



# Projected Changes in Climate in the SCAG Region

## WHAT ARE THE EXPECTED CLIMATE CHANGE TRENDS IN THE SCAG REGION?

Through mid-century, much of the SCAG Region is projected to experience:

- an increase in sea level,
- a slight increase in severe precipitation,
- a potential increase in inland flooding, and
- an increase in extreme heat.

These projections are described by the following maps. Notably, projections vary within the SCAG Region. More detailed, downscaled information can be accessed through the sources described above.

### Scenarios and Assumptions

SCAG Region transit asset data represents 2040 assets as outlined in the 2016 Regional Transportation Plan (RTP).

Additional information about the hazard-specific maps are discussed below.

### Sea Level Rise

The sea level rise (SLR) maps in this document depict coastal wave flooding extents under a 1-in-100-year coastal storm for SLR increments of 0.5 meters between present day (0 meters SLR) and end-of-century (2.0 meters of SLR). SCAG does not make a recommendation of which sea level rise increment to use, but refers transit agencies to guidance provided by California's Ocean Protection Council (OPC). OPC's [State of California Sea-Level Rise Guidance 2018 Update](#) recommends that projects or infrastructure with a medium-high level of risk aversion assume sea level rise (SLR) of 0.5 m by 2050, and 2.0 m by 2100.

### Precipitation and Heat

Projected changes in severe precipitation and extreme heat are based on a historical period centered around 1990 (1976 – 2005), and a future period centered around mid-century (2036 – 2065). Projections use a high-emissions scenario (RCP 8.5) and the average of four global climate models which cover a range of outputs (HadGEM2-ES, a warm/dry climate model; CNRM-CM5, a cool/wet climate model; CanESM2, an average climate model; and MIROC5, a complement model).

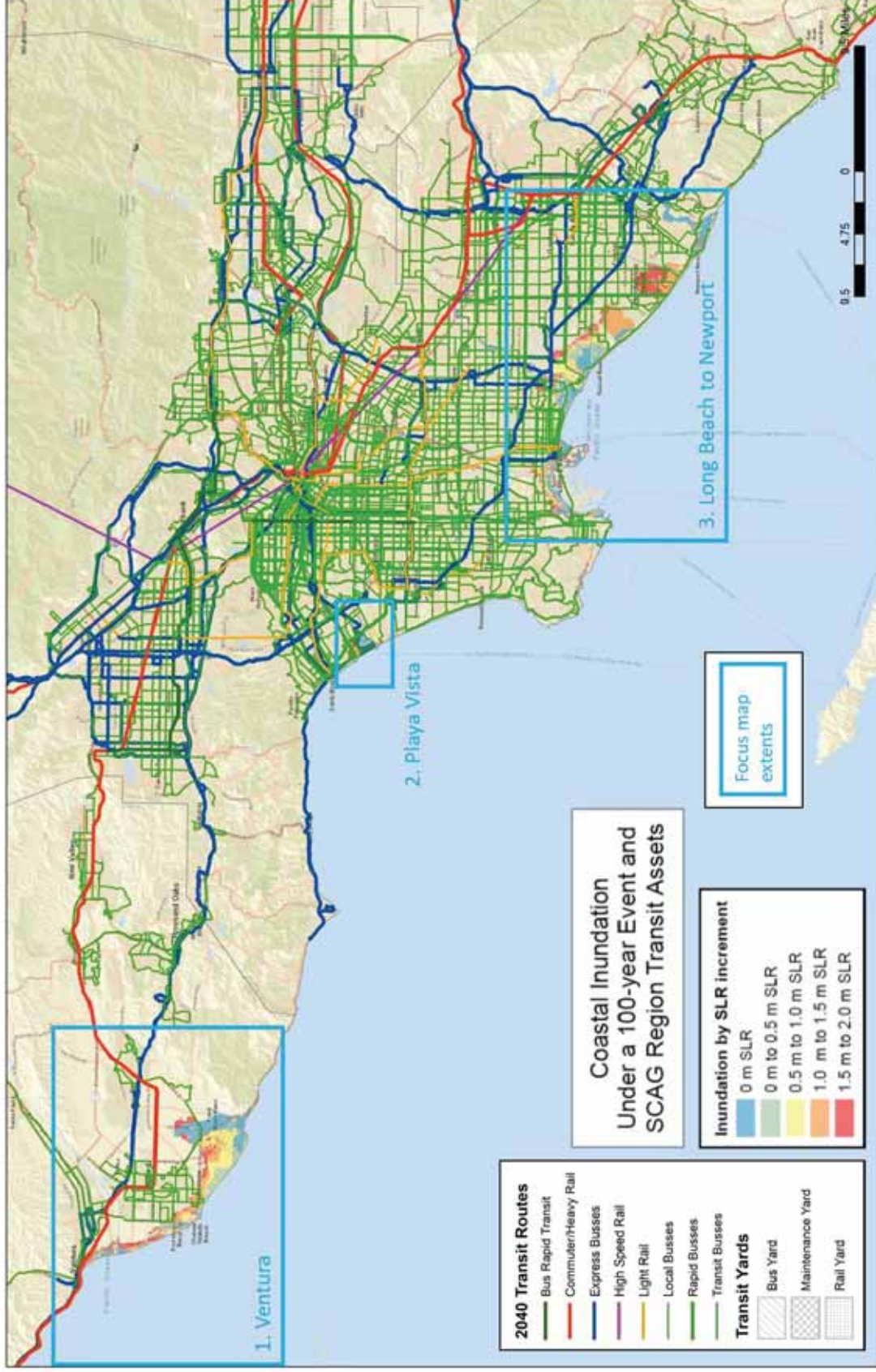
## Inland Flooding

Inland flooding is represented by present day FEMA flood zones as there is limited reliable, publicly available spatial data on projected inland flooding. Inland flooding extents may increase due to projected changes in extreme precipitation.

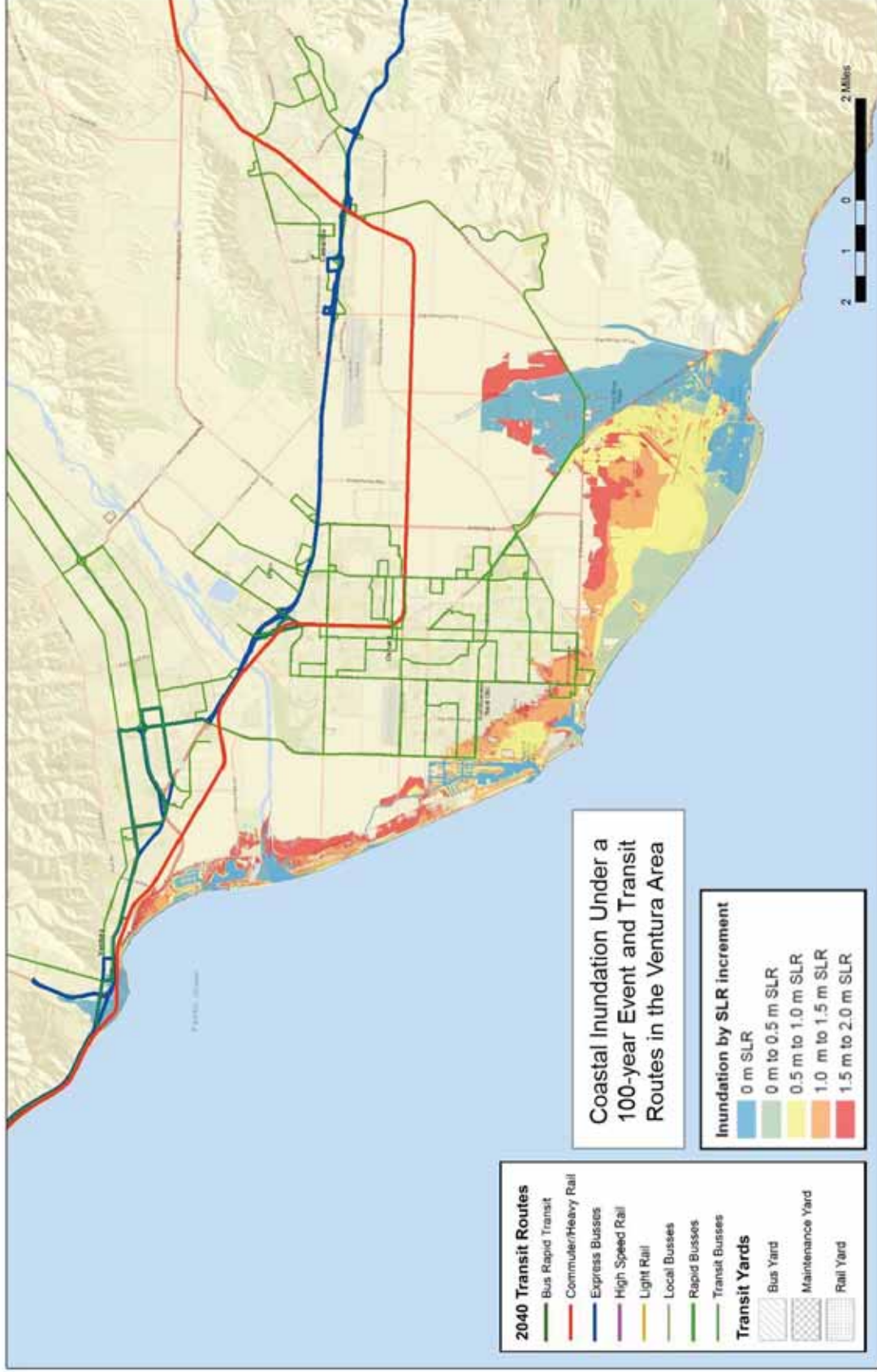
## SEA LEVEL RISE

By mid-century, sea level is projected to increase by about a half meter along the coast of the SCAG Region. Areas that are projected to experience the greatest extent of coastal wave flooding under a 100-year event include Ventura, Playa Vista, and Long Beach through Newport Beach. Projected 100-year event coastal wave flooding extents within the region and for these focus areas are depicted in the maps below.

