transit.⁶² Roads and sidewalks absorb and radiate heat, subjecting those nearby, including walkers and transit riders, to increased heat burdens.⁶³ The Sacramento Regional Transit (SacRT) powers their light rail system with overhead catenary systems lines, which can stretch with heat and may lead to severing of the connection with the rail car.⁶⁴

Increased temperatures can also have cascading effects through the environment as they increase the risk of wildfire and influence local precipitation patterns, as discussed later in this report.

CHANGES IN PRECIPITATION PATTERNS

Climate change models predict changes in the seasonal distribution of precipitation, with rainfall becoming more concentrated in extreme precipitation events during the winter months. Meanwhile, increasing average temperatures will cause more precipitation to fall in the form of rain, as opposed to snow. These changes may result in a number of secondary impacts, such as flooding, reduction in winter snowpack, drought, increased wildfire risk, changes in streamflow, and strain to health, energy, and infrastructure systems, as described below and in Table 2-3.

Table 2-3: Changes in Precipitation Patterns

Temporal Extent	<ul style="list-style-type: none"> Increases in annual rainfall projected to continue through the end of the century Most dramatic increases in extreme rainfall events projected to occur in the winter months Decreased snow fraction/increased rain fraction. April snowpack level projected to continue to decline through the end of the century
Spatial Extent	<ul style="list-style-type: none"> Flooding effects will be felt most strongly in low-lying areas, areas dependent on levee protection, and areas with inadequate stormwater infrastructure
Permanence	<ul style="list-style-type: none"> Effects may be felt most acutely in winter months, with drought periods also becoming more likely
Level of Disruption	<ul style="list-style-type: none"> High
Nature of Disruption	<ul style="list-style-type: none"> A large storm could cause significant health and infrastructure impacts over potentially large portions of the city or region. Increased water temperature is harmful to water treatment, reservoir and hydroelectric operation, and ecological health.
Level of Uncertainty	<ul style="list-style-type: none"> Low

⁶¹ Maxwell, K., et. al., 2018.

⁶² Sacramento Area Council of Governments, 2015.

⁶³ Sacramento Metropolitan Air Quality Management District, 2020.

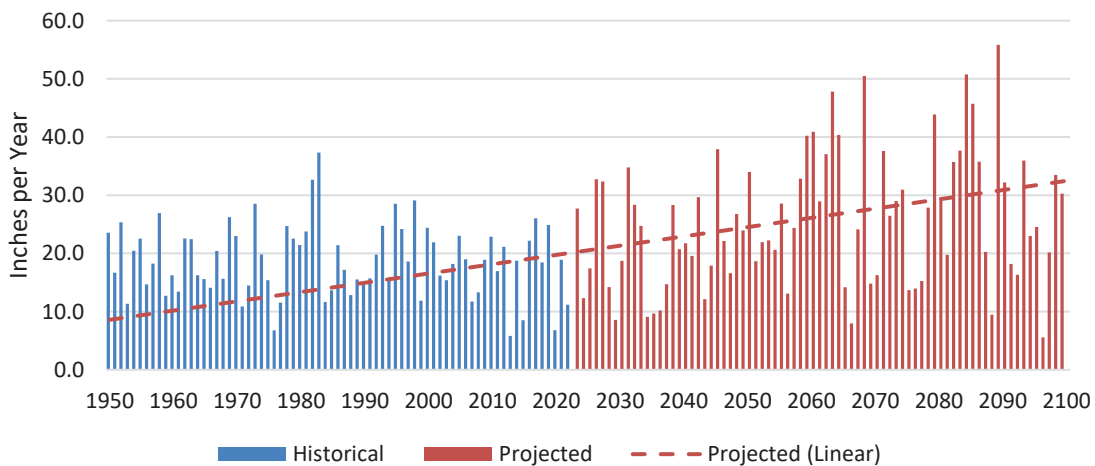
⁶⁴ Sacramento Metropolitan Air Quality Management District, 2020.

Overall, annual precipitation is expected to increase in the Sacramento region. Between the years of 1961 and 1990, the City of Sacramento received about 18.9 inches of rain per year. By midcentury, this number is projected to increase to an average of 25.5 inches per year. Annual precipitation may reach an average of 27.8 inches per year by the end of the century (Figure 2-15 through 2-16). However, this increase will not occur at a uniform rate throughout the year. Cal-Adapt predicts that the Sacramento region will experience a slight increase in fall and winter precipitation—which will fall more as rain and less as snow—while spring and summer months are generally expected to see less rainfall compared to historical patterns. Much of this increase in rainfall projected during winter months may be attributable to high-intensity or extreme storms. Cal-Adapt defines an extreme rain event for the City of Sacramento as an event where the two-day rainfall total exceeds 0.97 inches, the lowest annual maximum value that occurred in the historical period between 1961 and 1990. Historically, the City of Sacramento has experienced about four extreme rain events per year. This number could increase to about seven extreme rain events by the end of the century.

The most significant increases in extreme rainfall frequency are projected to occur in January and February. By mid-century, extreme rain events may also be common in November and December, though the frequency of these events may taper off towards the end of the century (Figure 2-19).

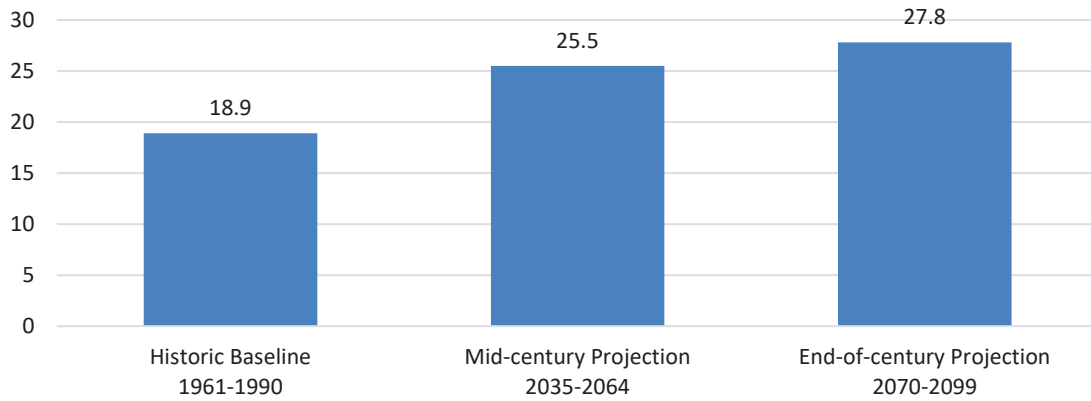
These high-intensity storms may produce higher volumes of runoff and higher river levels, contributing to increased flood risk. Higher intensity storms may also increase the burden on the City’s internal drainage and combined sewer systems. Higher river levels increase the risk of overtopping levees, which could contribute to levee failure. Shifts in winter precipitation will also increase the conflict between balancing flood control and water supply management at the Folsom Dam, discussed further below.

Figure 2-15: Total Annual Precipitation



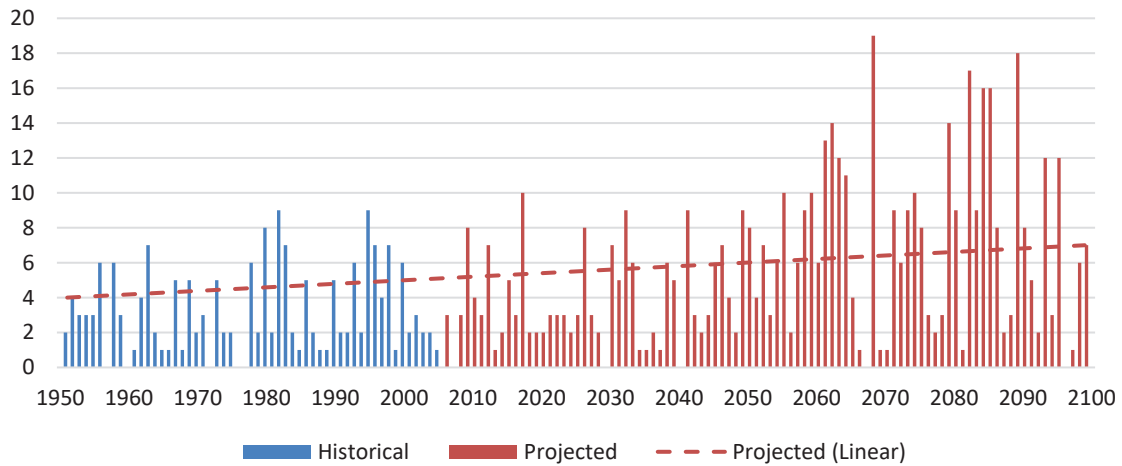
Created using historical and projected precipitation data from Cal-Adapt and observed measurements for 2007 to 2022 from NOAA’s NCEI Climate Data Online portal. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. Historical data (modeled and observed) is capped at 2005 and supplemented with data from NOAA. While significant variability in annual rainfall is projected to continue into the future, the dotted linear trendline illustrates a gradual increase in annual rainfall over time.

Figure 2-16: Average Annual Precipitation



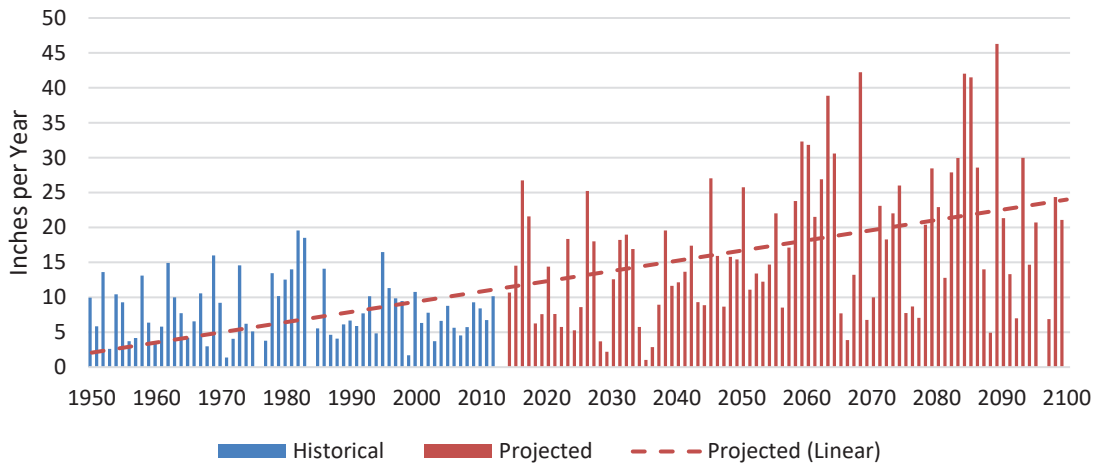
Created using historical and projected precipitation data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. There is a projected to be a larger jump in annual precipitation between the historical trends and mid-century than between mid- and end-of-century.

Figure 2-17: Number of Extreme Precipitation Events Per Year



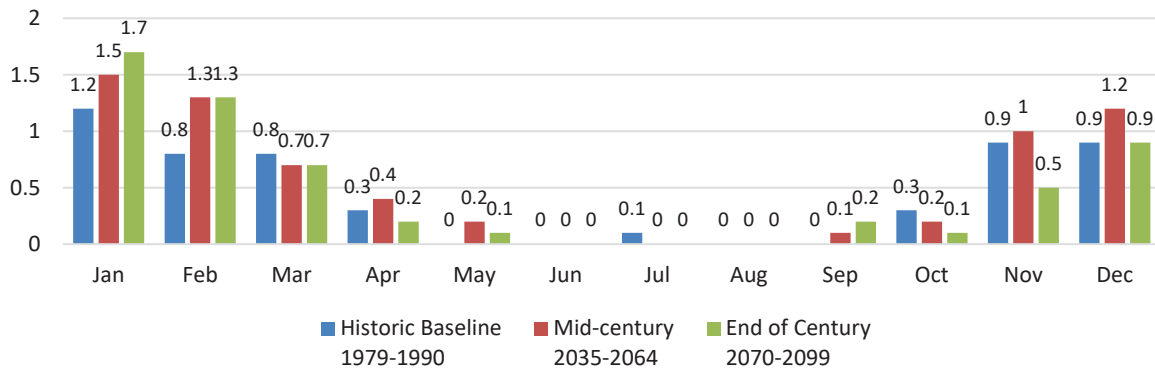
Created using historical and projected precipitation data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. A high degree of variability in the number of extreme rainfall events is projected to continue into the future. However, the dotted linear trendline illustrates, the amount of precipitation that falls during extreme events each year is projected to gradually increase.

Figure 2-18: Annual Inches of Rainfall from Extreme Precipitation Events



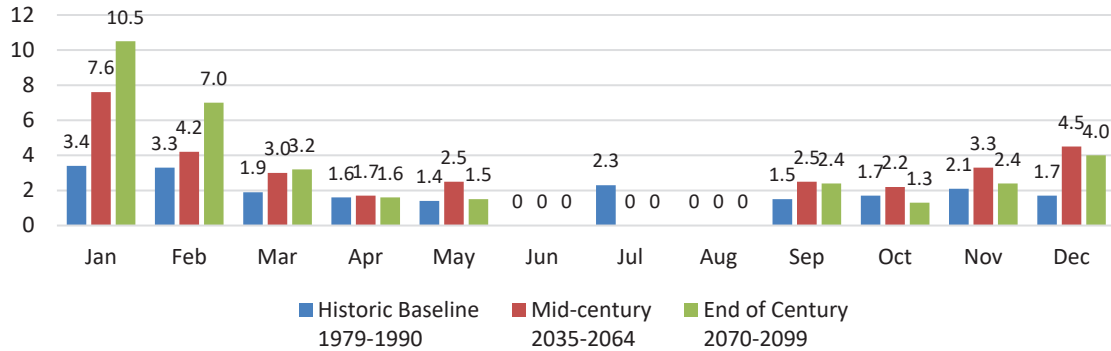
Created using historical (gridded observed meteorological data from University of Colorado Boulder for 1950 to 2013) and projected precipitation data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. A high degree of variability in the amount of rainfall from extreme rainfall events is projected to continue into the future. However, the dotted linear trendline illustrates, the amount of precipitation that falls during extreme events each year is projected to gradually increase.

Figure 2-19: Average Number of Extreme Precipitation Events Per Month



Created using historical (gridded observed meteorological data from University of Colorado Boulder for 1950 to 2013) and projected precipitation data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. The number of extreme precipitation events occurring in January and February is projected to increase dramatically by the end of the century; the number of extreme rain events occurring in October through December may rise at mid-century but taper off by the century's end.

Figure 2-20: Average Total Rainfall Due to Extreme Precipitation Events Per Month



Created using historical (gridded observed meteorological data from University of Colorado Boulder for 1950 to 2013) and projected precipitation data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the City of Sacramento. The amount of precipitation that falls during extreme events in January and February is projected to increase significantly by the end of the century. In November and December, the amount of precipitation falling during extreme events is projected to rise around mid-century but may level off by the end of the century.

Secondary Impacts

Flooding

Section 2.1 describes the historical context of California prior to anthropogenic climate change as a land of hydrological extremes. These extremes are not limited to its annual cycle of wet winters and dry, hot summers, but include mega-droughts and mega-floods. Recently uncovered paleoclimatic evidence reveals that massive floods occurred in California approximately every 100-200 years. These great floods were likely caused by “atmospheric rivers”, a term coined in the early 1990s to describe long narrow corridors of intense water vapor transport which can contain vapor flows comparable to the largest land rivers in the world.

Sacramento sits at the confluence of the Sacramento and American Rivers, which collectively drain water from a watershed the size of West Virginia.⁶⁵ Historically, flooding has been the most frequent natural hazard occurring in the Sacramento region. Even though an extensive system of dams, levees, weirs, and other infrastructure has been established, flooding remains a major concern as the Sacramento area has experienced major recent floods in 1986, 1995, 1997, 2006, 2017, and 2021.⁶⁶

⁶⁵ Sommer, L. “California Cities Will Flood, So Why Aren’t We Ready?” *KQED* Sep 25 2017. May 8 2020: <https://www.kqed.org/science/1915937/california-cities-will-flood-so-why-arent-we-ready>

⁶⁶ Sacramento County, “Storm Ready: Region’s Flooding History.” Nov 8 2019: <https://waterresources.saccounty.net/stormready/Pages/Region's-Flooding-History.aspx>; Esri, “Sacramento at Risk: Understanding Floods in California.” Nov 8 2019: <https://www.arcgis.com/apps/MapJournal/index.html?appid=8e7c54b2d9cf4c3cb8de0a093d5509e3>.



Downtown Sacramento following the Great Flood of 1862, the largest flood in recorded history.

Between 1996 and 2015, the National Climatic Data Center (NCDC) reported 32 flood events within Sacramento County. These floods have damaged bridges and levees and resulted in significant numbers of people injured, killed, or forced to evacuate (Table 2-4). Large floods can result in multiple severe and widespread impacts including damage to electric and transportation infrastructure, destruction of homes and businesses, increased rates of flood-borne disease, and loss of life.

The region's extensive network of levees, dams, and weirs therefore face a very challenging task that will become increasingly challenging as infrastructure ages and climate change induces larger storm and flood events.

The Sacramento area is particularly vulnerable to riverine flooding because it sits at a low elevation at the confluence of the Sacramento and American Rivers. Riverine flooding occurs when streams or rivers exceed the capacity of their natural or constructed channels and water overflows the river banks or overtops the levees. This generally occurs as a result of intense prolonged rainfall from atmospheric rivers or from the combined effects of rainfall and snowmelt in the Sierras.⁶⁷ Within

⁶⁷ Sacramento Municipal Utility District, 2018.

Sacramento County, riverine flooding can occur anytime from November through April.⁶⁸ In addition, Sacramento is vulnerable to flash flooding, as well as flooding associated with localized stormwater overflow. Flash floods are short, intense floods that occur within relatively confined areas, usually resulting from heavy rainfall. Flooding can be more severe when preceded by rainfall that has saturated the ground.

River water levels tend to rise in the winter and early spring months due to high flows from storm runoff and snowmelt. Flooding north of the American River is most likely to affect the Campus Commons, Cal Expo, Arden, and Natomas areas. Flooding occurring south of the American River is most likely to affect downtown Sacramento.⁶⁹

During most storms, the amount of water flowing through the levee system can be controlled by Folsom Dam on the American River and the reserve overflow area of the Yolo Bypass on the Sacramento River. The dam is owned and operated by the U.S. Bureau of Reclamation. Folsom Lake and its afterbay, Lake Natoma, release water to the lower American River and to the Folsom South Canal. The operation of Folsom Dam directly affects most of the water utilities on the American River system. Water flows into the Yolo Bypass via the Fremont Weir northwest of the city and the Sacramento Weir west of the city. The Sacramento River bypass system was federally authorized in 1917 and includes a system of flood relief structures and weirs that release Sacramento River flows into the bypass system west of the Policy Area when flows exceed downstream channel capacity. Downstream of the American River confluence, the Sacramento River has a design capacity (maximum flow that the flood control structures can convey) of 110,000 cubic feet per second (cfs).

Table 2-4: Major Flood Events in the Sacramento Region, 1986 - 2021⁷⁰

<i>Year</i>	<i>Summary of Flood Impacts</i>
1986	February rains across northern California resulted in 10 inches of rainfall in Sacramento over an 11-day period. Floodwaters resulted in significant damages to home foundations and levees.
1995	Heavy rains caused widespread localized flooding, particularly in the Arcade, Morrison, Florin, Union and Dry Creek areas.
1997	Early January storms caused riverine flooding and damage to levees along the Cosumnes River. Floodwaters inundated 33,000 acres of cropland and 84 homes, resulting in \$2,400,000 of property damage. This flood was responsible for one death. Heavy rains in late January were responsible for flooding 1,500 homes around Arden-Arcade and Chicken Ranch Slough.
2006	A series of winter storms resulted in heavy rain, mudslides, flooding, and high winds across northern California. Levee overtopping, breaching, and river flooding occurred along the Feather and Sacramento Rivers, as well as along smaller rivers, creeks, and streams.

⁶⁸ Sacramento County, 2016.

⁶⁹ Sacramento Municipal Utility District, Climate Readiness Assessment and Action Plan, 2016.

⁷⁰ Sacramento County, "Storm Ready: Region's Flooding History." Nov 8 2019:

<https://waterresources.saccounty.net/stormready/Pages/Region's-Flooding-History.aspx>; Sacramento County, "2016 Sacramento Countywide Local Hazard Mitigation Plan Update," 2016; Kasler D, Reese P, Sabalow R. "After years of drought, Sacramento confronts an old foe: Flood Risk." *Sacramento Bee* Jan 24 2017. May 8 2020: <https://www.climatesignals.org/headlines/after-years-drought-sacramento-confronts-old-foe-flood-risk>.

Table 2-4: Major Flood Events in the Sacramento Region, 1986 - 2021⁷⁰

<i>Year</i>	<i>Summary of Flood Impacts</i>
	Transportation infrastructure was impacted by road closures due to severe flooding and mudslides along Interstate 80 and US Highway 50. This series of floods resulted in \$4,500,000 of property damage within Sacramento County.
2017	January storms impacted several parts of Sacramento County. Several levees were breached along the Cosumnes River. The Sacramento Weir, a flood-release valve used to flush excess water from the Sacramento River, was open for the first time in a decade.
2021	In October 2021, a record-breaking 500-year storm event with more than five inches of rain in a 24-hour period resulted in localized flooding. However, the Department of Utilities and Citywide response and management fared exceptionally well.

The American River, however, enters the Sacramento River with a higher design capacity of 160,000 cfs. During periods of high flow, the two-mile portion of the Sacramento River between the Sacramento Bypass and the American River confluence can support reverse river flow so that a portion of the American River input flows upstream and through the Sacramento Weir. The Sacramento Weir diverts floodwaters west down the mile-long Sacramento Bypass into the Yolo Bypass. The Sacramento Weir was most recently opened in 1998, 2005, and 2017. It is a key structure protecting the City of Sacramento during high flows on the Sacramento River, diverting flows through the Sacramento Bypass into the Yolo Bypass for safe passage to the Delta. Construction to widen the Sacramento Weir and Bypass to minimize flooding downstream of the Sacramento and American rivers confluence began in 2020 (further detailed in Section 4.2: Existing Adaptive Capacity).

The City has approximately 65,183 improved parcels, \$27.2 billion of structure and contents value, and 161,675 residents within areas that are protected by levees, meaning that the threat of flooding via levee failure poses a great risk to life and welfare within the City. The majority of Sacramento's urban center, as well as vital public utilities, are dependent on levee protection.⁷¹ In the event of a significant levee failure, repair and dewatering could take over a year and costs could run as high as \$480 million.⁷² However, there are measures within the city to help relieve pressure from the rivers as water gets high. For example, the Yolo Bypass is a restored wetland that protects Sacramento and neighboring communities from flooding. During wet seasons, the bypass carries Sacramento River water overflow to the Delta, preventing flooding within the city. Map 3: Levee System and Leveed Areas, illustrates the nature of the extensive levee system on which the City of Sacramento depends. On Map 4: Repetitive Loss Areas and FEMA Flood Zones, the 100 Year Flood Zone refers to the area in which, historically, there is a one-percent annual chance of experiencing a flood. Similarly, the 500 Year Flood Zone refers to the area in which there is a 0.2-percent annual chance of experiencing a flood.

⁷¹ Sacramento Municipal Utility District, 2018; Water Education Foundation, "Sacramento-San Joaquin Delta Levees." Nov 9 2019: <https://www.watereducation.org/aquapedia/sacramento-san-joaquin-delta-levees>.

⁷² Porter K., et al., "Overview of the ARkStorm Scenario." United States Geological Survey (2010). July 1 2020: <https://pubs.usgs.gov/of/2010/1312/>; Cost estimates are based on modeling by USGS under the ARkStorm Scenario (footnoted above). Property damage methodology is based on FEMA's HAZUS-MH, census data, and other information developed for the ARkStorm Scenario. For more information see: https://pubs.usgs.gov/of/2010/1312/of2010-1312_text.pdf

Climate and topographic factors that affect flood risk and magnitude include elevation, topography, rainfall amount, intensity and duration; soil moisture and type; snow depth; impermeability of manmade surfaces, development patterns, and vegetation. Warmer temperatures and the increased fraction of precipitation falling as rain rather than snow contribute to greater, more intense surface runoff, which will peak in February through March, which is significantly earlier than historical peaks in May. Local flood management, such as of Folsom Reservoir, will correspondingly need to account for water capacity in anticipation of flood events, with consequent reductions in drinking water available in Folsom during summer and fall for drinking water, hydropower, irrigation and recreation. It is noted that federal storage facilities and operation of upstream water storage facilities will also play a pivotal factor in regional flood control management, given that Folsom Reservoir by itself is currently undersized for additional flood control management. Localized flooding associated with smaller creeks in the City are also a factor that may cumulatively pose substantial flood risk.

Although flooding due to levee failure may result in more catastrophic damage, most of the City's flooding damage since 1955 has been due to runoff that exceeded the capacity of underground storm drain pipes.⁷³ The limited capacity of the City's internal drainage system therefore is a risk factor affected by the increase in frequency and severity of storm events.

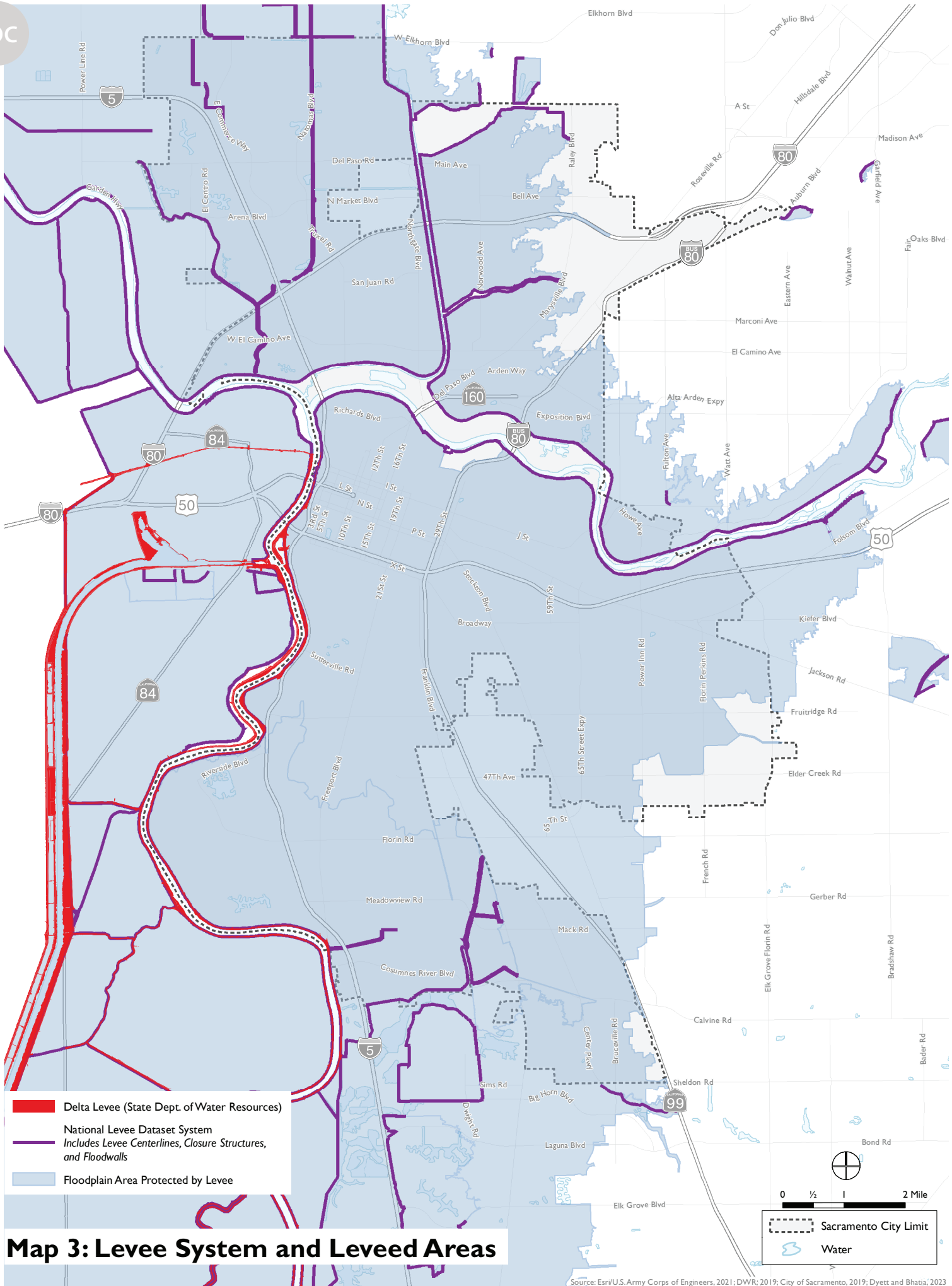
Several repetitive loss areas are identified within the City of Sacramento's 2017 Comprehensive Flood Management Plan. Repetitive loss areas are areas that have experienced significant flood damage numerous times within the past several decades. Repetitive loss properties are widely distributed throughout the City of Sacramento. The City's analysis indicated that the majority of repetitive loss properties within the city flooded during winter storms occurring in 1995 and 1997 due to undersized drainage conveyance systems, power outages at pump stations, and the properties' relatively low elevation within their respective neighborhoods.⁷⁴ The City is currently updating the 2017 Repetitive Loss Area analysis, which is anticipated to be completed in mid-2023.

The City of Sacramento's Repetitive Loss Analysis defines five Repetitive Loss Areas (RLA), as indicated in Map 4:

- **RLA 1**, South Natomas, sits within the Natomas Basin. The Natomas Basin is surrounded by levees, and is at risk to riverine flooding, levee breach, and flooding due to internal drainage issues. Within RLA 1, factors found to exacerbate flood risk and damage include high levels of development, presence of landfill with associated uneven land grading, and elevation changes.
- **RLA 2**, Downtown East, corresponds to the neighborhoods of River Park, McKinley Park, and Coloma Terrace. These are older areas of the City that may experience overbanking, erosion, and seepage from the American River levees. Undersized drainage systems were also found to contribute to flood risk in this area.

⁷³ City of Sacramento Department of Utilities, Comprehensive Flood Management Plan (February 2016). Nov 8 2019: <https://www.cityofsacramento.org/~media/Corporate/Files/DOU/Flood-Ready/2016%20CFMP.pdf>

⁷⁴ City of Sacramento, City of Sacramento Comprehensive Flood Management Plan (2017). Nov 8 2019: https://www.cityofsacramento.org/~media/Corporate/Files/DOU/Flood-Ready/Chapter-X-Appendix-D-RLAA-UPDATED_Final.pdf?la=en.



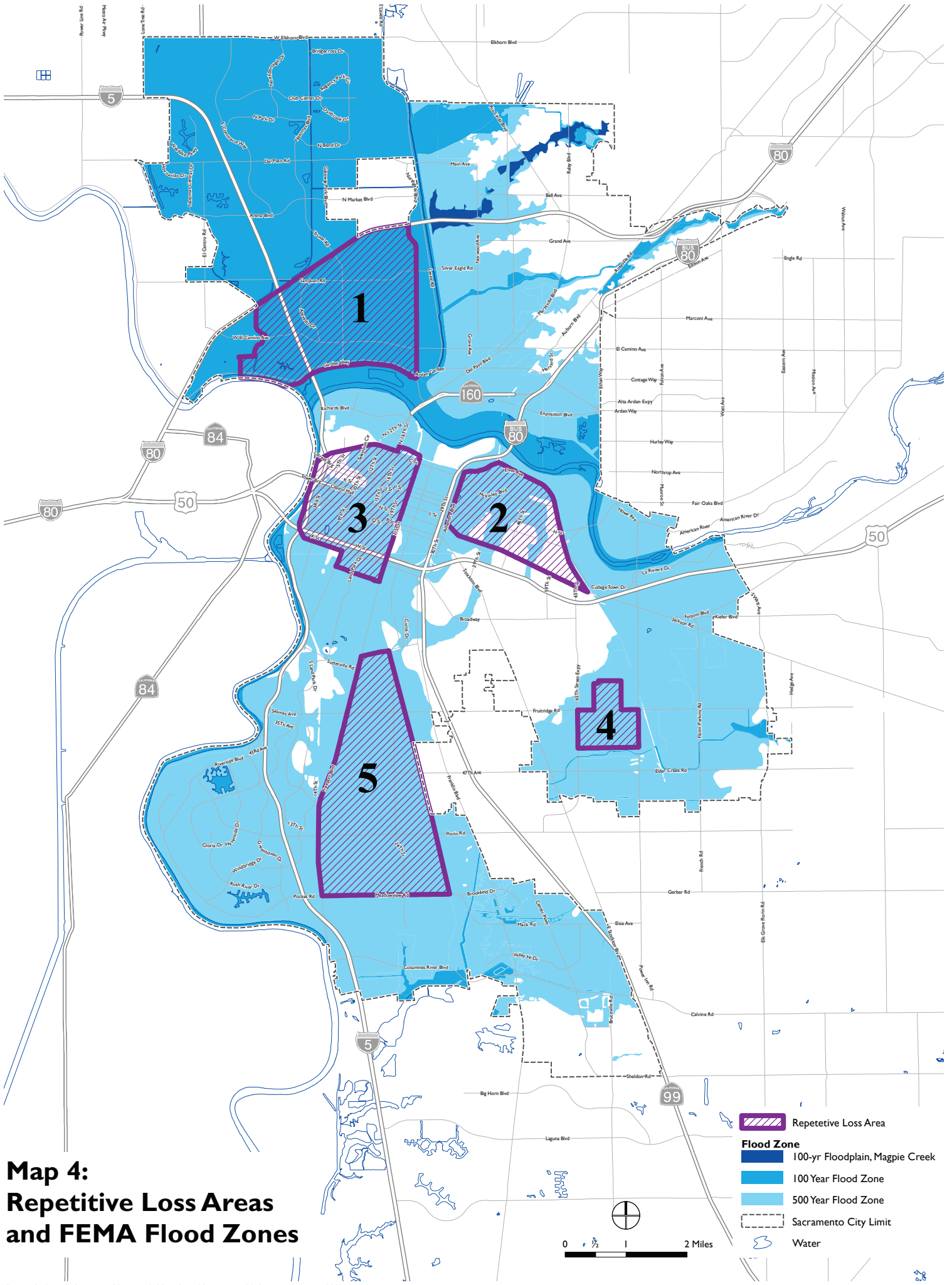
- Delta Levee (State Dept. of Water Resources)
- National Levee Dataset System
Includes Levee Centerlines, Closure Structures, and Floodwalls
- Floodplain Area Protected by Levee

Map 3: Levee System and Leveed Areas

Sacramento City Limit
 Water

0 1/2 1 2 Mile

Source: Esri/U.S. Army Corps of Engineers, 2021; DWR, 2019; City of Sacramento, 2019; Dyett and Bhatta, 2023



**Map 4:
Repetitive Loss Areas
and FEMA Flood Zones**

Source: CalAdapt/UC Berkeley, 2016; FEMA, 2015; City of Sacramento, 2019; Dyett and Bhatia, 2019

- **RLA 3**, Downtown West, is located just east of the Sacramento River in Downtown Sacramento. The repetitive loss properties in this RLA are residential, the primary source of flooding is an undersized combined sewer system that is overwhelmed during large storms.
- **RLA 4**, Southeast Sacramento, is a residential area located at the Southeast portion of the city limits. Flooding in this area has occurred when water from higher-elevation adjacent properties has flowed into lower-lying areas, causing some homes to flood.
- **RLA 5**, Sutterville/Meadowview, extends from Sutterville to Meadowview Road. The RLA is surrounded by levees and is primarily residential. Investigations within the RLA revealed that common sources of flooding are undersized drainage systems and low-lying elevation.

Flooding can have negative impacts on infrastructure integrity and human health. Flooding impacts transportation infrastructure, inhibiting the movement of vehicles and increasing accident rates,⁷⁵ and can damage electricity and telecommunications infrastructure, leading to service outages.⁷⁶ Floodwaters can also inundate important infrastructure such as sewer systems, water treatment facilities, and hazardous materials facilities, leading to contamination.⁷⁷ These impacts can take extensive time and resources to address, meaning that a flooded area may continue to experience flooding impacts for many months after the initial flood event. Damage to transportation networks, businesses, and related infrastructure may impede worker's ability to get to work and adversely affect local employment opportunities and business revenues. Ability to reach work and other key services may be especially significant for those who rely on public transportation.⁷⁸

Flood waters can contain a myriad of hazardous substances including dirt, oil, animal waste, and industrial chemicals.⁷⁹ These waters can overwhelm sanitary sewer lines, causing wastewater to back up into low-lying areas and homes and providing a breeding ground for bacteria such as e. coli.⁸⁰ Water intrusion into buildings can result in mold contamination, leading to indoor air quality problems and exacerbation of asthma, allergic reactions, and respiratory infections.⁸¹ Even as floodwaters begin to dissipate, remaining pools of stagnant water can provide breeding grounds for

⁷⁵ Mitsakis E, Stamos I, Diakakis M, Salanova Grau JM. "Impacts of high-intensity storms on urban transportation: applying traffic flow control methodologies for quantifying the effects." *International Journal of Environmental Science and Technology* Apr 10 2014. May 11 2020: <https://link.springer.com/article/10.1007/s13762-014-0573-4>.

