Handbook for Analyzing Greenhouse Gas Emission Reductions, Assessing Climate Vulnerabilities, and Advancing Health and Equity

California Air Pollution Control Officers Association

Designed for Local Governments, Communities, and Project Developers

CalEEMod
California Emissions Estimator Model

Emissions Modeling • Climate Resilience • Health & Equity

Updating the CAPCOA Handbook and CalEEMod

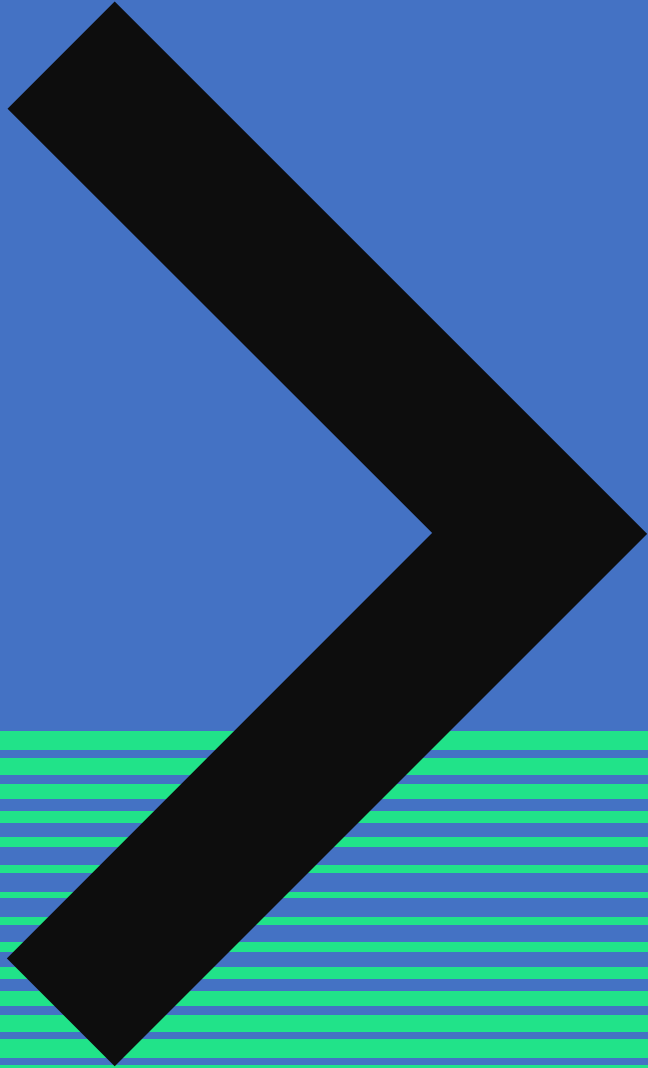Integrating Climate Resilience and Health & Equity

August 1, 2023

Meet Today's Speakers

Adam Parris
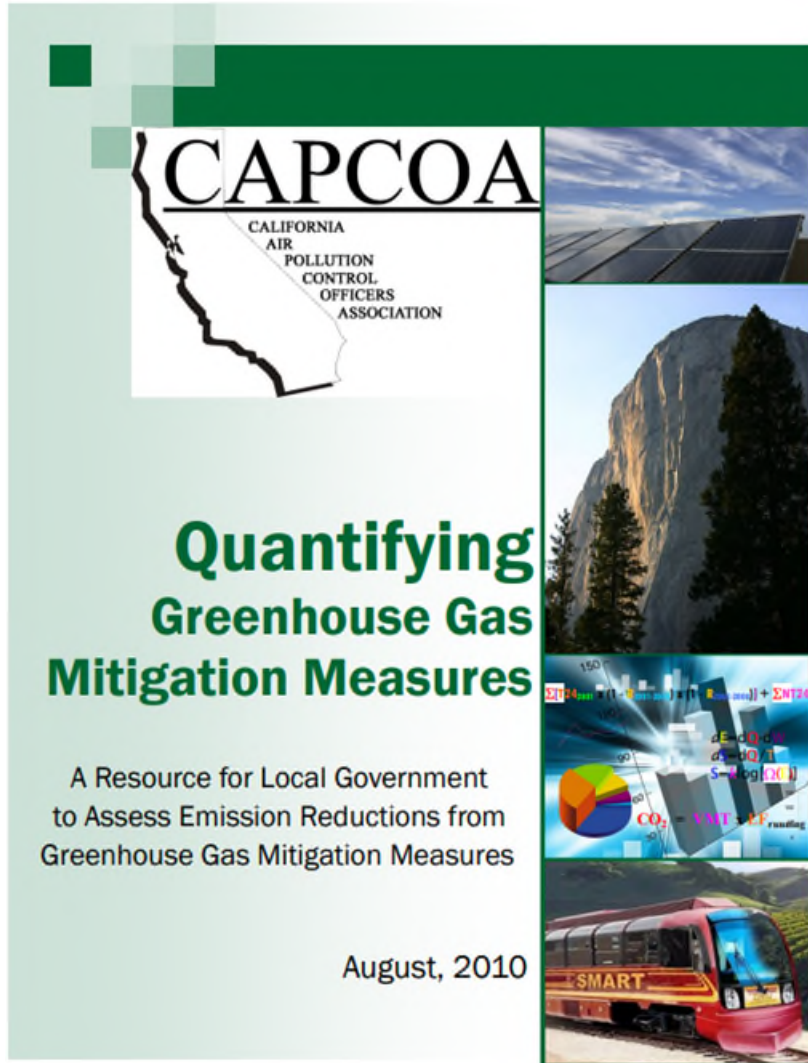Senior Consultant – Climate Planning
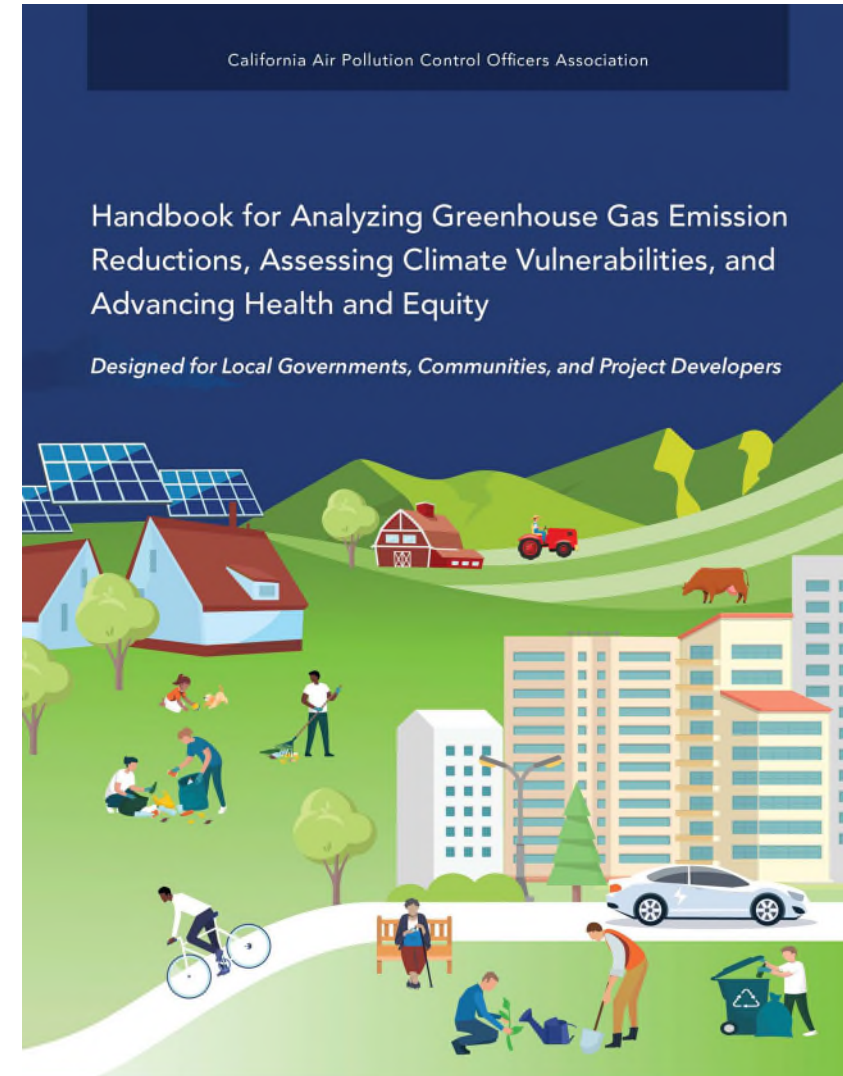ICF

Brianna Moland
Climate Coordinator
SMAQMD

Project Introduction

# What is the CAPCOA Handbook?

Then….