# Coastal Inundation Under a 100-year Event: SCAG Region



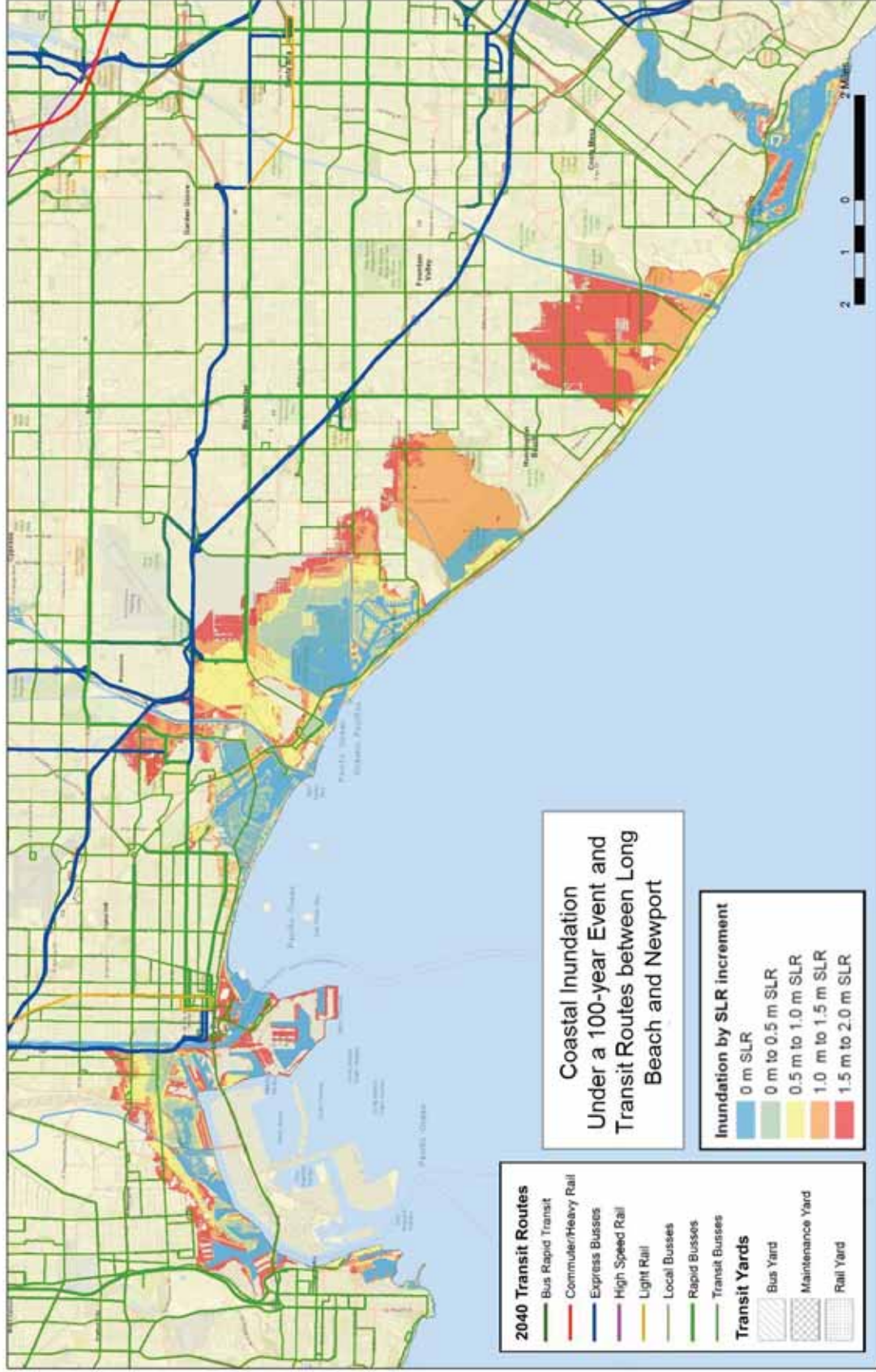
# Coastal Inundation Under a 100-year Event: Ventura



# Coastal Inundation Under a 100-year Event: Playa Vista



# Coastal Inundation Under a 100-year Event: Long Beach to Newport



## SEVERE PRECIPITATION

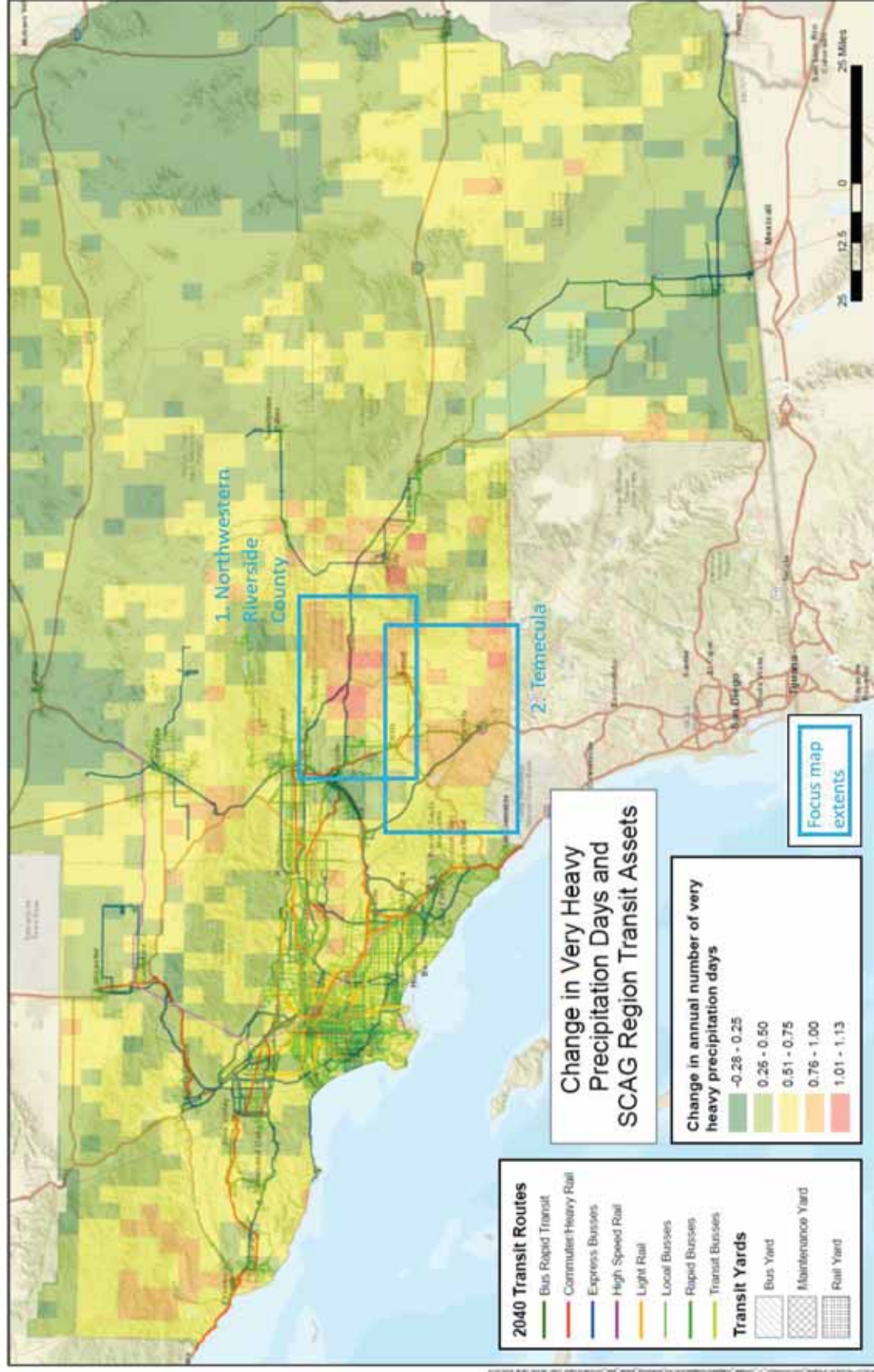
### Very Heavy Precipitation Days

Very heavy precipitation days are days in which precipitation exceeds the 95<sup>th</sup> percentile of daily precipitation. By mid-century, models project that over 99% of SCAG Region transit routes, assets, and yards will experience an average of between zero and one additional day of very heavy precipitation per year. While the change in number of days is relatively small, it is important to consider that historically, the SCAG Region has experienced an average of between 1.1 and 5.5 days of very heavy precipitation days per year. Therefore, an additional 0.5 very heavy precipitation days represents an increase of 20% for transit routes and 15% for transit assets and yards within the SCAG Region. Within the SCAG Region, northwestern Riverside County and Temecula are projected to experience the greatest increases, as shown in the following maps.



