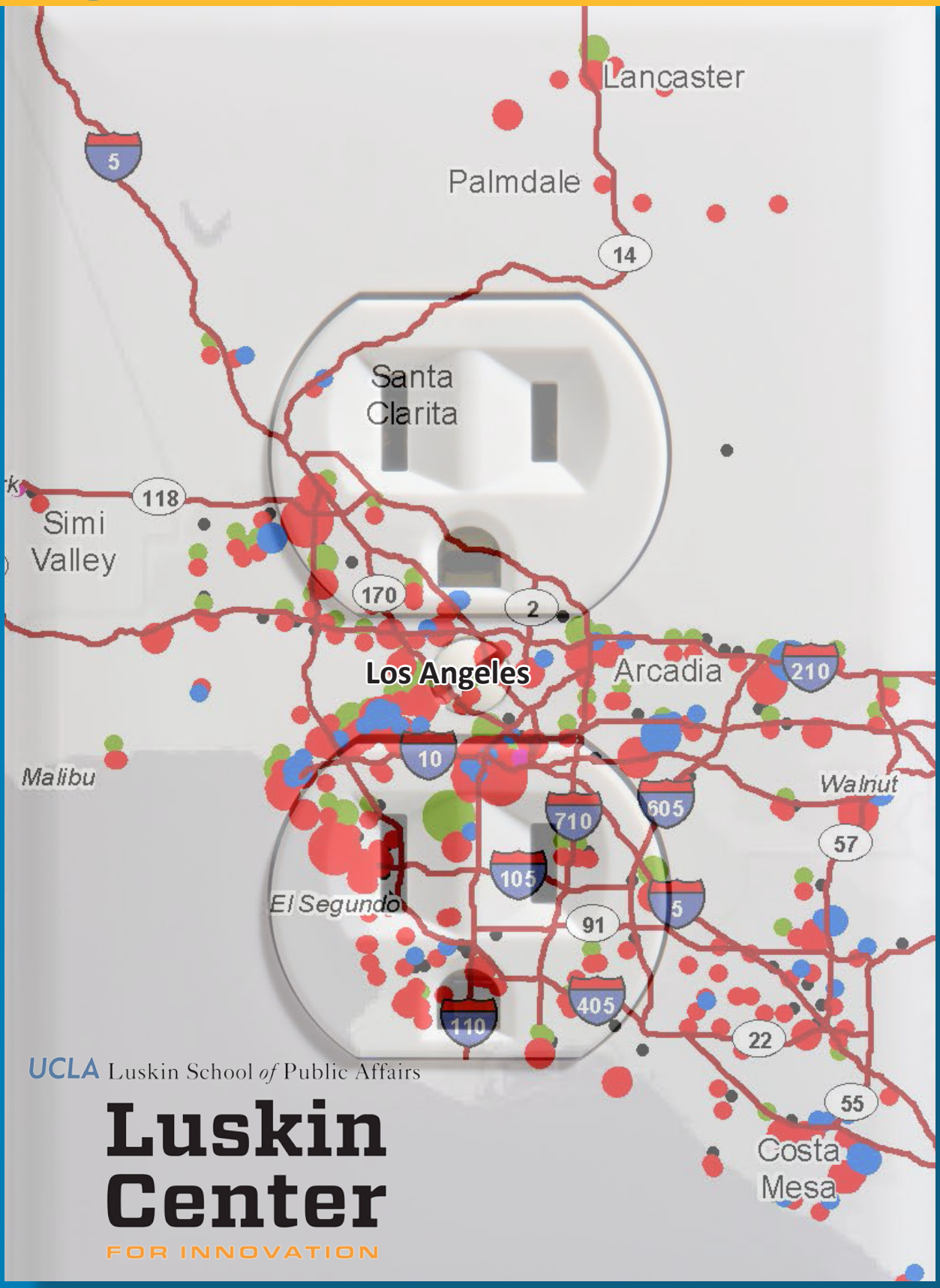
Southern California
Plug-in Electric Vehicle Atlas

SOUTHERN CALIFORNIA ASSOCIATION of GOVERNMENTS



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Southern California Plug-in Electric Vehicle Readiness Atlas

About this Document

This document was prepared for the Southern California Association of Governments (SCAG) by the UCLA Luskin Center for Innovation. It constitutes Deliverable 11 of SCAG contract 12-021-C1 to support regional planning for plug-in electric vehicle (PEV) adoption. SCAG is coordinating a multi-stakeholder group of government agencies, utilities, and university researchers to prepare multi-faceted and interdisciplinary regional PEV readiness plans. Among other purposes, these plans will help illuminate and guide strategic infrastructure investment, PEV-related economic development, and supportive policy design in Southern California.

Disclaimer

Acknowledgements

We thank the Southern California Association of Governments, the South Coast Air Quality Management District, U.S. Department of Energy, and the California Energy Commission for support of this project. In particular, we thank Marco Anderson of SCAG, Patricia Kwon of SCAQMD and the other governmental and utility members of the SoCal PEV Coordinating Council for their guidance and assistance. We also thank the University of California Office of the President Multicampus Research Programs and Initiatives for its support.

For More Information

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Southern California

Plug-in Electric Vehicle Readiness Atlas

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Council of government-level maps

Plug-in Electric Vehicles (PEVs) may provide a range of important benefits. For drivers, PEVs are a way to save money on fuel, avoid trips to the gasoline station, contribute to energy independence, and improve local air quality. For utilities, PEVs represent a new source of demand for power even as they support efficient use of energy produced during overnight hours. For state and regional air-quality regulators, PEVs help reduce criteria air pollutants and greenhouse gas (GHG) emissions.