… And Now!

Background

- Developed by the California Air Pollution Control Officers Association more than a decade ago.

- Quantifies criteria pollutant and greenhouse gas emissions from land use projects in California.

- Uses widely accepted quantification methods combined with default data.

- Designed for government agencies, land use planners, and environmental professionals.

- Used to generate emissions estimates for use in California Environmental Quality Act (CEQA) documents, general and climate action plans, and air district regulatory proceedings.

Versions

2011.1.1   2013.2.2   2016.3.2

2022.1

2013.2.1   2016.3.1   2020.4.0
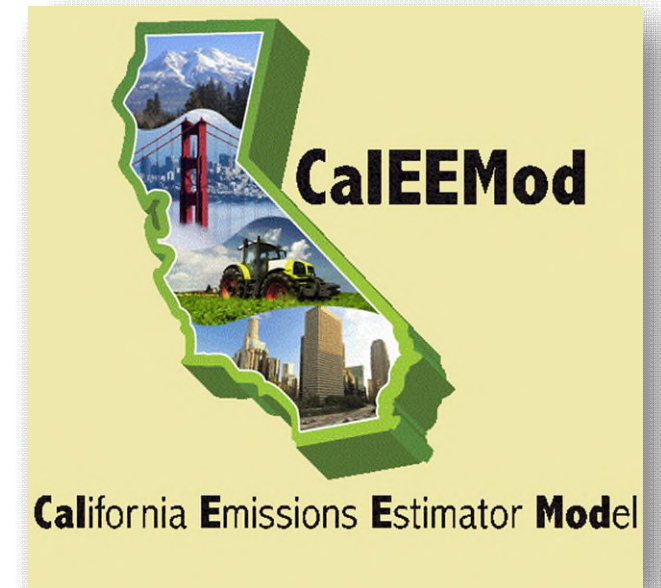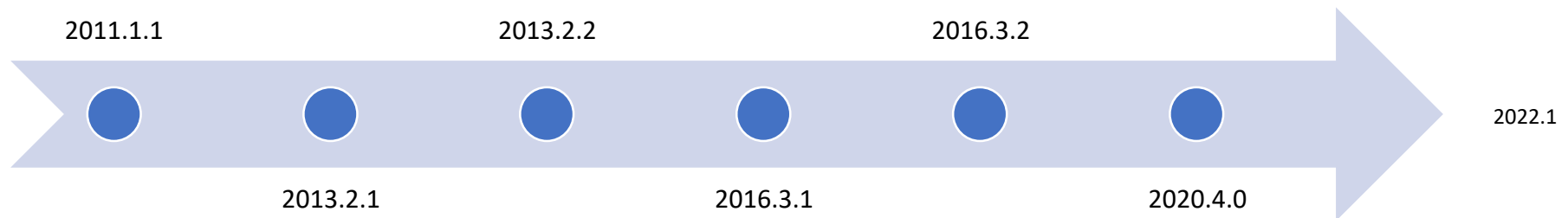
What is the California Emissions Estimator Model?

- A CEQA Tool
  - Disclose Impacts (GHG and air pollution)
  - Mitigation measures to reduce both

- A Resilience Tool
  - Cal–Adapt derived climate hazards
  - Location– and project-based climate adaptation measures

- A Health & Equity Tool
  - CalEnviroScreen and Healthy Places Index
  - Relevant measures to address existing challenges

- An Outreach Tool
  - Process measures to amplify marginalized voices and increase accountability

+ 287 measures

81 quantified emission reduction measures
57 supporting emission reduction measures
99 climate adaptation measures
50 health and equity measures

+ Co-benefit quantification
+ Climate vulnerability scoring
+ Health and equity scoring

Limitations of the Tool

- Data Limitations
  - Census tract level
  - May not include all facts on the ground

- Input & Measure Limitations
  - California is big and diverse
  - Custom inputs and measures may be needed

- Analysis Limitations
  - Relevant measures may not reflect community priorities

CalEEMod is a tool to aid discussions and decisions

CalEEMod is not a replacement for people

Key Model Updates – Climate Risk and Health and Equity Analysis

Analyzing Health & Equity
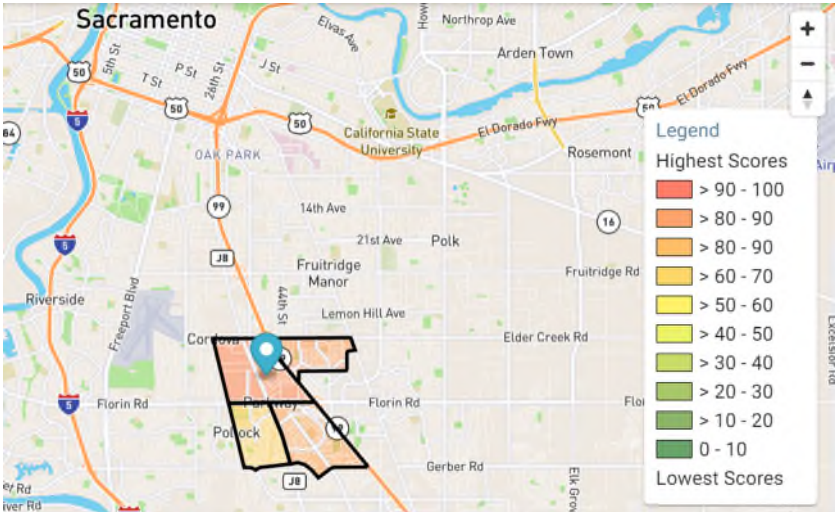
Is the project located in:
– A CalEnviroScreen disadvantaged community?
– An AB 1550 low-income community?
– An AB 617 community?

CalEnviroScreen and Healthy Places Index scores

Analyzing Climate Hazards

What is the project's exposure to projected climate hazards in the next 30 years?

Based on these indicators and data, the tool will recommend measures to address equity and climate hazards that can be implemented at the project level. Health and equity measures can be scored in a scorecard.
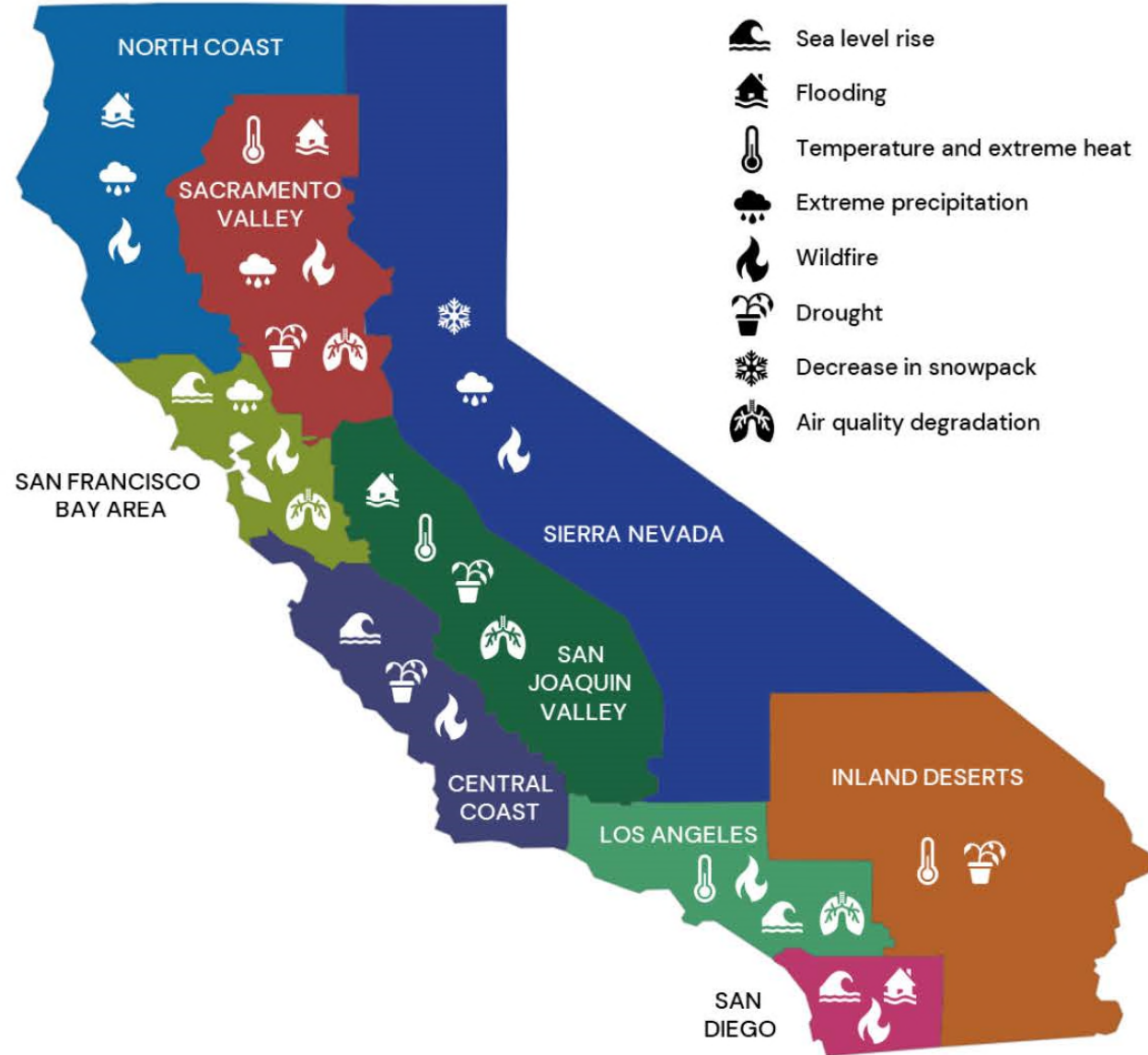
Climate Risks