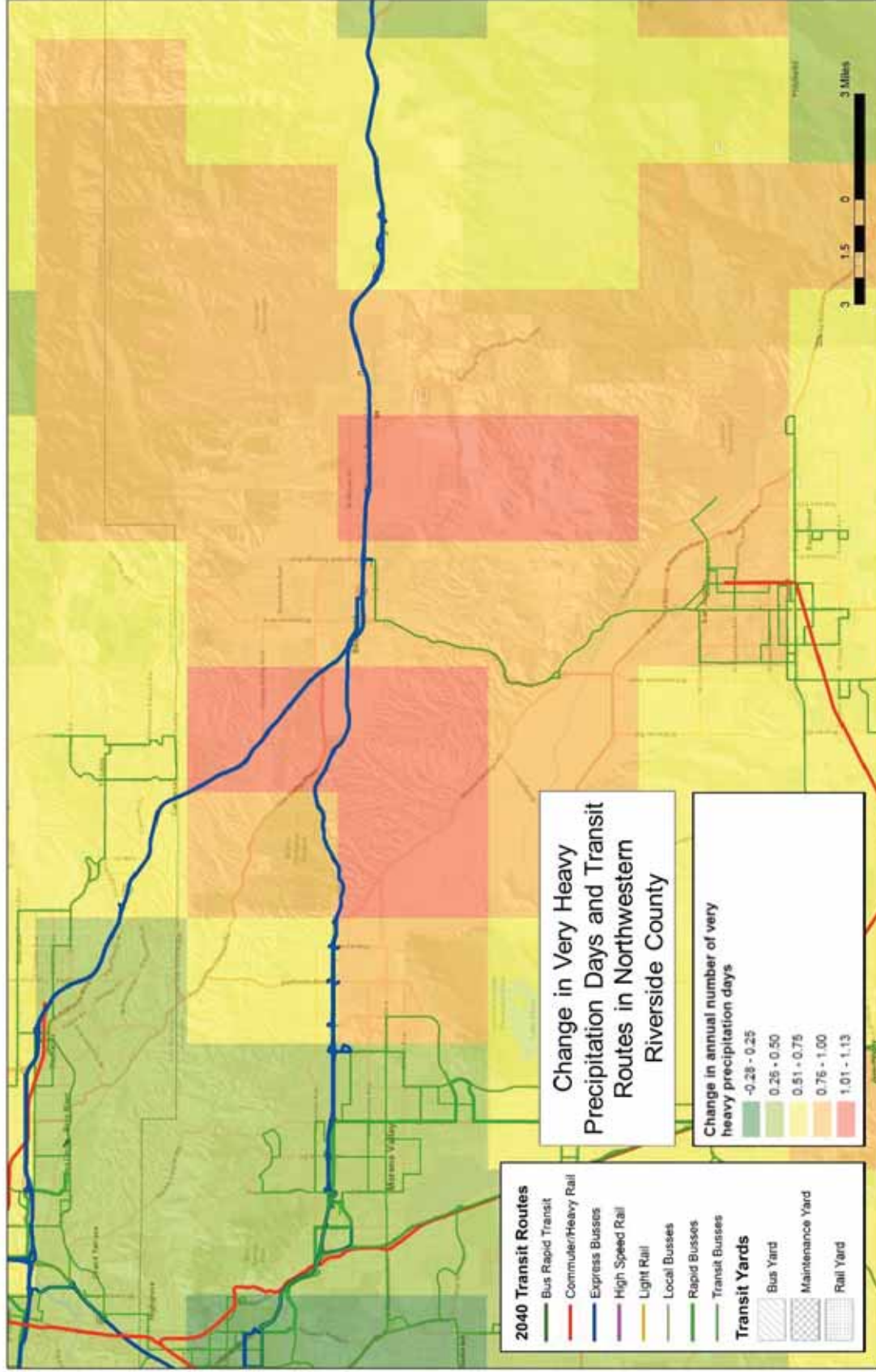
## Change in Annual Number of Very Heavy Precipitation Days: SCAG Region

A very heavy precipitation day is a day where precipitation exceeds the historical 95<sup>th</sup> percentile of daily precipitation.



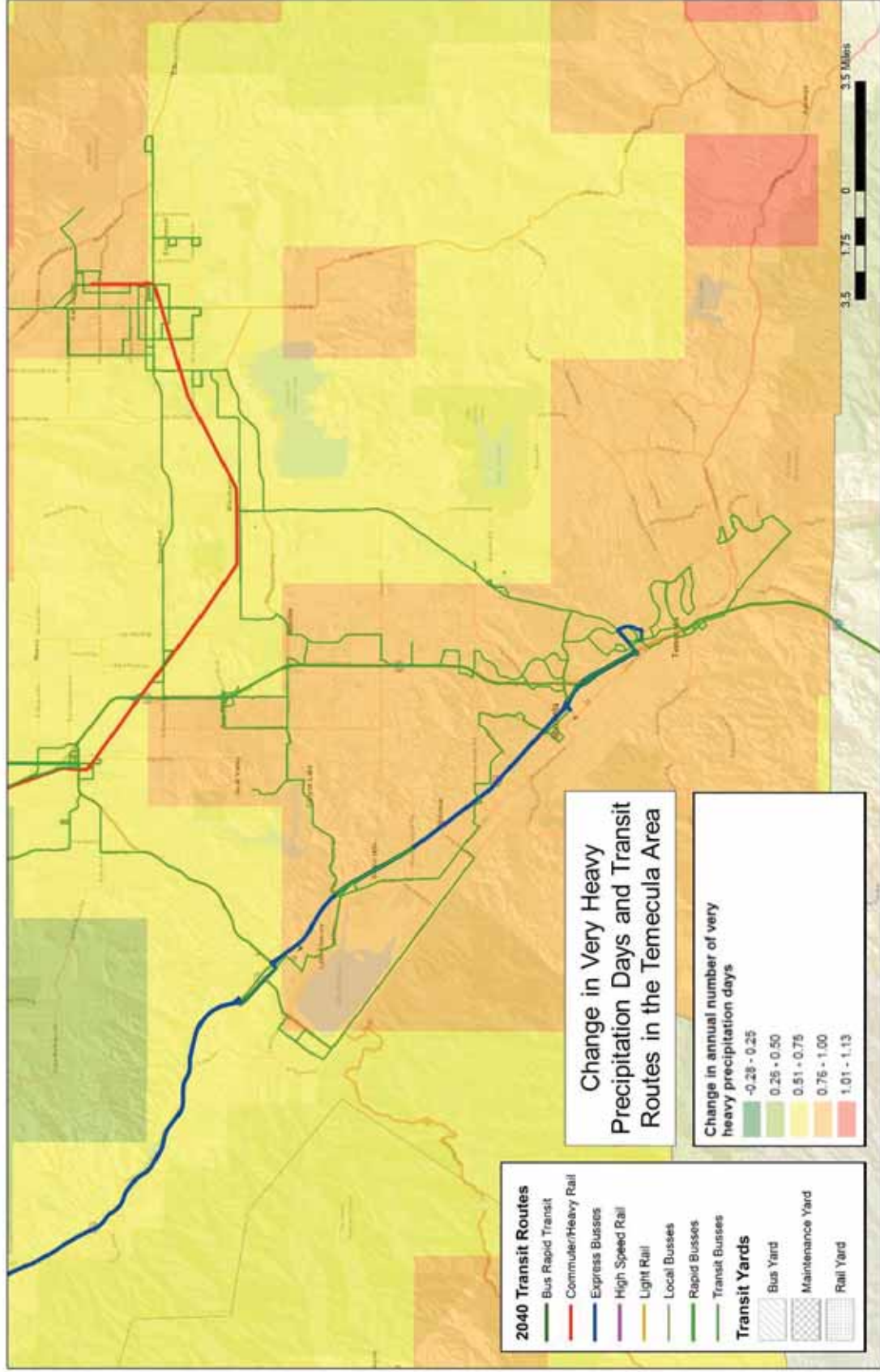
## Change in Annual Number of Very Heavy Precipitation Days: Northwestern Riverside County

A very heavy precipitation day is a day where precipitation exceeds the historical 95<sup>th</sup> percentile of daily precipitation.



## Change in Annual Number of Very Heavy Precipitation Days: Temecula

A very heavy precipitation day is a day where precipitation exceeds the historical 95<sup>th</sup> percentile of daily precipitation.