⁷⁶ Lane K, Charles-Guzman K, Wheeler K, Abid Z, Graber N, Matte T. "Health Effects of Coastal Storms and Flooding in Urban Areas: A Review and Vulnerability Assessment." *Journal of Environmental and Public Health* May 30 2013. May 11 2020: <https://www.hindawi.com/journals/jep/2013/913064/>; Porter K., et al., 2010.

⁷⁷ Rudolph L, Harrison C, Buckley L, North S. "Climate Change, Healthy, and Equity: A Guide for Health Departments." Public Health Institute, American Public Health Association (2018). May 11 2020: https://www.apha.org/-/media/files/pdf/topics/climate/climate_health_equity.ashx?la=en&hash=14D2F64530F1505EAE7AB16A9F9827250EAD6C79; Porter K., et al., 2010.

⁷⁸ Constible J, Chang B, Morganelli C, Blandon N. "On the Front Lines: Climate Change Threatens the Health of America's Workers." Natural Resources Defense Council Jun 2020. July 31 2020: <https://www.nrdc.org/sites/default/files/front-lines-climate-change-threatens-workers-report.pdf>.

⁷⁹ Sacramento County, "2016 Sacramento Countywide Local Hazard Mitigation Plan Update," 2016.

⁸⁰ Sacramento County, 2016.

⁸¹ CalBRACE, Climate Change and Health Profile Report Sacramento County (2017); Lane K, et al., 2013.

mosquitoes.⁸² Exposure to floodwater can thus increase risk of exposure to viral and bacterial contamination.

Flooding can also result in forced evacuation, which may strain local and regional emergency response resources and disrupt family and community stability.⁸³ Indeed, extreme climate events, including major storms and flooding, have been shown to be associated with mental health consequences, exacerbating pre-existing conditions and increase incidence of stress, post-traumatic stress disorder, anxiety, and depression.⁸⁴ By disrupting access to health services, these extreme events can continue to adversely impact health even after the event has passed.⁸⁵

Groups especially vulnerable to the health effects of flooding include the elderly, pregnant women, people with preexisting mental illness, low-income households, people experiencing homelessness, tribal and Indigenous communities, and emergency responders.

Geological Impacts

Stormwater runoff, particularly during high-intensity storms, can lead to erosion and transport and redistribution of soils, sediments, and rock materials. Such activities are expected to result in significant impacts to local species and habitats and pose a risk to human health and structures. Landslides triggered by severe storms have caused hundreds of millions of dollars in damage and numerous casualties across California.⁸⁶

Severe Winds

The strong winds that can occur during heavy storms can damage structures and pose a threat to electricity infrastructure. Wooden crossbars and pole-mount transformers on distribution-voltage utility poles can be damaged by wind speeds as low as 60 miles per hour. Moderate winds can also cause lines to sway, touch, and cause cross-phase shorting.⁸⁷ Individuals living in mobile homes are especially vulnerable to the effects of high winds.⁸⁸

Changes in Winter Snowpack

Historically, the Sierra snowpack and its spring and summer snowmelt has been a key part of the water planning process in the Sacramento region and throughout the watersheds of the Sierra Nevada. California's municipalities, industries, and ecosystems rely on the gradual melting of the Sierra snowmelt to provide a reliable supply of summertime freshwater and hydroelectric power.⁸⁹

⁸² Sacramento County, 2016.

⁸³ Maxwell, K., et.al., 2018.

⁸⁴ Lane K, et.al., 2013.

⁸⁵ Maxwell, K., et.al., 2018.

⁸⁶ Porter K., et al., 2010.

⁸⁷ Porter K., et al., 2010.

⁸⁸ The National Severe Storms Laboratory, "Severe Weather 101: Damaging Winds Basics," July 1, 2020: <https://www.nssl.noaa.gov/education/svrwx101/wind/>.

⁸⁹ Meisen P, Phares N. "Impacts of Climate Change on California's Water Supply." Global Energy Network Institute

As temperatures increase, more precipitation will fall as rain instead of snow, and snowmelt will occur earlier in the year, leading to more concentrated volumes of surface runoff.^{90 91} Statewide, average April snow water equivalence, or the depth of water that would occur if all the snow were melted, has been 2.1 inches between 1961 and 1990. By the middle of this century, this number could decline to about 1.0 inches. By the end of the century, April snow water equivalence is projected to be between 1.0 and 0.7 inches (Figure 2-21).

The Sierra winter snowpack plays a pivotal role in regulating water availability throughout the State by providing a steady supply of freshwater that can be stored in dams, supplementing the scant summer rainfall, and used to produce electricity. Disruption to the processes that ensure adequate snow supply may therefore have a significant impact on energy generation, water availability, flood risk, and ecosystem health throughout California and the Sacramento region.⁹² Climate change has significant implications for water management because the warming climate is increasing the fraction of rainfall and decreasing the fraction of snowfall in the Sierras. Higher levels of Sierra rainfall and faster rates of snowmelt produce quantities of water that are anticipated to exceed the State's reservoir capacity and therefore cannot be effectively stored for later consumption or used to generate electricity,⁹³ while increasing risk of flooding. Ecological impacts of decreased flows and increased temperatures in the Lower American River in summer and fall can threaten native Chinook salmon during future fall spawning. Additionally, earlier snowmelt will reduce the amount of water available for consumption during the summer, potentially leading to water scarcity.

An assessment of the City's water service reliability and drought risk concluded that "the City is well-positioned to withstand the effects of a single dry year and a five-year drought at any period between 2025 and 2045. The City's drought risk was specifically assessed between 2021 and 2025, assuming that the next five years are dry years. In each case, water supplies comfortably exceed water demands. This remains true whether the drought occurs in 2021, 2045, or any year between."⁹⁴ Since the City of Sacramento has senior water rights to natural flows and stored water Sacramento residents are at less pronounced risk than other water users throughout the State with lower priority access to surface water through the State Water Resources Control Board water rights process. However, historical records show that droughts are intrinsic to the natural climate of California, and that droughts of 5-10 years are not at all anomalous.

(2011). May 6 2020: <http://www.geni.org/globalenergy/research/impact-of-climate-change-on-californias-water-supply/Impacts%20of%20Climate%20Change%20on%20California%92s%20Water%20Supply.pdf>.

⁹⁰ United States Department of the Interior Bureau of Reclamation, Reclamation Managing Water in the West. West-Wide Climate Risk Assessment Sacramento and San Joaquin Basins Climate Impact Assessment (2014). Nov 8 2019: <https://www.usbr.gov/watersmart/baseline/docs/ssjbia/ssjbia.pdf>.

⁹¹ Reich KD, Berg N, Walton DB, Schwartz M, Sun F, Huang X, Hall A. "Climate Change in the Sierra Nevada: California's Water Future." UCLA Center for Climate Science (2018). May 6 2020: <https://www.ioes.ucla.edu/wp-content/uploads/UCLA-CCS-Climate-Change-Sierra-Nevada.pdf>

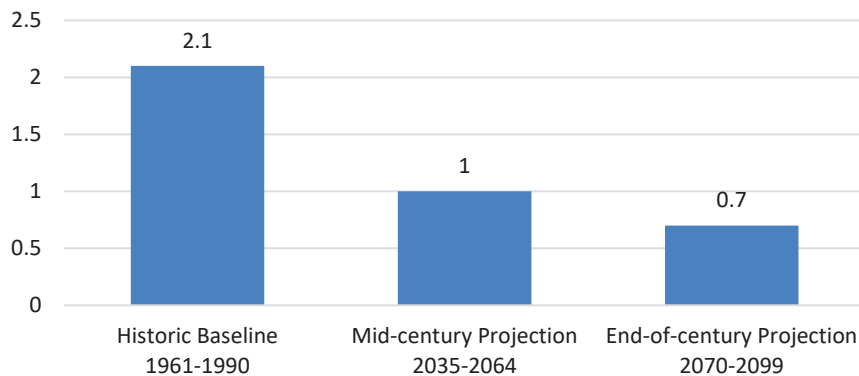
⁹² Sacramento Municipal Utility District, 2016.

⁹³ Meisen P and Phares N., 2011; Reich KD, et.al., 2018.

⁹⁴ City of Sacramento 2020 Urban Water Management Plan (May 2021). May 10 2021: <https://www.cityofsacramento.org/-/media/Corporate/Files/DOU/Reports/R---038---City-of-Sacramento-Draft-2020-UWMP---05-18-21.pdf?la=en>.

Reductions in winter snowpack are associated with declines in summer soil moisture content, which increases wildfire risk.⁹⁵ Additionally, reduced water flow during summer and fall months may lower water quality via reduced levels of dissolved oxygen, higher detritus and bacterial content, and increased salinity.⁹⁶ Maps 5, 6, and 7 illustrate historically observed and projected April snowpack levels at the middle and end of this century. The stark contrast in snowpack volume demonstrated in these figures demonstrates the significant degree to which Sacramento may experience limited access to vital Sierra snowpack water resources as the century unfolds.

Figure 2-21: Average Statewide April Snow Water Equivalence (Inches)



Created using historical and projected precipitation data from Cal-Adapt. Projected data was generated for the high emissions (RCP 8.5) scenario and the averaged (CanEMS2) climate model for the State of California. Snow water equivalence is projected to decline steadily through the end of the century.

Drought

Drought is a complex phenomenon that results from the long-term interaction of temperature, precipitation, snowpack retention, and other climate factors. Drought is associated with a number of ecosystem effects, including reduced soil moisture, increased risk of wildfire, and reductions in streamflow.⁹⁷ Other environmental and health impacts of drought include dust storms, flash flooding, lower crop yields, and reduced water quality.⁹⁸ Periods of surface water scarcity also increase demand for groundwater, with attendant environmental consequences as described below. Meanwhile, drought can increase the concentrations of industrial chemicals, heavy metals, and

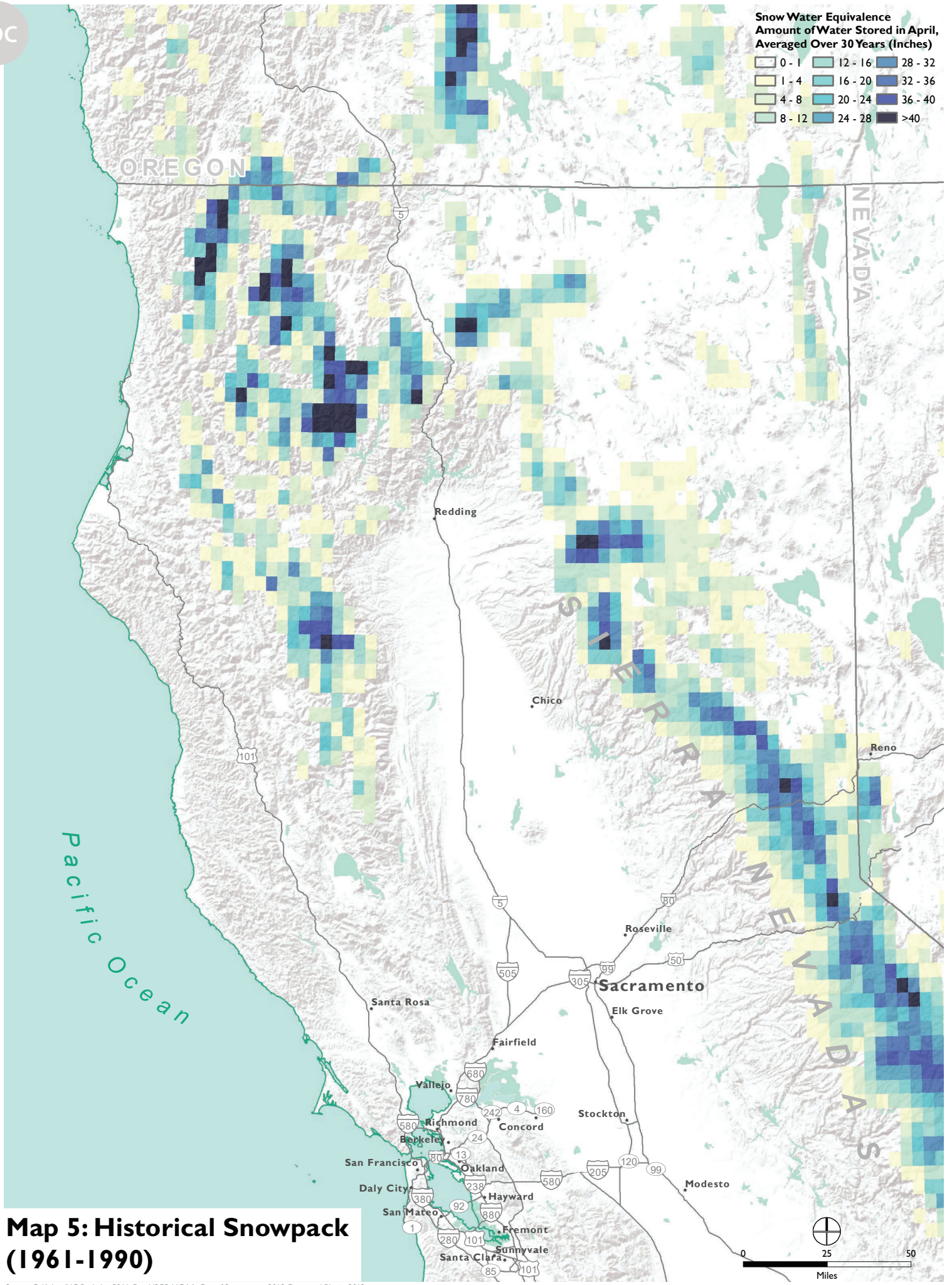
⁹⁵ Gergel DR, Nijssen B, Abatzoglou JT, Lettenaier DP, Stumbaugh MR. “Effects of Climate Change on Snowpack and Fire Potential in the Western USA. *Climatic Change* Feb 1 2017. May 6 2020: <https://link.springer.com/article/10.1007/s10584-017-1899-y>.

⁹⁶ Meisen P and Phares N., 2011.

⁹⁷ Williams AP, Seager R, Abatzoglou JT, Cook BI, Smerdon JE, Cook ER. “Contribution of Anthropogenic Warming to California’s Drought 2012-2014.” *Geophysical Research Letters*, Aug 20 2015. May 7 2020: <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2015GL064924%4010.1002/%28ISSN%291944-8007.CALDROUGHT1>.

⁹⁸ CalBRACE, Climate Change and Health Profile Report Sacramento County (2017); Sacramento Municipal Utility District, 2018;

**Snow Water Equivalence
Amount of Water Stored in April,
Averaged Over 30 Years (Inches)**

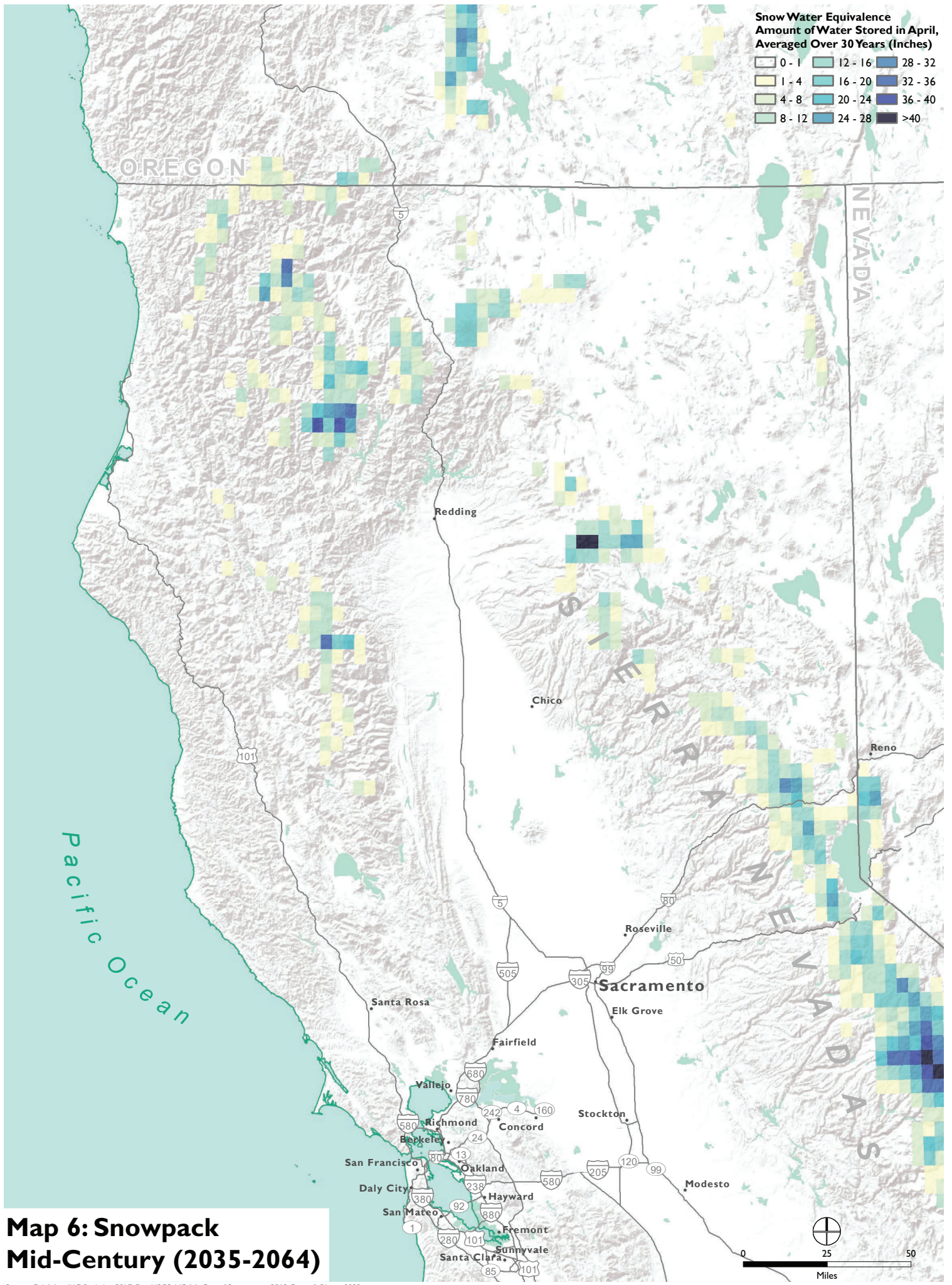


**Map 5: Historical Snowpack
(1961-1990)**

Source: CalAdapt/UC Berkeley, 2016; Esri, USGS, NOAA, City of Sacramento, 2019; Dyett and Bhatia, 2019

**Snow Water Equivalence
Amount of Water Stored in April,
Averaged Over 30 Years (Inches)**

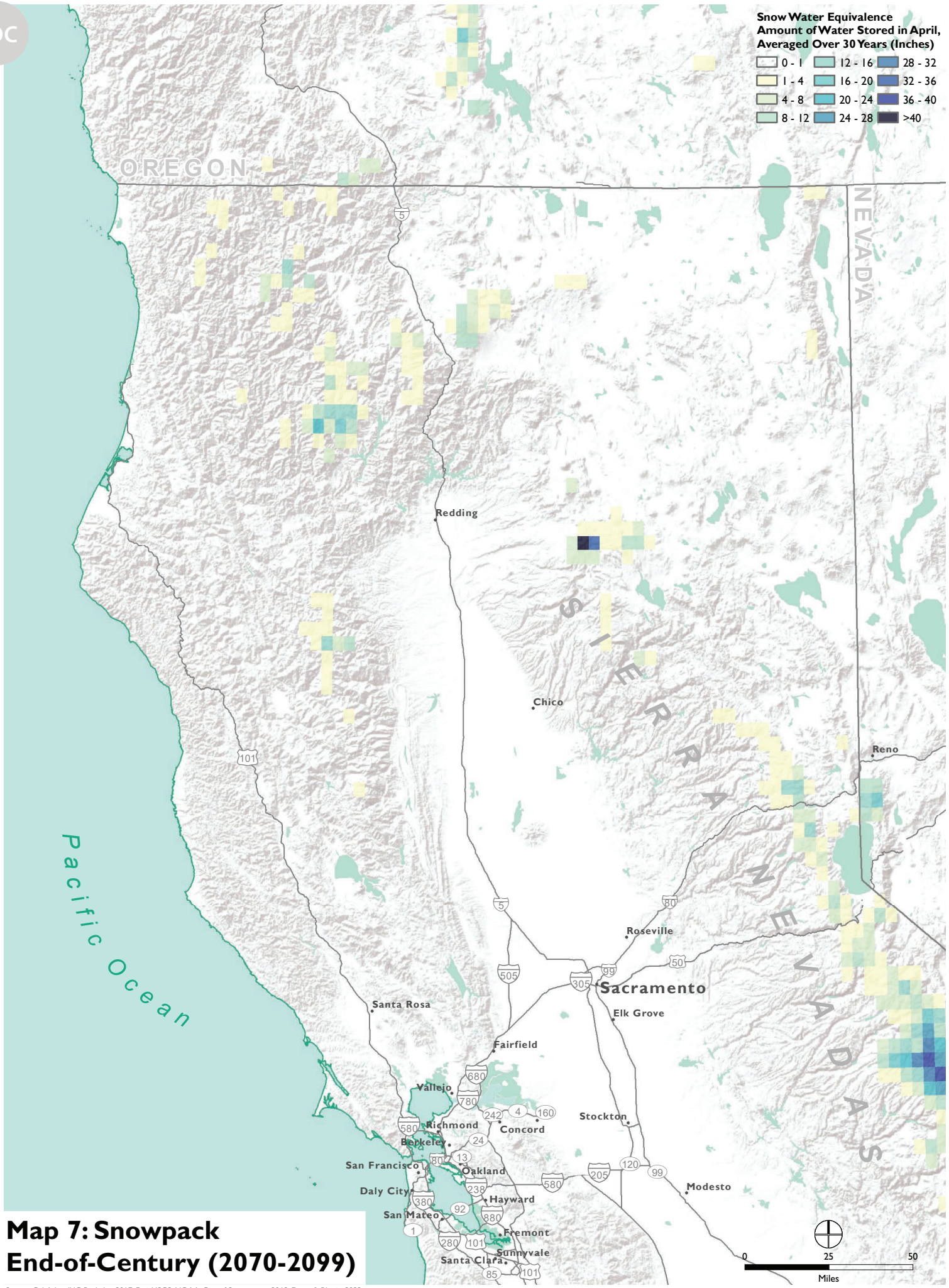
0 - 1	12 - 16	28 - 32
1 - 4	16 - 20	32 - 36
4 - 8	20 - 24	36 - 40
8 - 12	24 - 28	>40



**Map 6: Snowpack
Mid-Century (2035-2064)**

Source: Cal-Adapt/UC Berkeley, 2017; Esri, USGS, NOAA, City of Sacramento, 2019; Dyett & Bhatia, 2023

Snow Water Equivalence
Amount of Water Stored in April,
Averaged Over 30 Years (Inches)



**Map 7: Snowpack
End-of-Century (2070-2099)**

Source: Cal-Adapt/UC Berkeley, 2017; Esri, USGS, NOAA, City of Sacramento, 2019; Dyett & Bhatia, 2023



agricultural runoff contaminants in groundwater, increasing the risk of exposure among communities that rely of groundwater resources.⁹⁹

Drought conditions have profound impacts on water availability across California. Industries and communities especially vulnerable to the effects of drought include the agricultural sector, hydropower industry¹⁰⁰, rural populations, and those dependent on wells.¹⁰¹ The soil drying and weakening caused by long-lasting droughts can also comprise levee integrity.¹⁰²

A combination of drier soils and increased wildfire activity, which removes vegetation and other natural soil stabilizers, increases wind erosion and causes unhealthy dust to be released into the air. Small dust particles can travel deep into the lungs and enter the bloodstream, where they can cause or exacerbate conditions such as asthma and bronchitis. Dust can also carry pesticides and heavy metals as well as viral, bacterial, and fungal pathogens.¹⁰³

The exact timing, location, and duration of future droughts is difficult to predict. However, studies have shown that statewide shifts in precipitation patterns towards wetter winters and drier summers make drought-like conditions more likely.¹⁰⁴

California recently experienced a major drought from 2012 to 2016, and statewide efforts have since made several improvements to become less vulnerable to drought such as through the Sustainable Groundwater Management Act, establishing new water use standards, funding drought response and long-term water resilience projects, and preparing a Water Resilience Portfolio. Yet, two consecutive years of dry conditions have resulted in drought or near-drought conditions throughout the state, and the combination of exceptionally low precipitation, warm temperatures, and dry soils have resulted in record low runoff from the Sierra-Cascade snowpack, leading to significantly reduced water supply and extremely low reservoir storage levels. On May 10, 2021, Governor Newsom declared a drought emergency for 41 counties, including those within the Sacramento-San Joaquin Delta, and outlined water conservation and water supply contingency actions that the State Water Board, urban water suppliers, and other agencies should take or consider.¹⁰⁵ On October 19, 2021, the drought emergency was expanded statewide, and the State Water Board was empowered to prohibit wasteful uses of potable water such as washing sidewalks/driveways, filling decorative fountains/ponds, watering lawns during and right after rain,

⁹⁹ Rudolph, et.al., 2018.

¹⁰⁰ Sacramento Municipal Utility District, 2018.

¹⁰¹ Sacramento Municipal Utility District, 2018.

¹⁰² Maxwell, K., et.al., 2018.

¹⁰³ Constible J, et.al., 2020.

¹⁰⁴ Swain DL., Langenbrunner B., Neelin JD., Hall A., “Increasing precipitation volatility in twenty-first-century California.” *Nature Climate Change* (2018); Mann ME, Gleick PH. “Climate Change and California Drought in the 21st Century.” *PNAS* Mar 31 2015. May 7 2020: <https://www.pnas.org/content/112/13/3858.short>.

¹⁰⁵ California Water Boards, “Sacramento-San Joaquin Delta Watershed Drought & Curtailment Information,” last updated September 29, 2022, accessed October 3, 2022: https://www.waterboards.ca.gov/waterrights/water_issues/programs/drought/delta/.

and using hoses without automatic shutoff nozzles. California residents are also encouraged to voluntarily reduce water consumption by 15 percent.¹⁰⁶

Groundwater Supply

Sacramento County lies over the north central portion of California’s Great Valley Groundwater Basin, which provides groundwater to the City and County of Sacramento. Groundwater recharge occurs primarily from the American and Cosumnes rivers, with additional recharge from the Sacramento River and local streams. Groundwater currently comprises about one-third of the region’s water use.¹⁰⁷ This rate of usage is by design in the City of Sacramento, where policies in the City’s General Plan and regional groundwater sustainability plans implement a standing water management objective to rely on groundwater during surface water scarcity and rely on surface water during excess, a balance that allows groundwater supply to recharge.

Streamflow declines and changes in precipitation patterns anticipated under continued global climate change may increase demand for groundwater. Groundwater overdraft is associated with numerous economic and ecosystem effects, including higher groundwater pumping costs, decreased streamflow, land surface subsidence, and loss of wetland ecosystems.¹⁰⁸ Reduced snowpack in the upper watershed of the American River Basin, for instance, will directly impact water supply reliability in Sacramento. Increased flood risk in the winter (as discussed above) will prompt more flood releases from Folsom Reservoir. Along with decreased runoff in the spring, this will reduce water available in Folsom Reservoir during summer and fall for drinking water, hydropower, irrigation, and recreation, making the region more vulnerable to shortages. However, the City’s groundwater supplies are currently being managed sustainably, including through key partnerships such as the Regional Water Authority, and major overdrafts are not anticipated.¹⁰⁹

WILDFIRE

Historically, wildfire has exhibited a cyclical pattern within California – some years may see intense wildfire while others may not. Additionally, there used to be what was considered a “fire season” in California from mid-summer to fall; however, now fires are increasingly occurring year-round. As wildfire emerges from a variety of climate conditions including type of vegetative cover, precipitation,

¹⁰⁶ State of California, “State drought response,” accessed October 3, 2022: California Drought Action, <https://drought.ca.gov/state-drought-response/#regional-drought-response>.

¹⁰⁷ “Fact Sheet: The State of Sacramento Valley Groundwater.” *Northern California Water Association* Jul 1, 2017. May 7 2020: https://norcalwater.org/wp-content/uploads/Groundwater_factsheet.pdf

¹⁰⁸ Famigletti JS. “The Global Groundwater Crisis.” *Nature Climate Change* Oct 29 2014. May 7 2020: <https://www.nature.com/articles/nclimate2425>; Lund JR, Harter T. “California’s Groundwater Problems and Prospects.” *California Water Blog* Jan 30 2013. May 7 2020: <https://californiawaterblog.com/2013/01/30/californias-groundwater-problems-and-prospects/>.

¹⁰⁹ Northern California Water Association, “Fact Sheet: The State of Sacramento Valley Groundwater,” July 1, 2017. May 7 2020: https://norcalwater.org/wp-content/uploads/Groundwater_factsheet.pdf; West Yost Associates. “2015 Urban Water Management Plan.” City of Sacramento (2016). May 7 2020: <https://www.cityofsacramento.org/~/media/Corporate/Files/DOU/Reports/City%20of%20Sacramento%20Final%202015%20UWMP%20June%202016.pdf>.

and temperature, wildfire severity will continue to fluctuate over time. However, climate change will favor many of the climatic conditions that make wildfire more likely, meaning that average wildfire intensity will gradually increase. Wildfire is associated with secondary impacts such as smoke production and air quality reductions, reductions in soil and water quality, landslides and erosion, and impacts to health, energy, and transit systems, as discussed below and in Table 2-5.

Table 2-5: Wildfire

Temporal Extent	<ul style="list-style-type: none"> Wildfire extent and severity is projected to exhibit high levels of variability, but generally increase over time Historically, fire season has extended from early summer through late fall. Fire season may continue to expand in the future
Spatial Extent	<ul style="list-style-type: none"> A wildfire is unlikely to break out within Sacramento City limits. However, the entire City may be subject to wildfire smoke originating from across the Sacramento Valley Storm events will mobilize the debris from these events into the waterways and become a concern for source water protection.
Permanence	<ul style="list-style-type: none"> An overall trend of increased wildfire intensity with year-to-year variability Impacts of contamination to air and water quality may be irreversible.
Level of Disruption	<ul style="list-style-type: none"> Moderate
Nature of Disruption	<ul style="list-style-type: none"> The wildfire impact most likely to have a significant impact on the city is air pollution from wildfire smoke
Level of Uncertainty	<ul style="list-style-type: none"> Moderate

California has an extensive history of wildfires, with large-scale, highly damaging fires becoming increasingly common. Nine of California’s 20 largest wildfires have occurred since the year 2020 and generally rank among the largest within the list, damaging 4,098,950 acres of land and 8,327 structures. Four of these largest wildfires occurred in 2021.¹¹⁰ The Camp Fire that occurred in November 2018 resulted in 18,804 structures damaged or destroyed and 85 deaths—the highest amount of any fire recorded.¹¹¹ This fire occurred in Butte County, less than 100 miles from the City of Sacramento. Between 2014 and 2016, there were three wildfires that occurred within Sacramento County and caused a total of three million dollars in property damage.¹¹² There were 13 additional fires that occurred in Sacramento County between 2016 and 2020, burning more than 8,800 acres. Indeed, the Sacramento metropolitan area has among the highest number of homes at

¹¹⁰ CAL FIRE, “Top 20 Largest California Wildfires,” October 24, 2022, accessed April 24, 2023: https://34c031f8-c9fd-4018-8c5a-4159cdf6b0d-cdn-endpoint.azureedge.net/-/media/calfire-website/our-impact/fire-statistics/featured-items/top20_acres.pdf?rev=be2a6ff85932475e99d70fa9458dca79&hash=A355A978818640DFACE7993C432ABF81 .

¹¹¹ CAL FIRE, “Top 20 Deadliest California Wildfires,” October 24, 2022, accessed April 24, 2023: https://34c031f8-c9fd-4018-8c5a-4159cdf6b0d-cdn-endpoint.azureedge.net/-/media/calfire-website/our-impact/fire-statistics/featured-items/top20_deadliest.pdf?rev=e201e407ab6943c7854c7c917c7b818b&hash=8068F655A48FC601C6E2F55F9E0A1682.

¹¹² Sacramento County, 2016.

risk of damage from wildfires in the United States,¹¹³ posing a significant risk to structures within the region. While a wildfire may be unlikely to break out within city limits, these major wildfires have profound impacts on economies, health, and ecosystem function throughout the region.

Wildfire risk is influenced by a number of climatic factors, including topography, fuel type and availability, temperature, soil moisture, as well as local topography and wind and precipitation patterns.¹¹⁴ Climate change is expected to increase wildfire risk and intensity by increasing temperatures, reducing snowpack, and altering precipitation patterns.

Large swings in rainfall from season to season can encourage vegetation growth in rainy periods, allowing more vegetation to accumulate.¹¹⁵ Meanwhile, high temperatures increase the rate of evapotranspiration in plants, making vegetation drier and more prone to catching fire.¹¹⁶ High temperatures also reduce winter snowpack by encouraging precipitation to fall as rain instead of snow and prompting earlier snowmelt.¹¹⁷ These changes lead to longer and drier summers, during which wildfires may be more likely to occur.

Across the state of California, approximately 436,763 acres of land succumbed to wildfire per year between 1961 and 1990, as shown in Map 8. This figure is projected to increase to 538,388 acres per year by mid-century and may climb as high as 630,345 acres per year by the end of the century, a 44-percent increase over historic levels. Within the Sacramento-Delta Climate Region, approximately 29,913 acres were burned in wildfire per year between 1961 and 1990. This value is projected to increase to between 30,665 and 31,099 acres by mid-century and between 29,549 and 31,095 acres per year by the end of the century, a four-percent increase. Maps 9 and 10 illustrate the projected increase in wildfire extent and severity that is projected to take place in Northern California as climate change progresses. A notable increase in the annual area affected by wildfire is projected to occur to the northwest of Sacramento. Wildfires occurring in the Sierra Nevada are projected to increase in intensity.

Wildfires may pose a threat to the homes of those who live in the urban-wildland interface (UWI), areas where homes are built near or among lands prone to wildland fire outside the city limits.¹¹⁸

¹¹³ CoreLogic, “2019 Wildfire Risk Report.” 2019. May 8 2020: https://www.corelogic.com/downloadable-docs/wildfire-report_0919-01-screen.pdf; Milne S. “Sacramento Metro Area Ranks No. 4 On National Wildfire Risk Report.” *Capradio* Sep 12 2019. May 8 2020: <https://www.capradio.org/articles/2019/09/12/sacramento-metro-area-ranks-no-4-on-national-wildfire-risk-report/>.

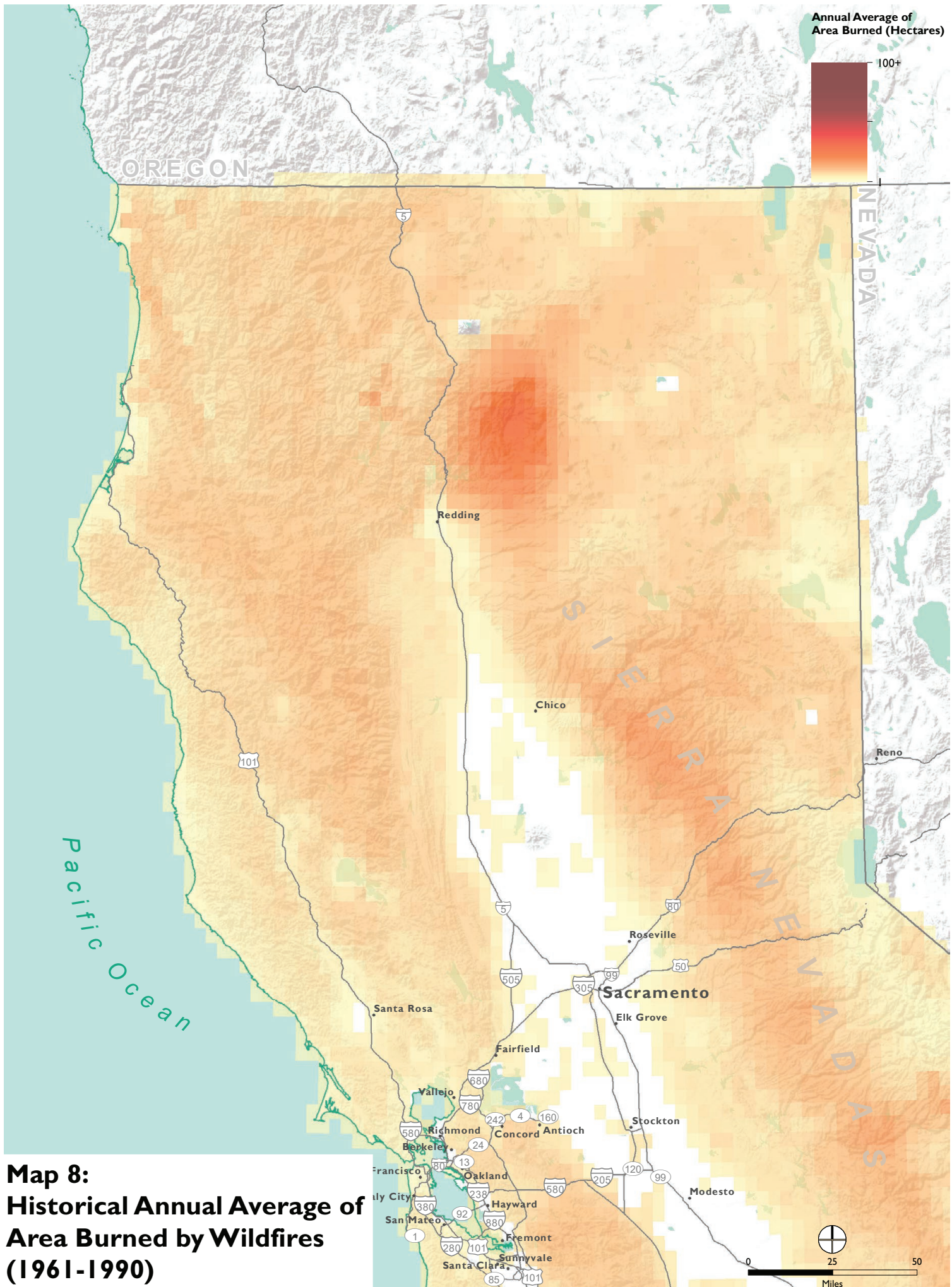
¹¹⁴ Sacramento Municipal Utility District, 2018; Sacramento County, 2016.