To fully realize the benefits of PEVs, planners must coordinate and facilitate the growth of two complementary markets: one for PEVs and another for the electric charging opportunities that these vehicles need to refuel. This Atlas describes how many PEVs are in a given neighborhood and how their spatial concentrations vary over the course of a day as their drivers travel to workplaces and retail destinations. This Atlas also projects PEVs growth over the next ten years within neighborhoods and municipalities in each of the 15 councils of government (COGs) within the Southern California Association of Governments region.

This Atlas also maps potential charging infrastructure opportunities to support and complement growth in the PEV market. It identifies the locations and sizes of workplaces, multi-unit residences and retail establishments that could potentially host PEV charging. Lastly, the Atlas includes maps of other resources that support PEV charging, such as existing publicly-accessible charging stations and stand-alone parking facilities.

This spatial information enables to planners to know where PEVs are currently and where growth will occur in the future. This will help them prioritize the municipal planning reforms such as those described in the Southern California PEV Readiness Plan. It describes where latent PEV demand is constrained because of the challenges of installing charging opportunities in multi-unit residences. It also describes the locations of workplaces and retail establishments that are in neighborhoods with a higher density of PEVs during the day and evening. With this information, planners can take the next steps to provide the targeted technical assistance to these sites as described in the Southern California PEV Readiness Plan.

The technical appendix that follows the Atlas provides detailed information on data sources and analyses used to generate each map. This Atlas features the following maps of the neighborhoods and municipalities within each COG in the SCAG region:

1. **PEV registration density as of 2012.** Knowing how many PEVs are currently registered in a given area will indicate the location of current and near-future demand for residential charging. By extension, this information can help planners and utilities anticipate locations that will carry additional nighttime electrical load.

2. **PEV morning travel to work, providing spatial daytime PEV density at or near workplaces.** Understanding where PEVs are concentrated during morning peak hours (6:00 a.m. to 9:00 a.m.) can help planners and utilities identify neighborhoods where there will be demand for daytime charging.

3. **Workplaces identified by numbers of employees.** Planners can target the largest employers for workplace charging initiatives, as they presumably host the largest numbers of parking spaces on-site and can potentially serve the highest numbers of employees.

4. **Workplaces overlaid with morning peak PEV density.** Planners and utilities can use these maps to assess the potential utilization of workplace charging by comparing the spatial distribution of employers and weekday morning peak travel destinations for PEVs.

5. **Publicly-accessible charging locations, identified by power level and number of stations per location.** Planners can use these maps to compare the location of existing publicly-accessible charge stations with the locations of employment centers, retail centers and PEV daytime destinations, also mapped at the COG level in the Atlas. The maps can also be used to identify where there are gaps in meeting demand for charging. For MUDs that do not have parking, publicly-accessible sites will become important charging options. The maps identify the number of charging units/cords available at each location along with the level of service (Level 1, Level 2, etc., or "Unknown" where there is charging available but the quantity of connectors and their level of service could not be immediately determined). The maps are based on information collected during the summer and fall of 2012.

6. **Multi-unit dwellings (MUDs) by number of units and density.** City planners can use these maps to identify specific buildings and/or MUD owners that could potentially host charging on-site. Planners can use the maps to compare spatial distributions of MUD density with employment and commercial density, publicly accessible charging stations, and stand-alone parking areas to assess the potential for these other PEV sites to serve the charging needs of MUD residents. Mapping the precise location of MUDs and knowing the density of units on a site will be of particular use in utility planning. Utilities can use such maps to anticipate where upgrades may be needed for transformers and distribution stations to accommodate PEV charging at MUDs.

7. **Retail destinations, from strip development to regional centers.** Many PHEV drivers find it valuable to charge when visiting retail destinations in order to maximize electric miles driven. After locating general categories of retail charging opportunities on the map, planners can turn to Chapter 8 of the Southern California PEV Readiness Plan for more detailed descriptions of how long cars are typically parked at specific types of retail destinations.

8. **Retail destinations overlaid with PEV mid-day travel, providing spatial retail PEV density at or near retail centers.** Planners and utilities can use these maps to assess potential for retail charging by comparing the spatial distribution of retail centers and mid-day travel destinations (9:00 a.m. to 3:00 p.m.) for PEVs.

9. **Stand-alone parking facilities.** Publicly-accessible parking facilities can fill a gap in PEV charging, particularly in older urban cores where retail stores and even some workplaces and multi-unit dwellings do not have dedicated parking. Park and ride lots in particular may substitute for Level 1 workplace charging if workers leave their PEVs parked all day. Parking lots and structures greater than 2.5 acres that are not attached to other land uses are mapped at the COG level.