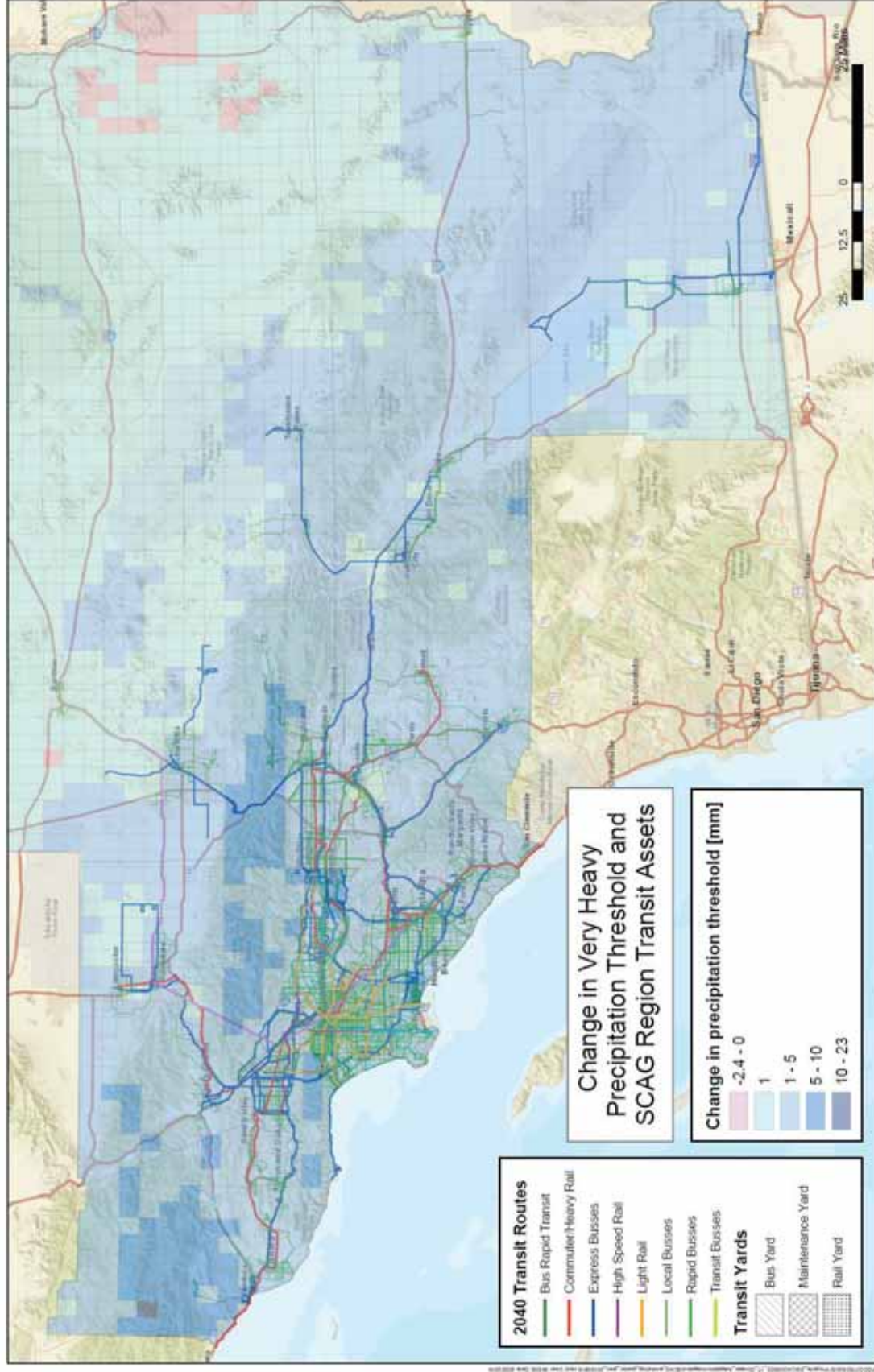


## Very heavy precipitation threshold

Very heavy precipitation days are days in which precipitation exceeds the 95<sup>th</sup> percentile of daily precipitation. By mid-century under a high emission scenario (RCP 8.5), the threshold for very heavy precipitation is projected to increase for much of the SCAG Region, with the greatest increases occurring in Ventura and Los Angeles Counties. The threshold is projected to decrease slightly in eastern San Bernardino County. These projected changes can be seen in the map below.

## Change in Threshold of Very Heavy Precipitation: SCAG Region

The threshold of very heavy precipitation is the 95<sup>th</sup> percentile value of daily precipitation, and is measured in millimeters (mm).

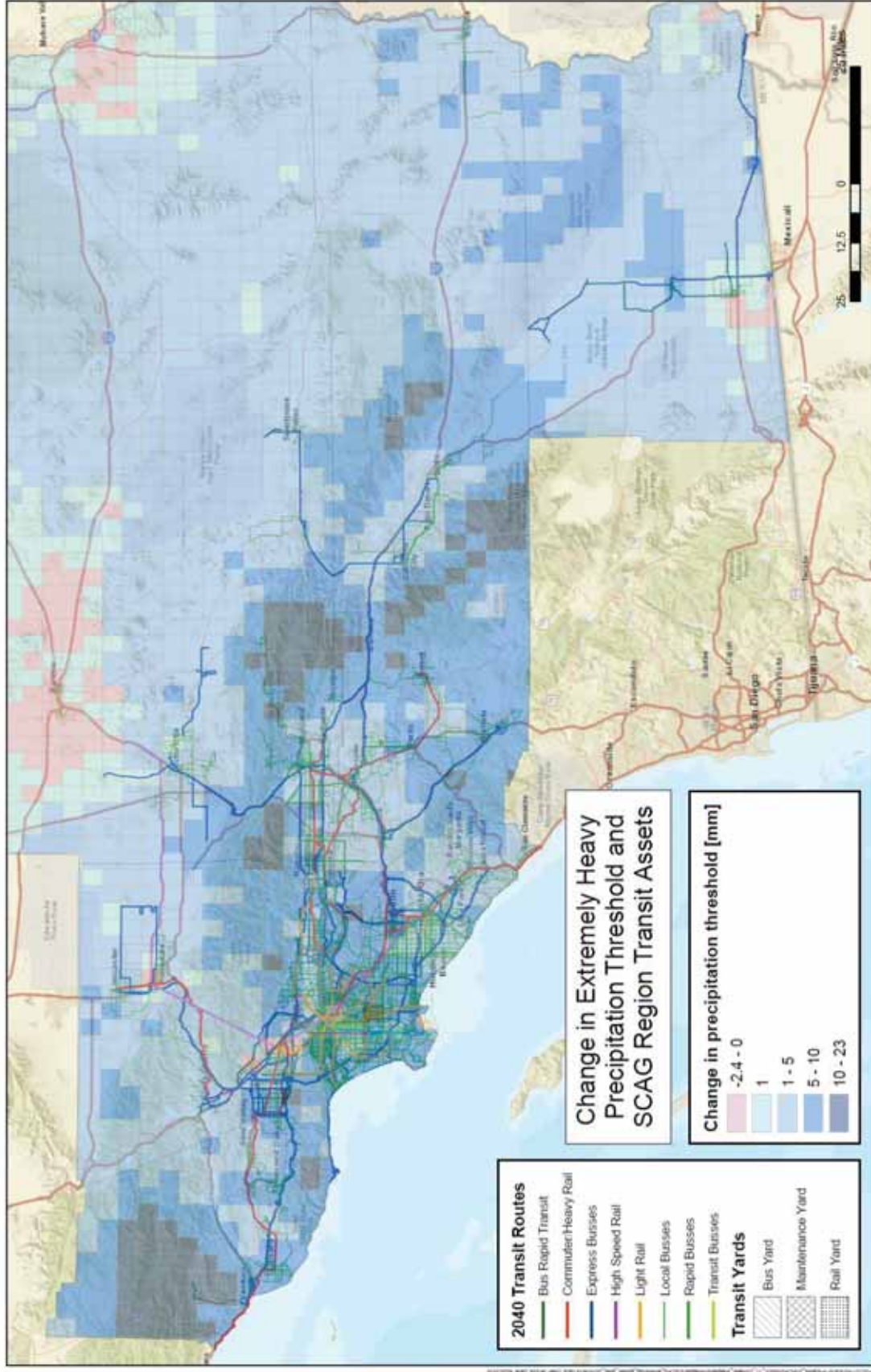


## Extremely heavy precipitation threshold

Extremely heavy precipitation days are days in which precipitation exceeds the 99<sup>th</sup> percentile of daily precipitation. By mid-century under a high emission scenario (RCP 8.5), the threshold for extremely heavy precipitation is projected to increase for much of the SCAG Region, with the greatest increases occurring in Los Angeles County, Orange County, western Riverside County, and southwestern areas of San Bernardino County. The threshold is projected to decrease slightly in parts of the SCAG Region, primarily in San Bernardino County. These projected changes can be seen in the map below.

### Change in Threshold of Extremely Heavy Precipitation: SCAG Region

The threshold of extremely heavy precipitation is the 95<sup>th</sup> percentile value of daily precipitation, and is measured in millimeters (mm).