¹¹⁵ Sacramento Municipal Utility District, 2016.

¹¹⁶ Sacramento County, 2016; Sacramento Area Council of Governments, 2015.

¹¹⁷ Sacramento Area Council of Governments, 2015.

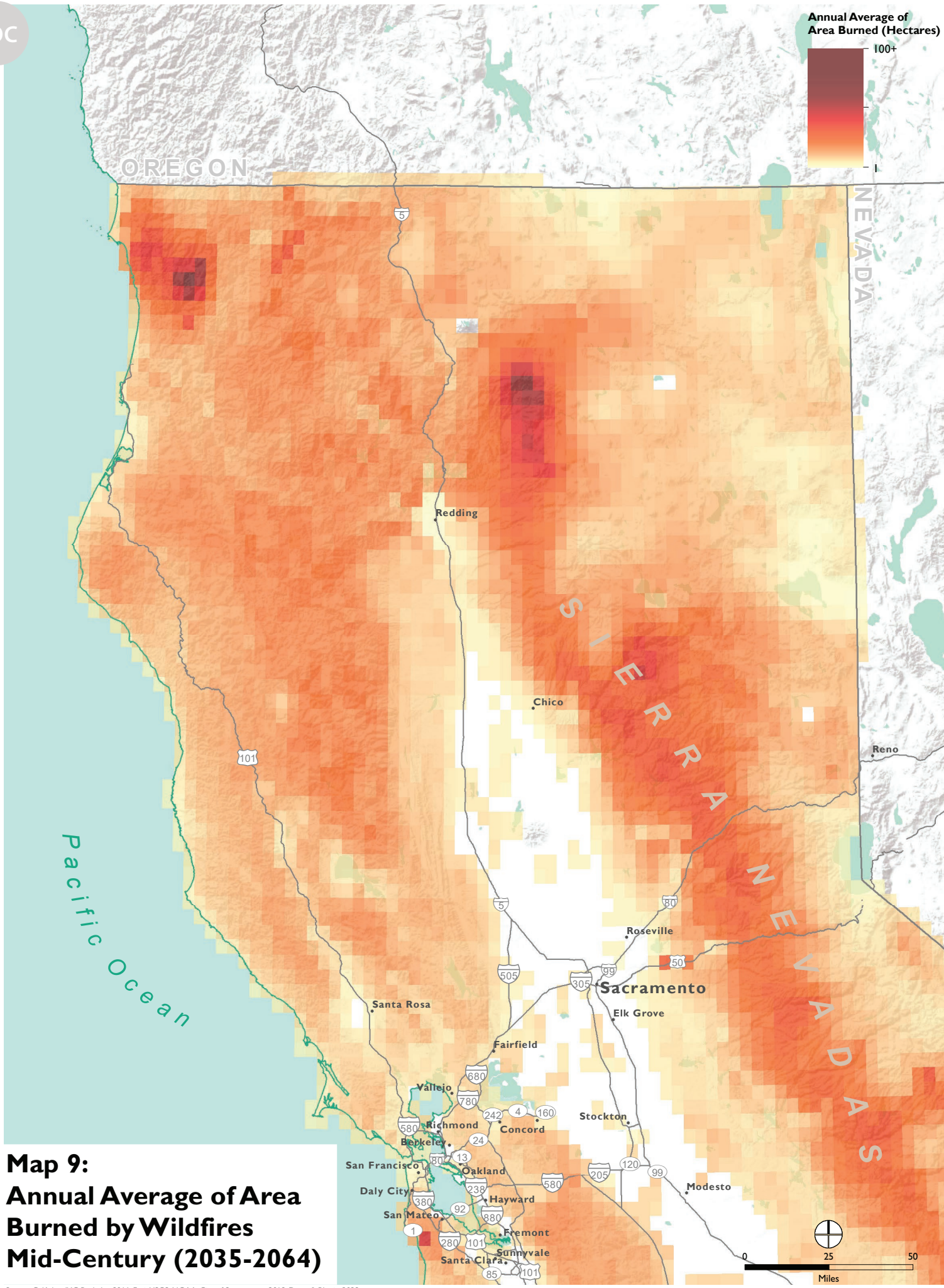
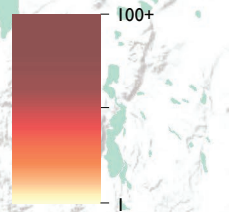
¹¹⁸ International Association of Fire Chiefs, “What Is The Wildland-Urban Interface?” April 24, 2023: https://www.wildlandfirersg.org/s/iafc2/what-is-the-wildland-urban-interface-MCVXRWBESZFCQ7IV6PER5CF6UVQ?language=en_US.



**Map 8:
Historical Annual Average of
Area Burned by Wildfires
(1961-1990)**

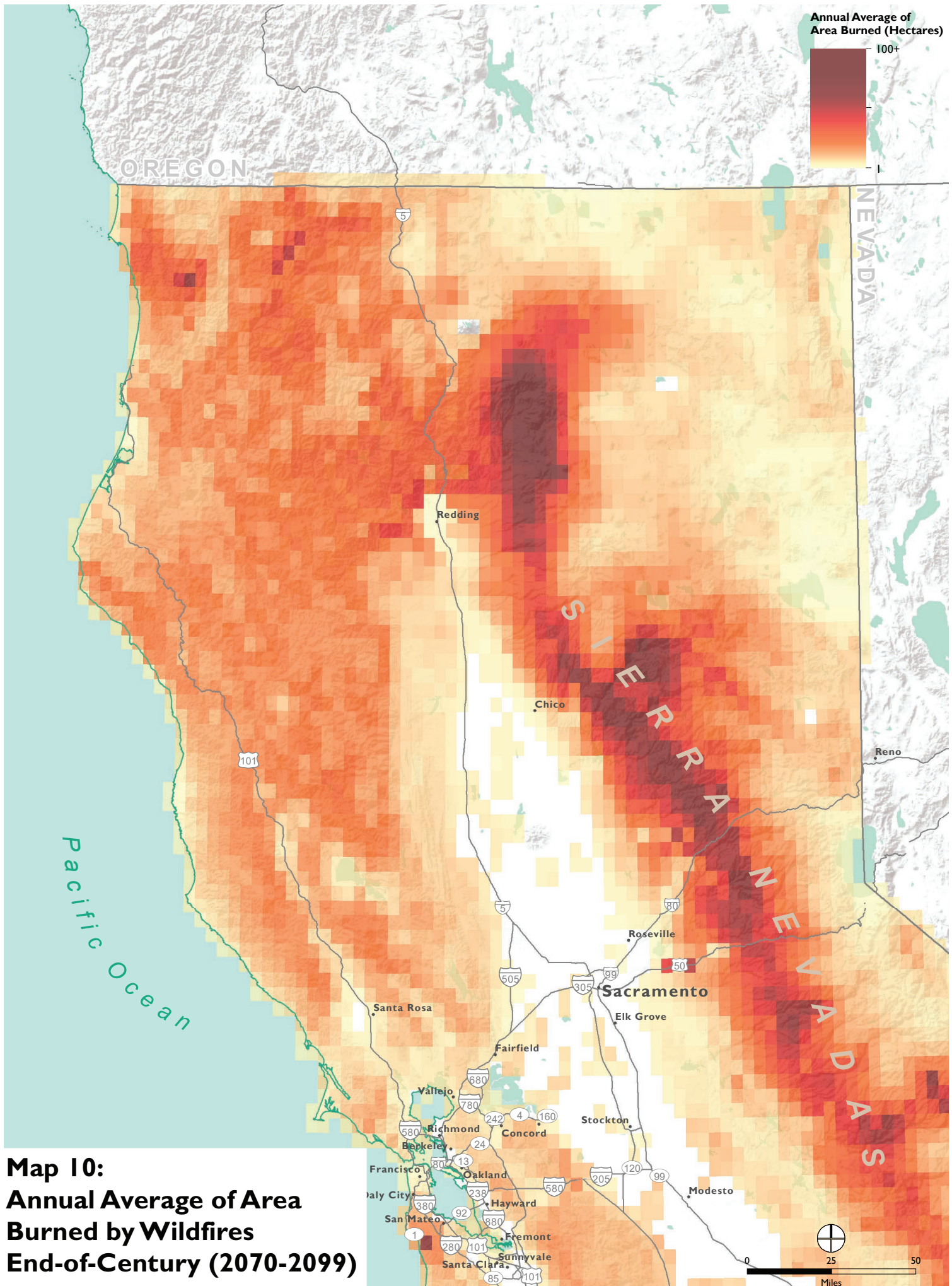
Source: CalAdapt/UC Berkeley, 2016; Esri, USGS, NOAA, City of Sacramento, 2019; Dyett & Bhatia, 2019

Annual Average of Area Burned (Hectares)



**Map 9:
Annual Average of Area
Burned by Wildfires
Mid-Century (2035-2064)**

Source: CalAdapt/UC Berkeley, 2016; Esri, USGS, NOAA, City of Sacramento, 2019; Dyett & Bhatia, 2023



Map 10:
Annual Average of Area
Burned by Wildfires
End-of-Century (2070-2099)

Source: CalAdapt/UC Berkeley, 2016; Esri, USGS, NOAA, City of Sacramento, 2019; Dyett & Bhatia, 2023

At the UWI, structures and vegetation are sufficiently close that a wildfire could spread to a structure, or a structure fire could ignite vegetation.¹¹⁹ Numerous factors can contribute to wildfire risk within the UWI, including type and distribution of vegetation, structure flammability, proximity to fire-prone vegetation, weather patterns, topography, lot size and structure density, and road construction.¹²⁰ The Sacramento Metropolitan Fire District has found that almost all the wildfires that occur within its territory are caused by humans and occur closer to developed areas.¹²¹ Areas characterized as UWI by the Sacramento Metropolitan Fire District occur along the eastern and northern edges of the city.

While the UWI area within the city is not extensive, the city will be impacted by wildfires occurring throughout the metropolitan region via impacts on air, water, and soil quality; damage to energy infrastructure and roads; and strain on local firefighting resources as the fire department is called to respond to fires across the region and State.

Secondary Impacts

Air Quality

Residents and employees of Sacramento's urban environment may not experience the direct impacts of wildfire the same way they might directly feel the immediate effects of heat waves, extreme rain events, and floods. However, wildfires are projected to increase in severity across Northern California, and their health impacts are not easily contained within city limits. In fact, particulate matter from wildfire can dissipate throughout the Central Valley and degrade air quality for extended periods of time.¹²²

Wildfires emit substantial quantities of particulate matter, carbon monoxide, nitrogen oxides, and volatile organic compounds.¹²³ The effects that wildfire smoke can have on Sacramento's air quality are immense. During the 2018 Camp Fire, Sacramento's PM 2.5 (particulate matter) concentrations exceeded 300 $\mu\text{g}/\text{m}^3$, among the highest in the world.

Wildfire smoke can cause adverse health effects including restricted breathing; eye irritation; aggravation of respiratory and cardiovascular diseases including asthma, chronic obstructive pulmonary disease (COPD), bronchitis, and pneumonia; and may increase cancer risk and impair immune function.¹²⁴

¹¹⁹ Ascent Environmental, "Sacramento Metropolitan Fire District Community Wildfire Protection Plan." (2014). Oct 29 2019: <https://www.ascentenvironmental.com/experience/climate-change-adaptation/sacramento-metropolitan-fire-district-community-wildfire-protection-plan/>.

¹²⁰ International Association of Fire Chiefs, 2023.

¹²¹ Ascent Environmental, 2014.

¹²² Sacramento County, 2016.

¹²³ Centers for Disease Control and Prevention, "Wildfires." (2019). Oct 29 2019: <https://www.cdc.gov/climateandhealth/effects/wildfires.htm>.

¹²⁴ Finlay SE., Moffat A., Gazzard R., Baker D., Murray, V. "Health Impacts of Wildfires." *PLoS Currents*, Nov 2, 2012. Oct 29 2019: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3492003/>; U.S. Global Change Research Program, *The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. (Washington, DC: 2016). Oct 29 2019: <https://health2016.globalchange.gov/air-quality-impacts>; Cascio, WE. "Wildland Fire Smoke and Human Health." *Science of the Total Environment*, Dec 27, 2017. Apr 30, 2020: <https://www.sciencedirect.com/science/article/pii/S004896971733512X>.

Many of the chemicals released during wildfires are ozone precursors, chemicals that can interact to form ground-level ozone.¹²⁵ Populations exposed to ozone air pollution are at greater risk of dying prematurely, experiencing respiratory-related hospital admission, and contracting asthma.¹²⁶ The health impacts associated with air pollution exposure may be compounded by exposure to additional climate stressors such that, for example, the risk of dying from exposure to a given level of ozone pollution may increase on warmer days.¹²⁷ In addition to wildfire, conditions that favor high ozone levels include high temperatures, sunny skies, low humidity, and periods of low wind.¹²⁸

Young children; middle-aged and older adults; pregnant women; those with hypertension, diabetes, and COPD; and smokers are particularly sensitive to the health effects of smoke.¹²⁹ African Americans have been found to experience higher rates of cardiovascular disease and asthma, which increase sensitivity to the health effects of smoke.¹³⁰ Some studies have also found associations between low socioeconomic status and health effects related to wildfire smoke exposure.¹³¹ Low socioeconomic status is associated with a higher prevalence of preexisting diseases, limited access to medical care, and limited access to fresh food, all of which may contribute to susceptibility to the health effects of particulate matter exposure.¹³² Members of the community such as outdoor workers and the homeless, who may not be able to remain indoors in order to reduce smoke exposure, are also at elevated risk for health impacts.

Many Sacramento residents may be required to make behavioral or lifestyle changes in order to minimize exposure to poor air quality during wildfires. These changes, such as avoiding active transportation, spending less time outdoors, or avoiding public transit if facilities are not adequately ventilated, may have ripple effects on community health, energy use, and transportation-related emissions as residents may not be able to partake in daily exercise or may choose to replace alternative transportation with the use of private vehicles.

Map 11 shows current air quality across the City of Sacramento. As can be seen in Map 11, areas with poor ambient air quality tend to be clustered in the center of the city and along major roadways Interstate 50, SR 99, and Interstate 80. In the event of a wildfire, the distribution of smoke-related air pollution will likely not be concentrated in separate neighborhoods as seen in Map 11 but will be dispersed across the City.

¹²⁵ United States Department of Agriculture, “Ozone Precursors.” (2012). Oct 29 2019:

<https://www.climatesignals.org/sites/default/files/resources/ozone%20precursors.pdf>.

¹²⁶ U.S. Global Change Research Program, 2016.

¹²⁷ U.S. Global Change Research Program, 2016; Orru H., Ebi KL., Forsberg. “The Interplay of Climate Change and Air Pollution on Health.” *Current Environmental Health Reports*, Oct 28, 2017. Oct 29 2019:

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5676805/>.

¹²⁸ U.S. Global Change Research Program, 2016; Orru H., et.al., 2017.

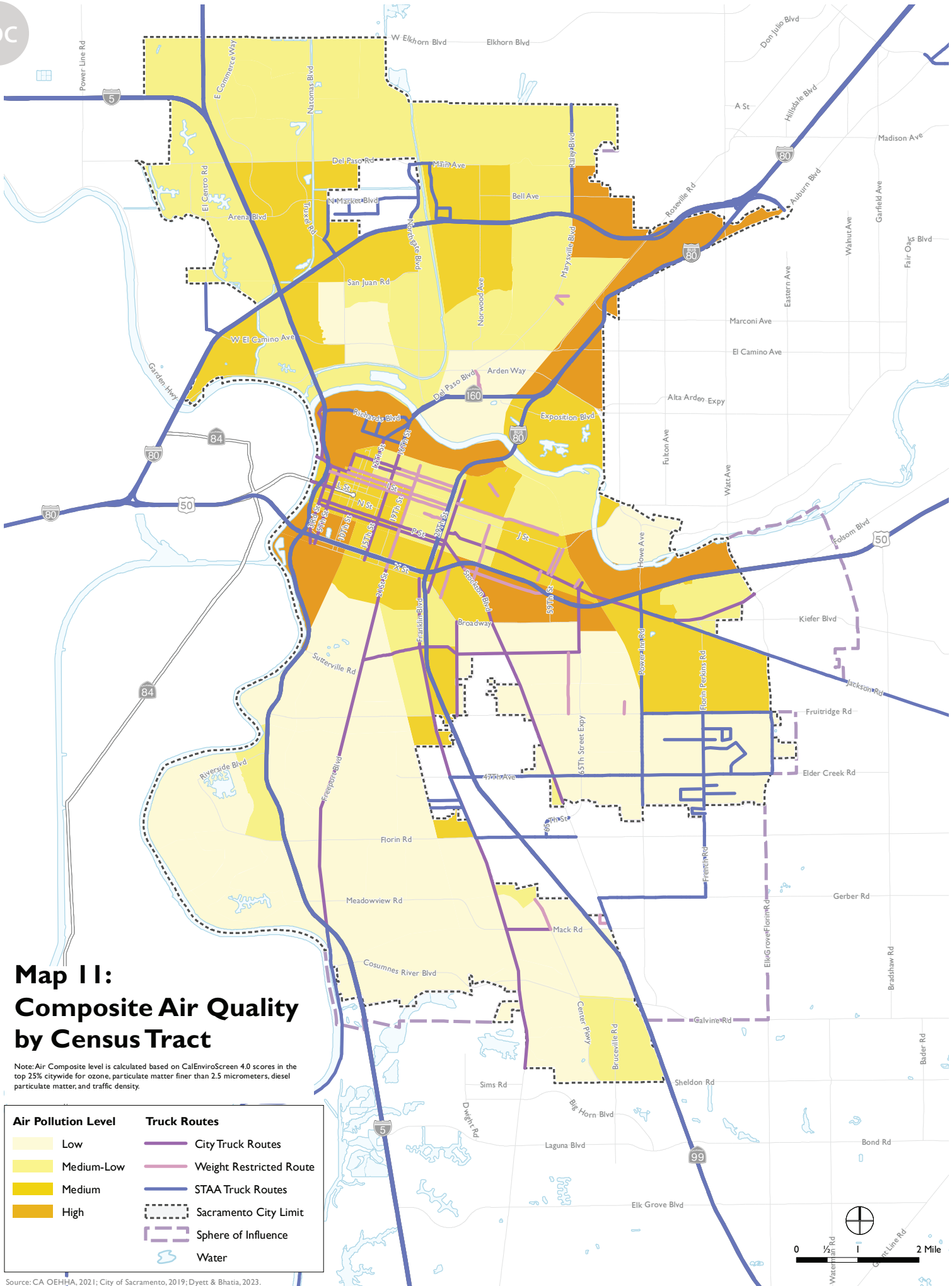
¹²⁹ Finlay SE., et.al., 2012; Cascio, WE. “Wildland Fire Smoke and Human Health.” *Science of the Total Environment*, Dec 27, 2017. Apr 30, 2020: <https://www.sciencedirect.com/science/article/pii/S004896971733512X>.

¹³⁰ Rudolph L, et.al., 2018.

¹³¹ Cascio, WE., 2017.

¹³² Sacks JD, Wichers Stanek L, Luben TJ, Johns DO, Buckley BJ, Brown JS, Ross M. “Particulate Matter-Induced Health Effects: Who is Susceptible?” *Environmental Health Perspectives*, Apr 1, 2011. Apr 30, 2020:

<https://ehp.niehs.nih.gov/doi/full/10.1289/ehp.1002255>

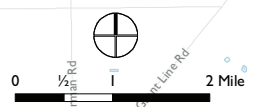


Map 11: Composite Air Quality by Census Tract

Note: Air Composite level is calculated based on CalEnviroScreen 4.0 scores in the top 25% citywide for ozone, particulate matter finer than 2.5 micrometers, diesel particulate matter, and traffic density.

Air Pollution Level	Truck Routes
 Low	 City Truck Routes
 Medium-Low	 Weight Restricted Route
 Medium	 STAA Truck Routes
 High	 Sacramento City Limit
	 Sphere of Influence
	 Water

Source: CA OEHHA, 2021; City of Sacramento, 2019; Dyett & Bhatia, 2023.



Water and Soil Quality

Even after a fire is put out, it can continue to have detrimental effects on the environment and surrounding communities. The infiltration capacity of soil is reduced following wildfire, increasing the risk of waterbody contamination from upstream landslides.¹³³ Ash debris from wildfires may contain high levels of heavy metals such as arsenic, cadmium, copper, and lead, potentially causing long-term effects to soil and water quality.¹³⁴

Infrastructure Damage

Energy production and distribution are threatened by heat and wildfires. Physical infrastructure such as power lines or pipes in the direct path of a fire can suffer extensive damage. Transmission capacity is affected by high heat, smoke, and particulate matter, and lines may be shut down as a firefighting measure.¹³⁵ Wildfire in the Sierra Nevada may damage water and energy infrastructure upon which the Sacramento region relies.¹³⁶

Extreme heat and wildfire also threaten water production and distribution. Water treatment and utility services depend on the electric utility to operate, and rely on diesel generators for back-up. Increased incidents of power outages may increase reliance on diesel and other fossil fuel as well as the possibility of water shortages.

Wildfire affects transportation infrastructure by causing road and airport blockages, closures, and reducing road visibility.¹³⁷ Transportation services such as electric rail lines and traffic signals may also be affected by the disruptions to power service described above. Transportation infrastructures such as roads and rail lines can also be damaged by wildfires that result in high heat.¹³⁸

¹³³ Sacramento Municipal Utility District, “Climate Readiness Assessment and Action Plan,” (2016); Sacramento Municipal Utility District, “2018 Local Hazard Mitigation Plan.” (2018); United States Environmental Protection Agency, “Wildfires: How Do They Affect Our Water Supplies?” (2019). Oct 28 2019: <https://www.epa.gov/sciencematters/wildfires-how-do-they-affect-our-water-supplies>.

¹³⁴ Finlay SE., Moffat A., Gazzard R., Baker D., Murray, V. “Health Impacts of Wildfires.” *PLoS Currents*, Nov 2, 2012. Oct 29 2019: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3492003/>.

¹³⁵ Sacramento Municipal Utility District, “Climate Readiness Assessment and Action Plan,” 2016; Maizlish N., English D., Chan J., Dervin K., English, P, “Climate Change and Health Profile Report Sacramento County,” Sacramento County Office of Health Equity, California Department of Public Health, 2017; Sacramento Municipal Utility District, “2018 Local Hazard Mitigation Plan.” (2018).

¹³⁶ Maizlish N., English D., Chan J., Dervin K., English, P. “Climate Change and Health Profile Report Sacramento County.” Sacramento County Office of Health Equity, California Department of Public Health (2017).

¹³⁷ Sacramento Area Council of Governments, 2015; Finlay SE., Moffat A., Gazzard R., Baker D., Murray, V. “Health Impacts of Wildfires.” *PLoS Currents*, Nov 2, 2012. Oct 29 2019: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3492003/>.

¹³⁸ Sacramento Area Council of Governments, 2015.

Higher Demand for Fire Fighting and Support Services

The Sacramento Fire Department maintains automatic aid agreements with all of its neighboring agencies and participates in the California Fire and Rescue Mutual Aid System, which provides Type I and Type III engine companies at the request of the California Office of Emergency Services (Cal OES). The department regularly provides overhead personnel for the Federal Emergency Management Administration (FEMA) Incident Support Teams (IST). In 2017, the department responded to 47 incidents with overhead personnel or resources, both throughout the state and internationally, and provided mutual aid for 8,114 incidents outside of the department’s service area.¹³⁹ As the severity and frequency of wildfire increase across the Sacramento region and beyond, municipalities throughout the state will experience increased demand for fire protection services and the City may experience increased demand for its fire protection services.

Increased levels of homelessness and higher housing costs have been reported following major California wildfires.^{140 141} Displaced residents from neighboring communities have the potential to increase demand for social support services in Sacramento. Meanwhile, reductions in housing stock and increases in local demand may lead to elevated housing prices and exacerbate housing insecurity among lower income individuals and families.

SEA LEVEL RISE

Climate models anticipate some degree of sea level rise in all areas that are connected to ocean bodies. Sea level rise is not as significant a concern in the City of Sacramento as changes in precipitation and riverine flood risk. However, sea level rise has the potential to raise the water level within the river channel and exacerbate Sacramento’s flood risk in combination with extreme storm events. The key characteristics of sea level rise’s impact on the City of Sacramento are summarized in Table 2-6.

Table 2-6: Sea Level Rise

Temporal Extent	• Projected to gradually increase over the course of the century
Spatial Extent	• Areas within or near the Delta are most at risk
Permanence	• High
Level of Disruption	• Moderate
Nature of Disruption	• Effects may be significant when coinciding with riverine flooding
Level of Uncertainty	• Moderate

The Sacramento-San Joaquin Delta has been a tidal freshwater marsh, with a vast network of channels, sloughs, and islands, for more than 6,000 years.¹⁴² The Delta’s characteristic intertidal

¹³⁹ City of Sacramento Fire Department, “2017 Annual Report.” (2016).

¹⁴⁰ Raphelson S. “Wildfires Exacerbate Chronic Homelessness In Northern California.” *NPR*, Dec 6, 2017. Apr 30 2020: <https://www.npr.org/2017/12/06/568857057/wildfires-exacerbate-chronic-homelessness-in-northern-california>.

¹⁴¹ Levine AS. “After a California Wildfire, New and Old Homeless Populations Collide.” *The New York Times*, Dec 3, 2018. Apr 30, 2020: <https://www.nytimes.com/2018/12/03/us/california-fire-homeless.html>.

¹⁴² Mount J, Twiss R. “Subsidence, sea level rise, seismicity in the Sacramento-San Joaquin Delta.” *San Francisco Estuary and Watershed Science* (2005).

conditions have created a unique and vibrant ecosystem that serves as a home for nearly 750 species.¹⁴³ While Sacramento is not a coastal city, the Sacramento-San Joaquin Delta's connection to the Pacific Ocean means that the Delta ecosystem, and potentially portions of the Sacramento River, may be impacted by rising seas. Ecosystem effects likely to result from sea level rise include saltwater intrusion¹⁴⁴, with subsequent effects on freshwater quality, agricultural production¹⁴⁵, and the wellbeing of aquatic species such as the delta smelt.¹⁴⁶ In 2014, the U.S. Department of Interior Bureau of Reclamation predicted that Delta salinity may increase by 33% by the end of the century.¹⁴⁷

Saltwater intrusion may affect municipal and agricultural water sources in the Delta. As upstream flows from the high Sierras decrease with reduced snowpack, so too will the amount of freshwater used to push back saltwater from higher sea levels, resulting in infiltration of saltwater further west into the Sacramento-San Joaquin Delta. However, the potential for saltwater intrusion to impact City of Sacramento municipal water sources is not considered a significant risk at this time. The delta is an important water source for California farmers and water agencies, and it also provides fresh water through the State Department of Water Resources (DWR) via the California aqueduct and the rest of the State Water Project's water delivery system. As sea level rise increases salinity of Delta waters, extra outflow of fresh water will be needed to meet environmental standards, an increasing issue that has conflicting tradeoffs during periods of water shortages.¹⁴⁸

Maps 12 and 13 illustrate the amount of sea level rise projected to occur in the Sacramento region over the course of the century. As can be seen in these images, sea level rise is projected to progress gradually over the course of the century, affecting the areas west of the Sacramento River Deep Water Ship Channel.

¹⁴³ Meisen P and Phares N., 2011.

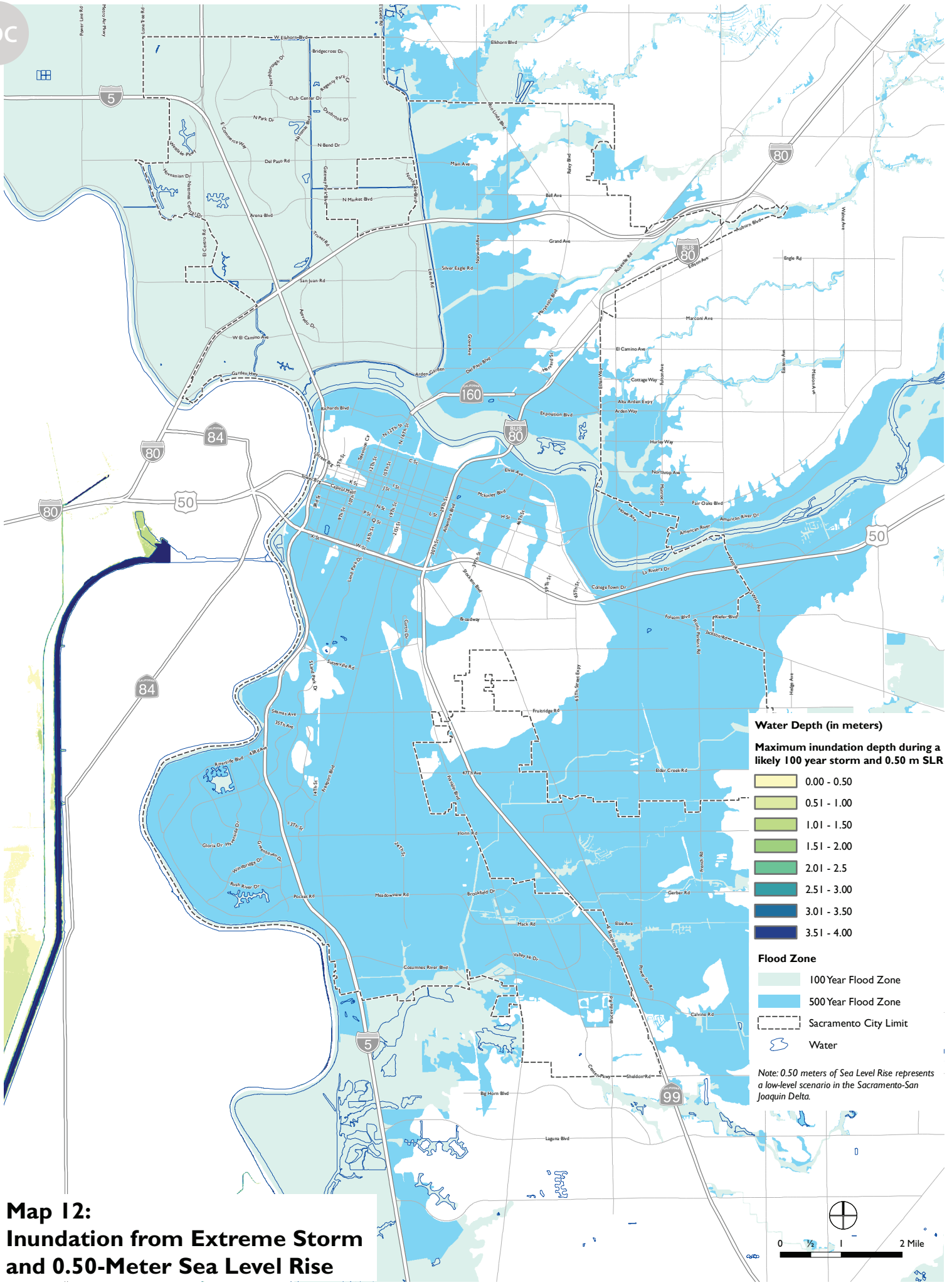
¹⁴⁴ Sacramento County, 2016; Sacramento County, Sacramento County Climate Action Plan (2011).

¹⁴⁵ Medellín-Azuara J, Howitt RE, Hanak E, Lund JR, Fleenor WE. "Agricultural Losses from Salinity in California's Sacramento-San Joaquin Delta." *San Francisco Estuary and Watershed Science* (2014). May 9 2020: <https://escholarship.org/uc/item/4b7295m9>

¹⁴⁶ Brown LR, Bennett WA, Wagner RW, Morgan-King T, Knowles N, Feyrer F, Schoellhamer DH, Stacey MT, Dettinger M. "Implications for Future Survival of Delta Smelt from Four Climate Change Scenarios for the Sacramento-San Joaquin Delta, California." *Estuaries and Coasts* (2013). May 9 2020: <https://link.springer.com/article/10.1007/s12237-013-9585-4>.

¹⁴⁷ United States Department of the Interior Bureau of Reclamation, Reclamation Managing Water in the West. West-Wide Climate Risk Assessment Sacramento and San Joaquin Basins Climate Impact Assessment (2014). Nov 8 2019: <https://www.usbr.gov/watersmart/baseline/docs/ssjbia/ssjbia.pdf>.

¹⁴⁸ California Department of Water Resources, "Could Sea Level Rise Threaten the Water Coming Out of Some California Taps?", September 17, 2019: <https://water.ca.gov/News/Blog/2019/Sept-19/Sea-Level-Rise-Climate-Change>.



Water Depth (in meters)

Maximum inundation depth during a likely 100 year storm and 0.50 m SLR

0.00 - 0.50
0.51 - 1.00
1.01 - 1.50
1.51 - 2.00
2.01 - 2.5
2.51 - 3.00
3.01 - 3.50
3.51 - 4.00

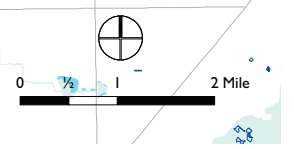
Flood Zone

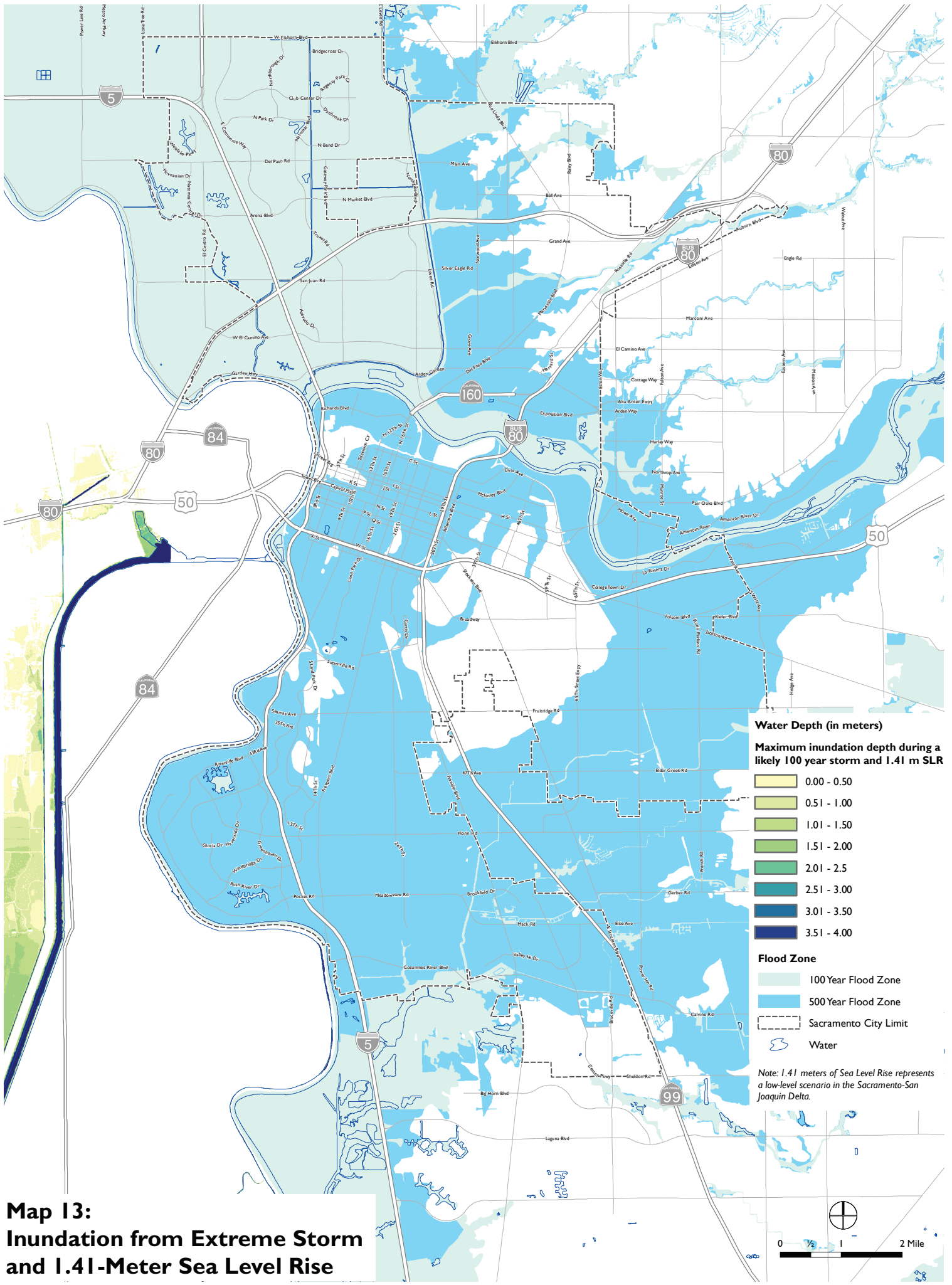
- 100 Year Flood Zone
- 500 Year Flood Zone
- Sacramento City Limit
- Water

Note: 0.50 meters of Sea Level Rise represents a low-level scenario in the Sacramento-San Joaquin Delta.