The Atlas provides this suite of spatial tools for PEV readiness planning for the following COGs:

- Arroyo Verdugo Subregion
- City of Los Angeles
- Coachella Valley Association of Governments
- Gateway Cities Council of Governments
- Imperial County Transportation Commission
- Las Virgenes Malibu Council of Governments
- North Los Angeles County
- Orange County Council of Governments
- San Bernardino Associated Governments
- San Fernando Valley Council of Governments
- San Gabriel Valley Council of Governments
- South Bay Cities Council of Governments
- Ventura County Council of Governments
- Western Riverside Council of Governments
- Westside Cities Council of Governments

Utility PEV growth projections

The Southern California Plug-in Electric Vehicle Atlas also provides projections of PEV growth and electric miles driven over 10 years by utility service territory for the following utilities[1]:

- Azusa Light and Power
- Burbank Water and Power
- Cerritos Electric Utility
- Glendale Water and Power
- Pasadena Water and Power
- Vernon Light and Power
- Anaheim Public Utilities Department
- City of Banning Electric Utility
- City of Colton Utilities Services
- Imperial Irrigation District
- Los Angeles Department of Water and Power
- Riverside Public Utilities
- Southern California Edison
- Anza Electric Cooperative
- City of Industry Electric Utility Service
- Moreno Valley Electric Utility
- Rancho Cucamonga Municipal Utility
- San Diego Gas & Electric (portion within SCAG)

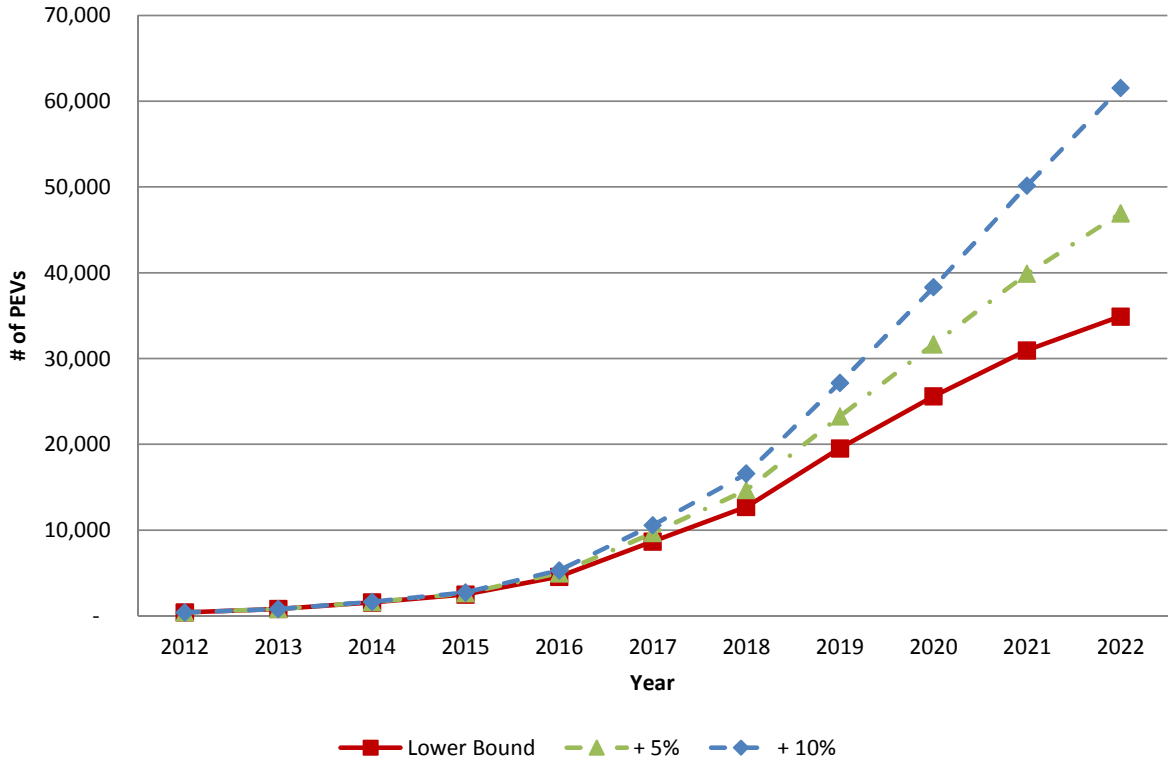
These projections are designed to help regional planners and utilities locate current and future demand for PEV charging and coordinate efforts to meet that demand.

1 Utilities not represented by the Southern California Public Power Authority and that have less than 2 PEVs attributable to their service territories have been excluded from this analysis. They are Bear Valley Electrical Service, Corona Water and Power, Needles Public Utility Authority, and Victorville Municipal Utility Services.