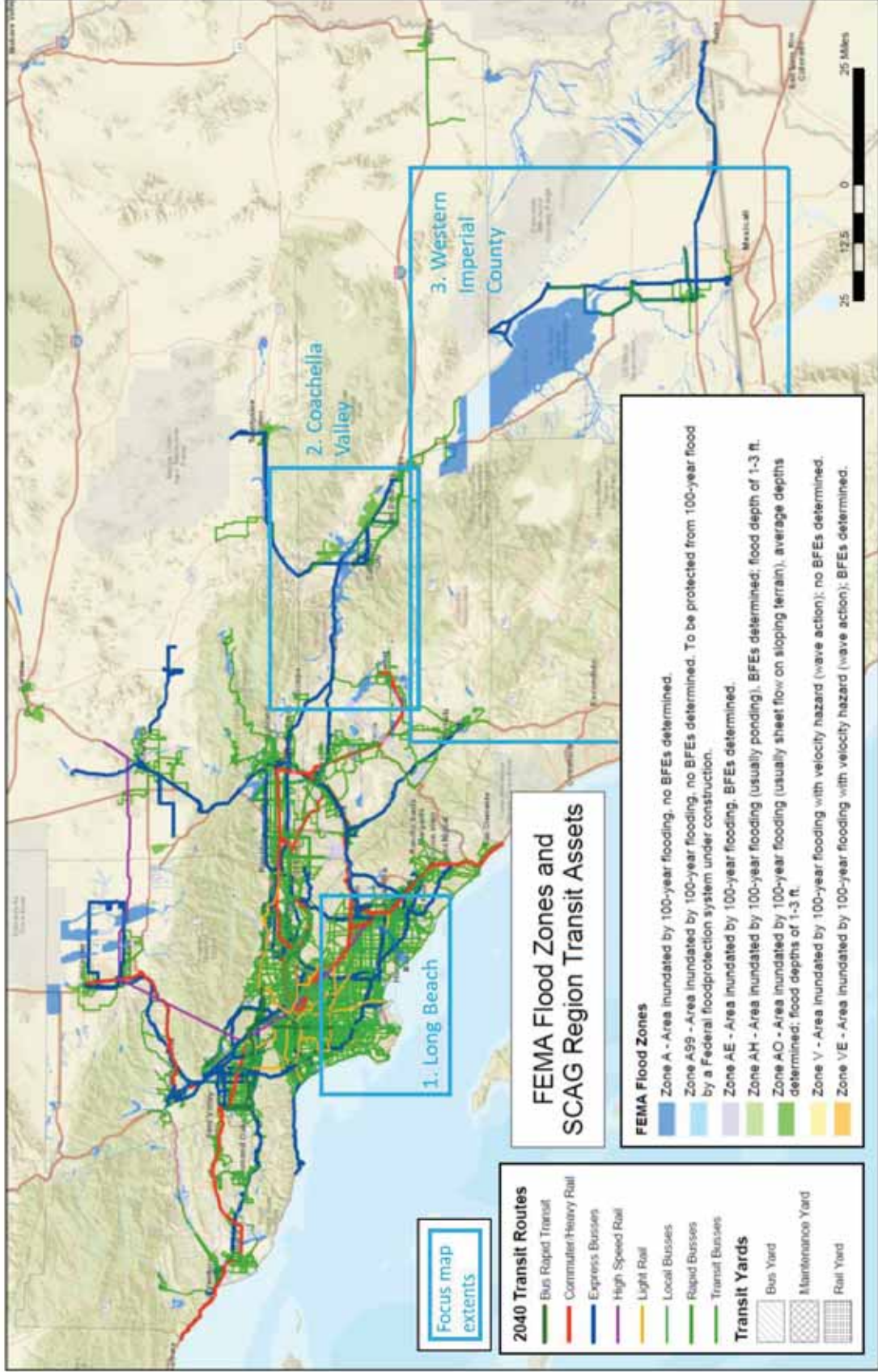


## INLAND FLOODING

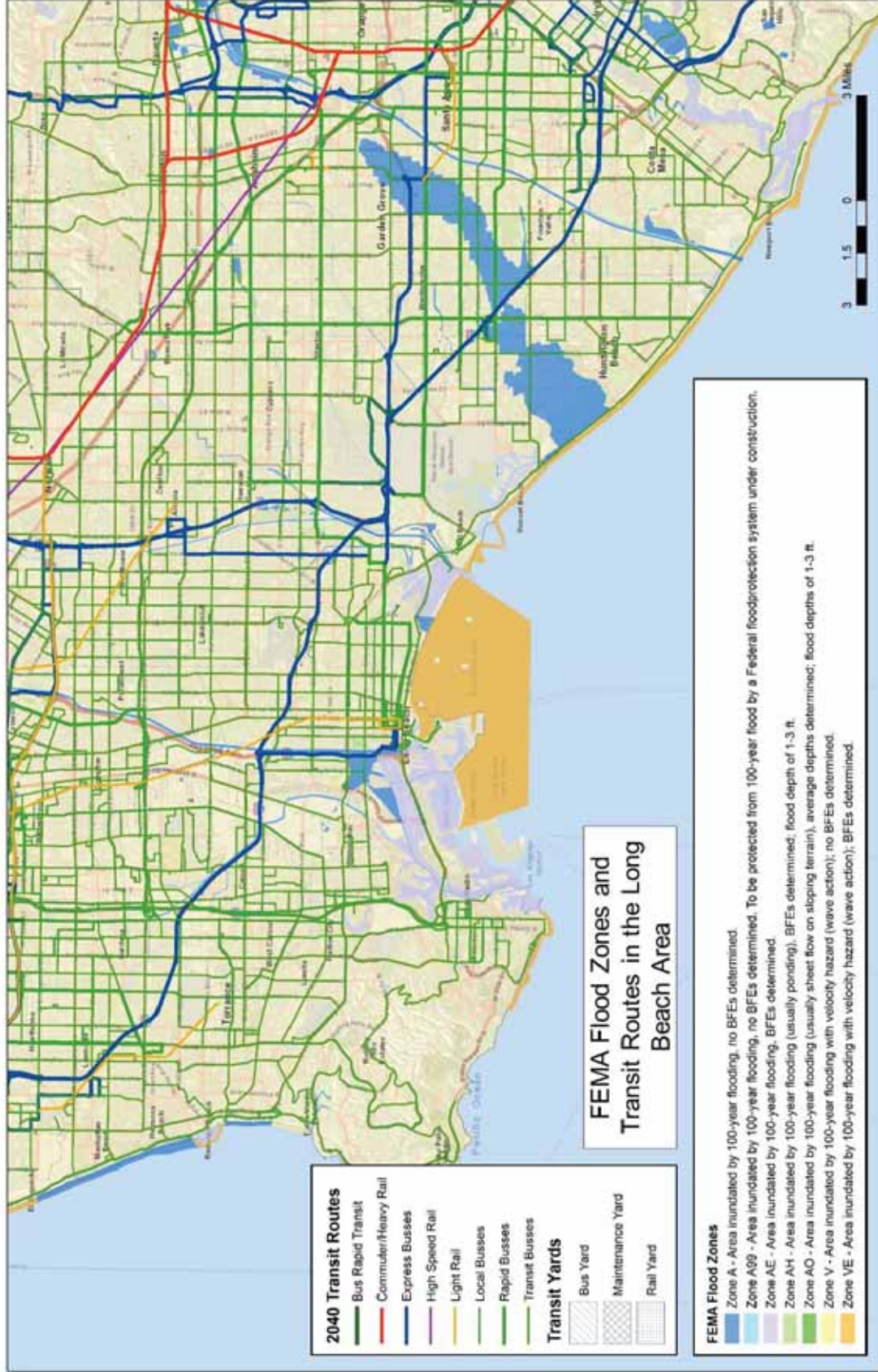
Within the SCAG Region, there are a number of areas that contain large floodplains, including Long Beach, Coachella Valley, and western Imperial County, as illustrated in the following maps.