Map 12:
Inundation from Extreme Storm
and 0.50-Meter Sea Level Rise

Source: CalAdapt/UC Berkeley, 2016; FEMA, 2015; City of Sacramento, 2019; Dyett & Bhatia, 2019





Water Depth (in meters)

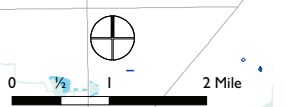
Maximum inundation depth during a likely 100 year storm and 1.41 m SLR

0.00 - 0.50
0.51 - 1.00
1.01 - 1.50
1.51 - 2.00
2.01 - 2.5
2.51 - 3.00
3.01 - 3.50
3.51 - 4.00

Flood Zone

- 100 Year Flood Zone
- 500 Year Flood Zone
- Sacramento City Limit
- Water

Note: 1.41 meters of Sea Level Rise represents a low-level scenario in the Sacramento-San Joaquin Delta.



Map 13:
Inundation from Extreme Storm
and 1.41-Meter Sea Level Rise

Source: CalAdapt/UC Berkeley, 2016; FEMA, 2015; City of Sacramento, 2019; Dyett & Bhatia, 2019

3 Vulnerability

This chapter identifies vulnerabilities to climate change which involve areas at risk, vulnerable populations, and areas at the intersection of these vulnerabilities in Sacramento. This analysis is meant to guide adaptation interventions to areas that are most susceptible and less likely to recover from the impacts of climate hazards.

3.1 Vulnerable Populations

Certain populations are particularly vulnerable to the effects of climate change and may require additional health interventions. The following section describes the different groups who are at risk, which include children (aged 14 and below), older adults (aged 65 and over), individuals with disabilities, low-income households, outdoor workers, cost-burdened households, households living in substandard housing conditions, linguistically isolated households, and communities of color.

DEMOGRAPHIC CHARACTERISTICS

Children

Children’s vulnerability to climate change arises primarily from their physiological characteristics and lifestyles, as well as their position of dependency on adults.

Increased time spent outdoors increases children’s exposure to high temperatures. This is especially true for student athletes.¹⁴⁹ Newborns are also highly susceptible to temperature extremes because their capacity for body temperature regulation is limited.¹⁵⁰ Children also have fewer opportunities than the average adult to make independent choices with regard to housing conditions, transportation, money management, medical treatment, and political representation. This means that children generally have fewer opportunities to take independent actions that might reduce their vulnerability.

Climate disruptions can be traumatic events which may result in injury, death, or displacement. Exposure to traumatic events can impact children’s ability to regulate emotions, undermine cognitive development, and contribute to PTSD, anxiety, depression, and other psychiatric disorders, to which children are highly susceptible.¹⁵¹ Poverty can exacerbate the effect of these traumatic exposures, as children in poverty may encounter financial barriers to receiving proper medical care and social-emotional support and may be less able to escape or recover from extreme weather events.¹⁵² Furthermore, children’s ongoing lung development, airway size, level of physical activity, and body weight increase their susceptibility to respiratory hazards including ozone and

¹⁴⁹ U.S. Global Change Research Program, 2016.

¹⁵⁰ U.S. Global Change Research Program, 2016.

¹⁵¹ U.S. Global Change Research Program, 2016; CalBrace, “Children <5 years.” Nov 8 2019: https://www.cdph.ca.gov/Programs/OHE/CDPH%20Document%20Library/CHVIs/Children0to4_788_Narrative.pdf

¹⁵² U.S. Global Change Research Program, 2016.

wildfire smoke.¹⁵³ About 6.5 percent of Sacramento’s population is under five years of age, 19.2 percent are 14 years of age or younger, and 25.1 percent are younger than 19.¹⁵⁴ Of those children aged 18 years and younger, about 31 percent are members of a household that participates in a public assistance program such as the Supplemental Nutrition Assistance Program (SNAP), 15.7 percent live in a household whose annual income is at or below the poverty level, and 11.8 percent have some form of disability.¹⁵⁵

Within the City of Sacramento, Map 14 illustrates that particularly high concentrations of young children occur in neighborhoods such as Valley Hi/ North Laguna, Meadowview, Del Paso Heights, Strawberry Manor, and Gardenland. These are primarily single-family neighborhoods in close proximity to schools such as Grant Union High School, Castori Elementary School, Fairbanks Elementary School, Smythe Academy of Arts and Sciences, Jefferson Elementary School, Valley High School, John Reith Elementary School, Samuel Jackman Middle School, and Prairie Elementary School.

Older Adults

Older adults are a diverse population whose potential vulnerability to climate change is influenced by such factors as underlying health status, economic situation, and level of social isolation.¹⁵⁶

The body’s natural aging processes and the effects of mental illness may interact to make the elderly especially vulnerable to the effects of heat. Aging can impair the body’s ability to regulate internal temperature.¹⁵⁷ This is especially true for individuals taking medication that interferes with internal temperature regulation, including medications used to treat mental illnesses such as depression, anxiety, and psychosis.¹⁵⁸ In addition, many older adults on fixed incomes may be especially affected by increases in costs for energy during high heat events.¹⁵⁹

¹⁵³ U.S. Global Change Research Program, 2016.

¹⁵⁴ 2016-2020 American Community Survey 5-Year Estimates Table S0101

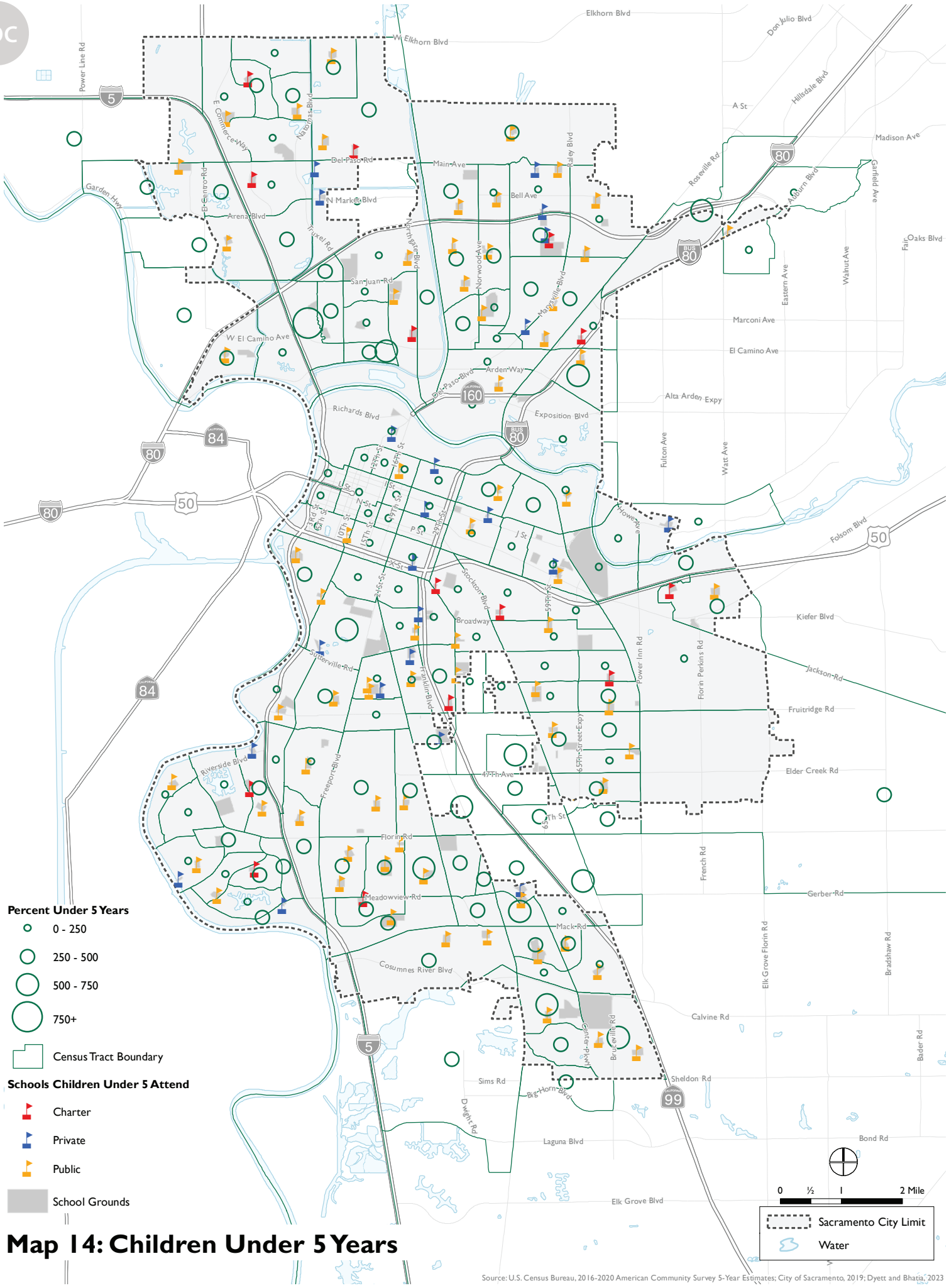
¹⁵⁵ 2016-2020 American Community Survey 5-Year Estimates Table S2201, Table S1701, Table S1810

¹⁵⁶ U.S. Global Change Research Program, 2016; Benevolenza MA, DeRigne L. “The impact of climate change and natural disasters on vulnerable populations: A systematic review of literature.” *Journal of Human Behavior in the Social Environment* (2019). Nov 8 2019: <https://www.tandfonline.com/doi/abs/10.1080/10911359.2018.1527739?journalCode=whum20>; Gamble JL, Hurley BJ, Schultz PA, Jaglom WS, Krishan N, Harris M. “Climate Change and Older Americans: State of the Science.” *Environmental Health Perspectives* Jan 1 2013. May 11 2020: <https://ehp.niehs.nih.gov/doi/full/10.1289/ehp.1205223>.

¹⁵⁷ U.S. Global Change Research Program, 2016; CalBrace, “Population aged ≥ 65.” Nov 9 2019: https://www.cdph.ca.gov/Programs/OHE/CDPH%20Document%20Library/CHVIs/Elderly_789_Narrative.pdf.

¹⁵⁸ U.S. Global Change Research Program, 2016.

¹⁵⁹ Gamble JL, et.al., 2013.



Percent Under 5 Years

- 0 - 250
- 250 - 500
- 500 - 750
- 750+

Census Tract Boundary

Schools Children Under 5 Attend

- Charter
- Private
- Public

School Grounds

Map 14: Children Under 5 Years

0 1/2 1 2 Mile

Sacramento City Limit
 Water

Older adults with cognitive or functional impairments may have difficulty responding to and recovering from extreme events, such as flooding.¹⁶⁰ These effects may be confounded by social isolation as older adults in isolation, especially those with cognitive impairments, may not receive emergency information or may underestimate the severity of warnings.¹⁶¹ Elders residing in assistive care facilities or with limited mobility also face additional complications during evacuations and may be adversely affected by interruptions in care for chronic medical conditions.¹⁶² In addition, older adults are more sensitive to certain diseases, such as West Nile Virus,¹⁶³ which may expand in range as precipitation patterns change.

Air pollution can exacerbate asthma and Chronic Obstructive Pulmonary Disease (COPD) and increase the risks of heart attack in older adults, especially those who are diabetic or obese.¹⁶⁴ Respiratory function often declines with age. The elderly thus may be more sensitive to the effects of air pollution, airborne pathogens, and allergens than the general population.¹⁶⁵

As depicted in Map 15, Sacramento's older adult population is highly concentrated in four small areas: the northern portion of the Pocket neighborhood, Little Pocket, the Central City, and Sierra Oaks. With the exception of the Central City, these are suburban neighborhoods that neighbor parks and other scenic resources but may render seniors socially isolated from the broader community.

Disabled People

Disability is a broad term that refers to any condition or impairment of the body or mind that limits a person's ability to do certain activities. Limited mobility and reliance on medical equipment can also contribute to vulnerability, particularly during times of emergency evacuation and power interruption.¹⁶⁶ Climate-related displacement can interrupt medical treatment, with health implications for those with chronic conditions. Further, mental health issues tend to increase following disasters. Rates of depression, anxiety disorders, post-traumatic stress disorders, substance abuse, and suicide are all projected to increase as the effects of climate change become more intense.¹⁶⁷ Use of certain medications, especially those used to treat mental health disorders, can increase sensitivity to high heat by interfering with the body's ability to regulate internal temperature.¹⁶⁸ In addition, the compounded effect of high poverty levels and low levels of educational attainment and employment among populations with disabilities can heighten climate change vulnerability.¹⁶⁹

¹⁶⁰ U.S. Global Change Research Program, 2016.

¹⁶¹ Gamble JL, et.al., 2013.

¹⁶² U.S. Global Change Research Program, 2016; CalBrace, "Population aged ≥ 65;" Gamble JL, et.al., 2013.

¹⁶³ CalBrace, "Population aged ≥ 65."

¹⁶⁴ U.S. Global Change Research Program, 2016.

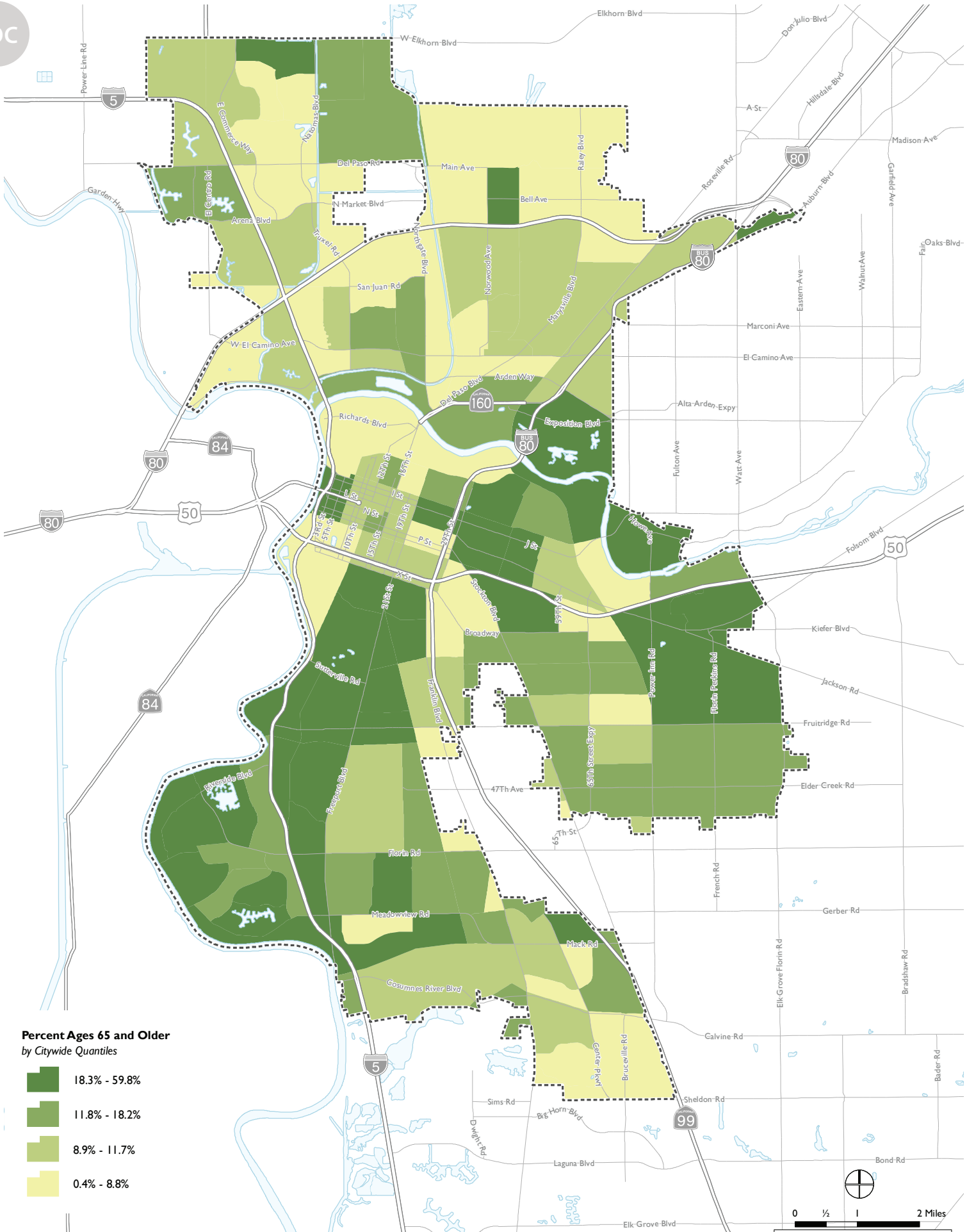
¹⁶⁵ Gamble JL, et.al., 2013.

¹⁶⁶ U.S. Global Change Research Program, 2016; CalBrace, "Disability." Nov 8 2019: https://www.cdph.ca.gov/Programs/OHE/CDPH%20Document%20Library/CHVIs/BRACE_Disability_Narrative_795_11-16-2016.pdf.

¹⁶⁷ CalBrace, "Disability."

¹⁶⁸ U.S. Global Change Research Program, 2016.

¹⁶⁹ U.S. Global Change Research Program, 2019.



**Percent Ages 65 and Older
by Citywide Quantiles**

- 18.3% - 59.8%
- 11.8% - 18.2%
- 8.9% - 11.7%
- 0.4% - 8.8%

**Map 15: Percentage of Adults
Ages 65 and Older**

0 1/2 1 2 Miles

Sacramento City Limit
S Water

Source: U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates; City of Sacramento, 2019; Dyett and Bhatta, 2023

Risk communication materials are not always designed or delivered with accessibility in mind, potentially limiting knowledge accessibility for those who are deaf or have hearing loss, who are blind or have low vision, or those with diminished cognitive skills.

About 12.4 percent of Sacramento’s population has some form of disability; 4.7 percent are both disabled and elderly. About 27.7 percent of Sacramento’s total disabled population reported yearly income at or below the poverty level; about 69 percent of working-age disabled individuals living in Sacramento are either unemployed or do not participate in the labor force. Map 16 illustrates that the incidence of disability is particularly strong at the southern end of the city, the areas around Freeport and Meadowview. Valley Hi / North Laguna, Pocket, East Sacramento, and the northern neighborhoods of Raley Industrial Parkway, Del Paso Heights, North Sacramento, and South Natomas also contain large numbers of disabled individuals.

Race/Ethnicity

Structural racism, meaning the “totality of the social relations and practices that reinforce white privilege”, contributes to the climate change vulnerability of communities of color.¹⁷⁰ Structural racism manifests in a number of policy-making decisions, including race-based housing segregation, lack of investment in public transit, and exclusionary zoning practices, whose legacy continues to have impacts on climate change vulnerability. Redlining is an example of structural racism. The term ‘redlining’ is often used to describe the discriminatory practices of delineating areas where banks would avoid investments based on the racial makeup of certain communities; this was common practice in the United States for decades, starting in the 1930s. Structural racism’s entrenched position in American life means that this race-based source of vulnerability manifests in a number of interacting ways, including inequities in housing quality and location, household wealth, and educational and employment opportunities.¹⁷¹ Historically, public policy has reinforced and compounded these inequalities as white and affluent residents have accrued disproportionate levels of wealth and influence in the political process.¹⁷²

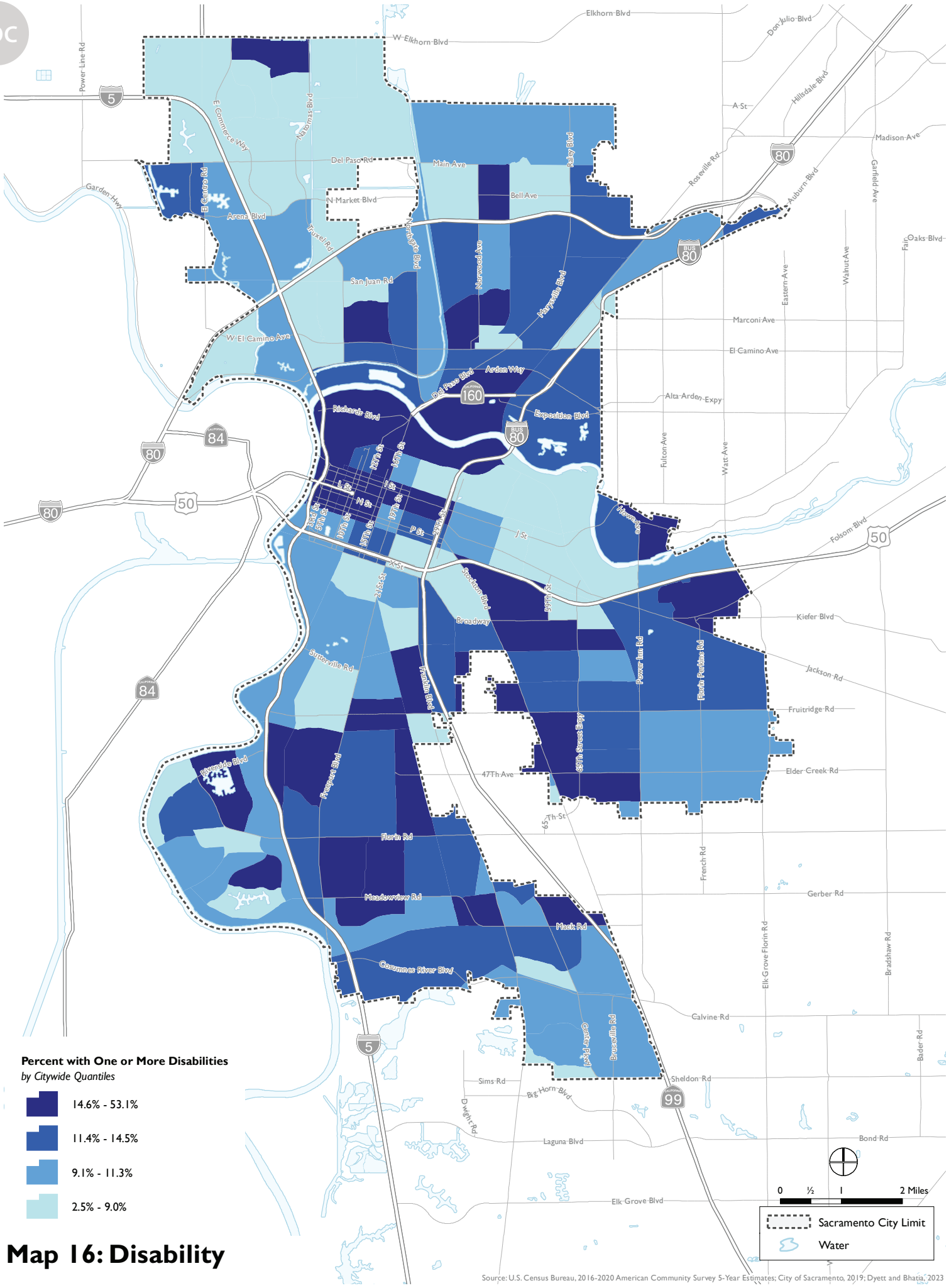
When analyzing the effect that race or ethnic group identity has on climate change vulnerability, it is important to keep this extensive history of race-based discrimination in mind. Race or ethnicity, considered in a historical and societal vacuum, may not contribute significantly to vulnerability. What matters in this case is the fact that factors such as race, immigration status, income level, educational attainment, and housing and employment opportunities have and continue to intersect to systematically affect access to resources, societal advantages, and environmental exposures in ways that are consistently associated with race.¹⁷³ As a result, being a racial or ethnic minority in the United States is correlated with lower income, poorer physical health, living in an area with sparse vegetation and more heat-absorbing surfaces, lower air conditioning ownership, and higher

¹⁷⁰ Thomas, K., et.al., 2018.

¹⁷¹ Thomas, K., et.al., 2018; U.S. Global Change Research Program, 2016; Bolin B and Kurtz LC, 2017.

¹⁷² Deas M, et.al., “Opportunities for Equitable Adaptation in Cities: A Workshop Summary Report.” Georgetown Climate Center (2017). Nov 8 2019: https://www.georgetownclimate.org/files/report/GCC-Opportunities_for_Equitable_Adaptation-Feb_2017.pdf.

¹⁷³ Bolin B and Kurtz LC, 2017.



**Percent with One or More Disabilities
by Citywide Quantiles**

- 14.6% - 53.1%
- 11.4% - 14.5%
- 9.1% - 11.3%
- 2.5% - 9.0%

Map 16: Disability

Source: U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates; City of Sacramento, 2019; Dyett and Bhatta, 2023

rates of participation in outdoor and farming work¹⁷⁴, all factors which increase vulnerability to climate change.

Communities of color are disproportionately impacted by poor air quality, such as that which may arise from wildfire, industrial and transportation emissions, and the urban heat island effect, due to both disproportionate levels of exposure to air pollutants and elevated rate of diseases such as asthma and COPD, whose symptoms are exacerbated by climate change.¹⁷⁵

Sacramento is one of America’s most racially diverse cities. Approximately 48.5 percent of the city is white, 18.7 percent Asian, 13.4 percent Black or African American, 1.6 percent Native Hawaiian or Pacific Islander, and 0.7 percent Native American. Approximately 17.1 percent identified as belonging to two or more races or a race not identified in the U.S. Census.

As can be seen in Maps 17 and 18, communities of color are clustered primarily at the northern and southern ends of the city, which, as demonstrated in the series of maps above, contain several neighborhoods that experience elevated levels of climate change vulnerability along several different axes.

SOCIOECONOMIC CHARACTERISTICS

Low-Income and Poverty

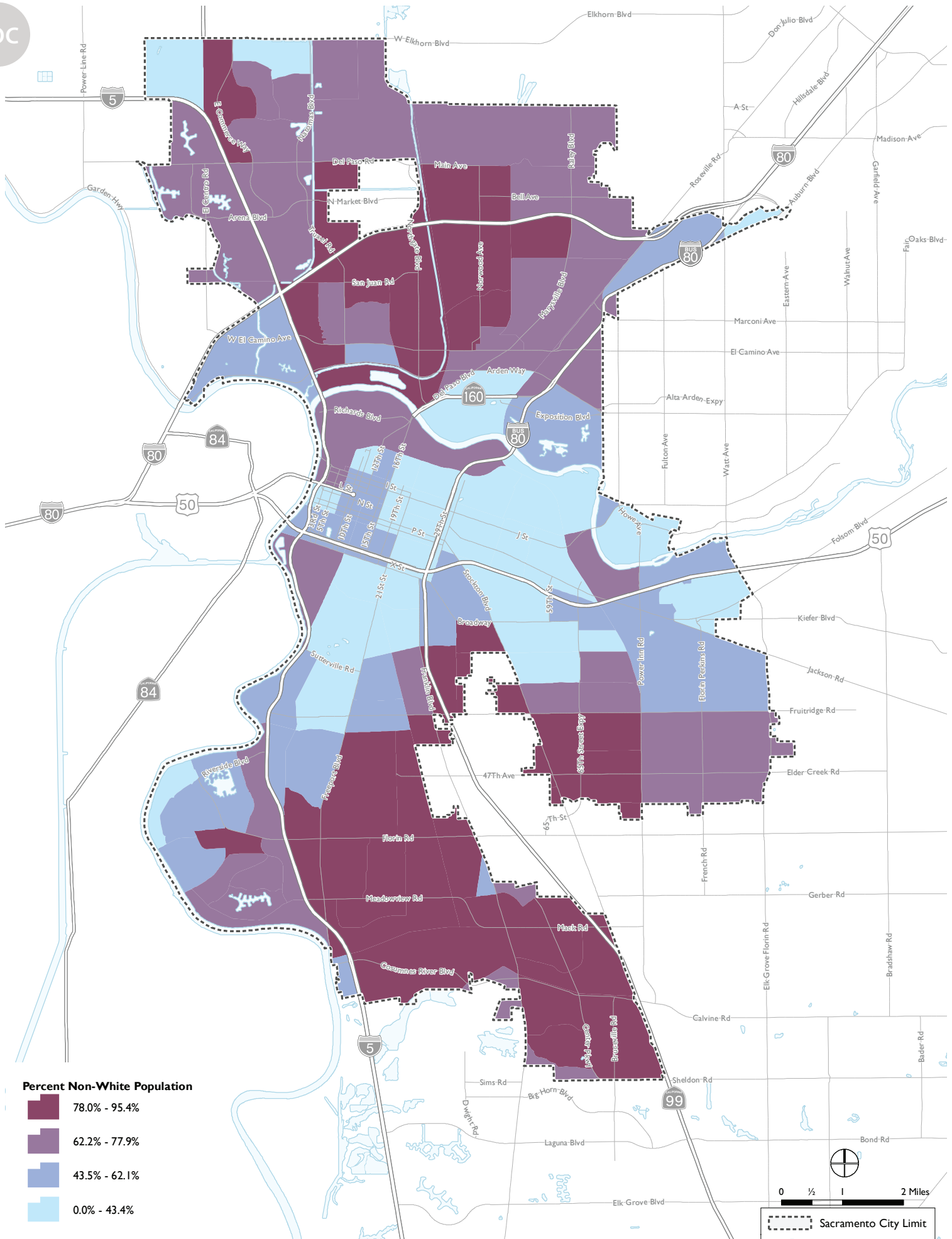
Low-income people can be more vulnerable to climate change as a result of pre-existing health conditions, reduced mobility options, reduced access to health care, and limited ability to purchase the goods and services that could mitigate the negative effects of climate change.¹⁷⁶ Anticipated increases in food, water, and utility prices under climate change may also be especially problematic for low-income households.¹⁷⁷

¹⁷⁴ Gronlund CJ, 2014.

¹⁷⁵ U.S. Global Change Research Program, 2016.

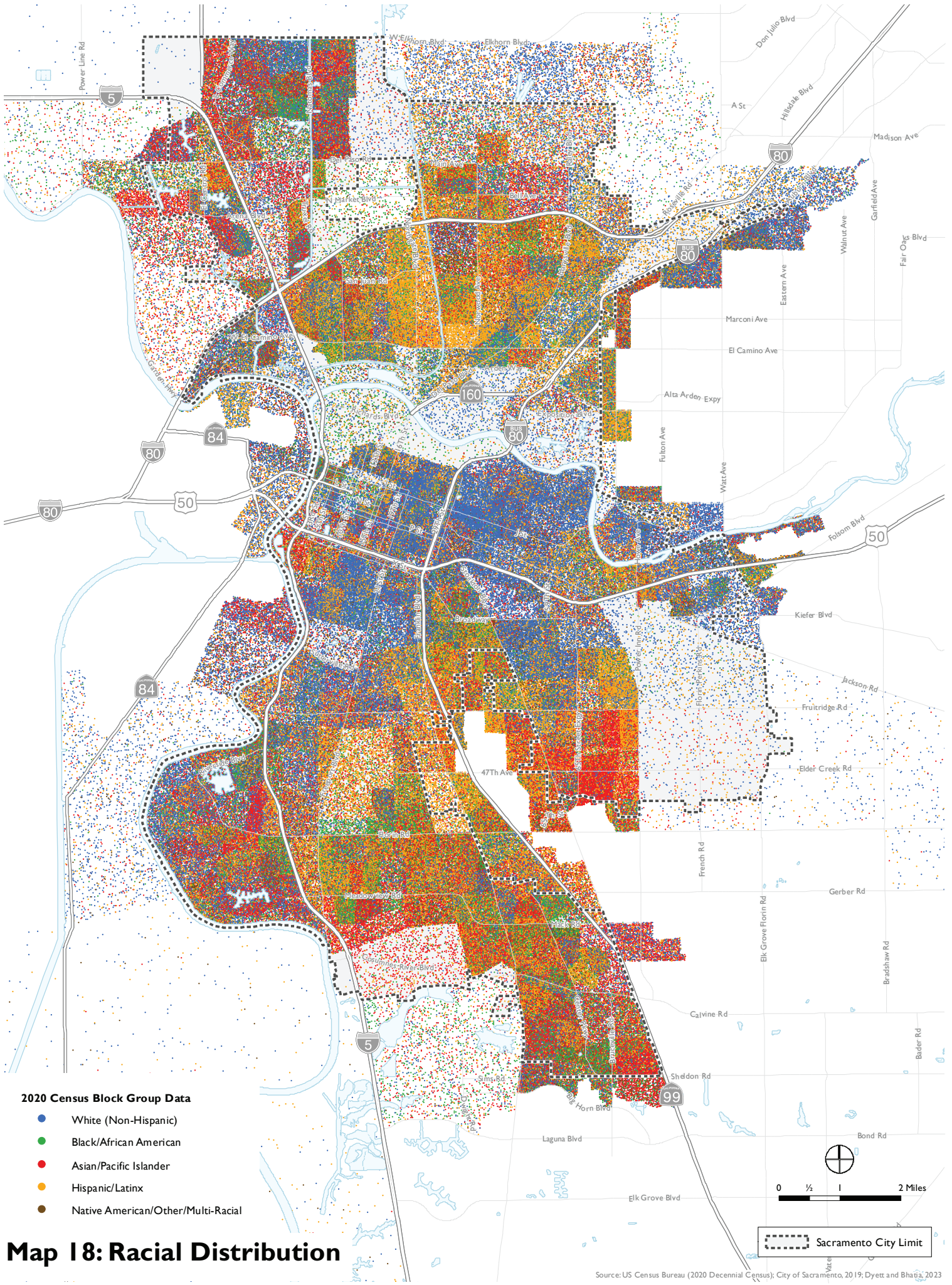
¹⁷⁶ U.S. Global Change Research Program, 2016; CalBrace, “Poverty Rate.” Nov 8 2019: https://www.cdph.ca.gov/Programs/OHE/CDPH%20Document%20Library/CHVIs/HCI_PovertyRate_754_Narrative_Examples11-5-13rev3-12-14.pdf; Wilson SM, Richard R, Joseph L, Williams E. “Climate Change, Environmental Justice, and Vulnerability: An Exploratory Spatial Analysis.” *Environmental Justice* Mar 17 2010. May 11 2020: <https://www.liebertpub.com/doi/abs/10.1089/env.2009.0035>.

¹⁷⁷ Tacoli C. “Urban poverty, food security, and climate change.” International Institute of Environment and Development (2013). May 11 2020: <https://pubs.iied.org/pdfs/17149IIED.pdf>; Shonkoff SB, Morello-Frosch R, Pastor M, Sadd J. “The climate gap: environmental health and equity and implications of climate change and mitigation policies in California – a review of the literature.” *Climatic Change* Nov 24 2011. May 11 2020: <https://link.springer.com/article/10.1007/s10584-011-0310-7>.



Map 17: Communities of Color

Source: U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates; City of Sacramento, 2019; Dyett and Bhatta, 2023



2020 Census Block Group Data

- White (Non-Hispanic)
- Black/African American
- Asian/Pacific Islander
- Hispanic/Latinx
- Native American/Other/Multi-Racial

Map 18: Racial Distribution

Source: US Census Bureau (2020 Decennial Census); City of Sacramento, 2019; Dyett and Bhatta, 2023

Poverty is also associated with societal exclusion and mental illness, and low-income individuals and families are more likely to work or live in environments that expose them to pesticides, lead, and outdoor air pollution.¹⁷⁸ During high heat events, concerns about utility costs may inhibit a low-income household's ability to stay cool and receive necessary medical care.¹⁷⁹ Lower income households are also more likely to suffer from chronic illnesses such as diabetes, heart disease, and stress.¹⁸⁰ Moreover, studies have shown that lower-income residents tend to have less access to working home air conditioners, transportation, and cool environments (e.g., shopping mall, library) during prolonged heat events, leading to substantially higher risk of heat-related deaths. Housing quality may also be a factor compounded with low income levels that affects disparities in heat-related mortality; those with lower income are more likely to live in overcrowded or substandard housing conditions where ventilation is inadequate.¹⁸¹

About 11 percent of Sacramento families (about 16 percent of all people) live in poverty.¹⁸² Some types of families are more likely to be in poverty than others. These include families headed by a single female, those whose heads are non-white, those whose heads have not attended college, and those that include multiple children.¹⁸³

Map 19 reveals that poverty rates are particularly high in the neighborhoods of North Sacramento, Del Paso Heights, Village Green, South Hagginwood, and Woodlake, as well as in Southern Pacific Richards, Tokay Meadows, Avondale, Central Oak Park, Woodbine, Brentwood, and South City Farms. A number of these neighborhoods are sparsely populated areas that contain or adjoin industrial land uses.

Unemployment and Occupation

Employment is considered a key social determinant of health because wages and benefits such as health insurance are an important factor in determining workers' ability to pay for safe housing, nutritious food, and medical care.¹⁸⁴ However, individuals who engage in certain occupations may also have elevated climate change vulnerability. Outdoor workers are often among the first to be exposed to the effects of climate change such as increased ambient temperature and degraded air quality.¹⁸⁵ There is emerging evidence that extreme heat can increase the risk of on-the-job injuries by making workers irritable or confused or by interfering with balance, motor control, and vision.¹⁸⁶

¹⁷⁸ CalBrace, "Poverty Rate."

¹⁷⁹ Gronlund CJ, 2014..