Ventura Council of Governments

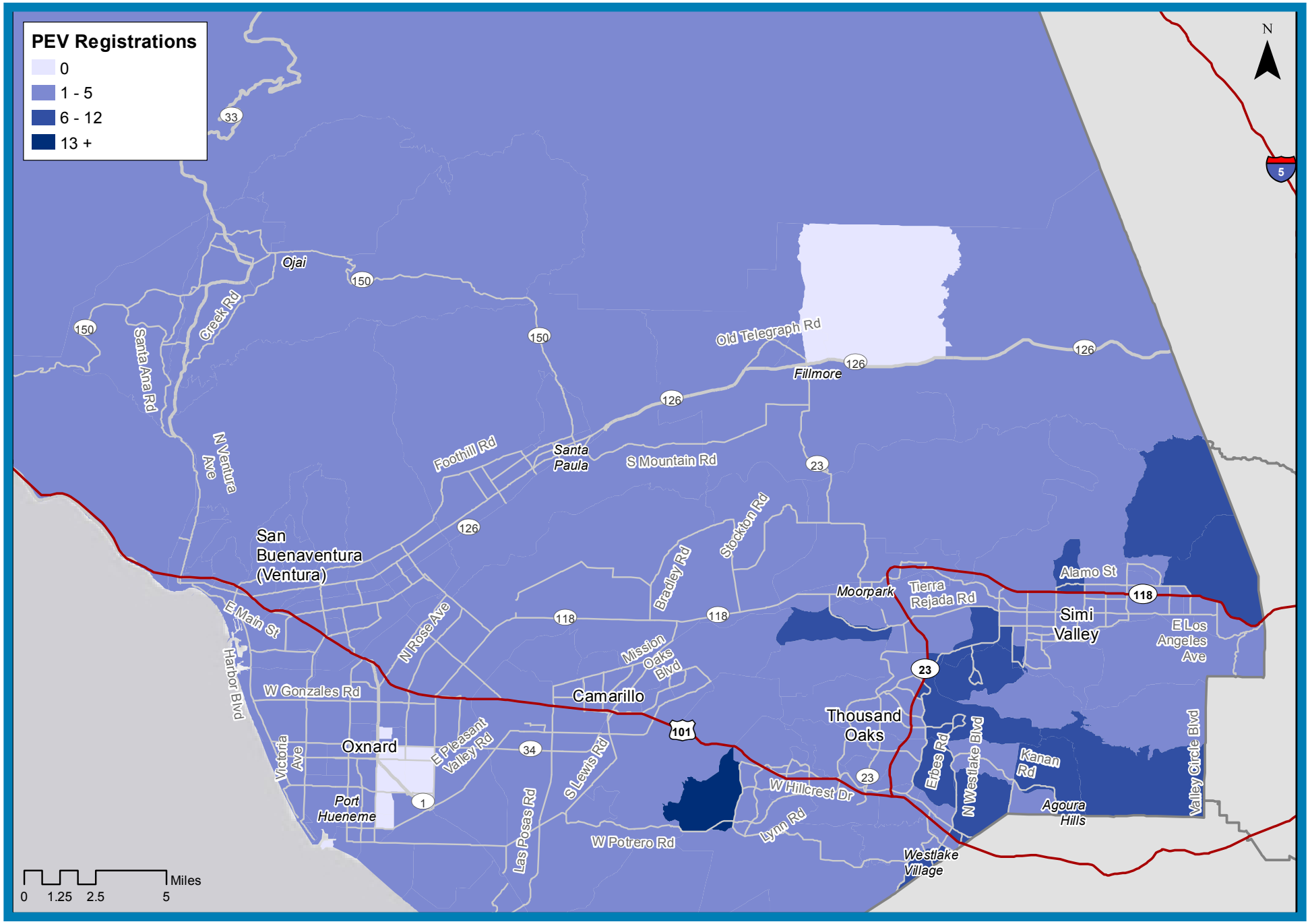
PEV Growth

Year	Cumulative PEV registrations*		
	Lower Bound	+ 5%	+ 10%
2012	405	405	405
2013	810	810	810
2014	1,564	1,605	1,620
2015	2,489	2,634	2,740
2016	4,566	4,964	5,300
2017	8,650	9,650	10,570
2018	12,700	14,651	16,576
2019	19,529	23,262	27,147
2020	25,597	31,653	38,297
2021	30,958	39,866	50,148
2022	34,893	46,926	61,537