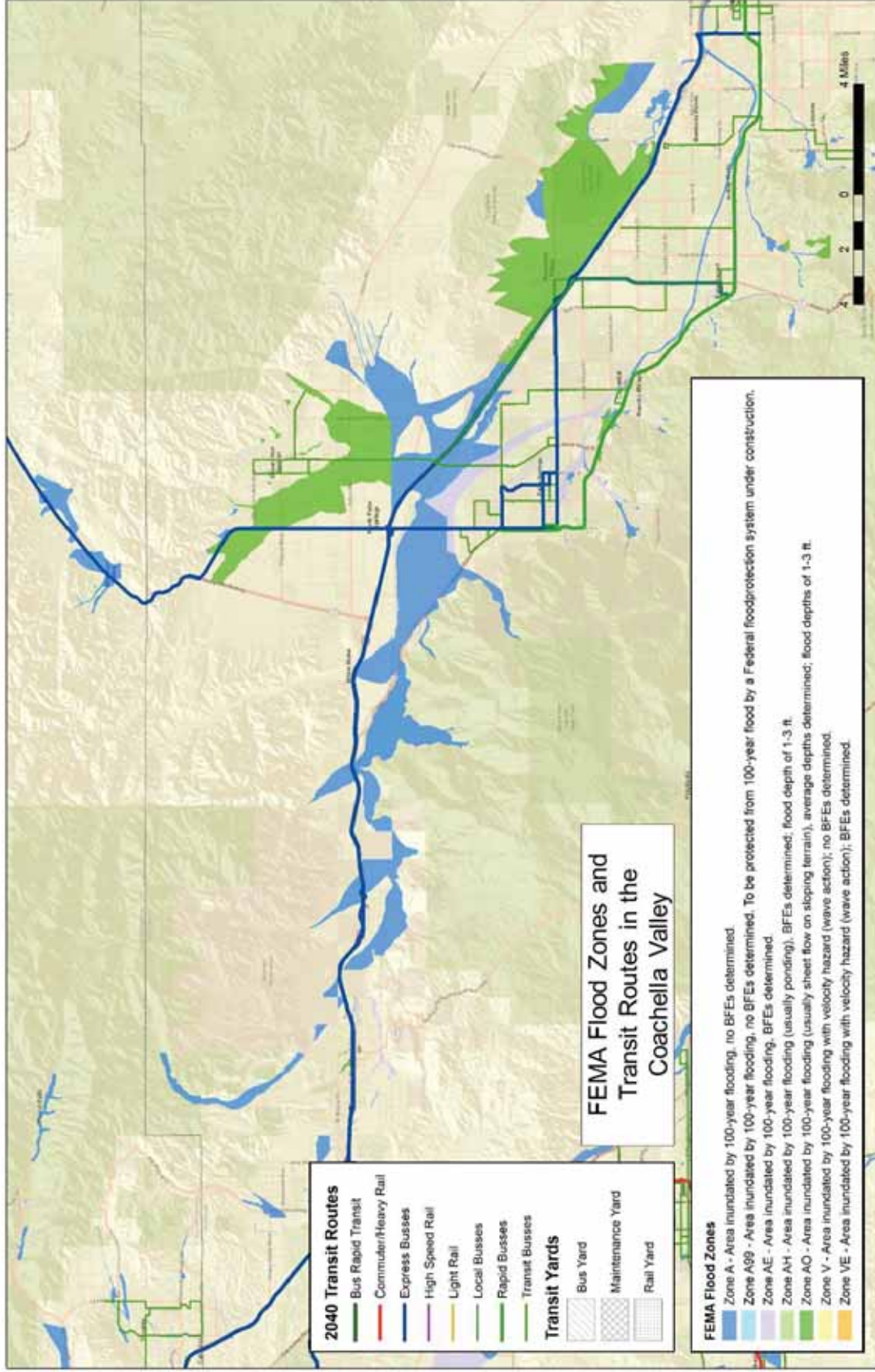
# Flood Zones: SCAG Region



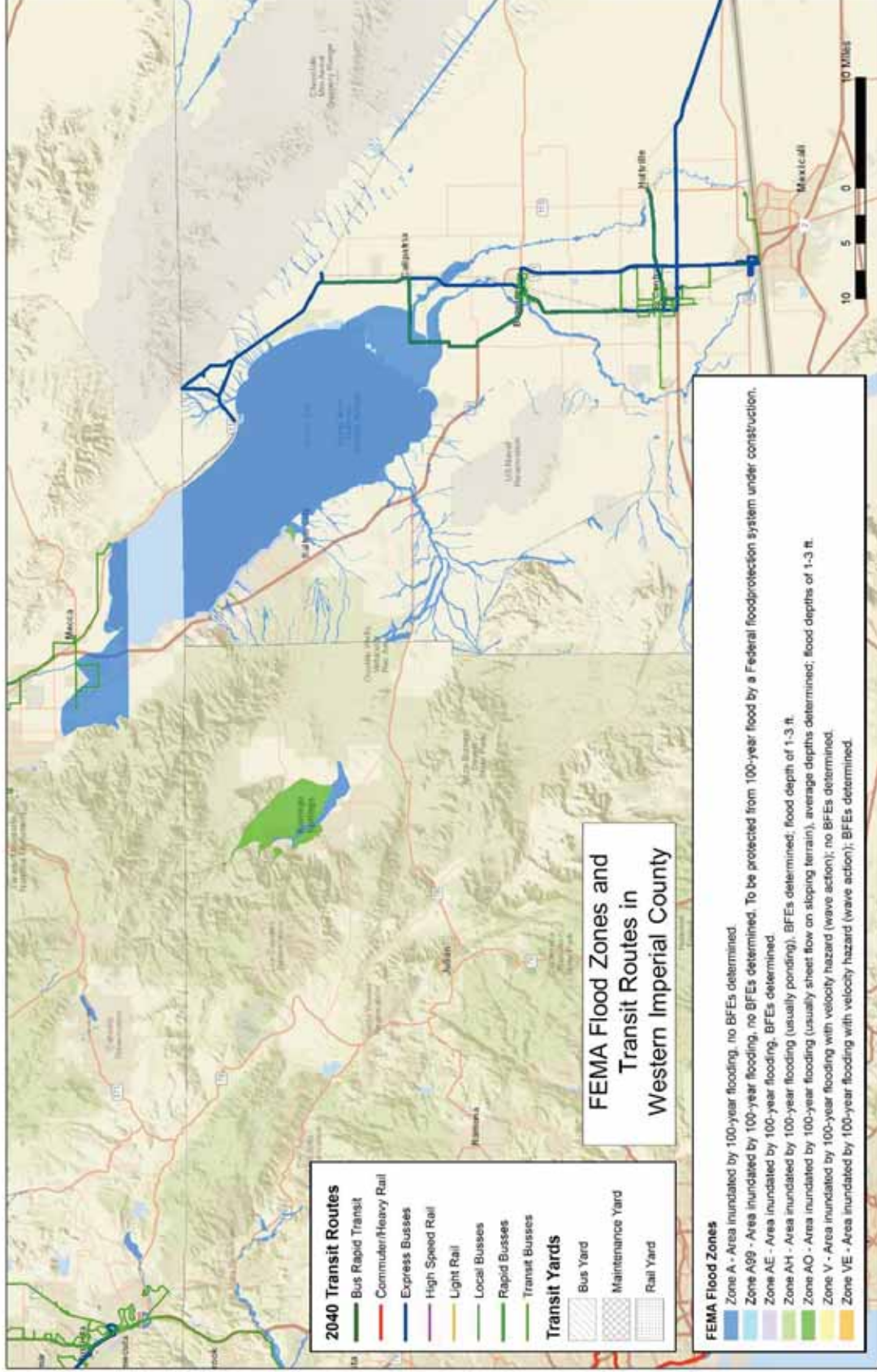
# Flood Zones: Long Beach



# Flood Zones: Coachella Valley



# Flood Zones: Western Imperial County



## EXTREME HEAT

### Extreme Heat Days

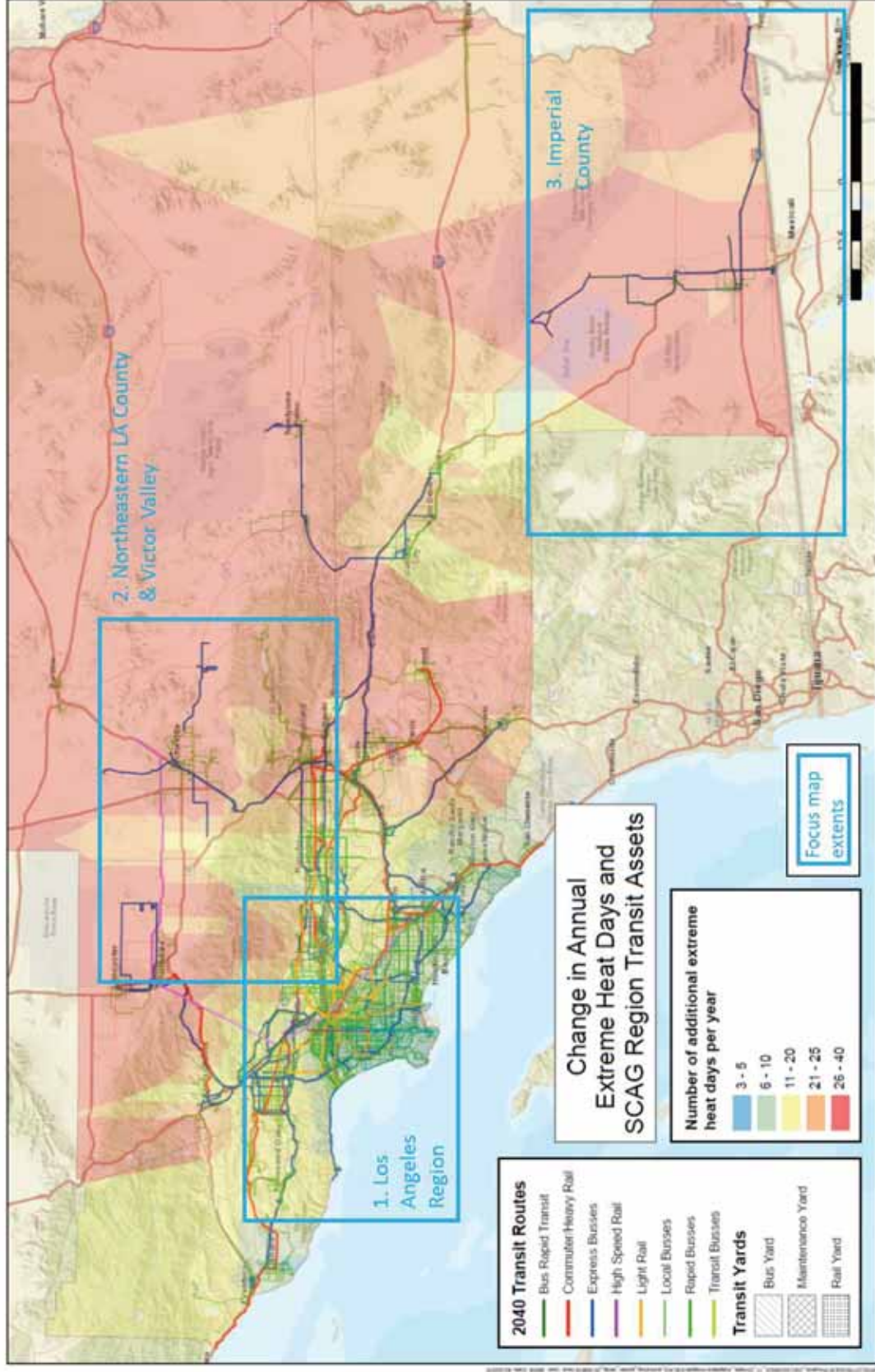
By mid-century, the number of extreme heat days<sup>1</sup> per year is projected to increase throughout the SCAG Region, with the greatest increases occurring inland, and the smallest increases occurring in the coastal areas. Within the region, the number of extreme heat days per year is projected to increase by three days to over five weeks under the high emissions scenario (RCP 8.5). Areas that are projected to experience the greatest increase in the number of extreme heat days include Victor Valley and Imperial County, as shown in the following maps.

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<sup>1</sup> Cal-Adapt defines extreme heat days as a day in April through October where the maximum temperature exceeds the location's extreme heat threshold, which is the 98<sup>th</sup> percentile of historical maximum temperatures between April 1 and October 31 based on observed daily temperature data from 1961 – 1990

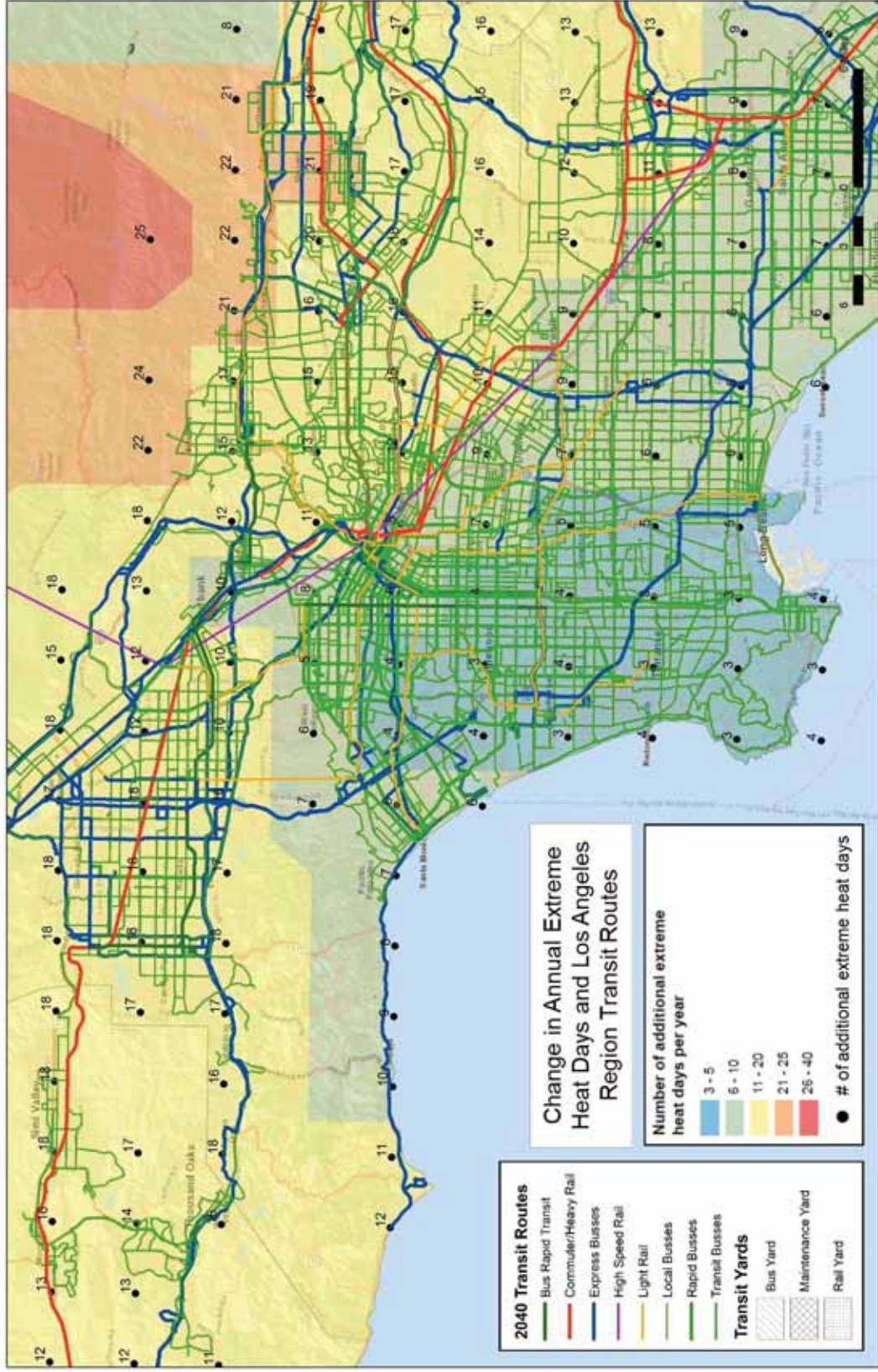
## Change in Annual Number of Extreme Heat Days: SCAG Region

Extreme heat days are days in April through October where the maximum temperature exceeds the location's extreme heat threshold, which is the 98<sup>th</sup> percentile of historical maximum temperatures between April 1 and October 31.