¹⁸⁰ CalBrace, "Poverty Rate."

¹⁸¹ Glen P. Kenny et al., "Heat Stress in older individuals and patients with common chronic diseases," *Canadian Medical Association Journal*, July 13, 2010, 182(10): 1053-1060, doi: 10.1503/cmaj.081050.

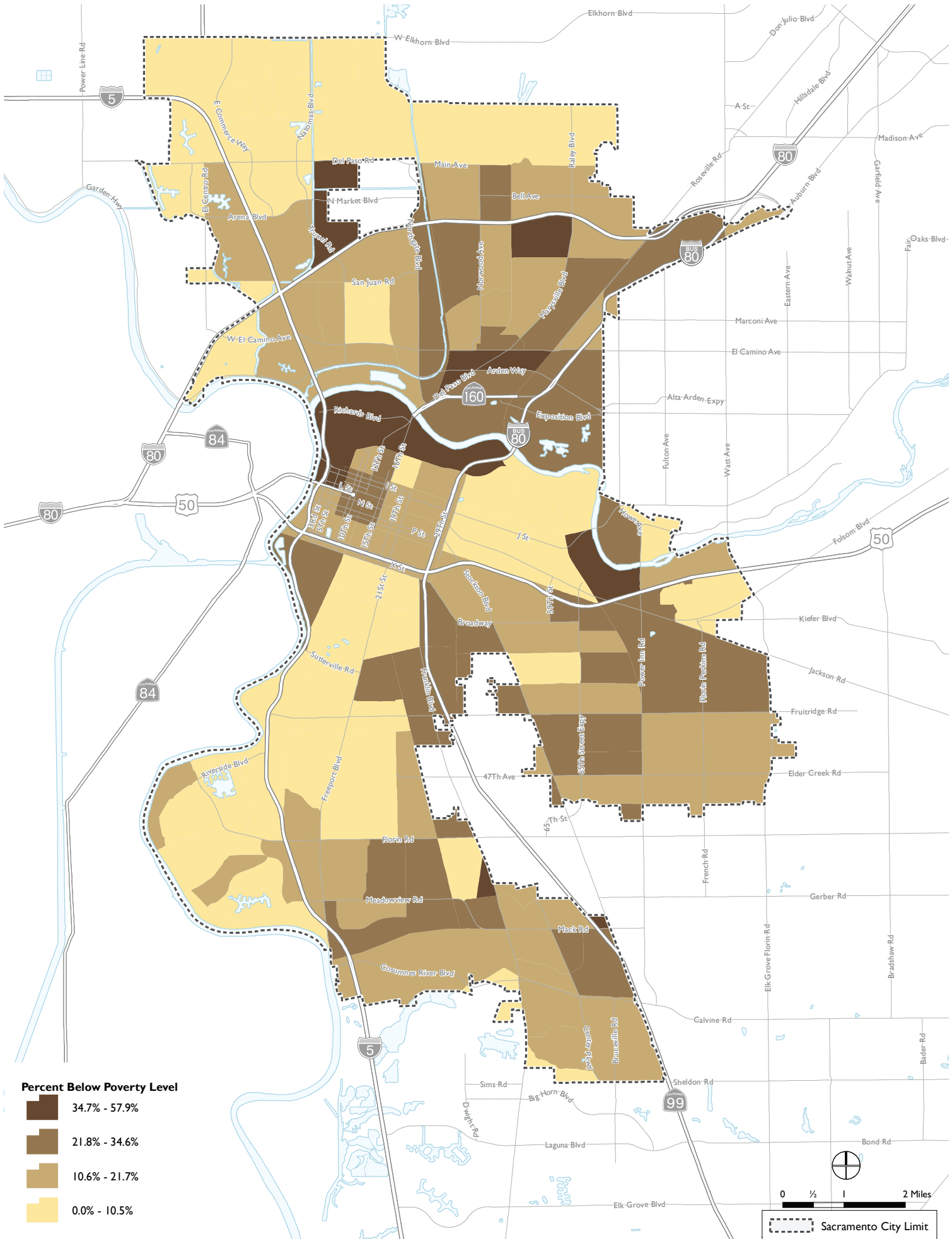
¹⁸² 2016-2020 American Community Survey 5-Year Estimates Table S1701, Table S1702

¹⁸³ 2016-2020 American Community Survey 5-Year Estimates Table S1702

¹⁸⁴ Constible J, Chang B, Morganelli C, Blandon N. "On the Front Lines: Climate Change Threatens the Health of America's Workers." Natural Resources Defense Council Jun 2020. July 31 2020:
<https://www.nrdc.org/sites/default/files/front-lines-climate-change-threatens-workers-report.pdf>.

¹⁸⁵ U.S. Global Change Research Program, 2016; CalBrace, "Outdoor Workers." Nov 8 2019:
https://www.cdph.ca.gov/Programs/OHE/CDPH%20Document%20Library/CHVIs/BRACE_OutdoorsWorkers_Narrative_790_12-5-2016.pdf.

¹⁸⁶ Constible J, et.al., 2020.



Map 19: Concentration of Poverty

Source: U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates; City of Sacramento, 2019; Dyett and Bhatta, 2023

Specific occupations that may experience heightened vulnerability include agricultural workers, groundskeepers, emergency responders, utility repair crews, and construction workers.¹⁸⁷ Statistics show that these occupations tend to have a higher percentage of Blacks or African Americans, Hispanics or Latinos, and low-wage workers¹⁸⁸ than the population as a whole, many of whom enjoy little job security and do not receive health insurance or paid sick leave.¹⁸⁹ For some groups, such as migrant laborers and day laborers, occupational-related vulnerability may be compounded by additional sources of vulnerability such as lack of access to quality housing¹⁹⁰, low income, linguistic isolation, and legal precariousness that introduces barriers to the use of emergency and legal protective services.¹⁹¹ Fear of discrimination or deportation dissuades some immigrant workers from reporting unsafe conditions or injuries and illnesses sustained on the job.¹⁹² Additionally, immigrant workers may be unaware of their workplace rights or ineligible for workers' compensation. Temporary and informally employed workers are more susceptible to occupational injuries and illnesses than are permanent employees because they often have less work experience, are unfamiliar with their workplaces, receive inadequate health and safety training, are assigned the most dangerous jobs, and may be fired or penalized for taking time off.¹⁹³ In addition, outdoor workers are often among the first to be exposed to the effects of wildfires, such as degraded air quality.¹⁹⁴

Housing Conditions

The availability of high-quality, stable, and affordable housing helps reduce exposure to extreme climate events and enables recovery. High housing costs may increase vulnerability by monopolizing financial resources, while lack of stable or high-quality housing may increase vulnerability by increasing exposure to environmental impacts.

The US Department of Housing and Urban Development (HUD) defines housing cost burdened households as those who pay more than 30 percent of their income on housing. Housing cost-burdened households may struggle to afford other necessities such as food, transportation, medical care¹⁹⁵, and—in the case of extreme climate events—emergency supplies and the ability to access a safe area. About 40 percent of households in Sacramento are housing cost-burdened.¹⁹⁶

In the absence of high-quality affordable housing options, the locations in which low-income households and individuals reside are often less resilient in the face of the impacts of weather and climate change¹⁹⁷ and may be farther from workplaces, shopping districts, and public transit—

¹⁸⁷ U.S. Global Change Research Program, 2016.

¹⁸⁸ Constible J, et.al., 2020.

¹⁸⁹ Shonkoff SB, et.al., 2011; Constible J, et.al., 2020.

¹⁹⁰ U.S. Global Change Research Program, 2016.

¹⁹¹ CalBrace, "Outdoor Workers."

¹⁹² Constible J, et.al., 2020.

¹⁹³ Constible J, et.al., 2020.

¹⁹⁴ U.S. Global Change Research Program, 2016; CalBrace, "Outdoor Workers."

¹⁹⁵ "Rental Burdens: Rethinking Affordability Measures." *PD&R Edge Home*. Nov 8 2019:

https://www.huduser.gov/portal/pdredge/pdr_edge_featd_article_092214.html.

¹⁹⁶ 2016-2020 American Community Survey 5-Year Estimates Table S2503

¹⁹⁷ Thomas, K., et.al., 2018..

increasing the costs associated with transportation. Patterns of settlement in which lower-income households locate in especially vulnerable areas could be exacerbated in the future as the real estate market begins to take exposure to climate change affects into account when setting housing prices.¹⁹⁸ As seen in Map 20, those neighborhoods where residents may experience particularly high housing cost burdens include North Sacramento, Del Paso Heights, South Hagginwood, Point West, Cal Expo, Southern Pacific/ Richards, Tokay Meadows, Weyand Industrial, North City Farms, Woodbine, Valley Hi/ North Laguna, and Central City.

A variety of housing types have been found to be correlated with higher sensitivity to climate change impacts. Poor quality home construction can also increase vulnerability to climate change impacts.¹⁹⁹ Manufactured or mobile homes are especially vulnerable to storm and flooding damage.²⁰⁰ Similarly, rental housing, manufactured housing, and subsidized housing are often located in neighborhoods where there are higher concentrations of populations who are sensitive to heat.²⁰¹ Thirty-one percent of Sacramento county's subsidized housing units are located in high-heat census tracts, one of the highest rates of the state.²⁰²

Low-income households may struggle to afford to invest in home upgrades that reduce climate exposure. Additionally, in the aftermath of an extreme climate event, it can be especially difficult for low-income individuals to cover costs associated with home repairs or relocation²⁰³, potentially perpetuating the vulnerability of low-income and housing cost burdened households.

Whether a resident owns or rents their housing unit may also affect climate vulnerability. Renters may have less control than homeowners when it comes to making home upgrades to reduce climate exposure or increase resiliency. Across the Sacramento region, renters are less likely to have access to air conditioning; when they do use air conditioning, renters are more likely than homeowners to use window conditioning units, which are less effective at cooling and more energy-intensive, and thus more likely to place an energy burden on residents.²⁰⁴ Additionally, areas with high rates of homeownership are associated with stronger local social networks, greater community involvement, and longer resident tenure. In past studies, a neighborhood's proportion of renter-occupied housing units was shown to be positively correlated with higher mortality rates among the elderly population during extreme heat events, perhaps reflecting a lack of stability, coping capacity, and strong community ties in these neighborhoods.²⁰⁵ About 50.2 percent (94,124) of Sacramento's occupied housing units are renter-occupied.²⁰⁶ As can be seen in Map 21, high concentrations of renter-occupied housing occur in downtown and the Natomas neighborhood.

¹⁹⁸ Deas M, et.al., 2017.

¹⁹⁹ Thomas, K., et.al., 2018.

²⁰⁰ Gamble JL, et.al., 2013..

²⁰¹ Gabbe CJ, Pierce G. "Extreme Heat Vulnerability of Subsidized Housing Residents in California." *Housing Policy Debate*. (Jul 2020). July 27 2020: <https://www.tandfonline.com/doi/full/10.1080/10511482.2020.1768574>

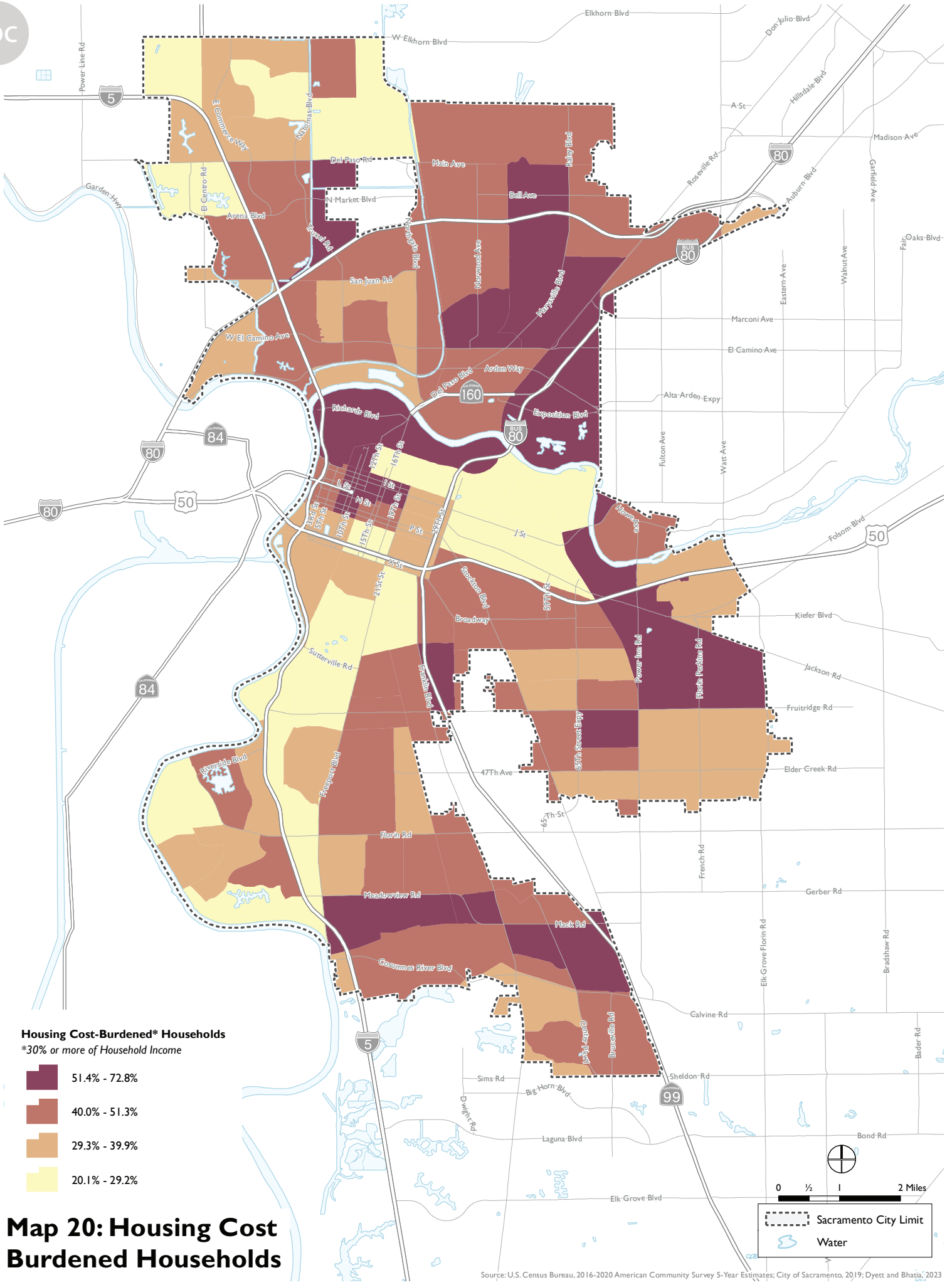
²⁰² Gabbe CJ and Pierce G., 2020.

²⁰³ Thomas, K., et.al., 2018.

²⁰⁴ Sacramento Metropolitan Air Quality Management District, 2020.

²⁰⁵ Klein Rosenthal J, Kinney PL, Metzger KB. "Intra-urban vulnerability to heat-related mortality in New York Coty, 1997-2006." *Health & Place* (2014). May 11 2020: <https://www.sciencedirect.com/science/article/pii/S1353829214001087>.

²⁰⁶ 2016-2020 American Community Survey 5-Year Estimates Table S2502

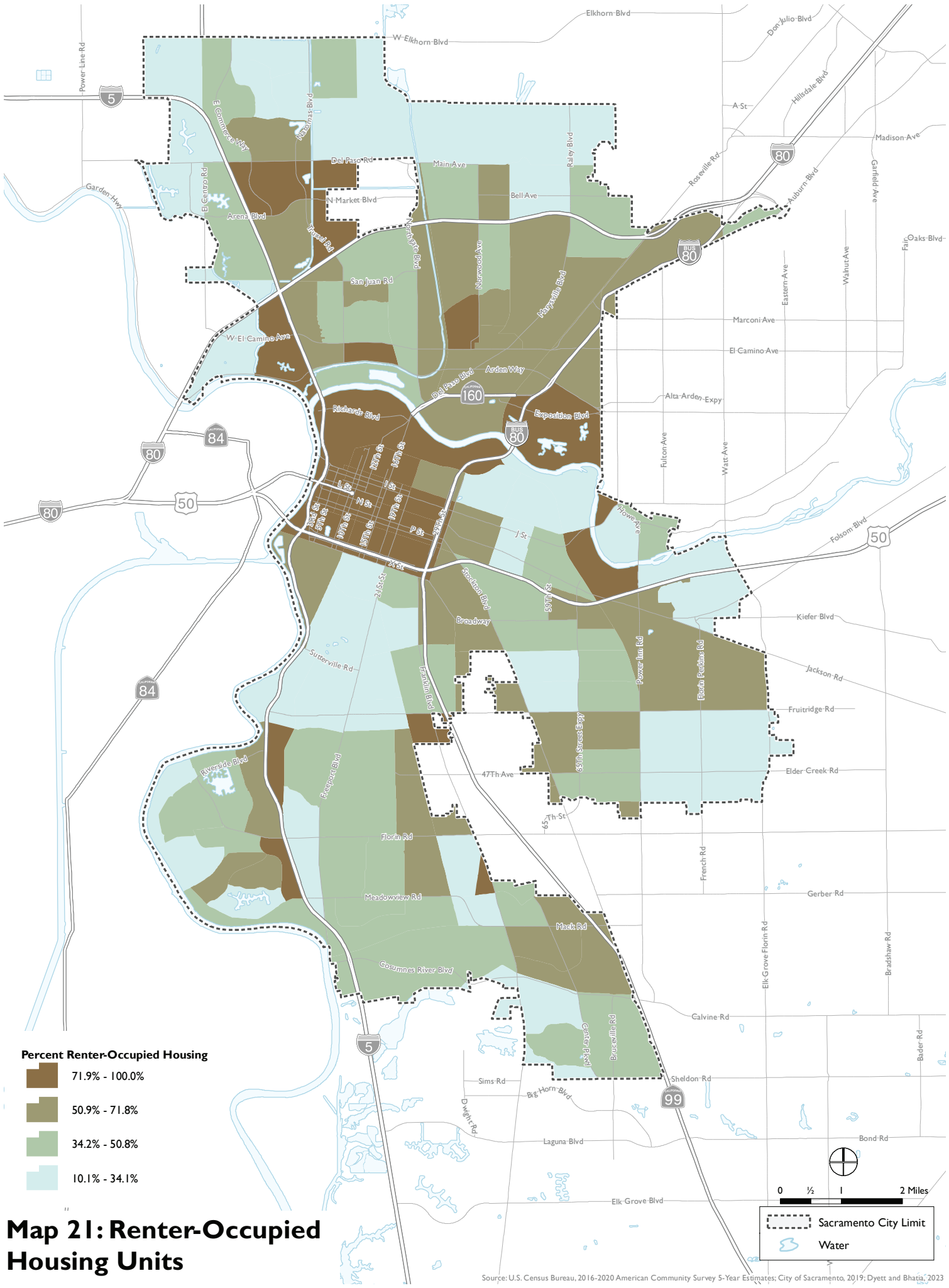


Housing Cost-Burdened* Households
 *30% or more of Household Income

- 51.4% - 72.8%
- 40.0% - 51.3%
- 29.3% - 39.9%
- 20.1% - 29.2%

Map 20: Housing Cost Burdened Households

Source: U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates; City of Sacramento, 2019; Dyett and Bhatta, 2023



Percent Renter-Occupied Housing

- 71.9% - 100.0%
- 50.9% - 71.8%
- 34.2% - 50.8%
- 10.1% - 34.1%

Map 21: Renter-Occupied Housing Units

0 1/2 1 2 Miles

Sacramento City Limit
S Water

Source: U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates; City of Sacramento, 2019; Dyett and Bhatta, 2023

Homelessness

People experiencing homelessness may be especially vulnerable to climate change impacts. Homeless individuals, who already experience elevated levels of exposure to environmental stressors such as high heat, poor air quality from wildfire smoke, and flooding, may lack a secure place to shelter in the event of a climate emergency and experience especially high levels of exposure to extreme weather. For example, there have been recent reports that homeless individuals in the Sacramento area are establishing shelters among the Delta's levee networks. Human interference with the levee system may threaten the structural integrity of the levees.²⁰⁷ Meanwhile, individuals who take up residence among the levees are at particularly high risk for suffering flood-related damages.

The needs of homeless individuals may be overlooked in disaster planning initiatives, and they are often more difficult to contact via emergency alert systems.²⁰⁸ Additionally, homeless communities often lack the legal standing that would help ensure their legitimacy and protection in times of emergency.²⁰⁹

As of 2022, it was estimated that approximately 9,278 individuals experienced homelessness in Sacramento each night. About 85 percent of these individuals were single adults over the age of 25, 15 percent were in family units, and 8 percent were unaccompanied youth.²¹⁰ Sacramento County's 2019 Point-In-Time Count revealed there was a 67 percent increase in nighttime homelessness between 2019 and 2022.²¹¹ The Point-In-Time Count also found that approximately 30 percent of individuals sleeping outside in Sacramento County are adults over the age of 55. Black and American Indian or Alaska Native people are also significantly overrepresented in the homeless population, especially within unsheltered families.²¹²

Linguistic Isolation

Linguistically isolated households are those in which there is no one aged 14 years or older who speaks English fluently.²¹³ Linguistic isolation may delay or prevent access to information such as

²⁰⁷ Heap, B. "‘Could be catastrophic’: Homeless camps on Sacramento-area levees cause concern," KCRA (May 10 2019). Nov 8 2019: <https://www.kcra.com/article/could-be-catastrophic-homeless-camps-on-sacramento-area-levees-cause-concern/27440429#>; CBS Sacramento, "Homeless People Damaging Flood Levees, Putting Thousands of Sacramento Homes In Danger." (May 9 2019). Nov 8 2019: <https://sacramento.cbslocal.com/2019/05/09/homeless-digging-flood-levees/>.

²⁰⁸ Thomas, K., et.al., 2018.

²⁰⁹ Thomas, K., et.al., 2018.

²¹⁰ Baiocchi A, Curry S, Morris J, Newham J, Caler, K, et al. "Homelessness in Sacramento County: Results from the 2022 Point-in-Time Count." (Sacramento, CA: Center for Health Practice, Policy & Research, California State University Sacramento and Sacramento Steps Forward, 2019). July 2022: <http://sacramentostepsforward.org/wp-content/uploads/2022/06/PIT-Report-2022.pdf>.

²¹¹ Baiocchi A, et al., 2022.

²¹² Baiocchi A, et al., 2022.

²¹³ CalBRACE, "Linguistic Isolation." Nov 8 2019: https://www.cdph.ca.gov/Programs/OHE/CDPH%20Document%20Library/CHVIs/BRACE_LinguisticIsolation_Narrative_11-15-2016.pdf.

public notices, job opportunities, and healthcare services. Linguistic isolation may hinder protective behaviors during extreme weather events or disasters by limiting access to or understanding of health and safety warnings and health information²¹⁴, such as the City’s own emergency response materials, the majority of which are only available in English. Studies have shown that people who live in linguistically isolated households are more likely to make heat-related calls to 911 during extreme heat events. In the aftermath of an extreme event, language barriers can present barriers to proper care and recovery services.²¹⁵ Language barriers can be a contributor to vulnerability for new immigrants, older first-generation immigrants, asylum seekers, and young children.²¹⁶ Additionally, lack of familiarity with American government and planning processes may present barriers to engaging in planning processes and accessing key government-provided resources.²¹⁷

Sacramento is a place of great linguistic diversity. Approximately 36.1 percent of Sacramento residents speak a language other than English at home.²¹⁸ Of those who speak a language other than English at home, 38.5 percent have limited English proficiency.²¹⁹ About 17 percent speak Spanish at home²²⁰, with other frequently spoken languages including Chinese (including Cantonese and Mandarin), Tagalog (including Filipino), and Vietnamese.

Within the City of Sacramento, neighborhoods where residents experience high rates of linguistic isolation show a significant amount of overlap with those neighborhoods that are high in poverty, residents with disabilities, and high-cost, reduced quality housing. As described above, a number of these neighborhoods are low-density, contain or are adjacent to industrial land uses, and relatively isolated from core City activities. However, many linguistically isolated residents are also located downtown in the City’s core. When compared with Map 18 (Racial Distribution), Map 22 shows how this area corresponds to a high density of the City’s Asian population.

AT-RISK VULNERABLE POPULATIONS

This section discusses and maps the overlay of areas that are impacted by each of the climate change effects with the vulnerable populations described above.

Urban Heat

Urban heat island effects in Sacramento are most prevalent in North Sacramento, Fruitridge-Broadway, the South Area, parts of the Central City, and in industrialized areas (see Map 1). Populations vulnerable to urban heat include children (aged 14 and below), older adults (aged 65 and over), individuals with disabilities, low-income households, outdoor workers, cost-burdened households, households living in substandard housing conditions, linguistically isolated households, and communities of color.

²¹⁴ CalBRACE, “Linguistic Isolation.” [↗](#)

²¹⁵ U.S. Global Change Research Program, 2016.

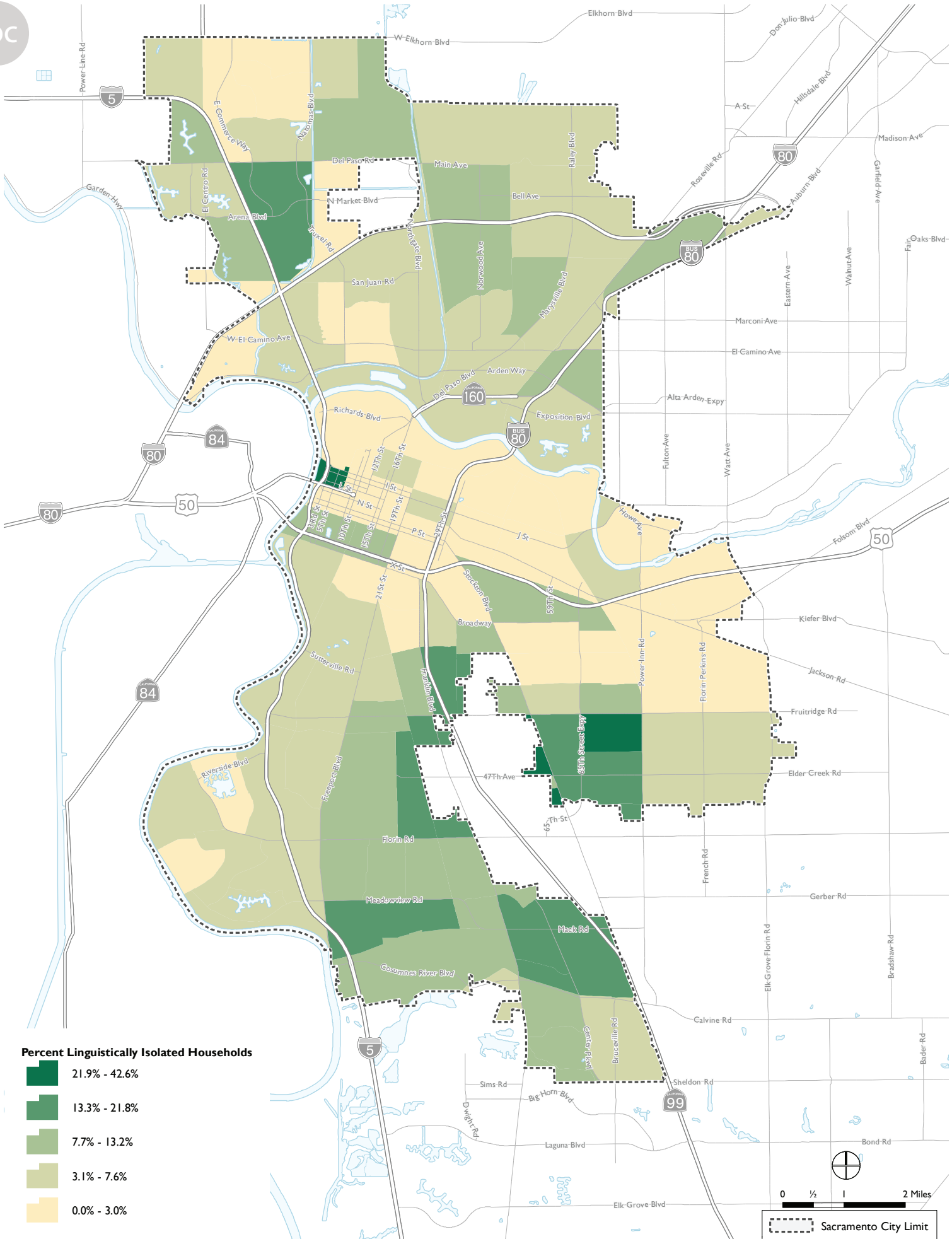
²¹⁶ CalBRACE, “Linguistic Isolation.” [↗](#)

²¹⁷ Deas M, et.al., 2017..

²¹⁸ 2016-2020 American Community Survey 5-Year Estimates Table S1601

²¹⁹ 2016-2020 American Community Survey 5-Year Estimates Table S1601

²²⁰ 2016-2020 American Community Survey 5-Year Estimates Table S1601



Percent Linguistically Isolated Households

- 21.9% - 42.6%
- 13.3% - 21.8%
- 7.7% - 13.2%
- 3.1% - 7.6%
- 0.0% - 3.0%

Map 22: Rate of Linguistic Isolation

Source: U.S. Census Bureau, 2016-2020 American Community Survey 5-Year Estimates; City of Sacramento, 2019; Dyett and Bhatta, 2023

Map 23: Urban Heat Island and Disadvantaged Communities (DACs) illustrates an overlay of areas that are impacted by the urban heat island effect as well as house a high proportion of disadvantaged communities (DACs). DACs are defined as the areas in the top 25 percent of CalEnviroScreen scores, which take into account census tracts' pollution burdens and population socioeconomic characteristics. Northeast and southeast Sacramento largely contain areas that are vulnerable to urban heat island effects and house DACs. While many of these areas represent industrial and large commercial areas, many adjacent neighborhoods were developed without street tree canopy, have large unshaded parking lots, and represent neighborhoods with fewer trees on private property. The City's Urban Forest Plan will focus on high-risk neighborhoods that contain vulnerable populations that should be prioritized for urban heat island mitigation and adaptation strategies.

Flooding

As described in Chapter 2.1, flooding is the most common natural hazard event to occur within the city limits, and climate modeling suggests that climate change has increased the likelihood of a storm event capable of producing catastrophic flooding. The majority of the city lies within the 100-year Magpie Creek floodplain, the 100-year flood zone, or the 500-year flood zone.

The most flood-prone areas are designated as repetitive loss areas. Areas of repetitive flooding include South Natomas, Downtown East, Downtown West, Southeast Sacramento, and Sutterville/Meadowview as illustrated in Map 4: Repetitive Loss Areas and FEMA Flood Zones.

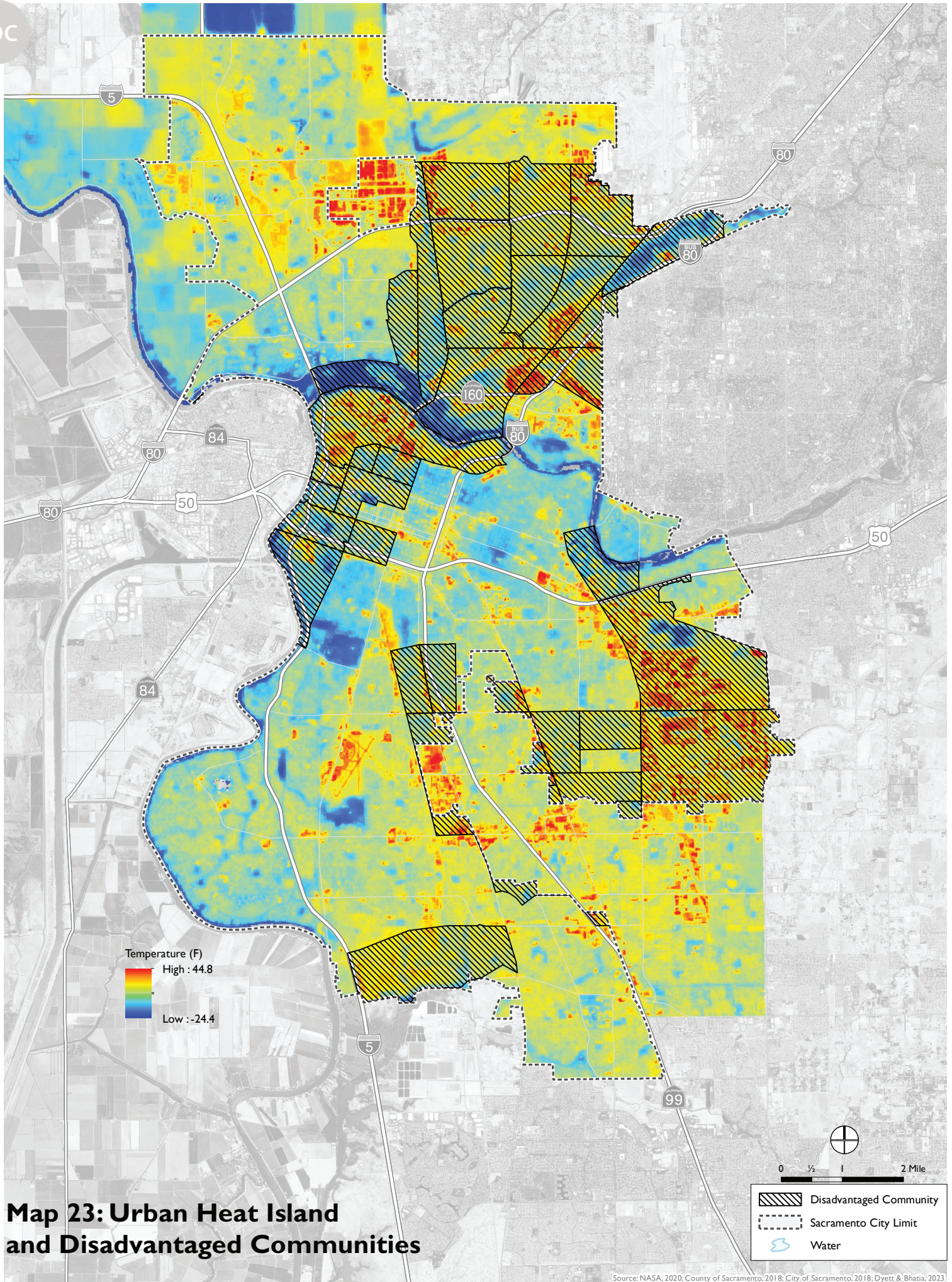
Numerous populations are particularly vulnerable to the effects of flooding and may require additional health interventions. As described above, groups who are at risk include older adults (aged 65 and over), individuals with disabilities, low-income households, cost-burdened and poor-quality households, linguistically isolated households, and communities of color.

Map 24: DACs in Repetitive Loss Areas (RLAs) and FEMA Flood Zones illustrates an overlay of areas that are impacted by flooding in Sacramento as well as house a high proportion of disadvantaged communities (DACs). Areas at particular risk include portions of RLAs 1, 3, and 4. Specific neighborhoods in these high-risk areas include Northgate, Downtown, Southside Park, Richmond Grove, Alkali Flat, Mansion Flats, and Avondale.

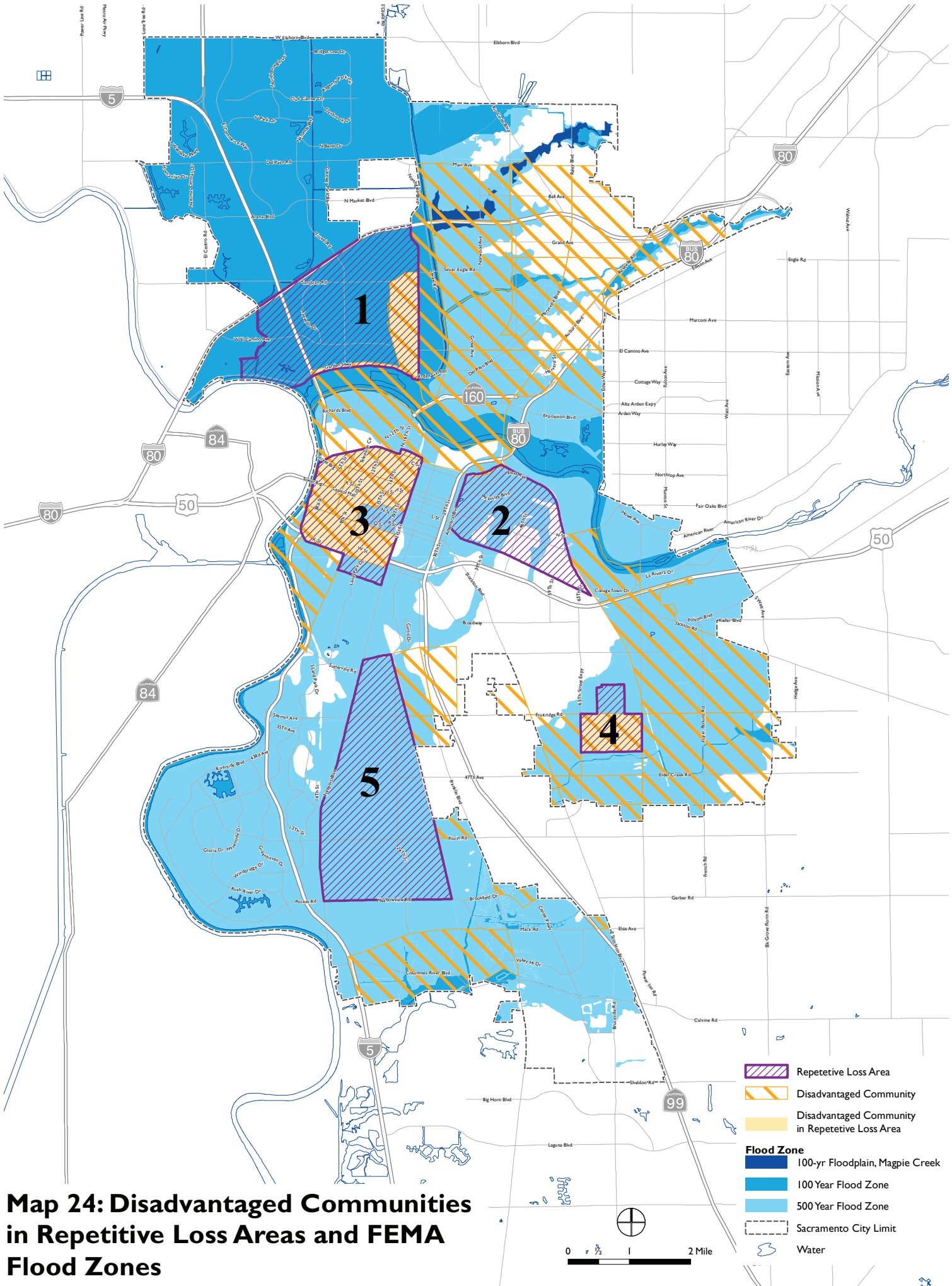
Drought

A significant drought may raise food prices and food insecurity. The scarcity of water factors into the costs of food throughout the system. Food prices in grocery stores may increase during a drought which could make it too costly for low-income households to purchase fresh produce, meats, and poultry.