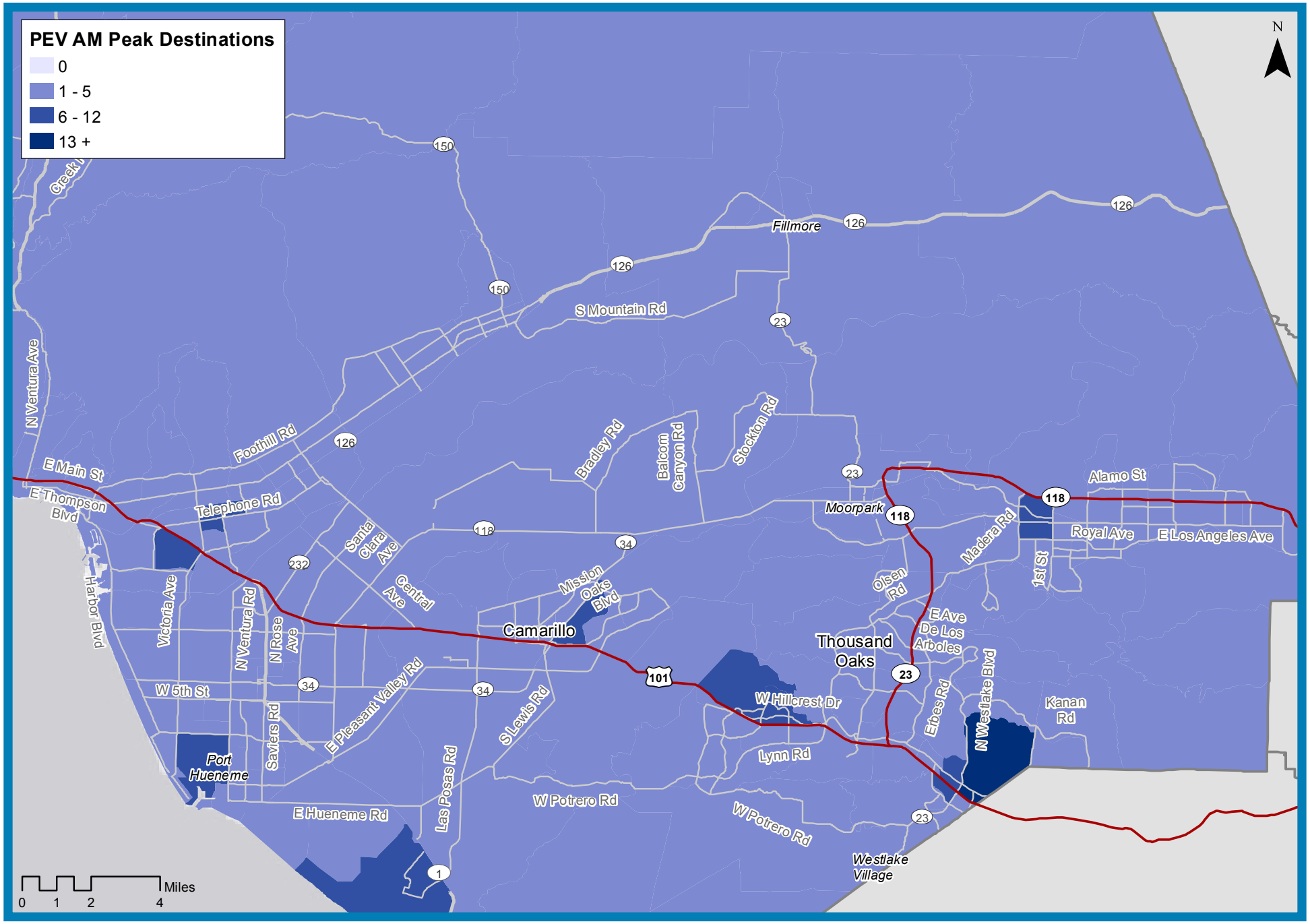


** The +5% and +10% projections begin in 2014, when uncertainty becomes greater.*

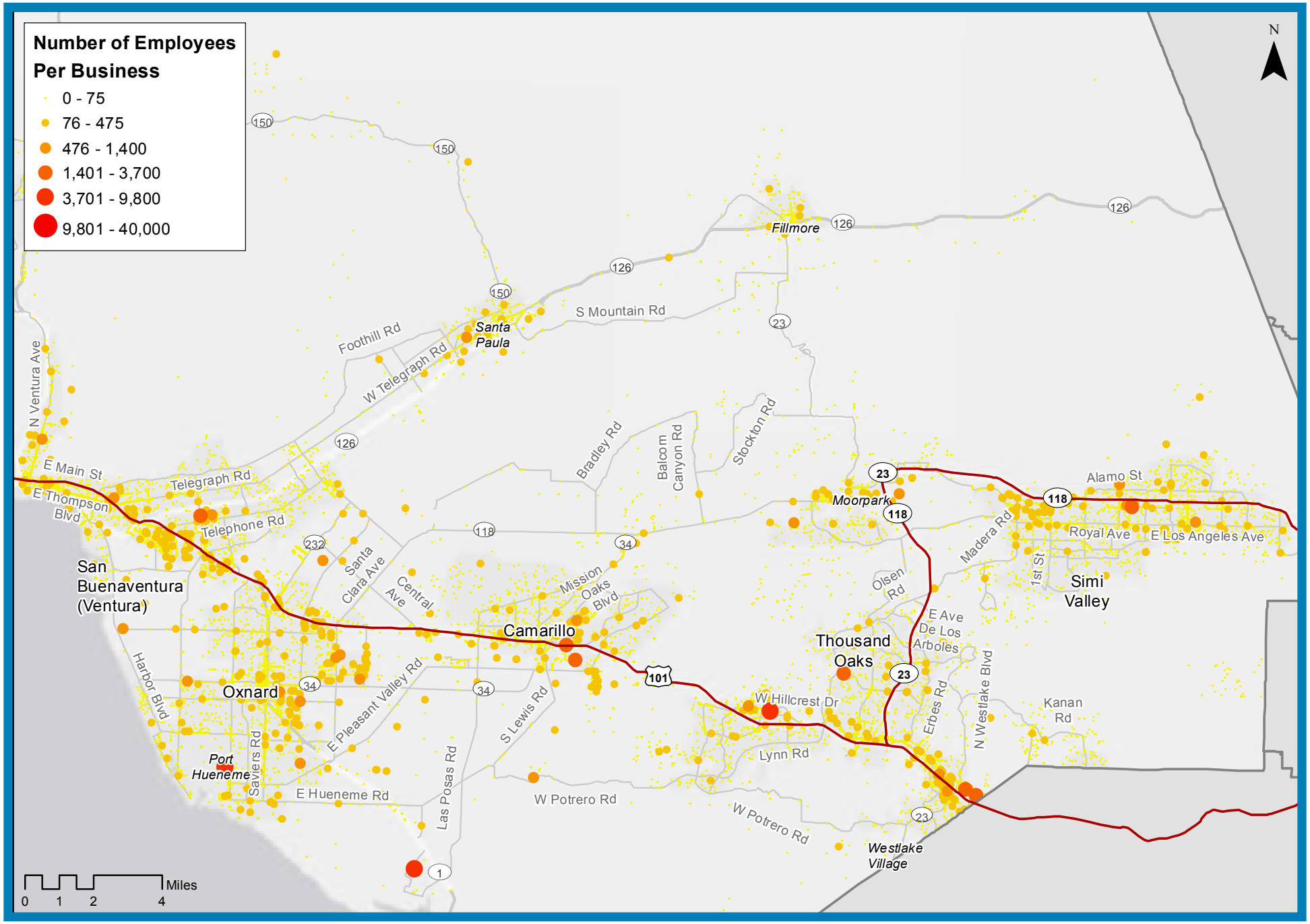