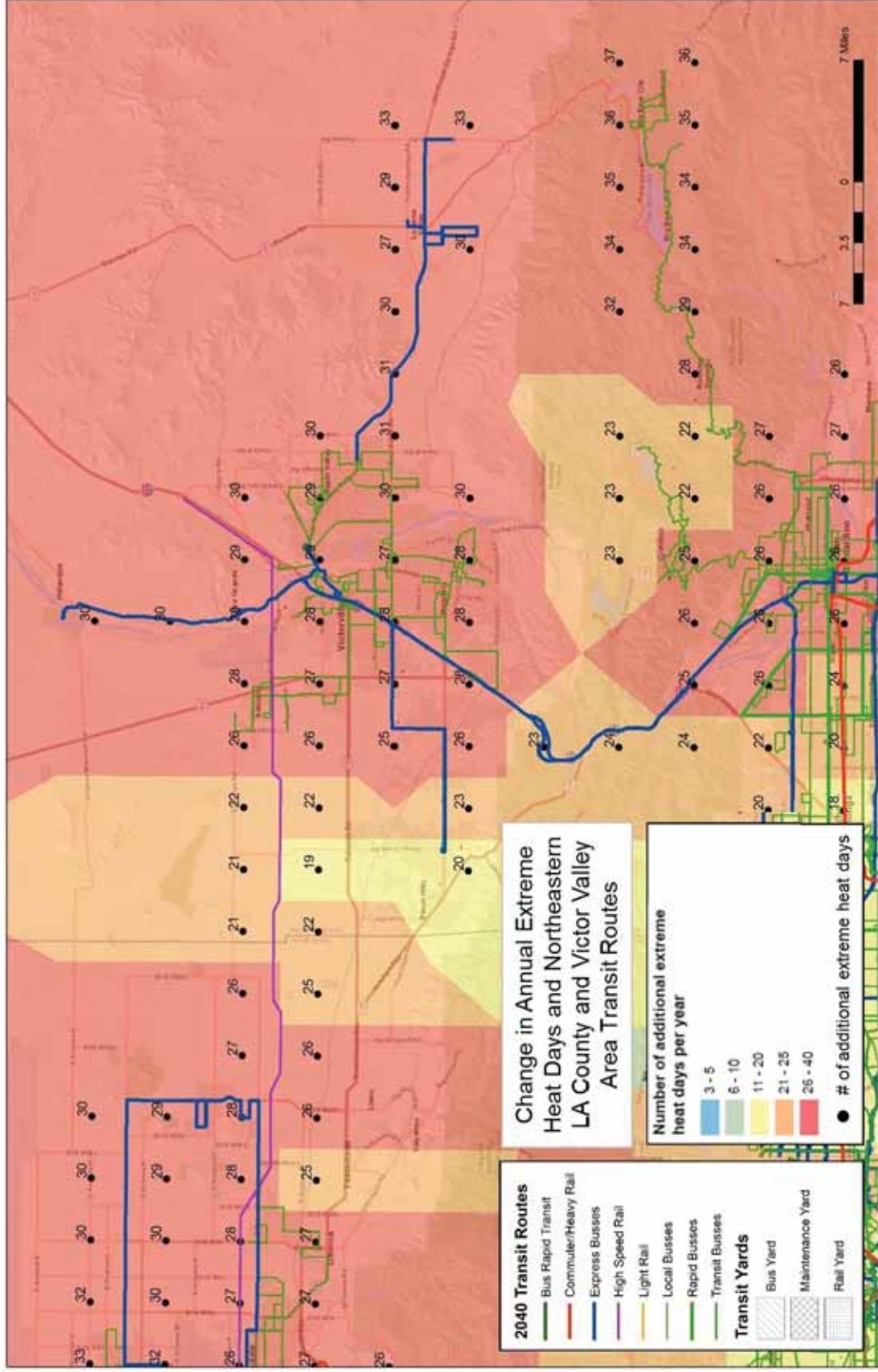
### Change in Annual Number of Extreme Heat Days: Los Angeles Region

Extreme heat days are days in April through October where the maximum temperature exceeds the location's extreme heat threshold, which is the 98<sup>th</sup> percentile of historical maximum temperatures between April 1 and October 31.



## Change in Annual Number of Extreme Heat Days: Northeastern LA County & Victor Valley

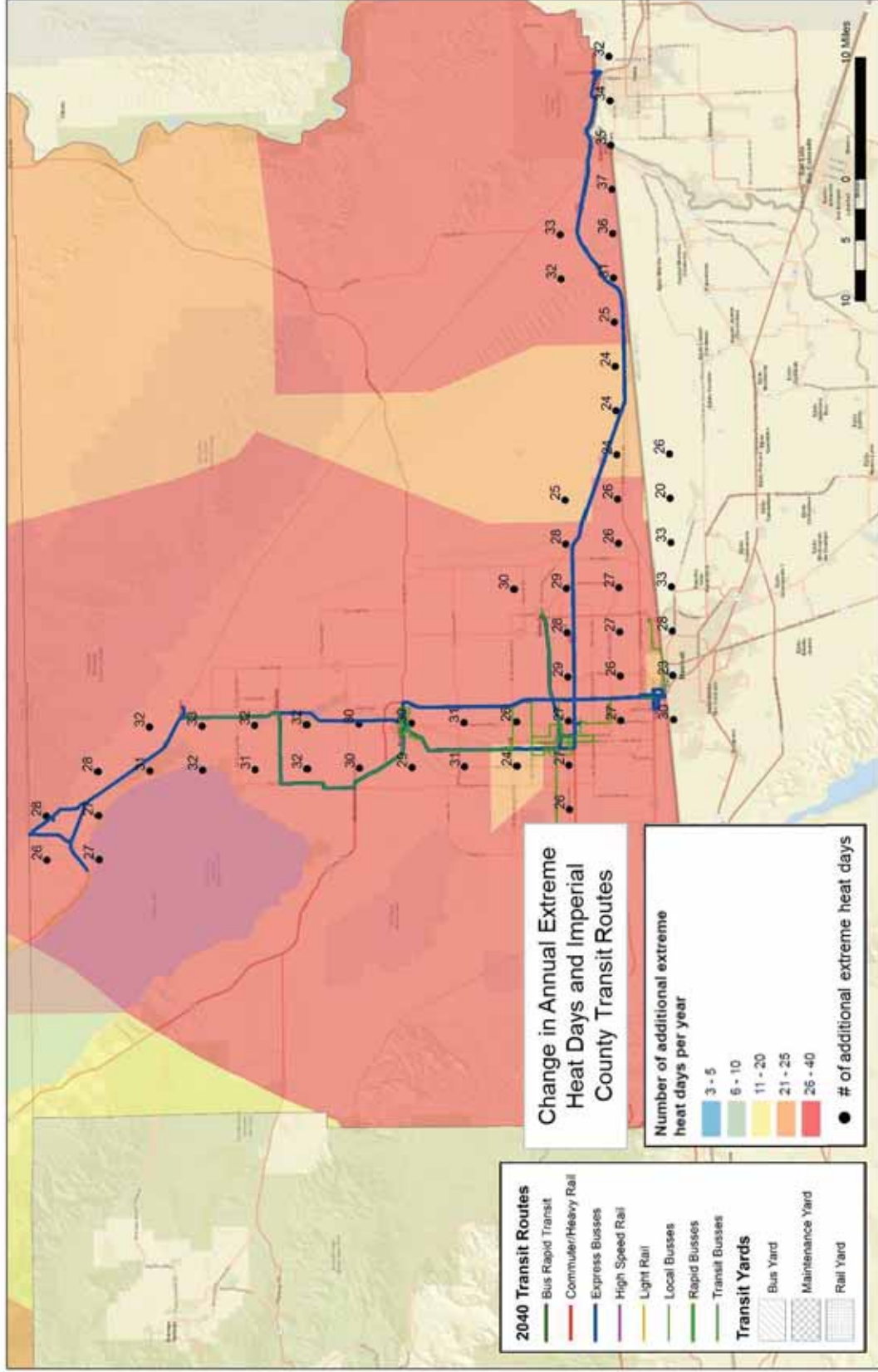
Extreme heat days are days in April through October where the maximum temperature exceeds the location's extreme heat threshold, which is the 98<sup>th</sup> percentile of historical maximum temperatures between April 1 and October 31.





### Change in Annual Number of Extreme Heat Days: Imperial County

Extreme heat days are days in April through October where the maximum temperature exceeds the location's extreme heat threshold, which is the 98<sup>th</sup> percentile of historical maximum temperatures between April 1 and October 31.