Unless groundwater resources are successfully managed, consistent droughts would likely result in significant groundwater depletion over time due to an increased reliance on the water source. Groundwater currently comprises about one-third of the region's water use; studies have shown that regional rates of groundwater extraction increase under drought conditions. The City's groundwater supplies are currently being managed sustainably and major overdrafts are not anticipated. However, climate change effects such as drought and shifting precipitation patterns could impact groundwater supply over the course of the century.



Map 23: Urban Heat Island and Disadvantaged Communities



Map 24: Disadvantaged Communities in Repetitive Loss Areas and FEMA Flood Zones

Source: CalEPA, 2022; CalAdapt/UC Berkeley, 2016; FEMA, 2015; City of Sacramento, 2019; Dyett & Bhatia, 2023

Wildfire

While a wildfire may be unlikely to break out within Sacramento city limits, wildfires can have profound secondary impacts on the health of vulnerable populations. Wildfire smoke can cause adverse health effects including restricted breathing; eye irritation; aggravation of respiratory and cardiovascular diseases including asthma, COPD, bronchitis, and pneumonia; and may increase cancer risk and impair immune function. Vulnerable populations include children (aged 14 and below), older adults (aged 65 and over), individuals with disabilities, low-income households, outdoor workers (such as construction workers), linguistically isolated households, and communities of color. Some studies have also found associations between low socioeconomic status and health effects related to wildfire smoke exposure.

While Sacramento itself may not be at a very high risk to wildfires within city limits, its secondary air quality impacts can have harmful health effects on the city's vulnerable populations. Even though Sacramento and the State of California have a plethora of resources on wildfire emergency preparedness, it is essential to ensure that all community members are well-informed and well-equipped to respond to a climate-related event.

Climate Disaster Preparedness

If evacuation is necessary due to a climate disaster event, several barriers may prevent residents from evacuating. Some residents, such as the elderly, the hospitalized, prisoners²²¹, the low-income²²², individuals with mobility issues, those who lack access to reliable transportation²²³, those whose do not receive language-appropriate warning and evacuation information, and those with pets,²²⁴ may not be able to evacuate in a timely manner even if they desire to do so. When a large-scale evacuation is taking place, the elderly may be left behind by caretakers and families, and their specific conditions and medical needs may be overlooked. Income influences the ability to evacuate by affecting ability to afford access to private transportation and services such as hotels. Additionally, research has shown that residents of high-density areas may require additional assistance while evacuating.²²⁵

Even in the absence of an evacuation event, disruptions to the transportation network can occur as a result of localized flooding, and can disproportionately affect low-income individuals and older adults who may have limited mobility as well as those with limited English proficiency who may not understand notices communicated only in English. These disruptions also affect those who commute into or out of the city for work, who may suffer economic losses as a result.²²⁶ Car ownership is an important marker of social vulnerability to storms and floods. During a sudden flood event, households in or near a flood zone without a personal vehicle may be at greater risk of

²²¹ Benevolenza MA, DeRigne L. "The impact of climate change and natural disasters on vulnerable populations: A systematic review of literature." *Journal of Human Behavior in the Social Environment* (2019). Nov 8 2019: <https://www.tandfonline.com/doi/abs/10.1080/10911359.2018.1527739?journalCode=whum20>.

²²² U.S. Global Change Research Program, 2016.

²²³ Nutters, H., 2012.

²²⁴ Porter K., et al., 2010.

²²⁵ Porter K., et al., 2010.

²²⁶ Maxwell, K., et.al., 2018.

harm because they have reduced capacity to evacuate.²²⁷ Approximately 8.3 percent of Sacramento's households lack access to a household vehicle.²²⁸

3.2 Critical Facilities

A critical facility is any facility whose damage or disruption would result in severe consequences to public health and safety or interrupt essential services for the community. The following section details critical facilities in Sacramento and their essential services which can consist of water utilities, wastewater services, energy infrastructure, communication infrastructure, power generation facilities, levees, roads and bridges, and medical services.

WATER SUPPLY

Water supply is critical to many functions and systems within the city, such as for fire suppression and water for public health including hospital and medical uses, and limited water supply can increase competition between these essential needs.

The City provides domestic water service to the area within the city limits, as these limits change from time to time, and to several small areas within the County of Sacramento. A small area in the northeastern portion of the city (Swanston Estates) is served by the Sacramento Suburban Water District, although City and District staff have held discussions relative to the City taking this service area over at some point in the future. Areas adjacent to the city limits are served by the Natomas Central Mutual Water Company, Rio Linda Elverta Community Water District, Sacramento County Water Agency, Sacramento Suburban Water District, California-American Water Company, Tokay Park Water District, Elk Grove Water Service, and the Florin County Water District.

The City supplies domestic water from a combination of surface water and groundwater sources. Two water treatment plants supply domestic water by diverting water from the American River and Sacramento River. In addition to the surface water diverted from the two rivers, the City operates groundwater supply wells. Emergency connections to adjacent water systems exist in various locations.

WASTEWATER

Three separate entities are involved in the collection, conveyance, treatment, and disposal of wastewater in the city. The City of Sacramento Department of Utilities (DOU) provides collection through its separated system and its combined system to about 65 percent of the population of Sacramento. The Sacramento Area Sewer District (formerly County Services District CSD-1) provides collection through its separated system to the remaining 35 percent of the population, primarily in the northwest and southeast sections of the city. The City's separated system and Sacramento Area Sewer District's system, as well as the dry-weather flow from the city's combined system, and a majority of the wet weather flows from the city's combined sewer system, drain into

²²⁷ Nutters, H., 2012.

²²⁸ 2016-2020 American Community Survey 5-year Estimates Table S2504

interceptors owned and operated by the Sacramento Regional County Sanitation District (Regional San) which in turn convey all flows to the Sacramento Regional Wastewater Treatment Plant (Sacramento Regional WWTP) also owned by Regional San. When a storm event results in combined sewer flows exceeding 60 million gallons per day, the City collects and treats the excess flows before discharging to the Sacramento River.²²⁹

The City collects fees for 54 sewer basins that serve the community plan areas of North Sacramento, and portions of Arden-Arcade, most of South Sacramento (e.g., Pocket, Airport, Meadowview, South Land Park), and most of East Sacramento. Fourteen of those basins are part of the combined sewer system. Four out of the other forty separated basins flow directly into the downtown area's combined system, where the flow joins the combined flow before being conveyed to the Sacramento Regional WWTP. The other 50 separated basins flow into the Regional San interceptors which convey flows to the Sacramento Regional WWTP. Out of these 50 basins, 40 are pumped through their own individual pump stations, while the other 10 basins flow by gravity.

The older Central City area is served by the Combined Sewer System (CSS). The area served by the CSS constitutes approximately 7,545 acres or 12 percent of the total area within the current city limits. There are some local areas within this larger area that have separate sewer and storm drainage systems, but the bulk of the area is served by the combined system. Additionally, there are some peripheral areas that have separate sewer and storm drainage that contribute sewage to the CSS, including the four separated sewer basins described above.

FLOOD PREVENTION

The City of Sacramento is located in the heart of California's Central Valley at the confluence of the Sacramento and American Rivers. The Central Valley is a flat alluvial plain approximately 50 miles wide and 400 miles long in central California. The northern part is the Sacramento Valley drained by the Sacramento River, and the southern part is the San Joaquin Valley drained by the San Joaquin River. It is surrounded by the Sierra Nevada Mountains to the east, the Tehachapi Mountains to the south, Coastal Range to the west, and Cascade Range to the north. The topography of the area is relatively flat. There is a gradual slope rising from elevations as low as sea level in the southwestern portion of the Valley up to approximately 75 feet above sea level in the northeastern portion.

Given this geographic context, the City of Sacramento is susceptible to various types of flood events: riverine, flash, and localized stormwater flooding; and levee and dam failure flooding. Regardless of the type of flood, the cause is most often the result of severe weather patterns and excessive rainfall, either in the flood area or upstream reach. Flooding is the most significant natural hazard that the City faces.

The majority of the city lies within areas with 0.2- to 1.0-percent annual probability of being flooded when compared to historic frequencies. Levee improvements are currently in progress. When these

²²⁹ City of Sacramento Department of Utilities, Where does it go? A Snapshot of the City's Combined Sewer System, <https://www.cityofsacramento.org/-/media/Corporate/Files/DOU/McKinley/How-it-works.pdf?la=en>

improvements are complete, the entire city will have at least 200-year riverine flood protection based on data available when the improvements were designed.

The Sacramento region's extensive network of levees, dams, and weirs protect vast portions of the city, people, property, and its critical facilities from flooding. If a storm event larger than the design capacity of flood protection infrastructure was to occur and cause major flooding, significant numbers of people could be impacted, forced to evacuate, or be injured or killed.

ENERGY SUPPLY

Climate change can disrupt energy supply and delivery via increased temperatures, changes in the hydrological cycle, wildfire, and heavy storms. Heat both increases demand for energy and reduces the efficiency of energy transmission, making the city more susceptible to interruptions. Changes in seasonal snowmelt reduces the generating capacity of SMUD's hydroelectric facilities. Both wildfire and heavy storms, including winds, can damage infrastructure, leading to electricity and telecommunications service outages.²³⁰ This may make it difficult or impossible for vulnerable populations, such as the elderly or persons with disabilities, to receive necessary medical care during a climate hazard event.

Energy production and distribution are threatened by heat and wildfires. Physical infrastructure such as power lines or pipes in the direct path of a fire can suffer extensive damage. Transmission capacity is affected by high heat, smoke, and particulate matter, and lines may be shut down as a firefighting measure. Wildfire in the Sierra Nevada may damage water and energy infrastructure upon which the Sacramento region relies.

High temperatures can impact key infrastructure including energy generation and distribution. High temperatures decrease the efficiency of power lines while increasing the demand for energy-intensive uses such as air conditioning and cooling equipment. This results in a higher risk of energy blackouts and increases energy bills. These impacts can strain household budgets, increase exposure to heat, and negatively impact the provision of medical and social services.

The Sacramento Municipal Utility District (SMUD) is responsible for the acquisition, generation, transmission and distribution of electrical service to customers for the City of Sacramento. SMUD's 900 square mile service territory also includes most of Sacramento County and a portion of Placer County. SMUD serves a population of approximately 1.5 million with a total annual retail load of approximately 12.565 million megawatt-hours. SMUD generates 1,771 megawatts (MW) of power and buys 1,483 MW of power to meet the region's power demands. SMUD supplies power through a distribution grid that is a looped system, which provides for more reliable power.

²³⁰ Lane K, Charles-Guzman K, Wheeler K, Abid Z, Graber N, Matte T. "Health Effects of Coastal Storms and Flooding in Urban Areas: A Review and Vulnerability Assessment." *Journal of Environmental and Public Health* May 30 2013. May 11 2020: <https://www.hindawi.com/journals/jep/2013/913064/>; Porter K., et al., 2010.

TRANSPORTATION

Extremely high temperatures can cause physical damage to roadways, railways, and bridges, as well as reduce the comfort and feasibility of walking, biking, and taking public transit.

Roads and sidewalks absorb and radiate heat, subjecting those nearby, including people walking and those using transit, to increased heat burdens.

Sacramento Regional Transit (SacRT) powers their light rail system with overhead catenary systems lines, which can stretch with heat and may lead to severing of the connection with the rail car.

Wildfire affects transportation infrastructure by causing road and airport blockages, closures, and reducing road visibility. Transportation services such as electric rail lines and traffic signals may also be affected by the disruptions to power service described above. Transportation infrastructures such as roads and rail lines can also be damaged by wildfires that result in high heat. Flooding can also result in roadways under water, critical facilities washed out, and damage to traffic signals, signs, and bridges.

The State highway system will also be affected. Caltrans owns or controls 350,000 acres of right of way, maintains 15,133 centerline miles of highway and 13,063 miles of state highway, and inspects more than 12,200 local bridges statewide. Caltrans engages in a number of climate-related initiatives to protect these critical assets. It conducts climate change vulnerability assessments to identify segments of the State Highway System vulnerable to climate change impacts including precipitation, temperature, wildfire, storm surge, and sea level rise. The results of these assessments are used to guide analysis of at-risk assets and develop adaptation plans and evacuation routes.

MEDICAL FACILITIES

A number of climate change effects, including higher ambient temperature, reduced ambient air quality, flooding, and wildfire will increase demand for medical services, potentially straining the City's medical services infrastructure. There are six hospitals within the Sacramento area that serve the region:

- Kaiser Permanente South Sacramento Medical Center (6600 Bruceville Road);
- Mercy General Hospital (4001 J Street);
- Methodist Hospital of Sacramento (7500 Hospital Drive);
- Shriners Hospital for Children – Northern California (2425 Stockton Boulevard);
- Sutter Medical Center, Sacramento (2825 Capitol Avenue); and
- UC Davis Medical Center (2315 Stockton Boulevard).

All of these facilities are designed and equipped to handle multiple, simultaneous patients during everyday activities and emergency situations.

The Kaiser Permanente South Sacramento Medical Center and UC Davis Medical Center are certified trauma centers serving the Policy Area. These facilities provide an enhanced level of life-saving care

to victims of traumatic injuries. These facilities are staffed 24 hours per day with physicians, nurses, and other health care professionals who have special training in treating critical injuries to the head, spine and vital organs. Kaiser Permanente’s hospital is a Level II Trauma Center. The UC Davis Medical Center is a Level I trauma center and a Level I pediatric trauma center.

Various groups offer health clinics designed to address the needs of specific underserved populations throughout the Sacramento area. Many of these clinics are operated in coordination with the UC Davis Medical Hospital, including the Joan Viteri Clinic, the Center for Aids Research and Education (CARES), the Paul Hom Asian Clinic, ClinicaTepati, Imani Clinic, and Shita Clinic. The County also provides CIMSP services at the following public clinics:

- Primary Care Center (4600 Broadway)
- Del Paso Health Center (3950 Research Drive)
- Capitol Health Center (1500 C Street)
- Oak Park Clinic - Oak Park Neighborhood Multiservice Center Health Clinic (3425 Martin Luther King, Jr. Boulevard)

The Department of Health and Human Services also operates the Sacramento County Mental Health Treatment Center (SCMHTC), located on 2150 Stockton Boulevard. The Minor Emergency Response Team unit also provides crisis intervention and stabilization for children and youth who are experiencing a psychiatric emergency. Inpatient hospitalization is available as a last resort when other treatment options are unsuccessful.

TELECOMMUNICATIONS SERVICE

Many telecommunications components (landline, wireless, and internet) and are susceptible to damage in a severe storm and telecommunications networks are susceptible to being slowed or blocked when overloaded by call volume.

AT-RISK CRITICAL FACILITIES

Some climate hazards, such as floods, pose a direct physical threat to critical infrastructure and facilities, while others, like rising temperatures, are associated with multiple effects that will increase burden on or even threaten capacity of these critical facilities. Risk factors are more significant for key transportation, power, water, communication, and related health and safety systems that are central to the operation of the City. For instance, the majority of Sacramento’s urban center, as well as vital public utilities, are dependent on levee protection.²³¹ Damage or disruption from flooding due to levee failure may interfere with the operation of key transportation, power, communication, health, and safety systems. In addition, secondary hazards such as industrial facilities that store hazardous materials can be potentially harmful to the public and expose residents to significant health and safety risks if damaged during a climate hazard event.

²³¹ Sacramento Municipal Utility District, 2018; Water Education Foundation, “Sacramento-San Joaquin Delta Levees.” Nov 9 2019: <https://www.watereducation.org/aquapedia/sacramento-san-joaquin-delta-levees>.

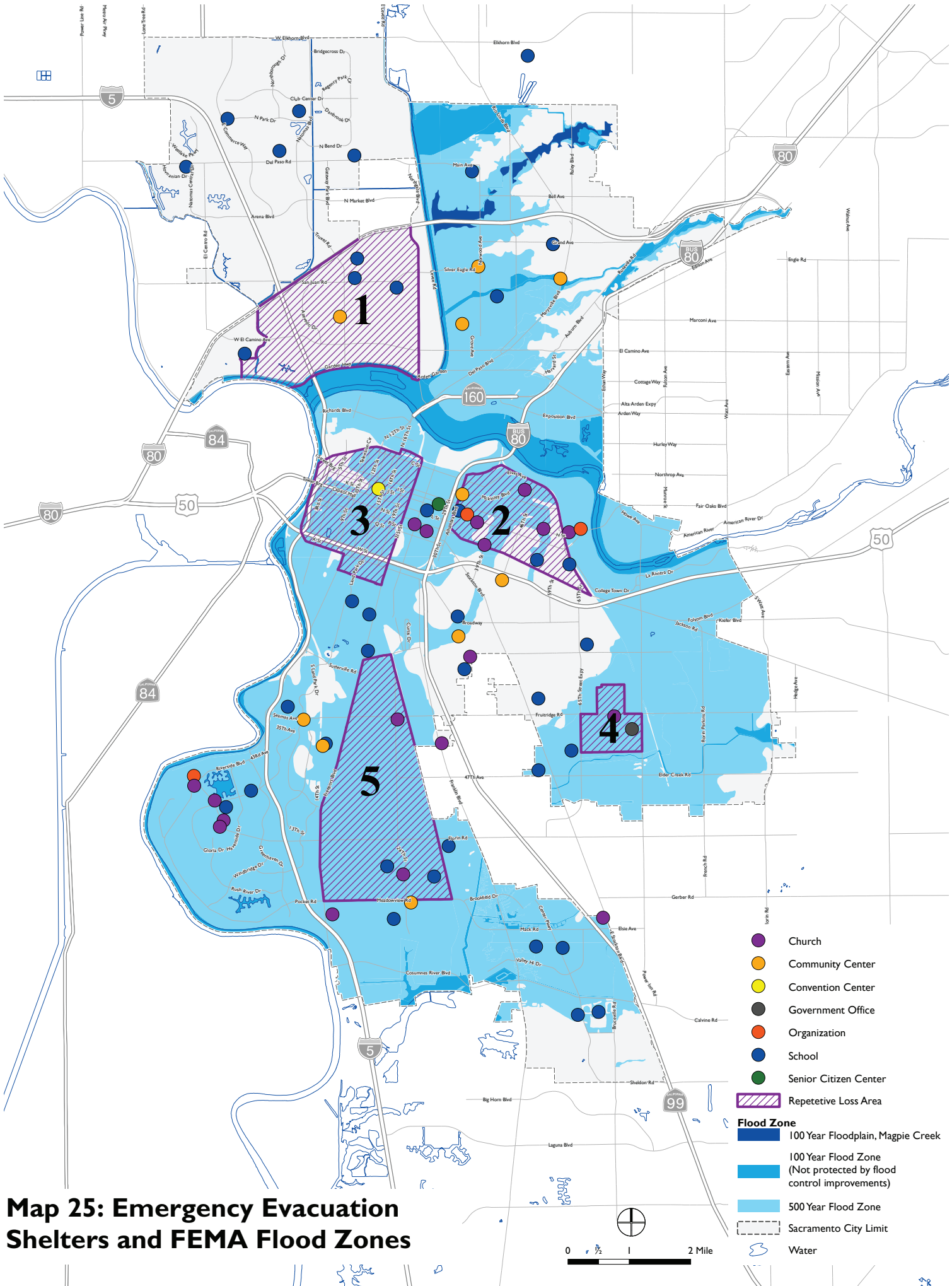
Similarly, secondary climate change effects pose a threat to stormwater and wastewater systems, which can be overwhelmed and/or damaged by floods or storm events. A combined sewer overflow (CSO) can occur when a CSS becomes inundated and the volume of stormwater and wastewater exceeds its storage and treatment capacity. This, in turn, can cause untreated stormwater and wastewater to be discharged into nearby streams, rivers, and other water bodies, threatening public and ecosystem health. This occurred three times between 2004 and 2012.²³²

Maps 25, 26, 27, and 28 illustrate critical facilities overlaid with FEMA flood zones. Critical facilities featured in the maps include emergency evacuation shelters, industrial facilities, public safety facilities, and transportation facilities. According to the maps, the vast majority of critical facilities are located within a flood zone. Areas with a higher probability of annual flooding, like the 100-year flood zone, may be unsuitable locations for existing critical facilities and may require relocations in the future.

Areas designated as Disadvantaged Communities by SB 535 (Chapter 830, Statutes of 2012) are specifically targeted for investment of proceeds from the State’s Greenhouse Gas Reduction Fund (pursuant to AB 32 [2006]), which the State appropriates to improve infrastructure, public health, quality of life, and economic opportunity, while also reducing pollution that causes climate change. Under SB 535, areas identified by CalEPA as Disadvantaged Communities—those that are disproportionately affected by environmental pollution and other hazards that can lead to negative health effects, exposure, or environmental degradation; or those with concentrations of people that are of low income, high unemployment, low levels of homeownership, high rent burden, sensitive populations, or low levels of educational attainment—represent opportunities to leverage funding for making improvements to existing critical facilities or providing new ones within the communities that need them most. Similarly, California Opportunity Zones, established in the Tax Cuts and Jobs Act of 2017, provide tax incentives for investment in designated census tracts. California Opportunity Zones support new investments in environmental justice, sustainability, climate change, and affordable housing.

Sacramento’s designation in 2015 as a “promise zone” by the U.S. Department of Housing and Urban Development is the catalyst for service expansion in Sacramento’s most economically distressed neighborhoods. Through the Promise Zone Initiative, the federal government works with local leaders and organizations in high poverty communities to increase economic activity, improve educational opportunities, leverage private investment, reduce violent crime, enhance public health, and address other priorities identified by the community. Promise Zone funding has supported expanded access to critical facilities and services including a new hospital and a new community health clinic. Additionally, improvements in communitywide health and wellness and strengthened community capacity can help reduce the factors that make certain populations more vulnerable to climate-related risks. Sacramento’s Promise Zone encompasses 22 square miles from Del Paso Heights in the north to Oak Park and part of Fruitridge Manor neighborhood in the south. Sacramento’s Disadvantaged Communities, Opportunity Zones, and federal Promise Zone are shown in Map 29.

²³² City of Sacramento Department of Utilities, Where does it go? A Snapshot of the City’s Combined Sewer System.

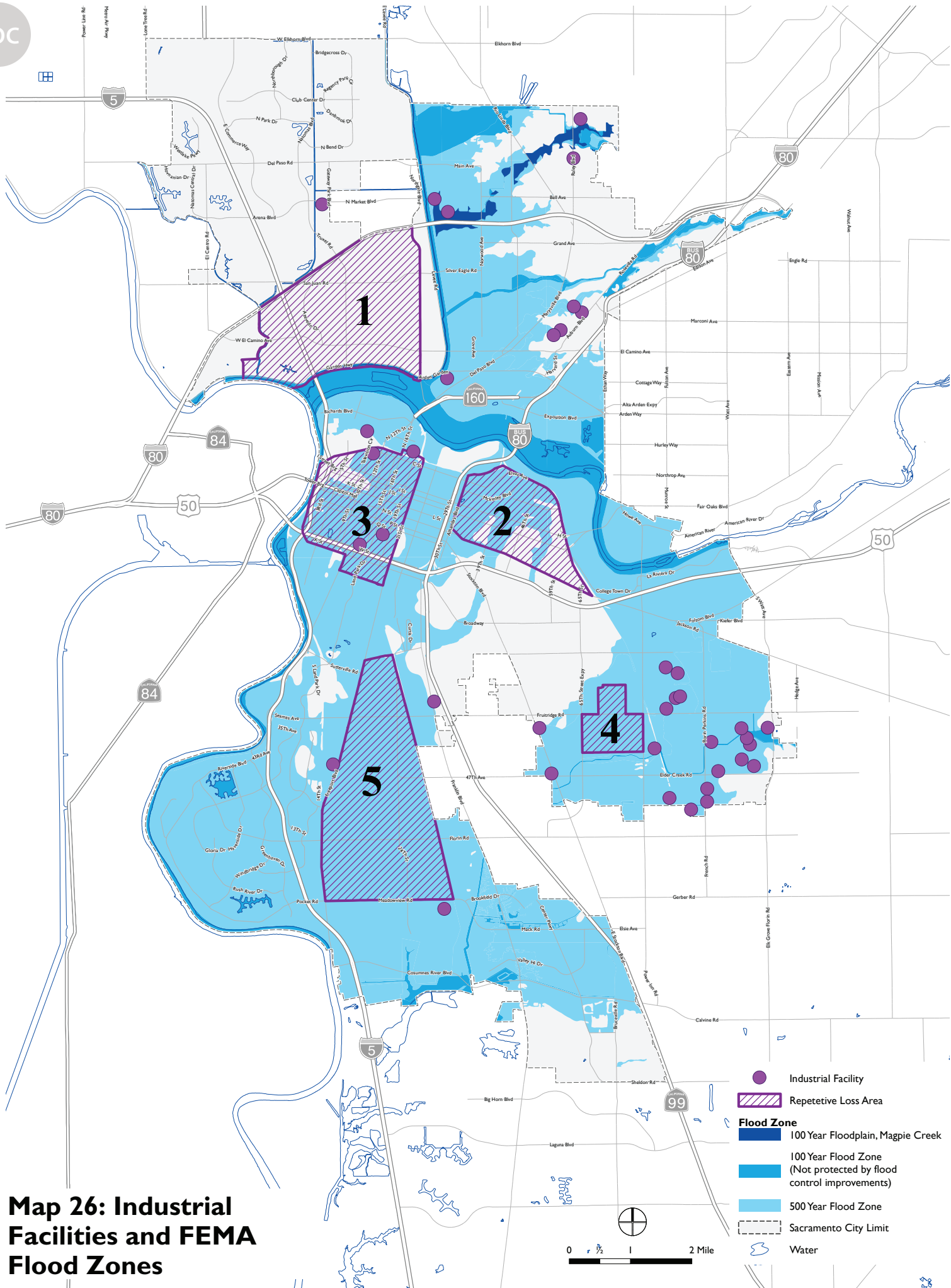


Map 25: Emergency Evacuation Shelters and FEMA Flood Zones

- Church
- Community Center
- Convention Center
- Government Office
- Organization
- School
- Senior Citizen Center
- Repetitive Loss Area

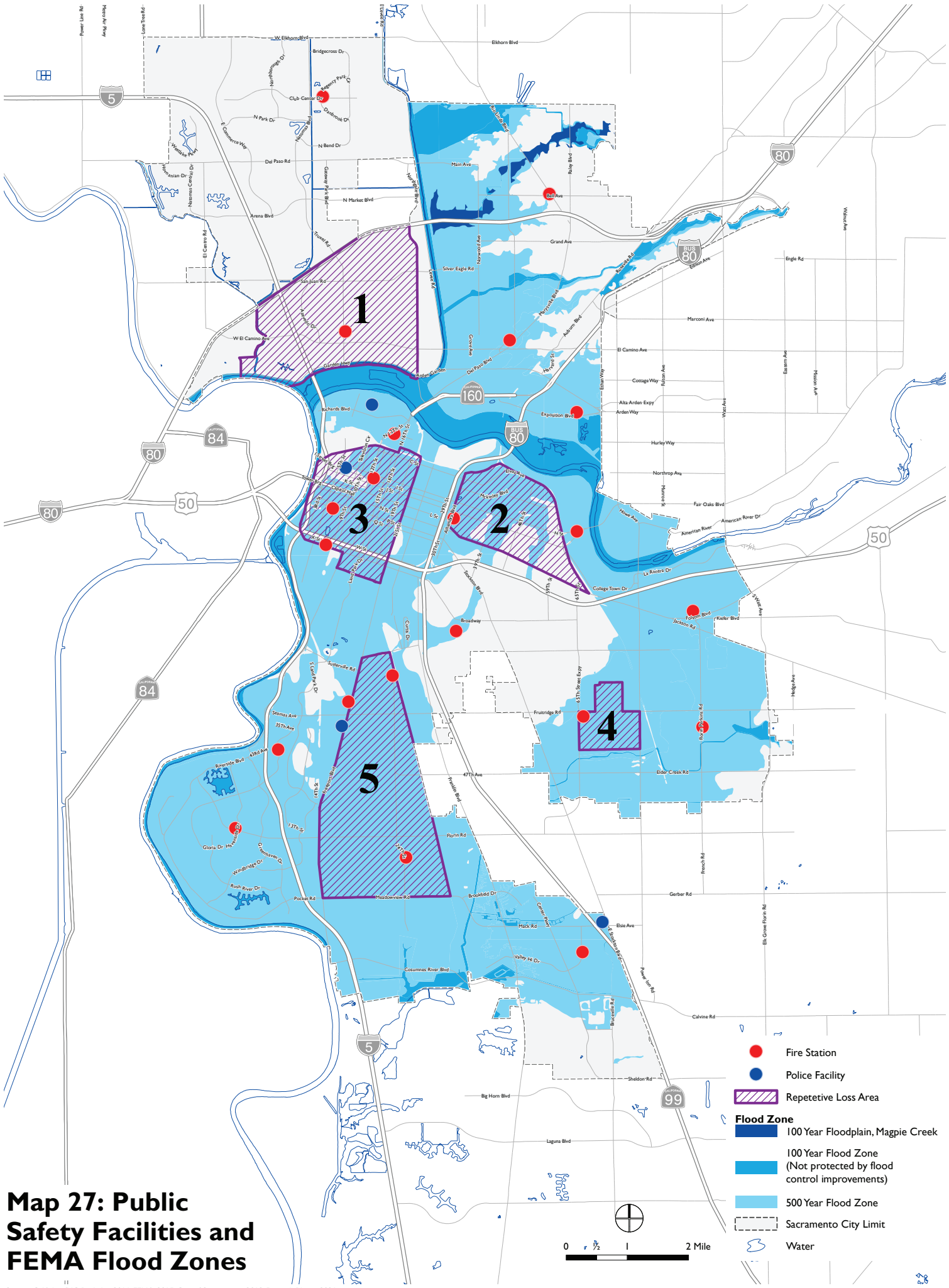
- Flood Zone**
- 100 Year Floodplain, Magpie Creek
 - 100 Year Flood Zone (Not protected by flood control improvements)
 - 500 Year Flood Zone
 - Sacramento City Limit
 - ~ Water

Source: CalAdapt/UC Berkeley, 2016; FEMA, 2015; City of Sacramento, 2019; Dyett & Bhatia, 2021



Map 26: Industrial Facilities and FEMA Flood Zones

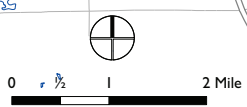
Source: CalAdapt/UC Berkeley, 2016; FEMA, 2015; City of Sacramento, 2019; Dyett & Bhatia, 2021

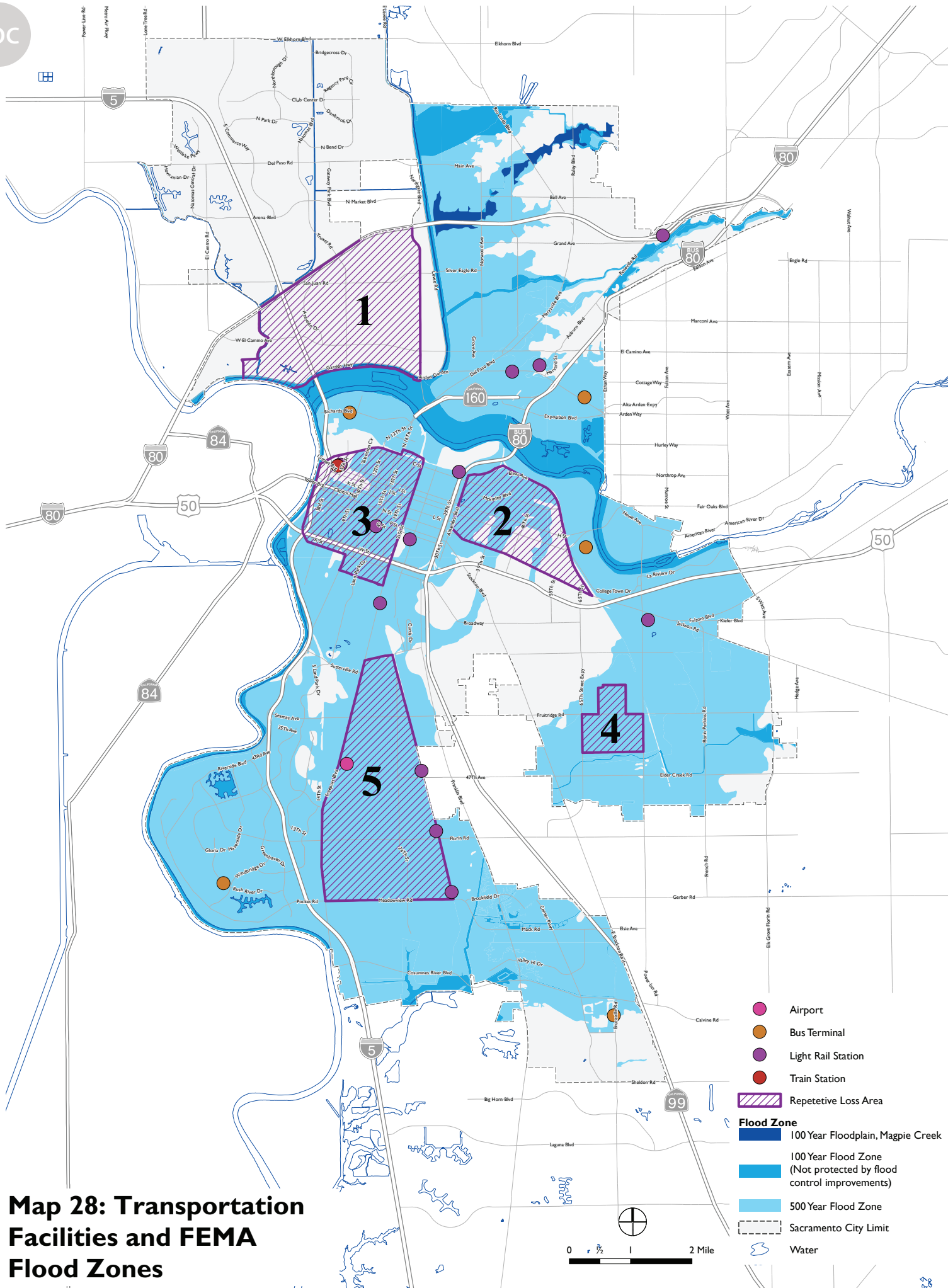


Map 27: Public Safety Facilities and FEMA Flood Zones

Source: CalAdapt/UC Berkeley, 2016; FEMA, 2015; City of Sacramento, 2019; Dyett & Bhatia, 2021

- Fire Station
- Police Facility
- Repetitive Loss Area
- Flood Zone**
- 100 Year Floodplain, Magpie Creek
- 100 Year Flood Zone (Not protected by flood control improvements)
- 500 Year Flood Zone
- Sacramento City Limit
- ~ Water





Map 28: Transportation Facilities and FEMA Flood Zones

Source: CalAdapt/UC Berkeley, 2016; FEMA, 2015; City of Sacramento, 2019; Dyett & Bhatia, 2021

Emergency Evacuation and Response

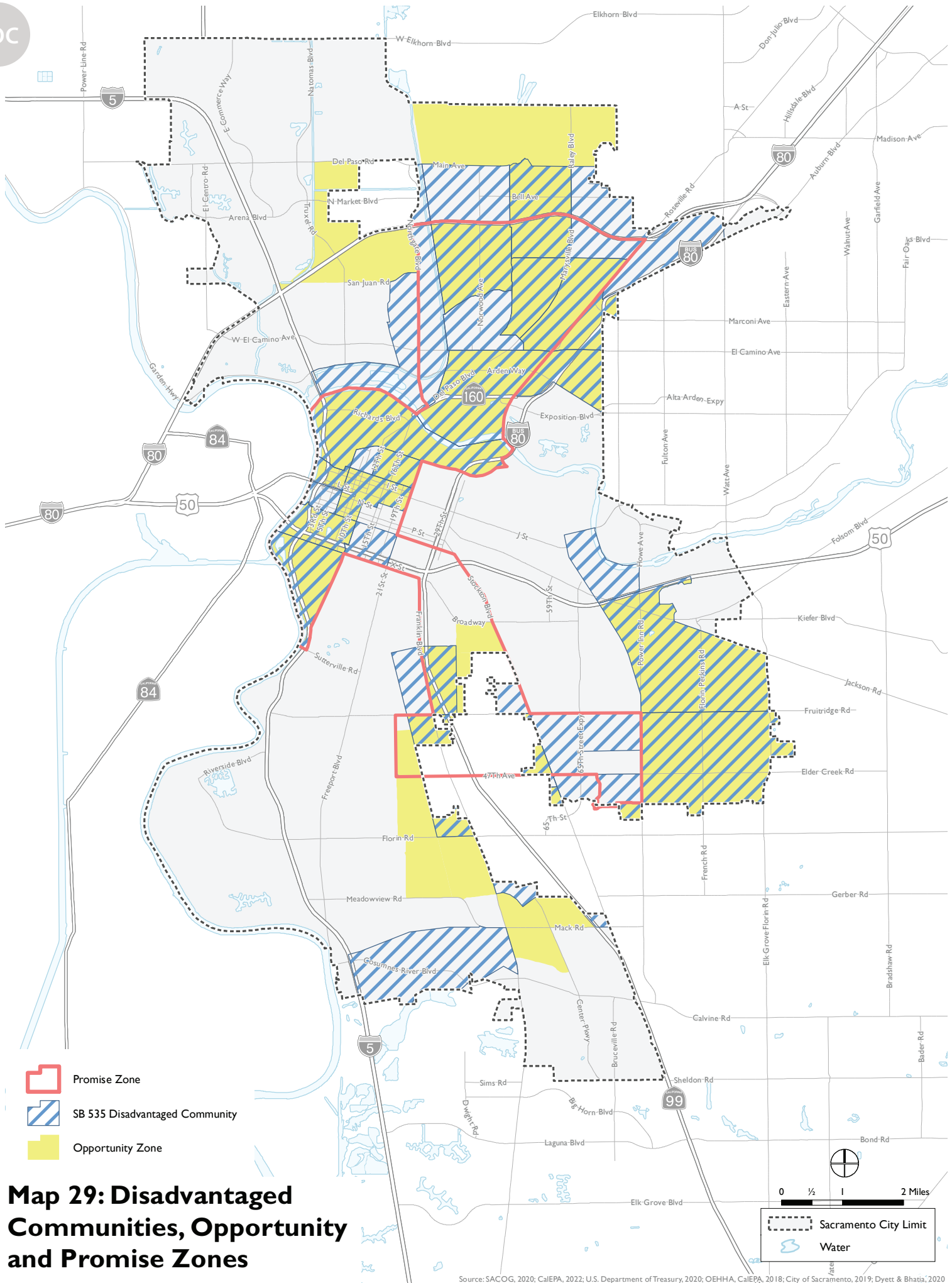
As the severity and frequency of floods across the Sacramento region and beyond, municipalities throughout the state will increasingly rely on emergency evacuation and response systems. Municipalities can expect an increased demand for emergency response/staff and social services, the need for more cooling/clean air/evacuation centers, and the need for expanded roadway capacity in the event of an evacuation.