Overview
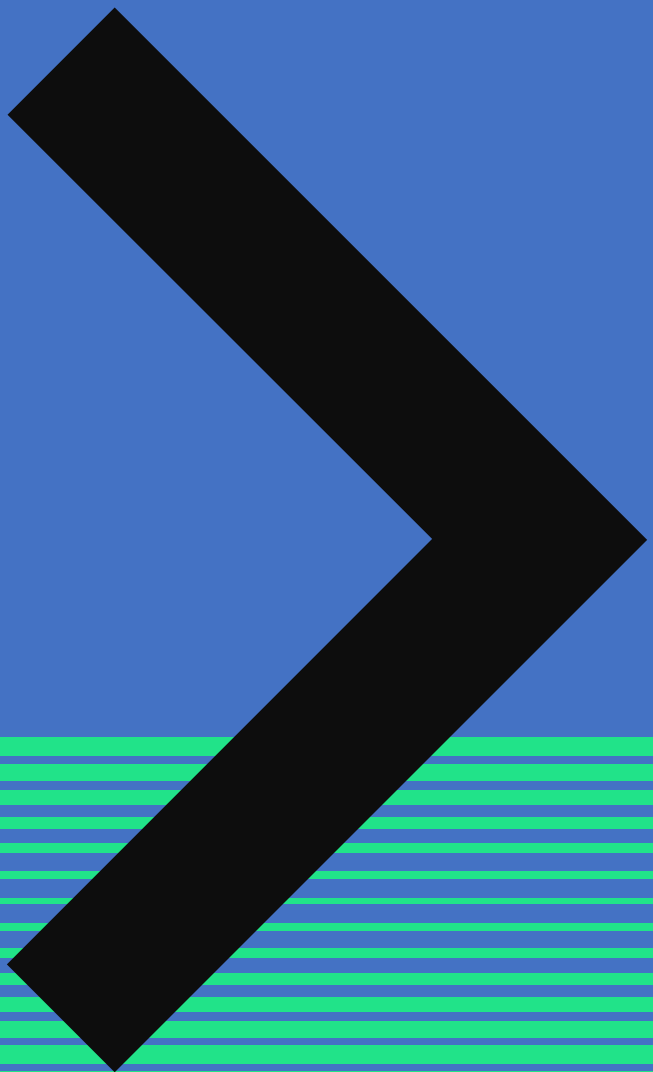
Assessing Climate Exposures and Measures to Reduce Vulnerabilities
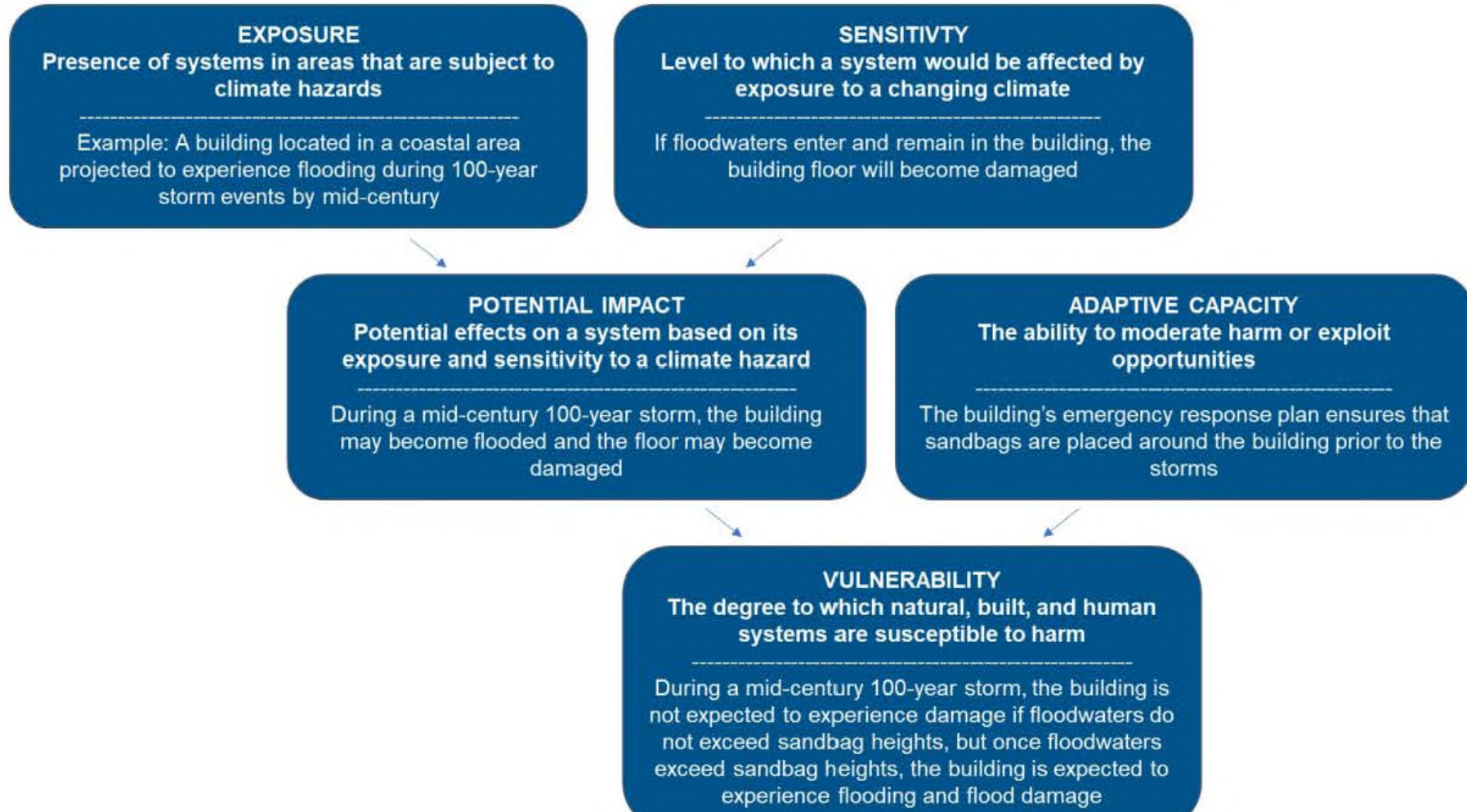
CHAPTER 4

Figure 4-2. Illustrative Climate Hazards in Nine Climate Regions of California under the California Fourth Climate Change Assessment

Climate Risk:
Vulnerability + Adaptation

Climate Vulnerability Assessment: Methodology

Figure 4-1. Vulnerability Assessment Process in California Adaptation Planning Guide (Source: California's Governor's Office of Emergency Services 2020)

EXPOSURE
Presence of systems in areas that are subject to climate hazards

Example: A building located in a coastal area projected to experience flooding during 100-year storm events by mid-century

SENSITIVTY
Level to which a system would be affected by exposure to a changing climate

If floodwaters enter and remain in the building, the building floor will become damaged

POTENTIAL IMPACT
Potential effects on a system based on its exposure and sensitivity to a climate hazard

During a mid-century 100-year storm, the building may become flooded and the floor may become damaged

ADAPTIVE CAPACITY
The ability to moderate harm or exploit opportunities

The building's emergency response plan ensures that sandbags are placed around the building prior to the storms

VULNERABILITY
The degree to which natural, built, and human systems are susceptible to harm

During a mid-century 100-year storm, the building is not expected to experience damage if floodwaters do not exceed sandbag heights, but once floodwaters exceed sandbag heights, the building is expected to experience flooding and flood damage

Climate Vulnerability Assessment: Exposure Score

Determine Exposure Score

This section guides the user through the following sub-steps to determine the exposure score.