## Days that exceed 100°F

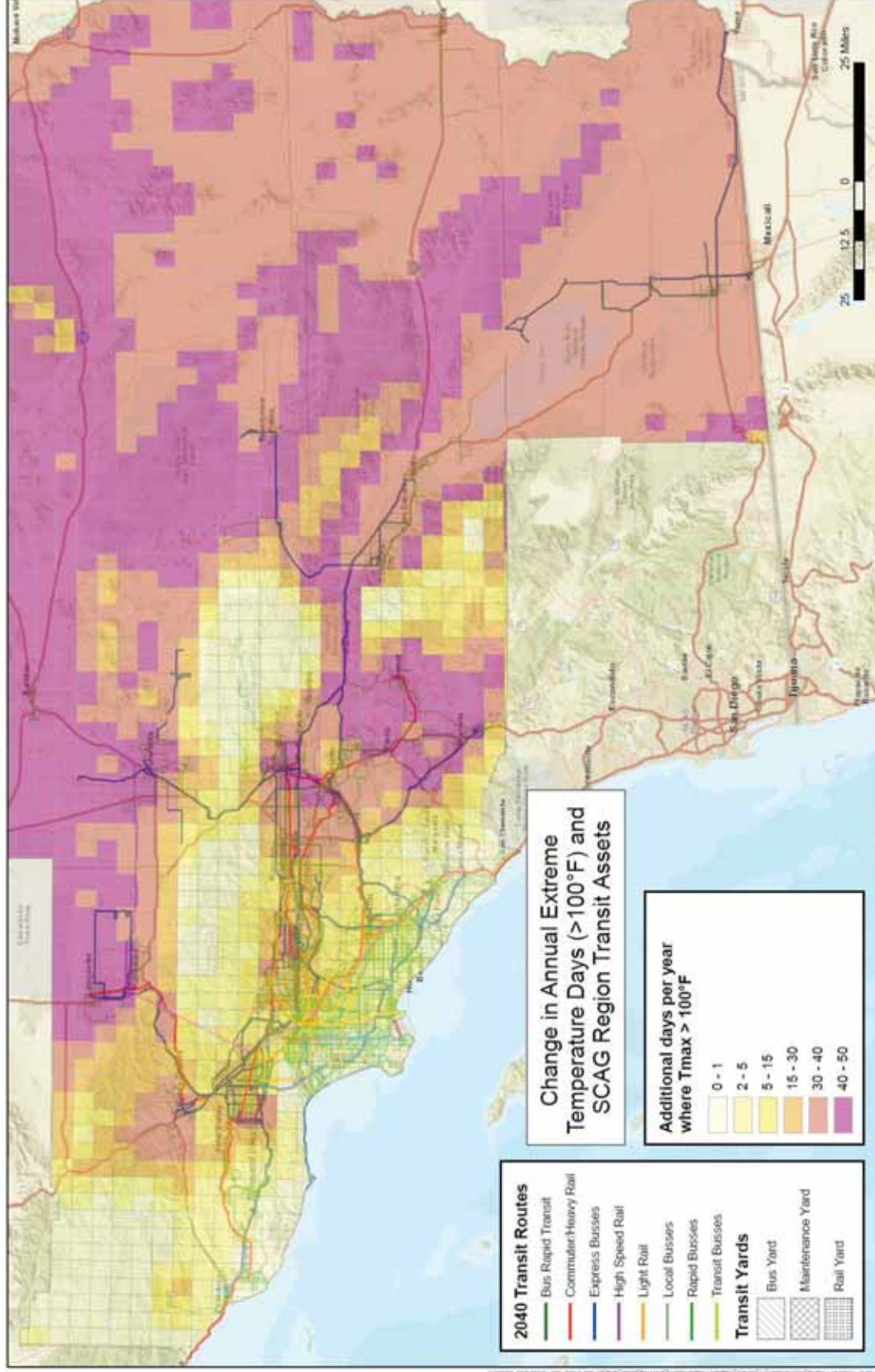
At 100°F, air conditioning units start to become overworked and can break down. Electrical support systems can also begin to malfunction. Additionally, one temperature reaches 100°F, the number of bus breakdowns and equipment malfunctions increase.<sup>2</sup>

By mid-century under a high emission scenario (RCP 8.5), the SCAG Region is projected to experience up to around seven additional weeks of days where maximum daily temperature exceeds 100°F. Coastal areas are projected to experience the smallest increase (approximately 0 – 5 days) while inland areas are projected to experience the greatest increases in days exceeding 100°F.

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<sup>2</sup> Los Angeles County Metropolitan Transportation Authority. 2012. Climate Action and Adaptation Plan. [http://media.metro.net/projects\\_sustainability/images/Climate\\_Action\\_Plan.pdf](http://media.metro.net/projects_sustainability/images/Climate_Action_Plan.pdf)

# Change in Annual Extreme Temperature Days that Exceed 100°F: SCAG Region



## Days that exceed 110°F

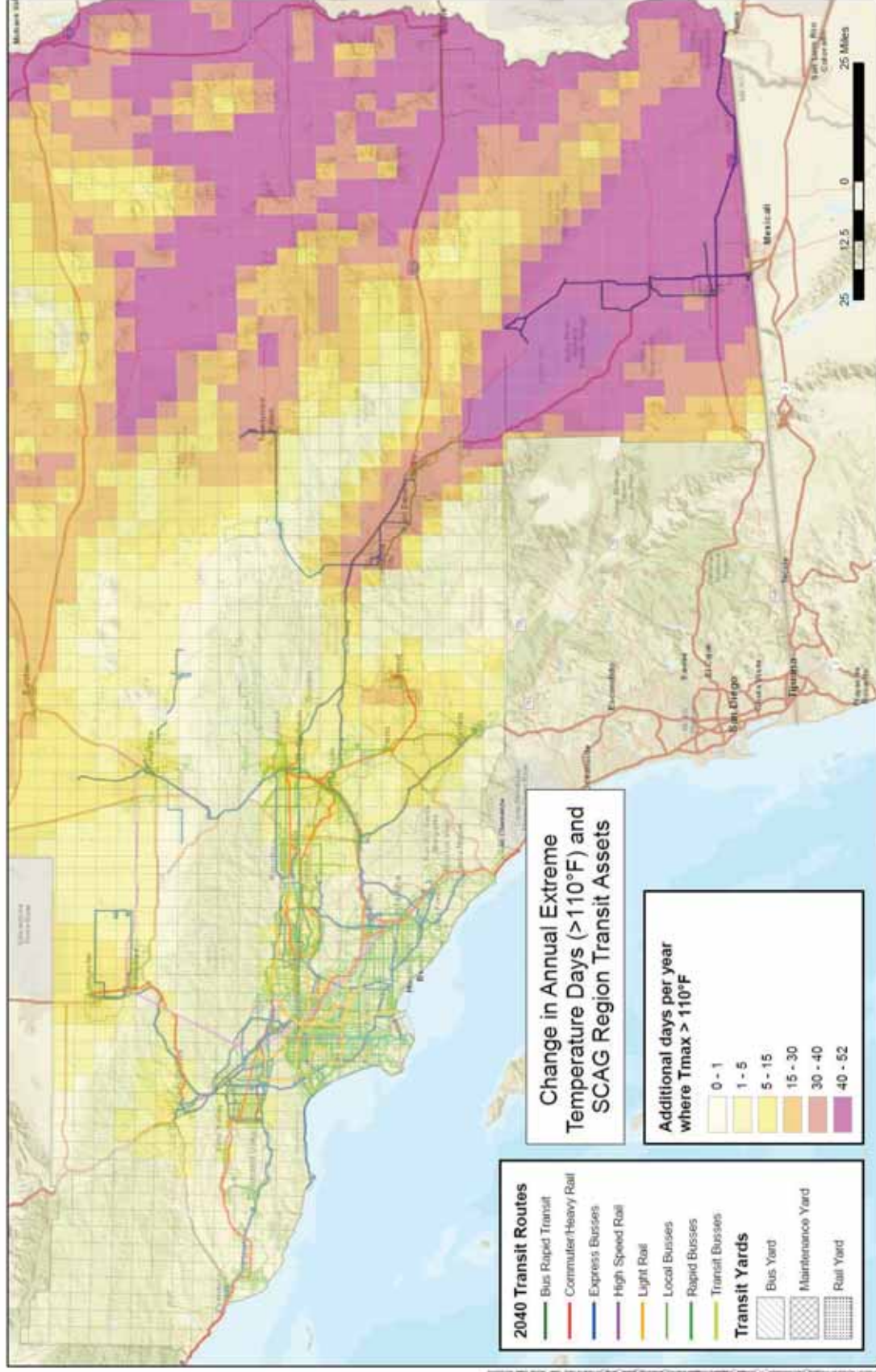
At 110°F, the risk of air conditioning system, electrical support system, bus, and equipment breakdowns and malfunctions grow. Rail buckling also begins to occur at this threshold.<sup>3</sup>

By mid-century under a high emission scenario (RCP 8.5), the SCAG Region is projected to experience up to around seven additional weeks of days where maximum daily temperature exceeds 110°F. The majority of Los Angeles, Orange, and Ventura Counties are projected to experience minimal increases (0 – 5 days). However, large parts of San Bernardino, Riverside, and Imperial Counties are projected to experience several additional weeks of days exceeding 110°F. Projected changes are shown in the map below.

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<sup>3</sup> Los Angeles County Metropolitan Transportation Authority. 2012. Climate Action and Adaptation Plan. [http://media.metro.net/projects\\_studies/sustainability/images/Climate\\_Action\\_Plan.pdf](http://media.metro.net/projects_studies/sustainability/images/Climate_Action_Plan.pdf)

# Change in Annual Extreme Temperature Days that Exceed 110°F: SCAG Region



### Days that exceed 120°F

By mid-century under a high emission scenario (RCP 8.5), the SCAG Region is projected to experience up to around two additional weeks of days where maximum daily temperature exceeds 120°F. The majority of Los Angeles, Orange, and Ventura Counties are projected to experience minimal increases (0 – 0.5 days). However, parts of San Bernardino, Riverside, and Imperial Counties are projected to experience several additional days exceeding 110°F. Projected changes are shown in the map below.

# Change in Annual Extreme Temperature Days that Exceed 120°F: SCAG Region