Sacramento may experience increased demand for its fire protection services. While the urban-wildland interface in the city is not extensive, there will likely be an added strain on local Sacramento firefighting resources as the fire department is called to respond to fires across the region and State. Wildfires also exacerbate the poor air quality conditions already experienced in California's Central Valley. Smoke and other air pollutants generated by wildfires can lead to increased need for medical attention and services among affected vulnerable populations, such as those with pre-existing medical conditions like asthma or populations that spend a lot of time outdoors including outdoor workers and unsheltered homeless people.

Climate change is expected to bring more frequent and severe heat waves, flooding, and drought to the Sacramento region. Wildfires around the Sacramento region can have significant air quality impacts within the city. This in turn requires more social and medical support services which include public cooling and clean air centers and evacuation centers. Additional social support infrastructure will require more public dollars from the City to operate, maintain, and properly engage with residents to advertise services. Public cooling centers are crucial facilities that provide cool shelter to prevent heat-related illness. Similarly, healthy air centers provide respite when there is poor ambient air quality, particularly when there are active wildfires nearby. Finally, pre-designated evacuation facilities are essential to ensure the safety of Sacramento's population in an event of a flood or wildfire.

Increased levels of homelessness and higher housing costs have been reported following major California wildfires. Displaced residents from neighboring communities also have the potential to increase demand for social support services in Sacramento. Reductions in housing stock and increases in local demand may increase housing prices and exacerbate housing insecurity, evictions, and homelessness among lower income individuals and families.

The primary natural hazard that would cause the City to begin a large-scale evacuation is a flood. Evacuation during a natural hazard event may result in the evacuation of hundreds or hundreds of thousands in Sacramento. Realtime information and GIS-operated mapping is posted to numerous public-facing sites during large-scale evacuation events, following procedures established in the City's Evacuation Plan (an annex of the City of Sacramento Emergency Operations Plan). If available to public safety officials, evacuation information may be provided in multiple languages. Emergency preparedness resources are available to the public both online and distributed during community events. The movement of evacuating vehicles during a large-scale evacuation requires extensive traffic control to maximize the use of roadway capacity and expedite safe escape from hazards. A transportation analysis identifies critical roadway segments and intersections that are not expected to flood and recommend specific traffic control measures and/or roadway modifications to help alleviate the anticipated problems in these areas. Special care should be given to transport vulnerable populations, such as the elderly or persons with access and functional needs.



Map 29: Disadvantaged Communities, Opportunity and Promise Zones

Source: SACOG, 2020; CalEPA, 2022; U.S. Department of Treasury, 2020; OEHHA, CalEPA, 2018; City of Sacramento, 2019; Dyett & Bhatta, 2020

4 Adaptive Capacity

The chapter describes the climate change readiness landscape in California and addresses the vulnerabilities discussed in Chapter 3 by identifying responsible agencies at the federal, state, regional, and local levels and potential gaps in existing adaptation strategies. This chapter also includes a discussion of Sacramento’s capacity to adapt and respond to those risks caused by climate change in an effort to improve resilience.

4.1 Climate Change Readiness Landscape

STATE LEGISLATION AND GUIDANCE

The State of California has adopted several legislative actions to mitigate the onset of climate change and prepare for its impacts. Passed in 2016, SB 379 requires that, beginning January 1, 2017, all cities and counties in California include climate adaptation and resiliency strategies in the safety element of their general plan as part of the general plan revision process. The climate adaptation update must include community goals, policies, and objectives that are informed by a climate change vulnerability assessment,²³³ as well as measures for addressing climate vulnerabilities. To assist with these requirements, the State of California has also established programs and guidance for climate change adaptation. These include the California Adaptation Planning Guide and Adaptation Clearinghouse,²³⁴ SB 246 (2015),²³⁵ and AB 1482 (2015).²³⁶ Collectively, these plans and policies identify the key climate impacts most likely to affect California, provide guidance on how to analyze climate change vulnerabilities and adaptation opportunities as part of the community planning process, and help local and regional governments and agencies collaborate to identify and implement equity-promoting adaptation strategies.

Additionally, in 2018 the State of California published the Fourth Climate Change Assessment, including the Sacramento Valley Regional Report.²³⁷ Primary climate impacts discussed in the report include warming air and water temperatures, more extreme heat waves, drier landscapes, less snow, variable precipitation and seasonal shifts, more intense droughts and floods, higher delta water levels, increased risk of wildfire, and loss of ecosystem habitat. The report concludes that public health challenges will arise in the form of an increased number of extremely hot days, the spread of infectious diseases, and reductions in air quality, with the young, elderly, and members

²³³ ResilientCA, SB 379. Oct 29 2019: <https://resilientca.org/projects/bf4c7799-3157-4cf0-ba4d-894f1ddcdf7a/>.

²³⁴ Adaptation Clearinghouse, California Climate Adaptation Planning Guide. June 2020: <https://resilientca.org/apg/>

²³⁵ Adaptation Clearinghouse, California SB 246 – Integrated Climate Adaptation and Resiliency Program. Oct 29 2019: <https://www.adaptationclearinghouse.org/resources/california-sb-246-integrated-climate-adaptation-and-resiliency-program.html>.

²³⁶ Adaptation Clearinghouse, California AB 1482: Climate adaptation strategy. Oct 29 2019:

<https://www.adaptationclearinghouse.org/resources/california-ab-1482-climate-adaptation-strategy.html>.

²³⁷ Benjamin Houlton and Jay Lund, California’s Fourth Climate Change Assessment - Sacramento Summary Report (University of California, Davis: 2018). October 3 2022: https://www.energy.ca.gov/sites/default/files/2019-11/Reg_Report-SUM-CCCA4-2018-002_SacramentoValley_ADA.pdf.

of disadvantaged communities most vulnerable. The report includes recommendations for reducing climate change risks, including developing climate-smart buildings and more accessible public cooling centers, fire reduction practices, enhanced emergency preparedness with a focus on disadvantaged communities, and land use planning practices that focus on extreme floods and drought.

REGIONAL AGENCY PLANS AND EFFORTS

Many agencies in the Sacramento region have already taken concrete steps toward addressing climate change vulnerability and implementing mitigation and adaptation strategies. Key regional climate change plans, assessments, and programs are summarized below.

Sacramento Area Council of Governments (SACOG)

- **Sacramento Region Transportation Climate Adaptation Plan (2015).** Highlights key climate change phenomena likely to influence the transportation system throughout the Sacramento region, as well as strategies and actions that Sacramento-area governments can take to ensure that transportation assets are adaptable. Transportation sectors and infrastructure types considered include roadways, railways, bridges, walking and biking, drainage, traffic flow, public transit, buildings and facilities, and traffic controls.²³⁸
- **SACOG Vulnerability and Criticality Assessment (2020).** Establishes a better understanding of extreme weather and climate change threats to the region's transportation system. Expected changes in wildfire, riverine flooding, sea level rise, storm surge in the Sacramento-San Joaquin River Delta, and extreme heat are identified as hazards that pose significant risks to portions of the regional transportation system.²³⁹
- **SACOG Project-Level Adaptation Strategies Guidance Document (2020).** Building on the findings of the Vulnerability and Criticality Assessment (above), this study examines risks facing individual transportation assets in greater detail and evaluates potential adaptation strategies at an asset-scale.²⁴⁰

County of Sacramento

- **Sacramento County Climate Action Plan Strategy and Framework Document (2011).** Describes actions that the County has already taken or has planned to take in order to reduce greenhouse gas emissions and adapt to climate change. The Plan discusses climate

²³⁸ Sacramento Area Council of Governments, 2015.

²³⁹ Sacramento Area Council of Governments, Vulnerability and Criticality Assessment (June 2020). August 25 2022: https://www.sacog.org/sites/main/files/sacog_vulnerability_and_criticality_assessment_report.pdf

²⁴⁰ Sacramento Area Council of Governments, Project-Level Adaptation Strategies Guidance Document (June 2020). August 25 2022: https://www.sacog.org/sites/main/files/sacog_project-level_climate_adaptation_strategies_for_transportation_guidance_report.pdf.

actions in terms of five sectors: transportation and land use, energy, water, waste management and recycling, and agriculture and open space.²⁴¹

- **Climate Change Vulnerability Assessment for the Sacramento County Climate Action Plan: Communitywide Greenhouse Gas Reduction and Climate Change Adaptation (Communitywide CAP) (2017).** Provides an overview of the primary and secondary threats associated with climate change and identifies the ones most likely to affect Sacramento County. The assessment identifies population subgroups, community functions, and structures that are most sensitive to each of the climate impacts.²⁴²
- **Sacramento County Multi-Jurisdictional Local Hazard Mitigation Plan Update (2021).** The County’s 2021 Local Hazard Mitigation Plan (LHMP) updates 2016 LHMP and addresses hazards posed by climate change. The Plan identifies drought and water shortage, extreme heat, and wildfire as hazard sources that are highly influenced by climate change; dam failure, flooding, levee failure, and wildfires are identified as hazards of high significance (widespread potential impact). The LHMP recommends County- and City-level hazard mitigation actions to address these hazards.²⁴³
- **Sacramento County Climate Action Plan (2022).** The Sacramento County Climate Action Plan details specific measures that will be implemented in Sacramento County by 2030 to reduce communitywide GHG emissions and also includes an adaptation plan that recommends actions to reduce the community’s vulnerability to the anticipated impacts of climate change.²⁴⁴ The County’s CAP is based on the 2011 Framework Document (above).

Sacramento Metropolitan Fire District

- **Community Wildfire Protection Plan (2014).** Addresses wildfire risk within the district’s service territory by providing community education materials to reduce residential wildfire risk.²⁴⁵

Sacramento Municipal Utility District (SMUD)

- **Climate Readiness Assessment and Action Plan (2016).** Highlights the key steps that SMUD has taken to respond to climate change threats, including a climate vulnerability

²⁴¹ County of Sacramento, Climate Action Plan: Strategy and Framework Document (November 9, 2011). May 12 2020: <https://planning.saccounty.net/PlansandProjectsIn-Progress/Documents/Climate%20Action%20Plan/CAP%20Strategy%20and%20Framework%20Document.PDF>.

²⁴² Ascent Environmental, 2017.

²⁴³ County of Sacramento, Sacramento County Multi-jurisdictional Local Hazard Mitigation Plan Update (September 2021). August 25 2022: <https://waterresources.saccounty.gov/stormready/Documents/LHMP%202021/Executive%20Summary%20and%20TOC.pdf>.

²⁴⁴ County of Sacramento, Climate Action Plan (February 2022), August 25 2022: https://planning.saccounty.net/PlansandProjectsIn-Progress/Documents/Climate%20Action%20Plan/Revised%20Final%20Draft%20CAP_February%202022.pdf

²⁴⁵ Sacramento Metropolitan Fire District, “Community Wildfire Protection Plan” (2014). August 25 2022: https://metrofire.ca.gov/files/915bebc83/cwpp+brochure_front.pdf.

- assessment for SMUD’s critical assets such as power plants, substations, and transmission and distribution lines.²⁴⁶
- **Local Hazard Mitigation Plan (2018).** Identifies and introduces strategies for reducing environmental and man-made hazards that have the potential to impact SMUD’s customers and energy delivery infrastructure. The hazard mitigation plan discusses climate change hazards explicitly, as well as hazards associated with secondary climate change impacts such as fire and flooding.²⁴⁷
 - **Wildfire Mitigation Plan (2022).** The 2022 wildfire mitigation plan (WMP) is the comprehensive update to the initial plan adopted in 2019 to construct, maintain, and operate SMUD’s electrical facilities to minimize the risk of wildfire posed by those facilities. The plan includes vegetation management programs, inspection and maintenance programs, protocols for deactivating automatic reclosers and for de-energizing power lines in severe weather conditions. It also identifies priority customers, including first responders and local agencies, healthcare providers, water and telecommunication facilities, and groups that assist vulnerable populations.²⁴⁸

Sacramento Metropolitan Air Quality Management District (SMAQMD)

- **Sacramento Metropolitan Air District Climate Change Protection Program.** Provides outreach and support for local, regional, state, and federal initiatives addressing climate change. Program efforts focus on reducing greenhouse gas emissions and helping the Sacramento region prepare for the effects of climate change. SMAQMD assesses new construction and development projects for greenhouse gas emissions and other air pollutants, provides financial assistance for residents to replace wood burning stoves, and has partnered with ZipCar, Mutual Housing California, and the Sacramento Housing and Redevelopment Agency to bring electric vehicle car sharing to multifamily and low-income housing communities as part of the first low-income EV-share program in the State.²⁴⁹

Regional Water Management

Water Forum

The Water Forum was created in 1993 by the City and County of Sacramento in response to increasingly conflicting water demand and environmental needs. In 2000, stakeholders came together to sign the Water Forum Agreement, forming a partnership between local governments, water managers, business and agricultural leaders, citizen groups, and environmentalists collaborating to provide a reliable and safe water supply for the region’s economic health and planned development through the year 2030, in addition to preserving the fishery, wildlife,

²⁴⁶ Sacramento Municipal Utility District, 2016.

²⁴⁷ Sacramento Municipal Utility District, 2018.

²⁴⁸ Sacramento Municipal Utility District, Wildfire Mitigation Plan (2022). August 25 2022: <https://www.smud.org/-/media/Documents/In-Our-Community/Safety/Wildfire-Safety/2022-SMUD-Wildfire-Mitigation-Plan.ashx>.

²⁴⁹ Sacramento Metropolitan Air Quality Management District, “Keeping Cool in the Capital Region: Capital Region Urban Heat Island Mitigation Project,” (2020). October 3 2022: <https://urbanheat-smaqmd.hub.arcgis.com/>

recreational, and aesthetic values of the lower American River. The Water Forum helps guide cohesive regional groundwater management across the North, Central, and South subbasins in the Sacramento area.²⁵⁰

There are seven elements of the Water Forum Agreement that are endorsed and implemented by signatories of the Water Forum Agreement: increased surface water diversions, actions to meet customers' needs while reducing diversion impacts in drier years, support improved fishery flow releases from Folsom Reservoir, habitat management, water conservation, the groundwater management, and the Water Forum Successor Effort.

Regional Water Authority

The Regional Water Authority (RWA) is a joint powers authority formed in June 2001, representing 24 water providers and agencies in the greater Sacramento region that seek to serve, represent, and align the interests of regional water providers and stakeholders to improve water supply reliability, availability, quality, and affordability.²⁵¹

RWA's Strategic Plan 2018+, published in 2013, established goals to guide effective regional water resources management, including developing a Regional Water Reliability Plan, implementing the American River Basin Integrated Regional Water Management Plan, increasing education and outreach, and expanding regional water regulatory efforts to protect water supply reliability.²⁵² RWA has since had recent success including participating in the regional conjunctive use program that supports reduced diversions from the American River in dry years, undertaking preparation of the American River Basin Integrated Regional Water Management Plan, developing the Regional Water Efficiency Program, providing assistance for local water suppliers to implement the Water Forum Agreement, and funding water supply, water quality, and environmental restoration projects through more than \$68 million of state and federal grant funds.²⁵³

Sacramento Groundwater Authority

The Sacramento Groundwater Authority (SGA) is a joint powers authority that manages the groundwater basin in Sacramento County north of the American River, encompassing the southern one-third of the North American Subbasin. SGA is an essential partner of the Water Forum Agreement of 2000, a key component of which is a regional program to manage and conjunctively use groundwater and surface water to help meet water needs through 2030, while reducing diversions from the lower American River during environmentally sensitive times such as droughts.

In 2021, SGA and other groundwater sustainability agencies of the North American Subbasin prepared a groundwater sustainability plan, pursuant to the State's Sustainable Groundwater Management Act. Based on a water budget of the Cosumnes-South American-North American

²⁵⁰ Water Forum, "About Us." October 3 2022: <https://www.waterforum.org/stakeholders/about-the-water-forum/>

²⁵¹ Regional Water Authority, "About." October 3 2022: <https://rwah2o.org/about-rwa/>

²⁵² Regional Water Authority, Strategic Plan 2018+ (2013). October 3 2022: <https://rwah2o.org/wp-content/uploads/2016/02/RWA-Strategic-Plan-2018.pdf>

²⁵³ Regional Water Authority, "Regional Water Authority Success." October 3 2022: <https://rwah2o.org/about-rwa/regional-water-authority-success/>

subbasins, there is a current surplus of water, which is projected to continue into the future but in lesser amounts. However, future conditions modeled with a moderate climate change scenario estimate a future deficit of about 3,500 acre-feet per year. To address this deficit, the North American Subbasin Groundwater Sustainability Plan evaluated a conjunctive use project that has a net benefit of reducing groundwater pumping by 5,000 acre-feet per year, using primarily existing infrastructure and funding by public water suppliers. The planned Natomas Cross Canal project will also improve flood protection and provide habitat for aquatic species. There are five management actions in the plan: continue developing the Sacramento Regional Water Bank; improve well permitting programs throughout the subbasin to protect domestic wells, groundwater-dependent ecosystems, and interconnected surface water; proactively coordinate with land use agencies; improve data collection and communication with domestic and other shallow well owners; and continue monitoring and assessment of groundwater-dependent ecosystems.²⁵⁴

Sacramento Central Groundwater Authority

The Sacramento Central Groundwater Authority (SCGA) is one of six groundwater sustainability agencies that manages the long-term sustainable groundwater yield of the South American Subbasin in Sacramento County between the American and Cosumnes Rivers. In 2006, the SCGA developed the Central Sacramento County Groundwater Management Plan, which assesses water supply and demand, incorporating water conservation measures from the Water Forum Agreement to reduce demand, in addition to assessing risks to groundwater quality.²⁵⁵ This plan establishes a groundwater extraction threshold of 273,000 acre-feet per year, sets minimum groundwater elevations within all areas of the subbasin consistent with the Water Forum, protects against potential subsidence and adverse impacts to surface water, and identifies water quality objectives for constituents of concern. As of 2018, SCGA continues to be under the groundwater yield threshold.²⁵⁶

The South American Subbasin Groundwater Sustainability Plan, published in October 2021, found that groundwater usage will continue to be sustainable over the next twenty years as long as planned recycled water, recharge, and other projects are implemented. These projects will raise groundwater levels above current levels, maintain storage volumes, and protect ecosystems, interconnected surface water, and shallow well users despite projected climate change conditions that will increase groundwater use. Implementing activities identified in the plan include: ongoing monitoring and annual reporting on conditions in the subbasin; public engagement and outreach; regional coordination; development and implementation of a shallow well protection and monitoring program; development of a regional water bank; coordination with land use and water supply

²⁵⁴ Sacramento Groundwater Authority, North American Subbasin Groundwater Sustainability Plan. December 2021: <https://www.sgah2o.org/programs/groundwater-management-program/groundwater-management-plan/>

²⁵⁵ Sacramento Central Groundwater Authority, Central Sacramento County Groundwater Management Plan (February 2006). October 3 2022: https://scgah2o.saccounty.gov/documents/CSCGMP_final.pdf

²⁵⁶ Sacramento Central Groundwater Authority, 2018 Sustainable Groundwater Management Act Annual Report – South American Subbasin (5-021.65) (March 2019). October 3 2022: https://scgah2o.saccounty.gov/Documents/2018%20SCGA%20Annual%20Report%20South%20American%20Subbasin%205-021.65_20180329.pdf

agencies to promote consistency with the plan; coordination with regional agencies to develop updated climate change projections; and preparation of a five-year update to the plan (in 2027).²⁵⁷

Regional San

In 1973, the County and City of Sacramento joined forces with the City of Folsom to form Regional San, which assumed responsibility for regional wastewater conveyance and treatment. Regional San's contributing agencies include the Sacramento Area Sewer District and the cities of Sacramento, Folsom, and West Sacramento. Located in Elk Grove, the Sacramento Regional Wastewater Treatment Plant (SRWTP) is connected to approximately 111 miles of interceptor pipelines. In 2021, the average effluent flow at the SRWTP was about 115 million gallons per day.²⁵⁸ The SRWTP is geographically located in an area with flood risk from high stages from Beach-Stone Lakes and Morrison Creek, and may be vulnerable to a Sacramento River levee failure near Freeport. In coordination with the Sacramento Area Flood Control Agency, Regional San constructed its own levee system in the late 1990's as part of the south Sacramento County Streams Flood Control Project. The levee system is designed to protect the SRWTP from a 200-year flood event.

Regional San's Harvest Water Program (formerly known as the South County Ag Program) is designed to provide safe, reliable supply of tertiary-treated water for crop irrigation, reducing groundwater pumping, supporting habitat protection efforts, and providing near-term benefits to the Sacramento-San Joaquin Delta. This program supports regional and State water supply reliability through groundwater storage and conjunctive use, with the potential to deliver up to 50,000 acre-feet per year of drought-resistant recycled water in lieu of pumping groundwater, resulting in an increase in groundwater storage by approximately 225,000 acre-feet within 10 years and up to 370,000 acre-feet over the course of the project. Such efforts will also serve to improve water quality by increasing in-stream flows in the Cosumnes River.²⁵⁹

Sacramento Area Flood Control Agency (SAFCA)

The Sacramento Area Flood Control Agency (SAFCA) was formed at the directive of the State Legislature in 1989 to address the Sacramento area's vulnerability to catastrophic flooding. This vulnerability was exposed during the record flood of 1986 when Folsom Dam exceeded its normal flood control storage capacity and several area levees nearly collapsed under the strain of high water pressure on levees from the storm. Formed under a Joint Exercise of Powers Agreement, SAFCA's board is comprised of the City of Sacramento, County of Sacramento, County of Sutter, American River Flood Control District and Reclamation District No. 1000.

SAFCA is responsible for the planning and implementation of major capital flood control improvements in the Sacramento area by providing the local cost-share to support construction of

²⁵⁷ South American Subbasin Groundwater Sustainability Agencies, South American Subbasin Groundwater Sustainability Plan – Final, (October 29, 2021). October 3 2022: http://www.sasbgroundwater.org/assets/pdf/resources/complete/FinalPDFs/SASbGSP_FrontEnd-ExecSumm_FINAL_10292021.pdf

²⁵⁸ Regional San, "About Us." October 4 2022: <https://www.regionalsan.com/about-us>

²⁵⁹ Regional San, "Harvest Water." October 4 2022: <https://www.regionalsan.com/harvest-water>

those projects. Day-to-day operations and maintenance of the flood control system is provided by various Local Maintaining Agencies (LMAs).

Central Valley Flood Protection Plan

The Central Valley Flood Protection Plan (CVFPP) is DWR’s flood risk management plan for the Central Valley, developed in accordance with the Central Valley Flood Protection Act of 2008. Although flood management in the valley has improved considerably since 2008, climate change will exacerbate flood risk in the region. The 2022 CVFPP Update²⁶⁰ evaluates progress made since major State bonds in 2007 and recommends future management actions, focusing on climate resilience, performance tracking, and alignment with other State efforts. The update continues to develop priorities to improve flood risk management in the Central Valley in the face of climate change, using new information, updated science, and innovative tools.²⁶¹

LOCAL CLIMATE CHANGE READINESS

Greenhouse Gas Reduction Efforts

The City of Sacramento has a long-standing commitment to foster sustainability in government operations and community activities. Since adoption of the City’s first Sustainability Master Plan in 2007, the City has led by example with internal projects that reduce reliance on fossil fuels while reducing operating costs and greenhouse gas (GHG) emissions. General Plan policies commit the City to continue striving for ongoing reductions in municipal and community GHG emissions through regular reviews and updates of the City’s GHG emissions inventory at least once every five years to track Sacramento’s progress towards its climate action goals. To date, GHG inventories have been completed for 2005, 2011, and 2016, as described further below.

In 2010, the City completed its first Climate Action Plan for Internal Operations (IO CAP) with strategies to reduce GHG emissions in City operations 22 percent below 2005 levels by 2020. In 2012, the City adopted its first community-wide Climate Action Plan (CAP), which included a target and strategies to achieve a 15 percent reduction below 2005 levels by 2020 for all sources of GHG emissions within the community as a whole. The IO CAP was later updated in 2016. The 2016 inventory counted emissions produced from residential and commercial electricity and natural gas usage, transportation, water delivery, wastewater treatment, and solid waste within City limits.

In March 2015, the City adopted the 2035 General Plan Update, which included new sustainability targets and an updated community-wide CAP integrated with the General Plan. The targets

²⁶⁰ California Department of Water Resources, Central Valley Flood Protection Plan 2022 Update Public Draft (April 2022). October 3 2022: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/Flood-Management/Flood-Planning-and-Studies/Central-Valley-Flood-Protection-Plan/Files/CVFPP-Updates/2022/2022updateCVFPP22_layout_v9_plus_Append_BC.pdf.

²⁶¹ California Department of Water Resources, “Central Valley Flood Protection Plan.” October 3 2022: <https://water.ca.gov/Programs/Flood-Management/Flood-Planning-and-Studies/Central-Valley-Flood-Protection-Plan>.

included reducing GHG emissions from internal operations by 22 percent below 2005 levels by 2020 (consistent with the 2010 IO CAP target), along with a long-term objective of achieving GHG reductions of 83 percent below 2005 levels by 2050. Reduction targets were established in the 2035 General Plan Policy ER 6.1.6, which also calls for maintenance and implementation of the IO CAP.

Current Climate Action, Sustainability and Resilience Efforts

The City of Sacramento already engages in a number of activities to reduce climate change vulnerability and promote adaptation across the city. These climate action efforts are in accordance with the City’s vision statement to become a national model of sustainable, equitable growth, and community development. Guiding principles to aid the City of Sacramento in becoming leader in the field include sustainable and responsible growth, resilience and climate action.

Key to these efforts is the Mayors’ Commission on Climate Change, which began in November 2018 as an effort between the City of Sacramento and City of West Sacramento to achieve carbon neutrality by 2045, in line with State GHG reduction goals. The final report from the Commission was published in June 2020 and recommended climate actions address the climate risks that threaten public health and safety in the two cities, with a focus on equity as well as foundational principles and strategies including urgency, advocacy, accountability, education, and financial and economic sustainability.²⁶²

In 2019, the City of Sacramento adopted Resolution No. 2019-0465, Declaring a Climate Emergency and Proposing Mobilization Efforts to Restore a Safe Climate Background.²⁶³ In addition to recognizing the importance of the Mayors’ Commission on Climate Change, this resolution underlined the role that the 2040 General Plan Update and CAP would play in achieving the City’s goal of carbon neutrality by 2045 and emergency actions needed toward emissions elimination by 2030 as mandated by SB 32 (2016), the California Global Warming Solutions Act of 2016. Building on the recommendations from the Mayors’ Commission on Climate Change, the City’s Climate Emergency Declaration, and the previous (2012) CAP, the findings from this Vulnerability Assessment have informed development of the Adaptation chapter of the CAAP and the goals, policies, and implementing actions of the Safety Element of the 2040 General Plan.

In addition to these recent and ongoing efforts, the following City departments and local agencies provide services that generally address the risks posed by climate change effects identified in Chapter 2:

²⁶² Mayors’ Commission on Climate Change (Local Government Commission), Achieving Carbon Zero in Sacramento and West Sacramento: Final Report (June 2020). August 28 2022: <http://www.cityofsacramento.org/-/media/Corporate/Files/CDD/Planning/Long-Range/Climate-Action-Plan/Mayors-Commission-on-Climate-Change-Final-Report.pdf?la=en>

²⁶³ City of Sacramento, Resolution No. 2019-0465 “Declaring a Climate Emergency and Proposing Mobilization Efforts to Restore a Safe Climate Background, Adopted December 10, 2019. August 29 2022: <https://www.cityofsacramento.org/-/media/Corporate/Files/CMO/Climate-Change/R2019-0465-Declaring-a-Climate-Emergency-and-Proposing-Efforts-to-Restore-a-Safe-Climate-Background.pdf?la=en>.

- **The City of Sacramento Community Development Department** has adopted a number of tasks and responsibilities related to climate change adaptation and hazard mitigation. These include coordinating with relevant organizations and agencies to consider the impacts of urbanization and climate change on long-term natural hazards and safety, and engaging in land use planning and development.
- **The City of Sacramento Department of Utilities** engages in many activities related to flood management and response, including the development of the Flood Recovery Plan and providing public information about flood response planning. The Department has participated in efforts to map and assess vulnerability to sea level rise, study climate change effects on drinking water quality, address aquifer shortage, study groundwater recharge, and monitor and respond to algal blooms. The Department maintains floodplain development standards and has conducted drainage improvement projects to address the presence of repetitive loss properties. The Department also monitors upstream snowpack and river water supply and use. This information is used to determine when to draw from the Sacramento River, the American River, and/or groundwater wells. The Department is also active in the City's response to drought. The Department's Water Conservation Office provides residents and businesses with information and rebates on drought tolerant landscaping, irrigation upgrades, and leak repairs. The Department also engages in education and outreach activities.
- **The Office of Emergency Management** conducts emergency preparedness outreach to the public through community engagement events and online resources. The office has led the development of the Emergency Operations Plan, Recovery Plan, Joint Information Center Addendum to the Operational Area Joint Information System Plan, and proactive emergency planning and coordination for access and functional needs populations within the City of Sacramento. Other recent activities include the development of a new emergency operations center and conducting emergency and disaster preparedness exercises.
- **The City of Sacramento Department of Public Works** has many responsibilities, including the planning, building, and maintenance of most transportation infrastructure and street landscaping, providing recycling services, managing the City's vehicle fleet and buildings, and leading the City's electric vehicle initiatives. The Department builds walking and bicycling facilities and collaborates with transit providers to ensure that Sacramento's transportation landscape is robust, accessible, and sustainable. The Department also manages the city's urban forest through planting, protecting, and maintaining trees in the city right-of-way, parks and public spaces.
- **The Sacramento City Fire Department** implements a fire education and information program, participates in fuel reduction along the American River Parkway, and conducts outreach on the effects of smoke on air quality. Spare the Air Sacramento and the City of Sacramento Public Information Office engage in similar educational activities regarding the effects of smoke on air quality.
- **The City of Sacramento Department of Youth, Parks, and Community Enrichment** undertakes a variety of sustainability and resiliency efforts. The Department acquires new green space and manages parks and recreation programs, open space, community gardens, and multi-use trails. These natural features provide health and wellness opportunities for

residents and visitors, flood protection, natural resource protection and wildlife habitat, and offer respite from excess urban heat. The City provides connectivity between parks and the multi-use trail and off-street bikeway network. Public community gardens encourage community building and community stewardship of the City’s green infrastructure. New tree plantings in parks are focused on under-canopied areas of Sacramento to expand the urban tree canopy. The Department also manages community centers which act as resiliency hubs during extreme weather events and other emergencies.

Community Climate Programs and Projects

The Sacramento region is home to a number of organizations that are actively involved in addressing climate issues in Sacramento. These organizations include community-based groups, larger non-profit organizations with Sacramento offices, and regional coalitions. These organizations are involved in a range of climate-related efforts include tree planting, air quality monitoring and education, urban agriculture, research, and disaster preparedness and recovery. Sacramento is also home to the Sacramento Community Emergency Response Team, an all-risk, all-hazard training program that educates volunteer community members about disaster preparedness and trains them in basic disaster response skills, in partnership with the City of Sacramento Fire Department.

4.2 Existing Adaptive Capacity

This section highlights the federal, State, regional, and local responsible agencies and ongoing actions that they are taking to help communities mitigate and adapt to each of the climate change effects identified in Chapter 2 in relationship with the vulnerabilities presented in Chapter 3.

EMERGENCY EVACUATION AND RESPONSE

Emergency management is an essential component of the City’s “whole-community” approach to emergency preparedness and response, including for climate-change-induced emergencies. Indeed, many risks and vulnerabilities are directly tied to the ability of service providers to adequately protect public safety and wellbeing in the face of an emergency event. The City of Sacramento has a comprehensive emergency management system that supplements the services and programs already set in place by the State. Together, these efforts build a strong foundation for the City’s existing adaptive capacity.

State

The California Department of Transportation (Caltrans) manages more than 50,000 miles of State highway and freeway lanes and oversees programs for highway transportation, mass transportation, and transportation planning, among others. In 2021, Caltrans published the California Transportation Plan 2050 (CTP 2050), which recognizes the increasing risk that climate change poses on the State’s transportation system. In particular, the State recognizes that climate change preparedness will require resilient infrastructure, reliable emergency response systems, and clean transportation options. One of the main safety objectives of the plan is to improve emergency preparedness, response, and recovery on the transportation system as these incidents become more

frequent and severe. Enhancing transportation system resiliency is also tied with equity, and CTP 2050 utilizes vulnerability assessments to identify and manage the specific risks posed by climate change. It also calls for expanded funding for implementing State, local, and regional climate mitigation and adaptation plans; increasing multi-jurisdictional collaboration on resiliency and adaptation efforts; creating a statewide transportation risk management plan; and increasing access to data, technical tools, and information sharing to make communities stronger and more resilient to future disruptions.²⁶⁴

Originally developed in 2005 and last updated in 2022, Caltrans' Strategic Highway Safety Plan (SHSP) is a statewide, coordinated traffic safety plan that also addresses emergency response, which has been identified as one of 16 stakeholder-identified "challenge areas" where State resources and efforts will be focused. The Emergency Response strategy seeks to improve emergency response times and actions to address this challenge area. Past accomplishments toward this goal include increasing emergency medical services and fire personnel taking traffic incident management training and revising the California Emergency Medical Services Authority (EMSA) Manual #145 with the latest information. The SHSP also seeks to improve emergency response by leveraging co-benefits from actions addressing the emerging technologies challenge area.²⁶⁵

In California, day-to-day emergency medical services system management is the responsibility of local and regional agencies. However, the State EMSA is charged with providing leadership in developing and implementing statewide emergency medical services systems and standards. EMSA also is responsible for promoting disaster medical preparedness and, when required, coordinating and supporting the state's medical response to major disasters. Some of EMSA's primary program responsibilities include emergency medical services systems planning and development, emergency medical services for children, emergency medical dispatcher standards and emergency medical services communications systems, and disaster medical services preparedness and response.²⁶⁶

The California Governor's Office of Emergency Services (Cal OES) responds to and aids in the recovery from emergencies within the State of California under the authority of the California Services Act, California Disaster Assistance Act, and the Stafford Act. Cal OES is responsible for managing disaster recovery and providing assistance to local governments, special districts, certain nonprofit organizations, individuals, and businesses and agricultural communities impacted by disasters. It provides technical support to reduce the costs and streamline the process of recovery efforts and serves as a liaison with local, State, and federal agencies, legislators, nonprofit organizations, and the general public. It develops and maintains state-level emergency plans, assists local governments in developing their own plans, and is also responsible for the design, installation, and repair of the statewide public safety radio communication system.