1. Identify key climate hazards based on the project site location.

2. Select initial regional exposure scores.

3. Refine initial regional exposure scores.

The following sections provide a high-level exposure map and accompanying table for users to identify key climate hazards. Guiding questions and resources to define the exposure score from 1 to 5 (with 1 being the least exposed and 5 being the most exposed) are then presented.

Climate Vulnerability Assessment: Sensitivity Score

Question #1. How have similar projects to the user's and the project site been impacted by past extreme climate events?

Score Spectrum

○ Similar projects and the project area have experienced little to no effects from this hazard.

○ Similar projects and the project area have faced damage from this hazard that may have been major and/or permanent but does not significantly affect the project.

○ Similar projects and the project area have faced catastrophic damage from this hazard that resulted in permanent effects and significantly altered the project's functionality and local community.

Question #2. Does the project include elements that are susceptible to physical damage from the climate hazards (either at their historic or projected levels)?

Score Spectrum

○ The project has no elements that are susceptible to physical damage from this hazard, including projected severity over the project lifetime.

○ The project has some elements that may be physically damaged by the hazard as projected over its lifetime, but they are not significant to the functionality of the project.

○ The project relies significantly on elements that are likely to be physically damaged by the hazard as projected to occur over its lifetime.

Climate Vulnerability Assessment: Adaptive Capacity Rating

Question #1. How have similar projects or other developments in the project area managed climate impacts in the past?

Score Spectrum

Low: Similar projects and developments in the project area were not able to manage climate impacts or required significant cost/effort in doing so.

Med: Similar projects and developments in the project area required a fair amount of cost and effort to manage climate impacts.

High: Similar projects and developments in the project area adapted to climate impacts with little cost and effort.

Question #2. Does the project have design elements that may mitigate climate impacts planned (e.g., drainage system, cool roof, modifications that can be made over time)?

Score Spectrum

Low: The project does not have any elements that may mitigate climate impacts.

Med: The project has some elements that partially address the most relevant climate hazards.

High: The project already has elements that address the climate hazard of most relevance.

Climate Vulnerability Assessment

→ Use the results from the potential impacts and adaptive capacity assessment to develop an overall vulnerability score for each climate hazard.

Figure 4-3. Vulnerability Score Matrix

Potential Impacts	Low	Low-Med	Med	Mid-High	High
5	5	5	4	3	2
4	5	4	3	2	1
3	4	3	2	2	1
2	3	2	2	1	1
1	2	1	1	1	1

Adaptive Capacity

Note: Color coding indicates severity of the score, with green cells showing the lowest (least vulnerable) scores and dark red showing the highest (most vulnerable).

Climate Risk Reduction Measures

#	Measure Title	Scale of Application	Risk Reduction Benefit			Co-Benefits									
			Reduces Exposure	Reduces Sensitivity	Increases Adaptive Capacity	Improved Air Quality	Energy and Fuel Savings	Vehicle Miles Traveled Reductions	Water Conservation	Enhanced Pedestrian or Traffic Safety	Improved Public Health	Improved Ecosystem Health	Enhanced Energy Security	Enhanced Food Security	Social Equity
EH-6.	Install Refillable Water Stations	All	0	0	1-2	O	O	O	O	O	●	O	O	O	●
EH-7.	Install Equipment Cooling System	All	0	2-3	0	O	●	O	O	O	O	O	O	O	O
EH-8.	Use Alternative Pavement Surfaces	All	0	1-2	0	O	●	O	O	O	O	O	O	O	O
EH-9.	Expand Urban Tree Canopy	All	1-2	1-2	0	●	●	O	O	O	●	O	O	O	⊙
EH-10.	Install Covered Parking	P/S	0	0	1-2	●	O	O	O	O	●	O	O	O	O
Temperature/Extreme Heat															
Infrastructure Improvements and Projects															
EH-1.	Install Green Infrastructure*	All	1-3	1-3	0	●	⊙	O	O	O	●	●	O	O	●
EH-2.	Provide Heat Mitigation for Public Walkways and Transit Stops	All	2-4	0	0	●	O	O	O	O	●	O	O	O	●
EH-3.	Install Heat-Reducing Roof	All	2-3	0	0	●	●	O	O	O	●	O	O	O	●
EH-4.	Enhance Building Envelope Efficiency	P/S	0	0	1-3	●	●	O	O	O	●	O	O	O	⊙
EH-5.	Upgrade to Efficient Equipment/Infrastructure	All	0	0	1-3	O	●	O	O	O	O	O	O	O	O

Mirasol Village Case Study

- Prior Use: Twin Rivers public housing community built in the 1940s (218 units)

- Location: Richards Blvd near N. 12th Street and Dos Rios Street in the River District

Neighborhood Transformation

- SHRA advocated for more than 10 years to revitalize the site and its surrounding neighborhood

- Awarded $330 million in Choice Neighborhoods Planning and Initiatives Implementation Grants
  - Neighborhood Transformation Plan
    - Guided by redevelopment principles from General Plan and Specific Plans
    - New transit station
    - New roads and sidewalks
    - Safe pedestrian access to downtown Sacramento
    - Connections to employment centers, retail, and cultural amenities

Community Stakeholder Engagement

- Included input from former Twin Rivers residents
- Renamed Mirasol Village by Twin Rivers residents and community leaders with strong ties to nature

427 affordable/mixed income units

New Amenities

- Community Rooms
- Business Center
- Swimming Pool
- Bicycle Parking
- Electric Vehicle Chargers
- Dog Park

- Park/Joint Use Detention Basin
- Playgrounds
- Community Garden
- Fitness Equipment
- Pedestrian Walking Paths
- Fruit and Shade Trees

Cal-Adapt provides a way to explore peer-reviewed data that portrays how climate change might affect California at the state and local levels.

We make this data available through downloads, visualizations, and the Cal-Adapt API for your research, outreach, and adaptation planning needs.

Understanding climate risks across California

Cal-Adapt is a climate risk screening tool that downscales climate projections from global climate models to the local level, allowing users to see future impacts of extreme heat, wildfire, drought, precipitation, etc., at a 3.7-mile grid resolution. Cal-Adapt was embedded into CalEEMod to provide this information as part of planning.

Climate Risk

6.1. Climate Risk Summary

Cal-Adapt midcentury 2040–2059 average projections for four hazards are reported below for your project location. These are under Representation Concentration Pathway (RCP) 8.5 which assumes GHG emissions will continue to rise strongly through 2050 and then plateau around 2100.

Climate Hazard	Result for Project Location	Unit
Temperature and Extreme Heat	20.2	annual days of extreme heat
Extreme Precipitation	6.00	annual days with precipitation above 20 mm
Sea Level Rise	0.00	meters of inundation depth
Wildfire	0.00	annual hectares burned

Measures

Select Climate Measures

The Climate Risk Reduction screen presents the available climate risk reduction measures for user selection and analysis. Based on prior inputs, your priority hazards are Temperature and Extreme Heat ♨, Air Quality Degradation ⇔, Flooding ⌂, Extreme Precipitation ☔, Wildfire 🔥, and Drought ☼ Measures that address these priority hazards are shown first in the list of available measures on this screen. The icons for priority hazards are also shown in larger font.

Each climate risk reduction measure could have one or more of the following risk reduction benefits:

Reduces exposure
Reduces the presence of project elements in areas that are subject to climate hazards.
Reduces sensitivity
Reduces the level to which a project element would be affected by exposure to a changing climate.
Increases adaptive capacity
Increases the ability of a project element to moderate harm or exploit risk reduction opportunities.

⏚ Air Quality Degradation

Please answer the questions below to determine a score.

Is the project area within a nonattainment area for federal or state ambient air quality standard?

◉ Yes ○ No

Is the user's project located within 0.25 mile of a major freeway?

◉ Yes ○ No

Is the user's project located within 0.25 mile of a major industrial zone or logistics center?

◉ Yes ○ No

Is the project located in the wildland-urban interface?

○ Yes ◉ No

Is the project area projected to experience a decrease in future air quality due to climate change (e.g., due to increased smoke from wildfires)?