Plug-in Electric Vehicle Registrations



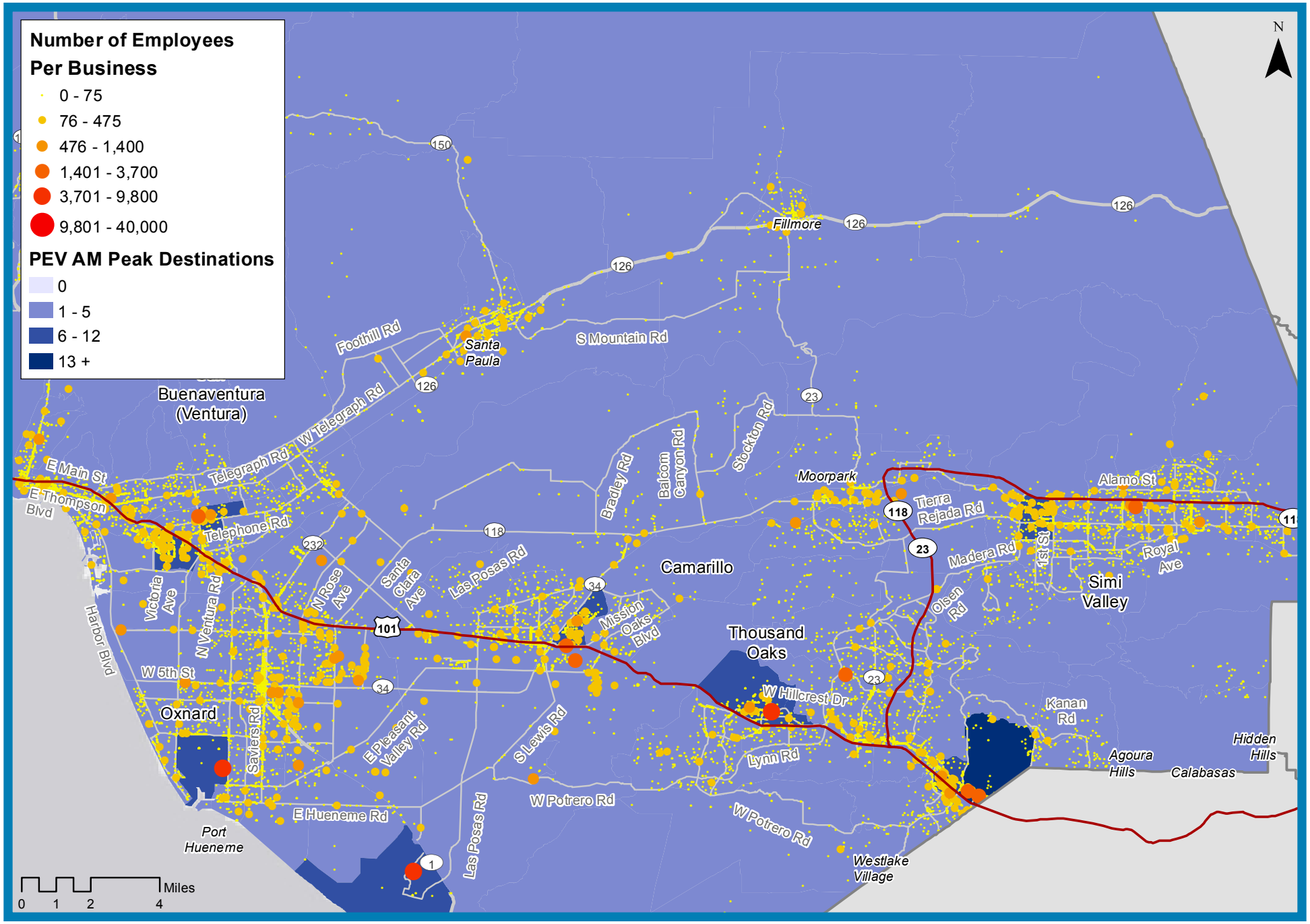
Plug-in Electric Vehicle Morning Peak Destinations