²⁶⁴ California Department of Transportation, California Transportation Plan 2050 (February 2021). August 31, 2022: <https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/ctp-2050-v3-a11y.pdf>

²⁶⁵ California Department of Transportation, California Safe Roads: Strategic Highway Safety Plan. August 31, 2022: <https://dot.ca.gov/-/media/dot-media/programs/safety-programs/documents/shsp/2022-shsp-full-report-2020-2024-a11y.pdf>.

²⁶⁶ California Emergency Medical Services Authority, "About the EMS Authority." August 31, 2022: https://emsa.ca.gov/about_emsa/#Dept_Description

The California Environmental Protection Agency (CalEPA) contains the CalEPA Emergency Response Management Committee, which coordinates preparedness for and responses to environmental emergencies in California. CalEPA's climate-related work includes analysis of the State's cap-and-trade program, studying urban heat islands, and operating the CalEPA Environmental Justice Task Force. The Environmental Justice Task Force coordinates the compliance and enforcement work of CalEPA's boards, departments, and offices in areas of California that are burdened by multiple sources of pollution and are disproportionately vulnerable to its effects.

The California Department of Public Health contains the Emergency Preparedness Office, which maintains and manages the Medical and Health Coordination Center, distributes funds to local health departments for disaster planning, and operates the California Health Alert Network. The Department also manages the Climate Change & Health Equity Program, whose goal is to systematically integrate work from climate change planning and public health planning with policies and principles that promote equity. The Department works with local, State, and national partners to assure that climate change mitigation and adaptation activities have beneficial effects on health while not exacerbating preexisting health disparities.

Local

The City of Sacramento participates in the County's Local Hazard Mitigation Plan (LHMP) which serves to reduce or eliminate long-term risk to people and property from hazards. In addition to providing representation to the Sacramento County Hazard Mitigation Planning Committee, the City formulated their own internal planning team to support broader planning process requirements. The City participated in developing their community profile and hazard profile and vulnerability assessment to develop strategies. Key mitigation actions specifically designated to the City of Sacramento are to integrate the LMHP into the City's General Plan, enhance community outreach and education around hazard preparation and mitigation, consider impacts of long-term natural hazard safety, maintain a critical facility database, evaluate and mitigate critical facility risks, retrofit repetitive loss properties and historical buildings, construct a new Emergency Operation Center (EOC), protect transportation infrastructure, develop regional emergency and disaster preparedness exercises, establish heating and cooling centers in high priority areas, and adopt floodplain development standards. LHMP suggests a variety of plans to develop and adopt that include a generation plan for pump stations, disaster housing plan, disaster resistant business plan, enhanced emergency plan for special needs populations, and a post-disaster action plan.

The City's Office of Emergency Management (SacOEM) provides comprehensive emergency management services for the City of Sacramento, including coordination of City-wide preparedness, planning, response, recovery, and mitigation activities. It is the mission of SacOEM to prepare City government and the community for potential natural, human-caused, and technological emergencies. Programs facilitated by the Office include Flood Ready, which strives to build a flood resilient community through preparedness and mitigation. Resources provided to residents include floodplain information, flood warning systems, flood insurance information, and floodplain construction requirements. Similarly, the Sacramento Ready program, which was renewed in 2022, provides downloadable guides for quick evacuation, family disaster communications, and a personal safety plan. Residents can also sign up for Sacramento Alert, which

is an emergency alerts notification system to disseminate public safety information rapidly and efficiently.

SacOEM also manages the City's Emergency Operations Center (EOC) which is staffed with City personnel who are trained to support first responders and community members in the event of a disaster. EOC also will assign paratransit and other transportation resources for the disabled or medically frail to the areas with greatest needs. In addition, EOC will designate task forces of buses, paratransit, and/or animal care vans as emergency vehicles able to enter evacuation zones.²⁶⁷ These programs in turn can help maximize roadway capacity.

The City's 2023 Emergency Operations Plan (EOP) addresses planned response to emergency situations associated with natural disasters and human-caused incidents. The Plan outlines emergency management operations, including personnel and departments responsible for managing an incident in the city. Operations in response to a disaster include preparedness and monitoring activity, alert and warning, proclaiming an emergency, city-wide coordination, and consideration of people with access and functional needs.

To facilitate the coordination and flow of mutual aid, the State has been divided into six OES Mutual Aid Regions (and three administrative regions). The City of Sacramento is in Mutual Aid Region IV. The City maintains an Automatic Aid agreement with Sacramento County and the City of West Sacramento. Under the automatic aid agreement, all emergency calls are routed through a central dispatch center and the nearest resource responds to the call. Statewide, California's mutual aid system is designed to ensure that adequate resources, facilities, and other support are provided to jurisdictions whenever their own resources prove to be inadequate to cope with a given situation. Local jurisdictions have the discretion to give and receive aid when needed, while state government is obligated to provide available resources to assist local jurisdictions in emergencies.

Sacramento's emergency alert and assistance systems include the Emergency Alert System, fire and law enforcement vehicle loudspeakers, Reverse 9-1-1, Sacramento 2-1-1, and agency websites. The Emergency Alert System is designed to provide emergency information via radio and television. The City of Sacramento's Reverse 9-1-1 system can send pre-recorded messages to individual households and businesses with phone numbers listed in the 9-1-1 database. The Community Services Planning Council, a non-profit organization, operates 2-1-1 in Sacramento County. Individuals can call into the system to request information on an emergency situation.

Evacuation procedures are most effective when residents are aware of the emergencies that are most likely to affect them and have ample time and support to prepare their own emergency plans. The City of Sacramento, in conjunction with Sacramento County, has a variety of systems and procedures in place to protect residents and visitors and to plan for, avoid, and respond to a hazard event. These include the provision of pre-disaster public awareness programs including a local emergency alert program, Community Emergency Response Training (CERT) program, and Crisis

²⁶⁷ City of Sacramento Office of Emergency Services, City of Sacramento Evacuation Plan for Floods and Other Emergencies (2008). August 26 2021: https://sacramentoaready.saccounty.net/Documents/sac_018943.pdf.

Action Team (CAT). Sacramento County's Office of Emergency Services maintains countywide emergency evacuation, operations plans, mass shelter, hazard mitigation, and severe weather plans and provides guidance to residents creating personal emergency preparedness plans. The City Manager's Office of Emergency Management coordinates communication, planning, preparedness, response, and recovery pertaining to emergency events and manages the City's Emergency Operations Center (EOC).

TEMPERATURE INCREASE

Increasing temperatures will result in more frequent and severe heat waves and warm nights that will be felt especially in urban heat islands. Given the high level of impact, vulnerable populations including children, older adults, individuals with disabilities, low-income households, outdoor workers, cost-burdened households, households living in substandard housing conditions, linguistically isolated households, and communities of color will be particularly at-risk. Critical facilities such as energy, transportation, and utility infrastructure as well as medical services may also be strained or physically damaged as a result of extreme heat.

General Mitigation and Adaptation Efforts

The County of Sacramento has engaged in a variety of climate-preparedness activities, some of which were initiated in partnership with the City. The Sacramento County Office of Emergency Services provides emergency-related information to the public. The Department of Public Health provides community-wide information for how to stay safe during periods of extreme heat. This includes warning signs of heat stroke and heat exhaustion, how to protect against heat-related illness, descriptions of heat-related illness among older adults, and how to help someone with a heat-related illness. Through the Sacramento Ready Program, the County has also designated public cooling centers in the event of a heat emergency. The Sacramento County General Plan also contains policies to promote cool communities in order to reduce urban heat island effects. Some of these policies include streetscaping, preserving habitats and open space, restoring natural areas, and reducing urban sprawl.

The City of Sacramento is also in the process of preparing an Urban Forest Plan. This Plan will address the protection, maintenance, sustainability, and enhancement of Sacramento's tree canopy. The City's longstanding emphasis on the importance of its beautiful tree canopy will aid its adaptation to the worsening effects of urban heat. In 2003, the City published parking lot tree shading and maintenance guidelines. These guidelines are meant to help achieve the City's parking lot tree shading ordinance which requires that all new parking lots include tree plantings designed to result in 50 percent shading of parking lot surfaces within 15 years. Guidelines include information about tree planting practices, drainage and water quality options, irrigation plans, landscape plans, grading, and maintenance.

The Sacramento Tree Foundation is a community-based non-profit organization working to support a healthy tree canopy for Sacramento. Ongoing programs include the Shade Tree Program in partnership with SMUD, which provides free shade trees to residents and businesses, which can help cool buildings and reduce air-conditioning use in summer. All Sacramento County residents and SMUD customers can qualify for a free landscape assessment and up to 10 free shade trees. An additional program formed from the Foundation's partnership with SMUD is Trees for

Community Spaces. This program provides free consultation and trees to qualifying public spaces, such as schools and parks. The Shady Eighty tool provided by the foundation is a tree guide to help residents choose the best trees for their yard. Users can input characteristics such as size, water needs, shape, growth rate, and flowers to determine the species that best work for their property.

Vulnerable Populations

The California Department of Community Services and Development (CSD) administers the federally funded Low-Income Home Energy Assistance Program (LIHEAP). This program provides two types of assistance: Home Energy Assistance and Energy Crisis Intervention. The first type of assistance is a direct payment to utility bills for qualified low-income households. The second type of assistance is available to low-income households that are in a crisis. CSD also offers free weatherization assistance, such as cooling system repairs to low-income households.²⁶⁸ These financial assistance programs can help vulnerable populations cool their households if they experience health hazards from urban heat.

In addition, the Sacramento County Department of Human Assistance (DHA) facilitates numerous programs to mitigate and adapt to the effects of urban heat. The severe weather sheltering program activates five cooling center locations for all community members during heat waves. Homeless outreach partners also issue motel vouchers to highly vulnerable unsheltered individuals. Transportation will be provided to and from the hotel and individuals participating in the program are allowed to bring partners, pets, and belongings to respite facilities.

The Sacramento Municipal Utilities District (SMUD) provides utilities services within the City of Sacramento. SMUD has engaged in a number of climate readiness initiatives, including the creation of Climate Readiness Action Plan in 2016. The report lists several on-going or planned climate change-related initiatives that target increased resiliency to periods of drought and extreme weather events. Specific strategies related to urban heat include the Regional Urban Heat Island Initiative, SMUD Cool Roof Incentive, and the SMUD Shade Tree Program. SMUD's Regional Urban Heat Island Initiative focuses on reducing urban heat island effects through the identification of areas prone to urban heat island development and projected impacts on electrical load and health. This work will enable mitigation measures to be more effectively targeted and used to their greatest effect. The Cool Roof Incentive offers rebates to residential customers who use cool roofing technologies. Under this program, a single family could earn a \$300 rebate (or more) for incorporating a cool roof and save an estimated \$50 per year on their annual cooling bill. However, program utilization has more than doubled in 2016 yet is still quite modest. SMUD also provides low-income assistance and non-profit discount through the Community Resource Project. The Energy Assistance Program Rate (EAPR) provides discounts on monthly bills. Customers with the lowest household income, based on the federal poverty level, will receive the largest discount. Priority may be given to applicants based on the greatest need and income, vulnerable populations and households with young children. The Shade Tree Program started through a partnership between SMUD and the Sacramento Tree Foundation to provide more than 1,000,000 free shade trees to residents in the Sacramento area. This program encourages residents to strategically plant

²⁶⁸ City of Sacramento, City of Sacramento Housing Element Appendix H-6 Opportunities for Energy Conservation. September 7 2021: https://www.cityofsacramento.org/-/media/Corporate/Files/CDD/Planning/Long-Range/Housing-Element/H6_Sac-HE_AdoptionDft_Energy-Conservation_Aug2021.pdf?la=en.

vegetation around their homes to reduce energy consumption. Homeowners must agree to plan and care for the trees.

As part of the NASA DEVELOP program in Fall 2020, the City partnered with the NASA Langley Research Center to study the effects of urban development on urban heat islands in the City of Sacramento and the potential for urban interventions to reduce risks, particularly in areas with the greatest vulnerability. The study used satellite imagery and input from City staff and Dyett & Bhatia, the 2040 General Plan Update consultant, to model current and future (2040) conditions under different scenarios—including buildout of the General Plan—down to a neighborhood scale. In turn, the results of this study informed policy development for the Environmental Justice and Environmental Resources Element of the General Plan. Specifically, urban heat priority intervention areas have been identified to target resources where they will be most effective and benefit those who are most at risk.

The Healthy Sacramento Coalition was initiated in 2011 by the Sierra Health Foundation in an effort to develop and implement a chronic disease prevention plan for Sacramento County. The goals of the Healthy Sacramento Coalition were to reduce tobacco use, obesity, death and disability due to chronic disease, reduce health disparities, build a safe and healthy physical environment, and improve the social and emotional well-being of Sacramento County residents. In 2016, the Coalition broadened its focus to include the social determinants of health and refined its vision to address health inequities in Sacramento. In 2018, the Coalition released *Advancing Health Equity and Inclusive Growth in the Sacramento Region*, highlighting inequities in income, employment, and educational opportunities in Sacramento.

Critical Facilities

As technologies advance, so too do the State’s increasingly stringent building energy efficiency standards. The State of California’s Title 24 Building Standards Code includes requirements for energy efficiency standards for residential and nonresidential buildings, and any new critical facilities would be subject to these requirements as it would apply in the code, such as for emergency evacuation centers (e.g., schools, community centers, churches, etc.) and public safety facilities (i.e., police and fire stations). Part 6 covers topics that include thermal emittance, three-year aged reflectance, and Solar Reflectance Index (SRI) of roofing materials used in new construction and re-roofing projects. These requirements apply to nonresidential, high-rise residential, and low-rise residential buildings across California. In addition, roofing products used for meeting the Title 24, Part 6 requirements must be rated and labeled by the Cool Roof Rating Council (CRRC).²⁶⁹ However, it is important to note that these cool roof requirements only apply to new construction, retrofits, or additions, rather than existing buildings.

CHANGES IN PRECIPITATION

As described previously, flooding is Sacramento’s most significant natural hazard, and climate change is increasing the severity and frequency of storm events that can induce flooding. Climate change is projected to lead to an increased percentage of precipitation in the American River

²⁶⁹ Cool Roof Rating Council, California Building Energy Efficiency Standards (Title 24, Part 6). September 7 2021: <https://coolroofs.org/resources/california-title-24>.

watershed falling as rain in the fall and early winter, increasing the likelihood of flood events in these months. This change in precipitation patterns is also expected to result in reduced snowpack, reduced summer river flows, and increased summer drought and reduced groundwater supply. Drought and flooding conditions are high-priority impacts in Sacramento, and groups who are most at risk include older adults, individuals with disabilities, low-income households, cost-burdened households, linguistically isolated households, and communities of color. Critical facilities that are at risk include water supply, wet utilities and stormwater infrastructure, locations within flood hazard zones (Maps 24 through 27), and Sacramento's urban forest, which has multiple benefits including cooling and urban heat island mitigation.

General Mitigation and Adaptation Efforts

The Federal Emergency Management Agency (FEMA) provides guidance, resources and support to prepare for, plan, and manage disasters. They share a wealth of federal resources to provide a national-level response, while implementing resources and programs designed to help local authorities respond to and mitigate the impacts of disasters, including the extreme weather events associated with climate change. FEMA conducts mapping of flood zones and administers the National Flood Insurance Program. The National Flood Insurance Program aims to reduce the socioeconomic impact of flooding on private and public structures through the provision of flood insurance and by encouraging communities to adopt and enforce floodplain management regulations. FEMA also provides general disaster response and hazard mitigation assistance through such entities as the Hazard Mitigation Grant Program, the Flood Mitigation Assistance Program, and the Pre-Disaster Mitigation Program.

Furthermore, the U.S. Army Corps of Engineers (USACE) may supplement state, tribal, territorial, and local governments with flood or coastal storm preparedness and response services and advanced planning measures designed to reduce the amount of damage caused by flooding. This assistance is in accordance with Public Law 84-99. When flooding occurs, it is not just a local USACE district or office that responds but may include personnel and other resources across the nation.

The California Natural Resources Agency is responsible for California EcoRestore, an initiative implemented in coordination with State and federal agencies to advance the restoration of the Sacramento-San Joaquin Delta. The Agency leads and coordinates the administration's climate adaptation policy and its natural resources climate policy and has helped guide the State's efforts towards increasing the resilience of water systems. Adaptation strategies primarily include floodplain and tidal habitat restoration and enhancement projects.

The Delta Stewardship Council is responsible for adopting and implementing a comprehensive management plan for the Sacramento-San Joaquin Delta. The Delta Plan is intended to help State and local agencies provide a more reliable water supply while protecting, restoring, and enhancing the Delta ecosystem. Policies and recommendations to meet these goals include the development of a Delta Science Plan, regional water self-reliance, water efficiency and management laws, water supply reliability guidelines, groundwater management plans, improved water conveyance infrastructure, expanded water storage, habitat and floodplain restoration projects, flood insurance requirements, and continued monitoring of existing conditions.

In addition, the City of Sacramento partnered with Sacramento County, other incorporated nearby communities, and numerous special districts to update the countywide Local Hazard Mitigation Plan (LHMP) in 2021. Flood, drought, earthquake, and severe weather are all addressed in the plan. While climate hazards such as these cannot be prevented, an LHMP forms the foundation for a community's long-term strategy to reduce disaster losses by breaking the repeated cycle of disaster damage and reconstruction. The plan aims to mitigate these hazards, such as floods, while providing the tools and information for residents to be able to better anticipate, adapt, and recover from such events.

The State Water Resources Control Board (SWRCB) engages in a number of climate change-related actions, including the expansion of recycled water to increase drought resilience, adoption of regulations to increase the capture of urban stormwater, and efforts to reduce flood risk. SWRCB has been involved in the Central Valley Region Climate Change Work Plan. Key focus areas of this plan include addressing impacts due to drought and flooding, issues related to groundwater quality, and changes in surface water supply, with a focus on disadvantaged communities.

Vulnerable Populations

A number of federal agencies provide direct relief and recovery support for drought impacts, particularly geared to those working in the agricultural industry. Short-term drought relief and recovery programs include Disaster Assistance Programs, Environmental Quality Incentives Program, Emergency Watershed Protection Program, Rural Utilities Service Water and Environmental Programs, and Economic Injury Disaster Loans. Long-term drought relief and recovery programs include the Federal Crop Insurance Corporation, Agricultural Conservation Easement Program, Conservation Technical Assistance Program, Watersmart Drought Response Program, Watersmart Water and Energy Efficiency Grants, Building Resilient Infrastructure and Communities (BRIC) Program, and the Watersense Program.

Critical Facilities

The California Department of Water Resources engages in flood management and flood emergency response programs. It developed the Flood Emergency Response Information Exchange to improve flood emergency preparedness, response, and recovery. The Department maintains levees and access roads under their jurisdiction through the Levee Repairs Program and has supported local efforts at reducing flood risks in the Sacramento and San Joaquin Deltas. The Department has been involved in the Bay Delta Conservation Plan, the Central Valley Flood Protection Plan, and the South Sacramento Streams Groups Projects. The Department also implements the Sustainable Groundwater Management Act and administers the California Statewide Groundwater Elevation Monitoring Program.

The Central Valley Flood Protection Board is the State regulatory agency responsible for ensuring that appropriate standards are met for the construction, maintenance, and protection of the flood control system. The Board issues encroachment permits, works with other agencies to improve flood protection structures, enforces removal of problematic encroachments, and monitors the Central Valley's flood management system. In 2012, the Board adopted the Central Valley Flood Protection Plan. This Plan guides California's participation in managing flood risk along the Sacramento River and San Joaquin River systems. Primary goals of the Plan include identifying,

recommending, and implementing structural and nonstructural projects and actions that benefit flood-prone lands and formulating standards, criteria, and guidelines to facilitate implementation of flood protection interventions.

The County's Department of Water Resources educates residents on flood risk and preparedness. The County has also been involved in the South Sacramento Streams Groups projects to implement more than 265 acres of habitat enhancements and the flood control projects on Magpie Creek which includes the construction of a floodwall, levee, culvert, and acquisition and protection of a 72-acre floodplain.

The Sacramento Area Flood Control Agency (SAFCA) provides regional flood control for the Sacramento Region. The overarching goal of their work includes strengthening the local levee system, improving the region's ability to manage flood events via improved reservoir level management, and addressing erosion along the Sacramento River. Key programs under this Agency include:

- **American River Common Features Project:** USACE has begun construction for up to 11 miles of erosion protection along portions of both the north and south banks of the American River. Once completed, the cumulative flood control improvements will allow the levee system to safely handle sustained flows of up to 160,000 cubic feet per second in the event of an extreme flood event in the American River watershed.
- **Folsom Dam and Reservoir Joint Federal Program:** To further increase flood control space in the reservoir, the USACE is raising the existing main dam and reservoir's surrounding dikes by 3.5 feet. Construction began in 2019 and is nearly complete.
- **Natomas Basin Levee Improvement Program:** By 2013, SAFCA and the state completed 18.3 of the 42 miles of levee improvements required to meet current flood control standards. In 2019, USACE began construction on the additional 24 miles of levee improvements necessary to provide a minimum 200-year level of flood protection to the Natomas Basin.
- **Sacramento Weir and Bypass Project:** USACE and the State of California are planning to widen the Sacramento Weir and Bypass to allow more water to enter into the Bypass system during flood events, thereby reducing the water surface elevation in the Sacramento River. This work includes widening the existing weir by 1,500 feet and constructing a new two-mile-long setback levee along the Sacramento Bypass. The first phases of construction began in 2020.

The City of Sacramento strives to build a flood resistant and resilient community through preparedness and mitigation projects. One such project is the City's Repetitive Loss Area Analysis (RLAA). This analysis identifies five regions of repetitive loss that are prone to experiencing numerous flood events. These regions include South Natomas, Downtown East, Downtown West, Southeast Sacramento, and Sutterville/Meadowview. In addition, the City has identified total of 49 repetitive loss buildings in these regions. However, 28 of these buildings have already been mitigated with measures introduced by the City. Mitigation recommendations typically include green infrastructure, grading improvements, pipe and drain improvements, construction of floodwalls, elevating buildings, combined sewer system improvements, and storm readiness outreach programs.

In 2020, City of Sacramento adopted an Urban Water Management Plan (UWMP). The purpose of the UWMP is to help water suppliers assess the availability and reliability of their water supplies and current and projected water use to help ensure reliable water service under different conditions. The Plan details water use baselines, targets, and 2020 compliance; a water supply analysis; a water service reliability and drought risk assessment, a water shortage contingency plan; and demand management measures to increase the city's resilience to droughts.

In August 2022, the federal Bureau of Reclamation published the American River Basin Study, which covers major water uses (municipal, agricultural, hydropower, recreation, flood control, and fish/wildlife), surface water uses from the American and Sacramento rivers, groundwater uses from North and South American groundwater basins, key reclamation facilities (Folsom and Nimbus dams and Folsom South Canal), and key regional facilities (Middle Fork Project 184, Sly Park Unit, and Upper American River Project). The study highlighted the growing imbalance between water demands and water supplies due to continued economic development, regulatory updates, and effects from climate change. Notably, changing climate conditions complicate operation of Folsom Reservoir. Severe drought conditions in late 2015, for example, resulted in the reservoir's lowest recorded water level (135,000 acre-feet), and only three months later in March 2016, several moderate El Nino storms necessitated releases for flood control management. Such rapid shifts underline the need for effective flood risk management strategies and potential upgrades to Folsom Dam infrastructure in response to anticipated climate changes.²⁷⁰

WILDFIRE

There is low risk of wildfire itself as a climate change effect in Sacramento, but its secondary impacts on air, water, and soil quality have more direct implications for the city's residents. In particular, smoke from wildfires in upwind high-risk areas such as the Sierras will affect the entire city and exacerbate ambient air pollution levels, especially affecting vulnerable populations such as children, older adults, individuals with disabilities, low-income households, outdoor workers, linguistically isolated households, and communities of color. Critical facilities that may be affected include clean air/evacuation centers and transportation infrastructure essential to emergency evacuation/response.

General Mitigation and Adaptation Efforts

FEMA provides general disaster response that can aid in wildfire hazard mitigation and prevention through such entities as the Hazard Mitigation Grant Program, the Pre-Disaster Mitigation Program, and the Fire Management Assistance Grant Program. These grant programs help states, tribes, and territories invest in measures that mitigate wildfire disasters and create safer and resilient communities.

The California Department of Forestry and Fire Protection (CAL FIRE) manages fire prevention and response for the State of California. CAL FIRE oversees enforcement of California's forest protection regulations, implements fuel management projects, participates in forest conservation

²⁷⁰ Bureau of Reclamation, American River Basin Study: Interior Region 10 – California-Great Basin, U.S. Department of the Interior, August 2022: <https://www.usbr.gov/watersmart/bsp/docs/arbs/ARBS-Study.pdf>

and management, and provides training and educational programs. CAL FIRE also engages in general emergency response activities.

The California Public Utilities Commission enforces rules and regulations to ensure that energy infrastructure and utility companies run a safe and reliable electric or communication system. The Commission reviews the wildfire mitigation plans of utilities and transmission owners. The Commission also examines investor-owned utilities' public safety power shutoff processes during severe wildfire threat conditions.

Vulnerable Populations

The SMAQMD engages in a number of initiatives for protecting air quality. In cooperation with the California Air Resources Board (CARB), SMAQMD implements AB 617 (2017) by targeting air quality improvement efforts in communities disproportionately impacted by air pollution. This means sustained involvement in community-level air monitoring, the creation of community-specific emissions reduction plans, review of pollution control technologies, and provision of air quality improvement incentive programs. In 2018, SMAQMD nominated 10 communities in Sacramento for consideration under AB 617, which is a community-focused program to more effectively reduce exposure to air pollution and preserve public health. CARB selected the South Sacramento-Florin community to be one of the first 10 communities in California to develop and implement a community air monitoring plan. Since July 2019, sensors have been monitoring real-time air quality throughout the South Sacramento-Florin community as well as in the northwestern portion of the Fruitridge-Broadway area. From August 2020 to November 2021, SMAQMD deployed more advanced monitoring to collect air quality information measuring more types of toxic air pollutants, and professional-grade air monitoring is planned for the third phase of the plan in the near future.²⁷¹ Although the focus of AB 617 is to improve air quality in vulnerable communities affected by air pollution primarily resulting from industrial uses and goods movement, the air monitoring network could also be leveraged to implement protections against pollution due to smoke from wildfires.

However, air quality improvement efforts are not exclusive to the South Sacramento-Florin community selected by CARB. Local organizations such as United Latinos in South Area are also actively involved in community-based air monitoring. In 2020, SMAQMD conducted an updated suitability analysis that recommended 3 additional general community areas for the State's Community Air Protection Program: North Sacramento, Oak Park/Fruitridge, and Meadowview. These places scored in the top fifth percentile (i.e., most burdened by air quality issues), indicating that there are populations throughout Sacramento who are vulnerable to air quality impacts exacerbated by wildfire.

Fire Protection

The City of Sacramento is served by the Sacramento Fire Department (SFD). The SFD is a full-service fire department, with the responsibility for responding to and mitigating incidents involving fires, medical emergencies, hazardous materials, technical and water rescue within its service area.

²⁷¹ Sacramento Metropolitan Air Quality Management District, "Community Air Monitoring." (March 9, 2022). August 29 2022: <https://www.airquality.org/air-quality-health/community-air-protection/community-air-monitoring>

The department also provides a full range of support services including fire prevention, public education, fire investigation, and domestic preparedness planning and response. The SFD's operational mission and objective is to save lives, conserve property, and minimize environmental impact. To help meet this objective, SFD also participates in an automatic aid agreement with neighboring fire jurisdictions, as well as state and federal agencies.

The SFD provides fire protection services to the entire city which includes approximately 99.2 square miles within the existing city limits, as well as two contract areas that include 47.1 square miles immediately adjacent to the city boundaries within the unincorporated county. Contracted areas within SFD's jurisdiction include the Pacific/Fruitridge and Natomas Fire Protection Districts.

SFD Headquarters operates from the Public Safety Center, located at 5770 Freeport Boulevard. This facility is also the headquarters for the Sacramento Police Department. Twenty-four fire stations are strategically located throughout the city to provide assistance to area residents and businesses. Although each fire station operates within a specific response district encompassing the immediate geographical area around the station, all of the Sacramento County fire agencies (Sacramento Fire Department, Sacramento Metro Fire District, Sacramento International Airport Fire, Cosumnes Fire District, and the Folsom Fire Department) share an automatic aid agreement, known as boundary dropping, which means that the closest fire unit responds regardless of jurisdiction. Increased incidence of wildfire across the region may tax SFD in the future.

5 Conclusions

Overall, there are a variety of hazards and risks that are experienced in Sacramento that are likely to increase in frequency and intensity due to climate change. These risks include urban heat, flooding, drought, wildfire, infrastructure damage, and emergency evacuation and response. Certain populations face unequal exposures to climate hazards or have a reduced capacity to respond, adapt, and recover from these events. Vulnerable populations that require special consideration and support in climate action and adaptation planning include children (aged 14 and below), older adults (aged 65 and over), individuals with disabilities, low-income households, outdoor workers, cost-burdened households, linguistically isolated households, and communities of color.

5.1 Risk Assessment Summary

The risk assessment approximates Sacramento's level of vulnerability to climate change hazards as well as its adaptive capacity for vulnerable populations to be able to respond and recover from these events. Generally, risks with high levels of vulnerability and low levels of adaptive capacity should be prioritized in terms of the development new strategies, policies, and actions for adaptation interventions, starting with aiming to protect and improve the livelihoods of the most vulnerable communities.

By midcentury, Sacramento is projected to experience between 21 and 26 extreme heat days per year and as many as eight four-day heat waves per year. Based on analysis from this Vulnerability Assessment, vulnerable populations have a very high vulnerability to urban heat, especially if they reside in urban heat islands, and have a low level of adaptive capacity. Interventions to mitigate urban heat island effects tend to take time and may be costly, which lowers the city's adaptive capacity. Therefore, the development of new strategies, policies, and actions for urban heat interventions should be prioritized.

Both people and infrastructure have a high vulnerability to flooding. Sacramento is already flood-prone and climate change will increase flood risk due to more frequent and severe storms. Moreover, the majority of the City's critical infrastructure exists in flood zones. Due to the high level of significance for flooding, there are numerous interventions already in place at the federal, state, regional, and local levels to protect the city from floods, including an extensive system of dams, levees, storm drains and pumps that protect the city and thus increase its adaptive capacity. However, as climate change increases flood risk, flood protection will need to be adaptively managed and improved.

Sacramento's vulnerability to drought and water shortage is high, and there is an increased likelihood of future occurrence with climate change. Adaptive capacity is moderate due to existing and planned infrastructure and management practices. Drought can potentially impact the entire city, including the urban forest, which is needed to mitigate extreme heat and urban heat island impacts.

Sacramento has a moderate vulnerability to wildfire impacts. While major wildfire is not likely to directly impact the city, air pollution associated with wildfires can significantly reduce outdoor air quality and impact the health of vulnerable populations, who may have a very low adaptive capacity.

6 Understanding Cal-Adapt and Key Scenario Assumptions

Material in this section is adapted from technical support information provided by Cal-Adapt and available on the Cal-Adapt website (www.cal-adapt.org).

Understanding Climate Projections

The data presented in Cal-Adapt tools are projections of future climate. They are not weather predictions and should not be treated as such. Weather is the behavior of the atmosphere over short periods, such as days and weeks. Climate is the long-term behavior of the atmosphere, and it is almost always expressed in averages – for example, average annual temperature, average monthly rainfall, or average water equivalent of mountain snowpack at a given time of year.

Climate projections cannot predict what will happen on a given date in the future. But they can provide information about what to expect from the future climate in general. Climate projections can also predict how much more often (or less often) extreme events such as heat waves and heavy rainfall are likely to occur in the future. However, they cannot predict when those events will actually occur.

How Climate Projections Are Produced

Climate scientists create projections of future climate using powerful tools called global climate models. Global climate models are complex pieces of computer software that crunch through thousands of mathematical equations representing the scientific theory of how the climate system works. They can be used to simulate climate over past periods or to run experiments, in which scientists impose certain conditions on the model to see how the climate system responds. A future climate projection is the product of global climate model experiments in which scientists impose upon the model some scenario of the future atmospheric concentration of greenhouse gases.

When climate scientists run a climate model, they divide the area of study into a grid, and the model performs calculations for each individual cell within the grid. The output from those calculations can then be visualized on a map.

The grid cells in most global climate models are very large—from 100 to 600 square kilometers. This coarse resolution is sufficient when scientists are studying climate on the global scale, but it is not very useful when trying to understand climate change on smaller scales. Present-day climate varies greatly from region to region in California, and so future climate will vary accordingly. But that detail is lost in the global climate models, in which all of California may be represented by just a few grid cells. To be able to plan for the future, higher-resolution projections of future climate are needed. Climate scientists can create these high-resolution projections by using various techniques to "downscale" global climate model output to finer spatial scales. The data in Cal-Adapt is taken from a selection of global climate models, and downscaled to about seven-kilometer resolution.

Cal-Adapt allows users to visualize climate changes under any of ten Global Climate Models (GCMs) selected by California's Climate Action Team for performance in California. Four of these models, HadGEM2-ES (Warm/Dry), CNRM-CM5 (Cooler/Wetter), CanESM2 (Average), and MIROC5 (Compliment), are designed as priority models. These GCMs are part of the Climate Model Intercomparison Project version 5 and were developed to support the work of the United Nation Intergovernmental Panel on Climate Change (IPCC). Modeled data available on Cal-Adapt represent statistically downscaled GCMs using localized constructed analogs (LOCA) method by Scripps Institution of Oceanography as part of State of California's Fourth Climate Change Assessment.

About the Greenhouse Gas Scenarios

The main driver of human-caused climate change is emissions of carbon dioxide and other greenhouse gases into the atmosphere. Greenhouse gases are so called because they trap heat in the atmosphere, causing it to warm over time. Atmospheric warming in turn leads to other changes throughout the earth system. How much the climate changes in the future depends in large part on the amount of greenhouse gases emitted now and in the future. However, since emissions of greenhouse gases depend on a variety of different social, political, and economic factors, it is difficult to predict how they will change. However, scientists can formulate educated guesses about how greenhouse gas emissions might change and use those scenarios to create future climate projections.

Each tool in Cal-Adapt shows outcomes for two different greenhouse gas scenarios: a high-emissions scenario in which greenhouse gas emissions continue to rise over the 21st century, and a low-emissions scenario in which greenhouse gas emissions level off around the middle of the 21st century and by the end of the century are lower than 1990 levels.

To address the uncertainty in future emissions of greenhouse gases and aerosols, Cal-Adapt allows users to visualize climate projections based on either of two possible emissions scenarios used in California's Fourth Climate Assessment, originally appearing in the Fifth Intergovernmental Panel on Climate Change (IPCC). The Fourth Climate Assessment uses so-called Representative Concentration Pathways (RCPs), which encapsulate different possible future greenhouse gas and aerosol emission scenarios. RCP 4.5 is a "medium" emissions scenario that models a future where societies attempt to reduce greenhouse gas emissions, while RCP 8.5 is a higher baseline emissions scenario. Key assumptions underlying the RCP 8.5 scenario include rising emissions through 2050, which plateau around 2100. RCP 8.5 is commonly understood as a business-as-usual (BAU) scenario that would result in atmospheric CO₂ concentrations exceeding 900 parts per million by 2100 and a temperature increase of four to seven degrees Celsius (°C). RCP 4.5 is a scenario where

GHG emissions rise until mid-21st century and then decline, resulting in a CO₂ concentration of about 550 ppm by 2100²⁷² and a temperature increase of two to four °C.²⁷³

Sources of Uncertainty in Climate Projections

As with any statement about the future, there is no way to be certain that climate projections are accurate. One source of uncertainty in future climate projections is human greenhouse gas emissions. Projected climate data may not prove to be accurate if the actual emissions pathway differs from the scenarios used to make the projections.

Another source of uncertainty in climate projections is the fact that different climate models—the tools used to simulate the climate system and produce future climate data—may produce different outcomes. There are more than 30 global climate models developed by climate modeling centers around the world, and they have different ways of representing aspects of the climate system. In addition, some aspects of the climate system are less well understood than others. Climate scientists are constantly working to improve their theories of the climate system and its representation in climate models. In the meantime, one way to account for model differences is to look at projections from as many different models as possible to get a range of possible outcomes. Scientists can then take the average of the values across the different models, and this average value is a more likely outcome than the value from any single model. The default visualizations in Cal-Adapt are based on the average values from a variety of models.

²⁷² Bedsworth, L., Cayan D., Franco G., Fisher L., Ziaja S. (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: SUM-CCCA4-2018-013.

²⁷³ Pierce D. W., Kalansky J.F., Cayan D.R., (Scripps Institution of Oceanography). 2018. Climate, Drought, and Sea Level Rise Scenarios for the Fourth California Climate Assessment. California Fourth Climate Change Assessment, California Energy Commission. Publication Number: CNRA-CEC-2018-006.

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