◉ Yes ○ No

Determine Exposure

		Number	Measure Title	Climate Hazards Addressed	Reduces Exposure ⓘ	Reduces Sensitivity ⓘ	Increases Adaptive Capacity ⓘ
∨	☑	EH-1	Install Green Infrastructure	☁ 🌡! ☼!	1 ▾	2 ▾	0
∨	☑	EH-15	Provide Low-Income Air Conditioning	🌡!	0	3 ▾	4 ▾
∨	☑	EH-3	Install Heat-Reducing Roof	☁ 🌡!	2 ▾	0	0
∨	☑	EH-4	Enhance Building Envelope Efficiency	☁ 🌡!	0	0	2 ▾
∨	☑	EH-9	Expand Urban Tree Canopy	🌡!	1 ▾	1 ▾	0
∨	☑	MH-13	Support Local Food Systems	🌧 🏛 🔥 ☁ 🌡! ☼! ≋ ❄	0	0	1 ▾
∨	☑	MH-14	Maintain Trails and Parks	🌧 🏛 🔥 🌡!	0	2 ▾	2 ▾
∨	☑	MH-27*	Provide Greater Affordable Housing Options	🌧 🏛 🔥 ☁ 🌡! ☼! ≋ ❄	0	1 ▾	2 ▾

Select Climate Risk Measures

Climate Risk Dashboard

Climate Risk

Project Location (County): Sacramento

Climate Risk
- ⦿ Air Quality Degradation
- ○ Drought
- ○ Extreme Precipitation
- ○ Flooding
- ○ Temperature and Extreme Heat
- ○ Wildfire

Vulnerability Score ⓘ

Exposure Score: 5 ⓘ

Sensitivity Score: 5 ⓘ

Adaptive Capacity Score: Med ⓘ

Initial Vulnerability Score: 4 ⓘ

Vulnerability Score with Measures: 1 ⓘ

Climate hazard icon.

Radio buttons to select climate risk for dashboard display.

Evaluation report showing number of scored measures, points earned, maximum possible points, and weighted scores.

Climate Risk Dashboard

A. Top Performing User-Selected Measures for Air Quality Degradation ⓘ

- **EH-1** Install Green Infrastructure
- **EH-3** Install Heat-Reducing Roof
- **EH-4** Enhance Building Envelope Efficiency

B. Air Quality Degradation Risk-Reducing Measures ⓘ

You have selected

3

of 13 available strategies
Additional strategies
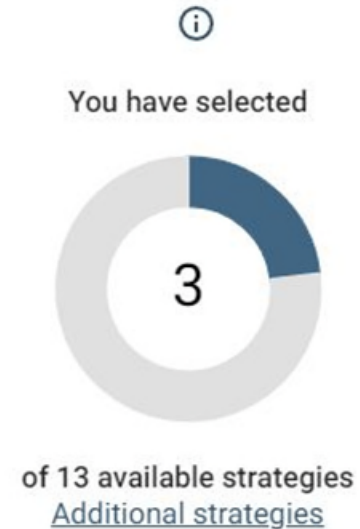
A. Three user-selected measures that achieve the greatest improvement in vulnerability.

B. Number of user-selected measures that address the selected hazard.

Your Selected Air Quality Degradation Risk Reduction Measures Have the Following Co-Benefits

Energy and Fuel Savings   Improved Air Quality   Improved Ecosystem Health   Improved Public Health   Social Equity

Potential co-benefits achieved by user-selected measures.

Mirasol Village Measures in Action

Extreme Heat
- Expand Urban Tree Canopy

Flooding & Extreme Precipitation
- Use Green Infrastructure for Stormwater Management
- Install Stormwater Cistern/Retention Basin

Air Quality Degradation
- Enhance Building Envelope Efficiency
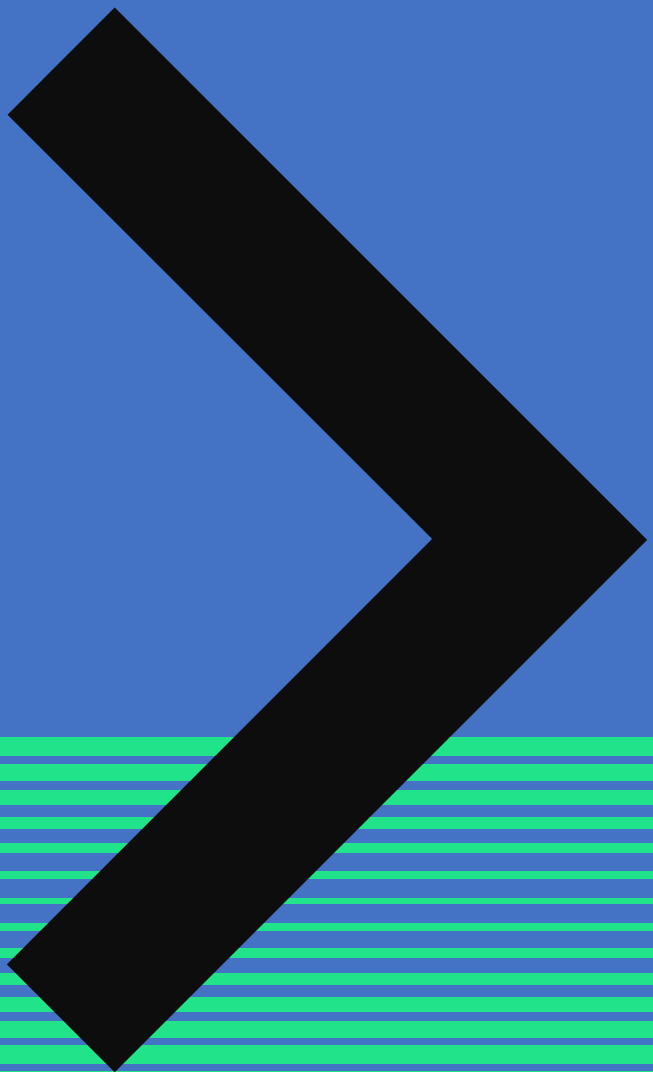
Health + Equity

Overview: Why Addressing Health Equity is Integral to Addressing Air Quality and Climate Change