Workplaces by Number of Employees



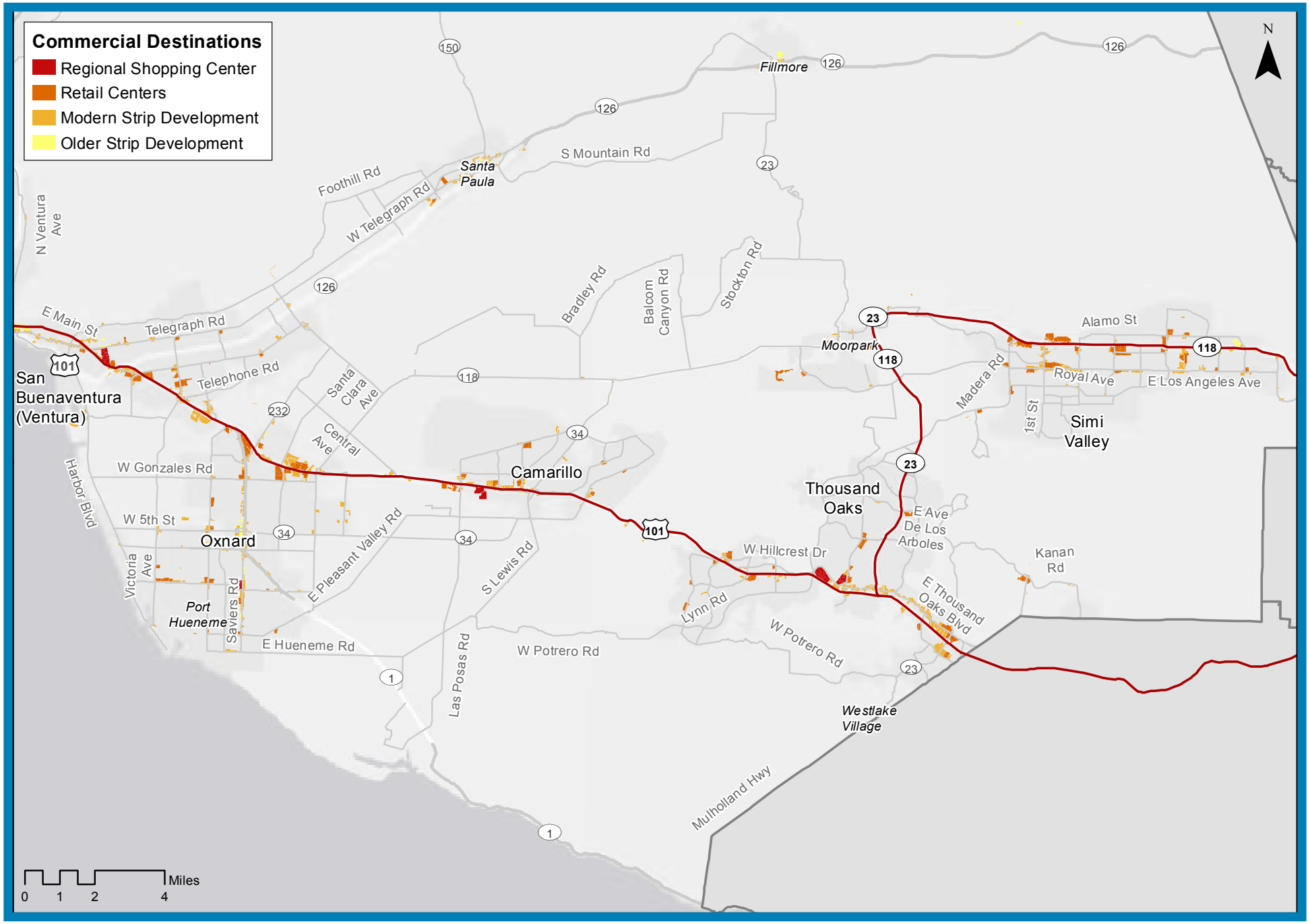
PEV Morning Peak Destinations and Workplaces



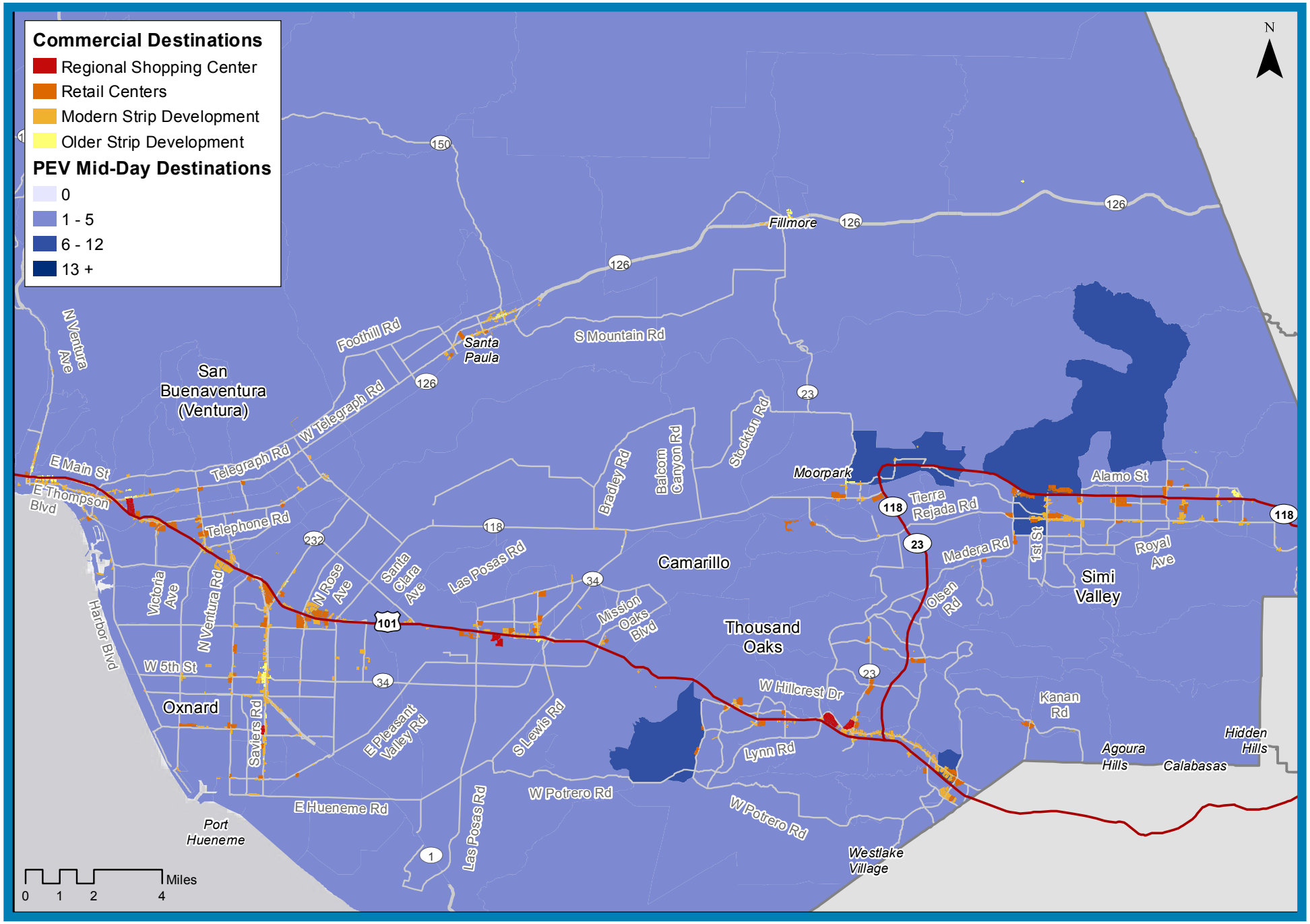
Publicly-Accessible Charging Stations (Summer/Fall 2012)