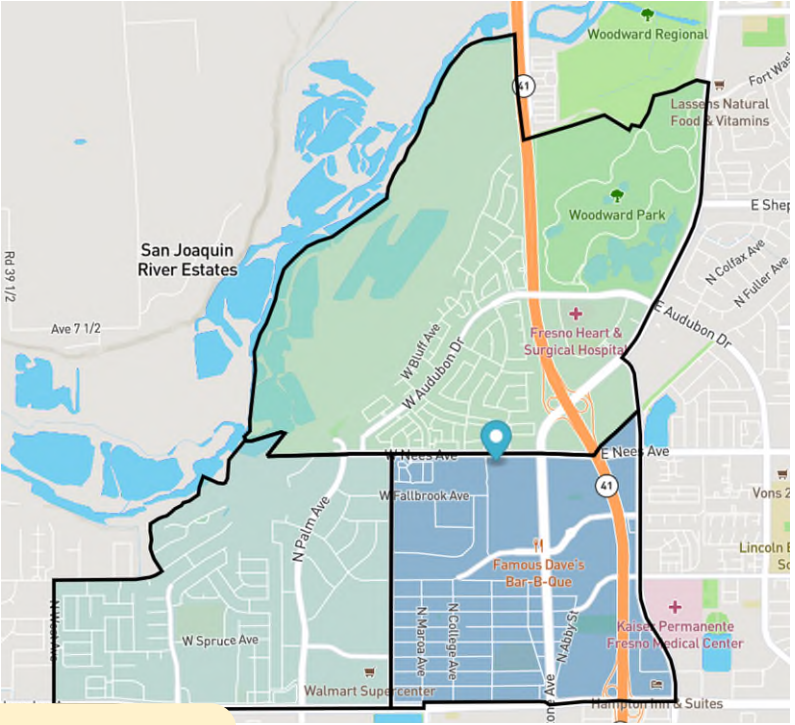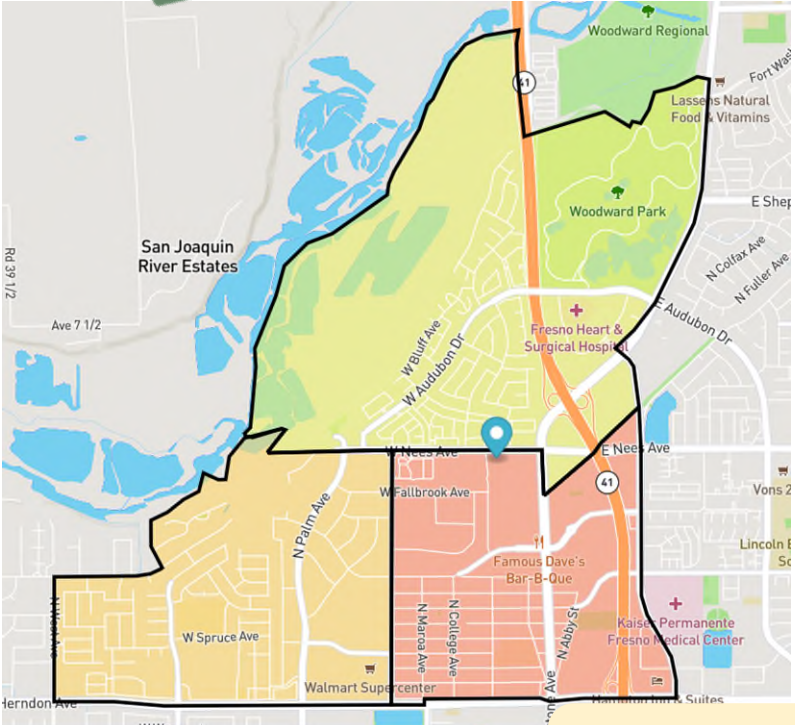Figure 2-2. Intersections of Social Determinants on Health and Vulnerability
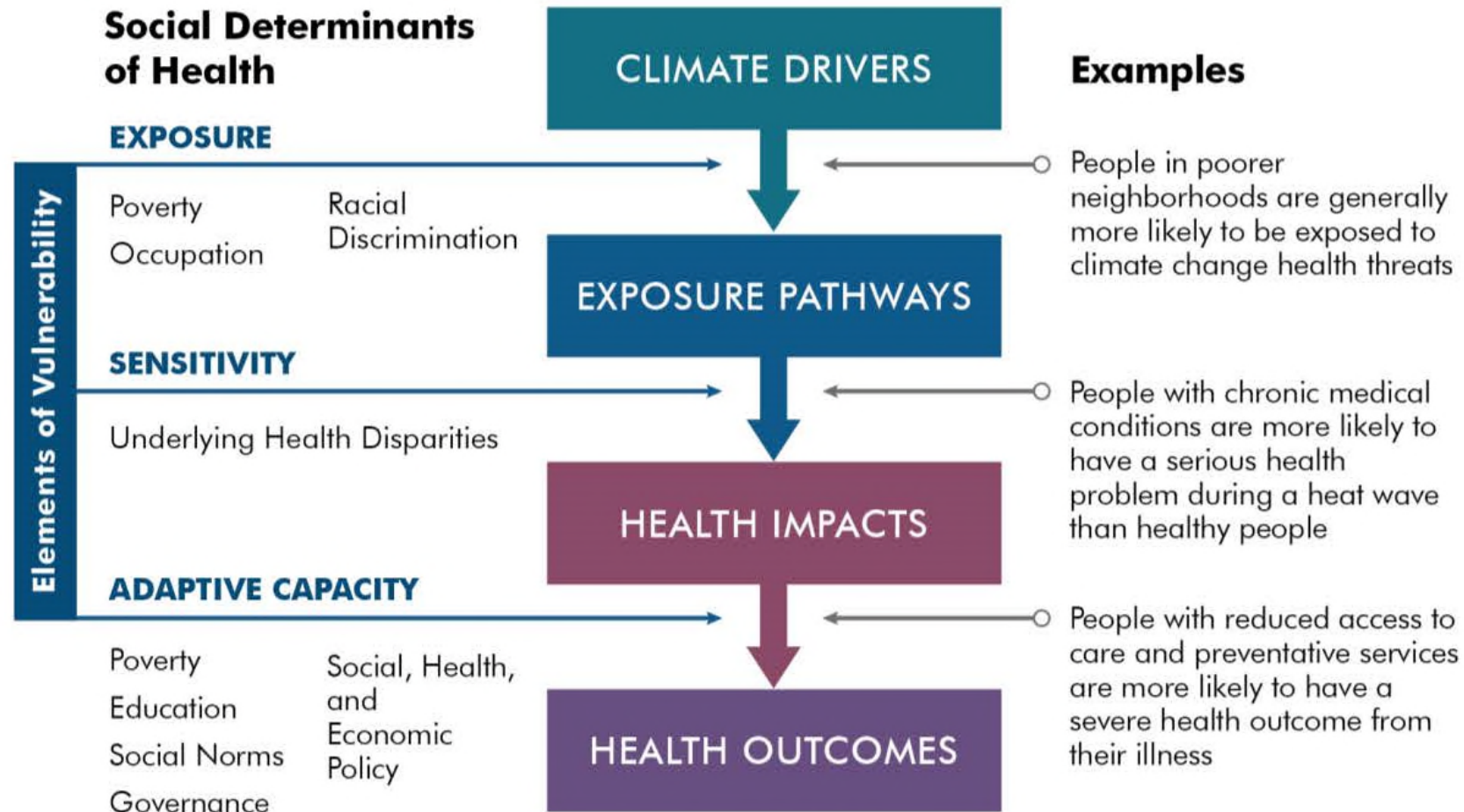
Disadvantaged and Low-Income Communities in California

SB 535 Disadvantaged Communities

AB 1550 Low Income Communities
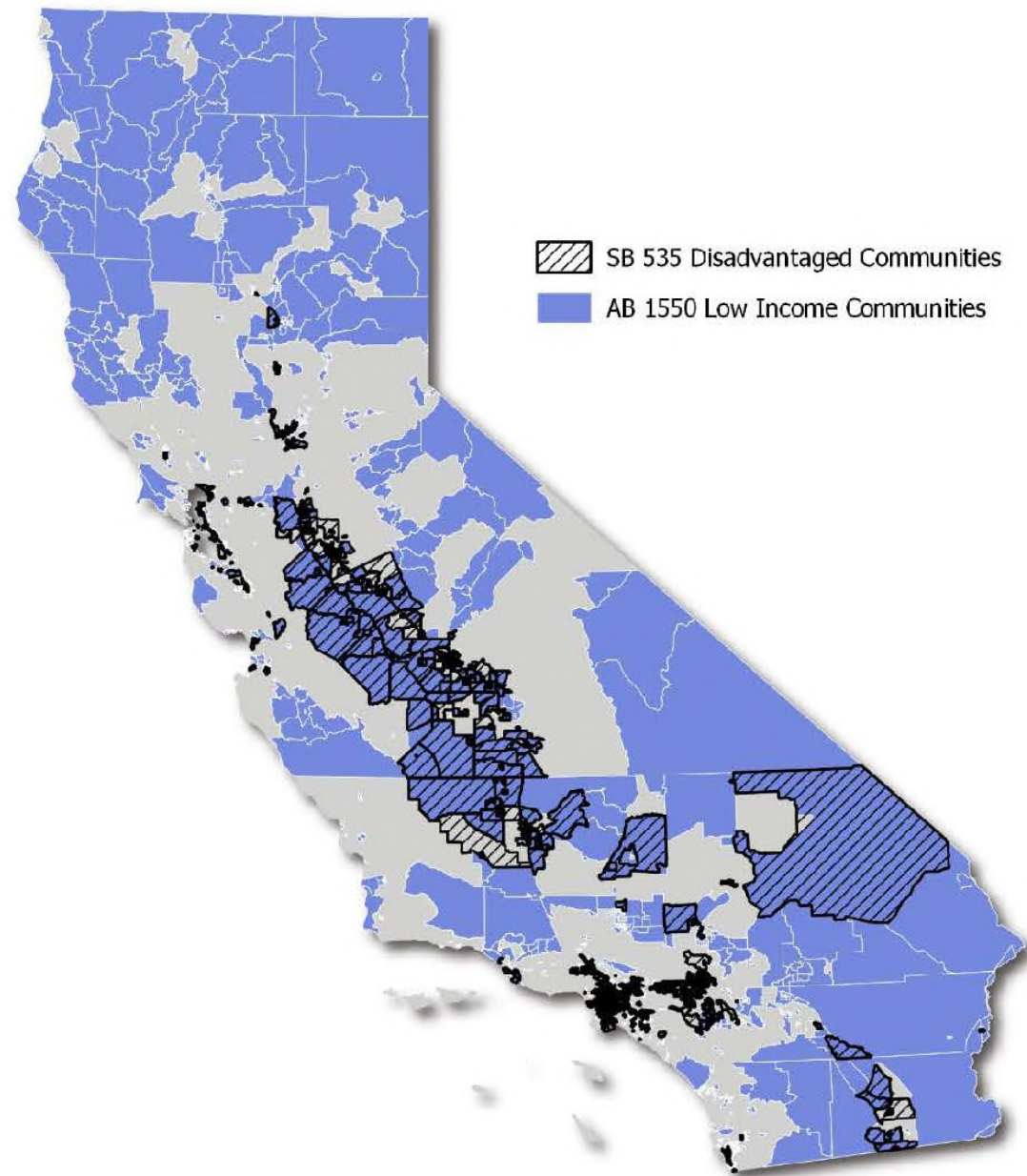
Using CalEEMod to Understand Existing Health & Equity Burdens

CalEEMod's embedded geospatial layers provide data from CalEnviroScreen 4.0 and the Healthy Places Index to help identify existing health, environmental, and equity conditions in the project location.

Also identifies if the project is located in a

- SB 535 Disadvantaged Community

- AB 1550 Low-Income Community

- AB 617 Community Air Protection Community

Can display individual CES 4.0 and HPI scores

Figure 5-1. Equity Measures by Planning Phase
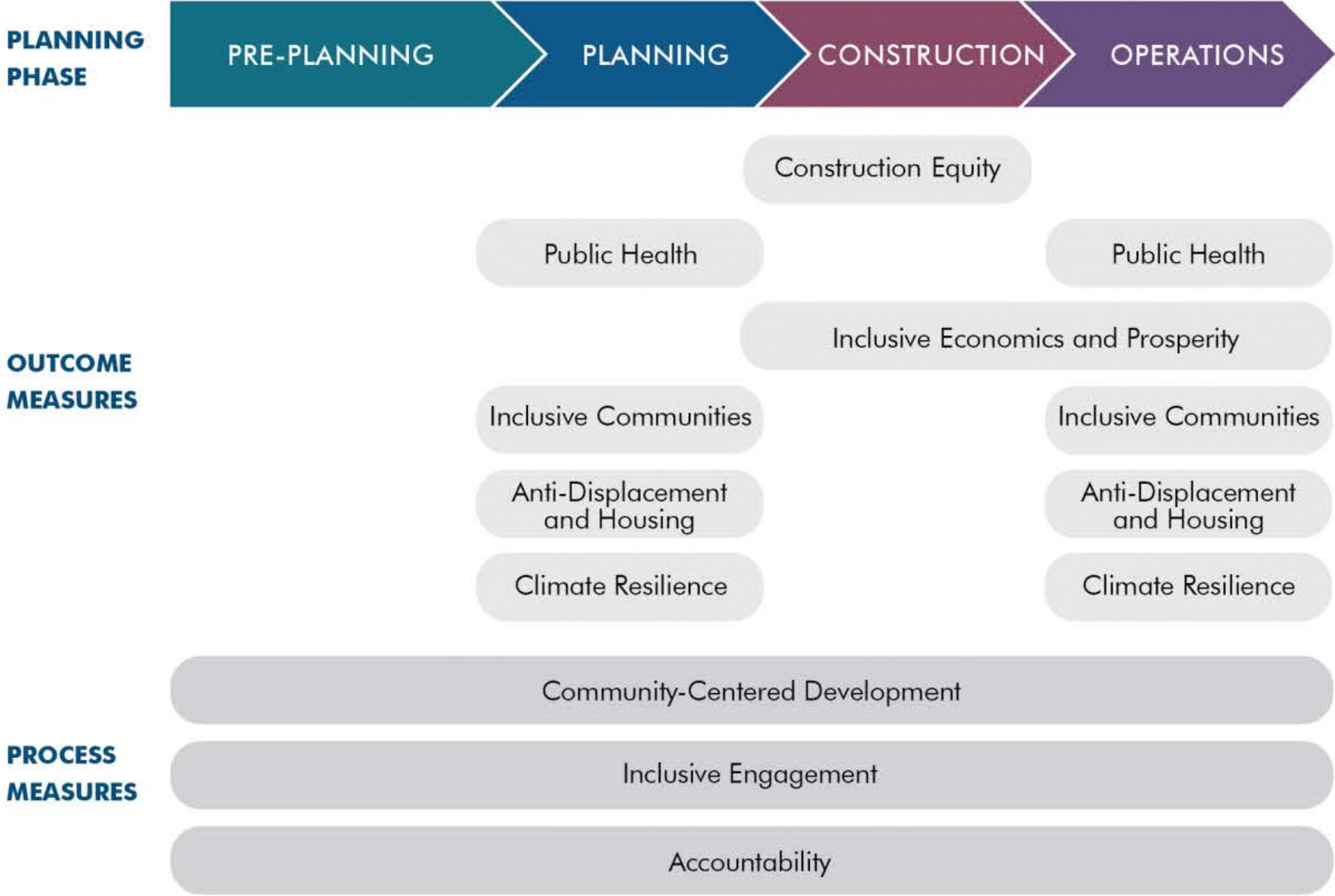
Advancing Health + Equity

CalEnviroScreen

Healthy Places Index

More burdened/less healthy (62 years LE)
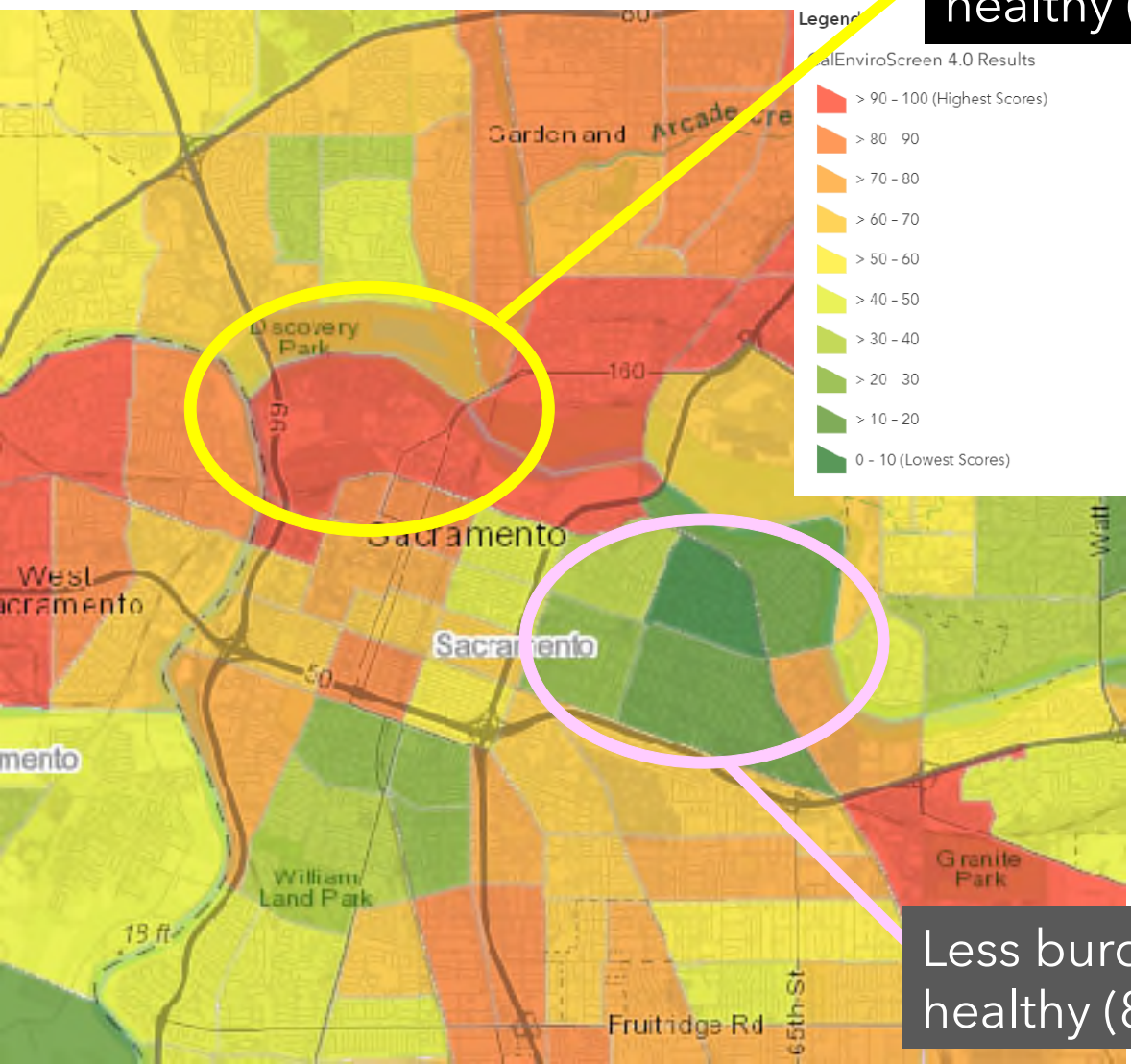
Less burdened/more healthy (82 years LE)

Legend
CalEnviroScreen 4.0 Results
> 90 – 100 (Highest Scores)
> 80 – 90
> 70 – 80
> 60 – 70
> 50 – 60
> 40 – 50
> 30 – 40
> 20 – 30
> 10 – 20
0 – 10 (Lowest Scores)

HPI Score (3.0)
Percentile Ranking
Less → More healthy community conditions
0   25   50   75   100   Excluded
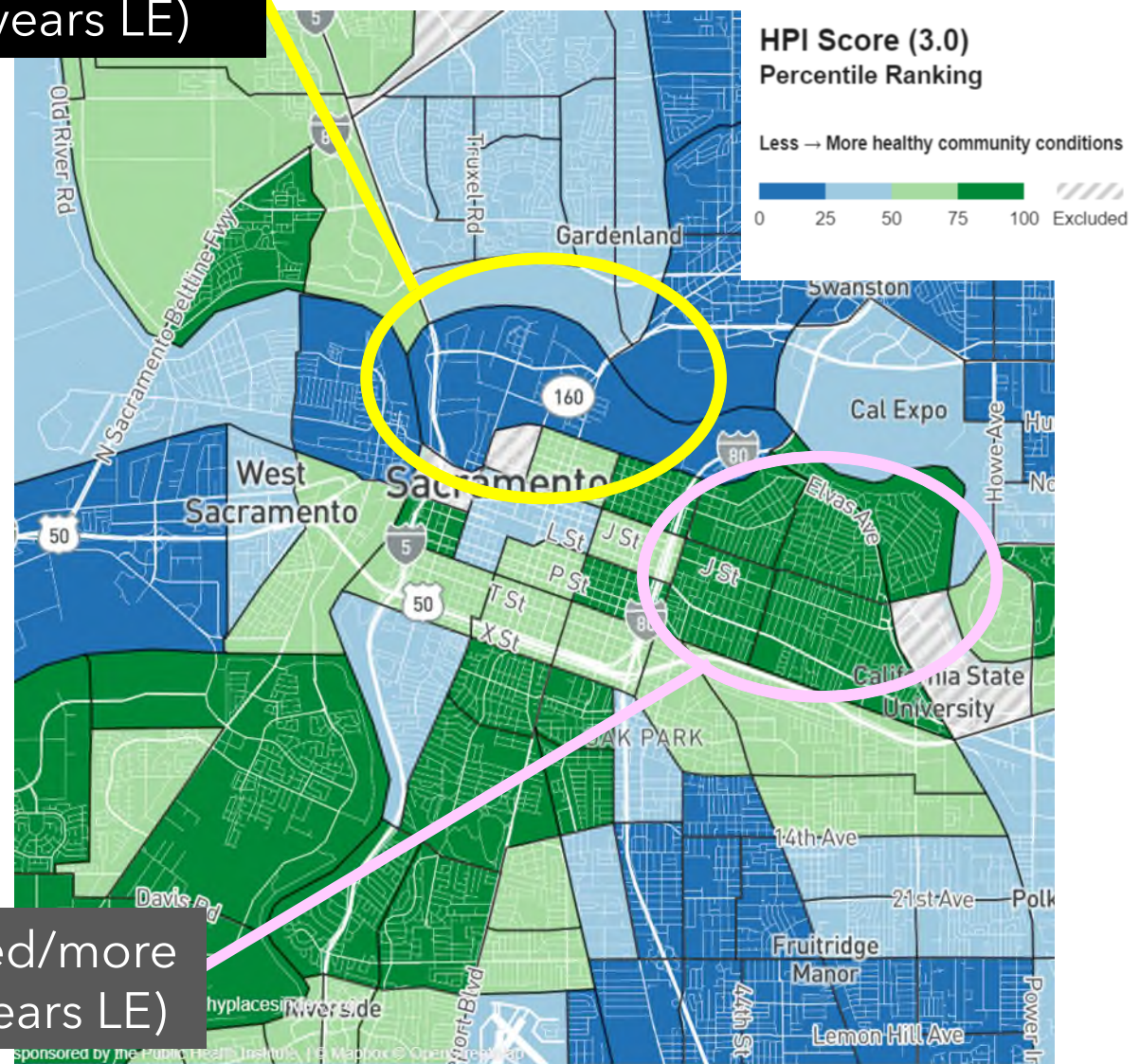
Selecting Health and Equity Measures

Anti-Displacement & Housing (AH) ⊕

	Number	Measure Title		Implemented
⌄	AH-1	Support Community Land Trusts	📄	☐
⌄	AH-2	Promote Affordable Housing in Transit-Rich Areas	📄	☑
⌄	AH-3	Protection for Existing Tenants of Redevelopment Projects	📄	☐
⌄	AH-4	Incorporates Permanent Supportive Housing	📄	☐
⌄	AH-5	Make Housing Units Permanently Affordable	📄	☑
⌄	AH-6	Support the Formation of Collective Ownership Models: Limited-Equity Housing Cooperatives or Mutual Housing Associations	📄	☐
⌄	AH-7	No Net Loss of Affordable Housing Units/One-For-One Affordable Housing Policies	📄	☑

Climate Resilience (CR) ⊕

	Number	Measure Title		Implemented
⌄	CR-1	Adapt and Re-use Vacant Lots for Green Infrastructure	📄	☑
⌄	CR-2	Support the Development and Operations of Community Resilience Centers	📄	☐
⌄	CR-3	Passive Survivability	📄	☐

Health and Equity Dashboard

Health & Equity

Health and Equity Metrics

CalEnviroScreen 4.0 Score — 99 ⓘ — As defined by CalEnviroScreen, the overall CalEnviroScreen score is calculated by multiplying the pollution burden and population characteristics scores.

Healthy Places Index Score — ⓘ — Represents the composite score of all HPI indicators.
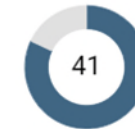
A. User Selected Measures for Health and Equity

Top Performing User-Selected Measures for Health and Equity ⓘ
- T-3 — Provide Transit-Oriented Development
- T-4 — Integrate Affordable and Below Market Rate Housing
- T-1 — Increase Residential Density

Show More

B. Measures for Health and Equity

You have selected
41
of 50 available strategies
Additional strategies

Your Selected Health and Equity Measures Have The Following Co-Benefits

Energy and Fuel Savings | Enhanced Pedestrian or Traffic Safety | Improved Air Quality | Improved Public Health | Social Equity | VMT Reductions | Enhanced Energy Security | Improved Ecosystem Health | Water Conservation | Enhanced Food Security

Overall CES and HPI scores relevant to the project census tract.

A. Three user-selected measures with highest score to address health and equity indicators.
B. Number of user-selected health and equity measures.

Potential co-benefits achieved by user-selected measures.

Health and Equity Evaluation Scorecard

Category	Number of Applicable Measures	Total Points Earned by Applicable Measures	Max Possible Points	Weighted Score
Community-Centered Development	4	17	20	12
Inclusive Engagement	6	24	30	11
Accountability	3	13	15	12
Construction Equity	5	3	25	2
Public Health and Air Quality	4	9	20	6
Inclusive Economics & Prosperity	4	0	20	0
Inclusive Communities	7	33	35	13
Total	33	99	165	58

Evaluation report showing number of scored measures, points earned, maximum possible points, and weighted scores.

A.

B.

Project Award Level ⓘ

SEEDLING

Weighted Score	Tier Level
0-40	Acorn
40-50	Sprout
50-60	Seedling
60-80	Sapling
80+	Heritage Oak

A. Spider chart displaying weighted category scores.
B. Equity tier awarded to the project based on the total weighted score.

- Do you often consider the impacts of climate change on your projects?

- Would this tool help you factor in adaptation and health and equity options?

- Looking at the category of measures listed in the Health & Equity module, in your experience which of these are most requested by your communities?

  - Community-Centered Development
  - Inclusive Engagement
  - Accountability
  - Construction Equity
  - Public Health and Air Quality
  - Inclusive Economics & Prosperity
  - Inclusive Communities
  - Anti-Displacement & Housing
  - Climate Resilience

Team Acknowledgements - Handbook

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Questions?

Thank you for attending today's session!

For further questions, please contact:

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Handbook available at:

https://www.caleemod.com/handbook/index.html

CalEEMod available at:

www.caleemod.com

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