Multi-Unit Residential

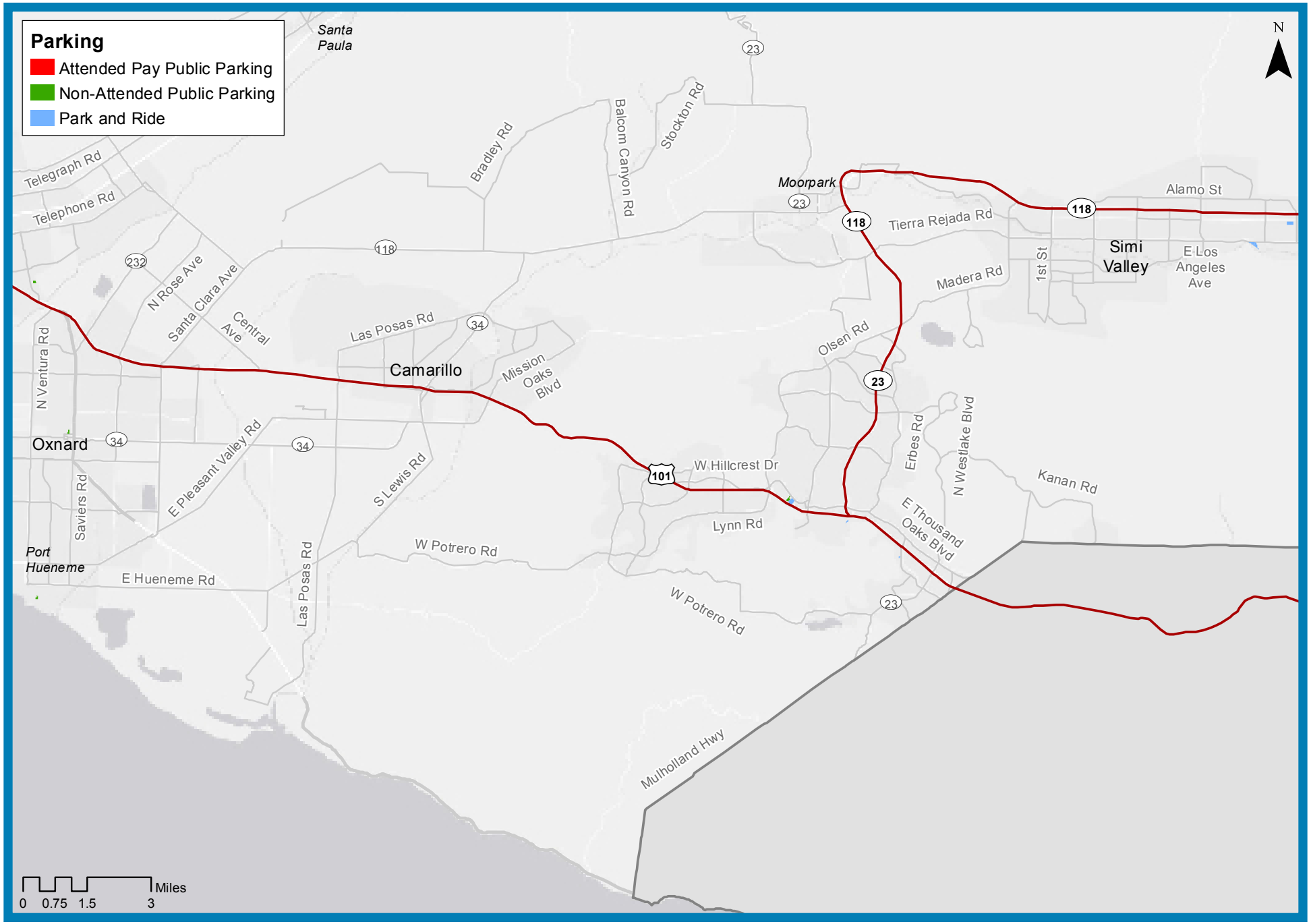
Commercial (Retail) Destinations



PEV Mid-Day Destinations and Commercial (Retail) Locations



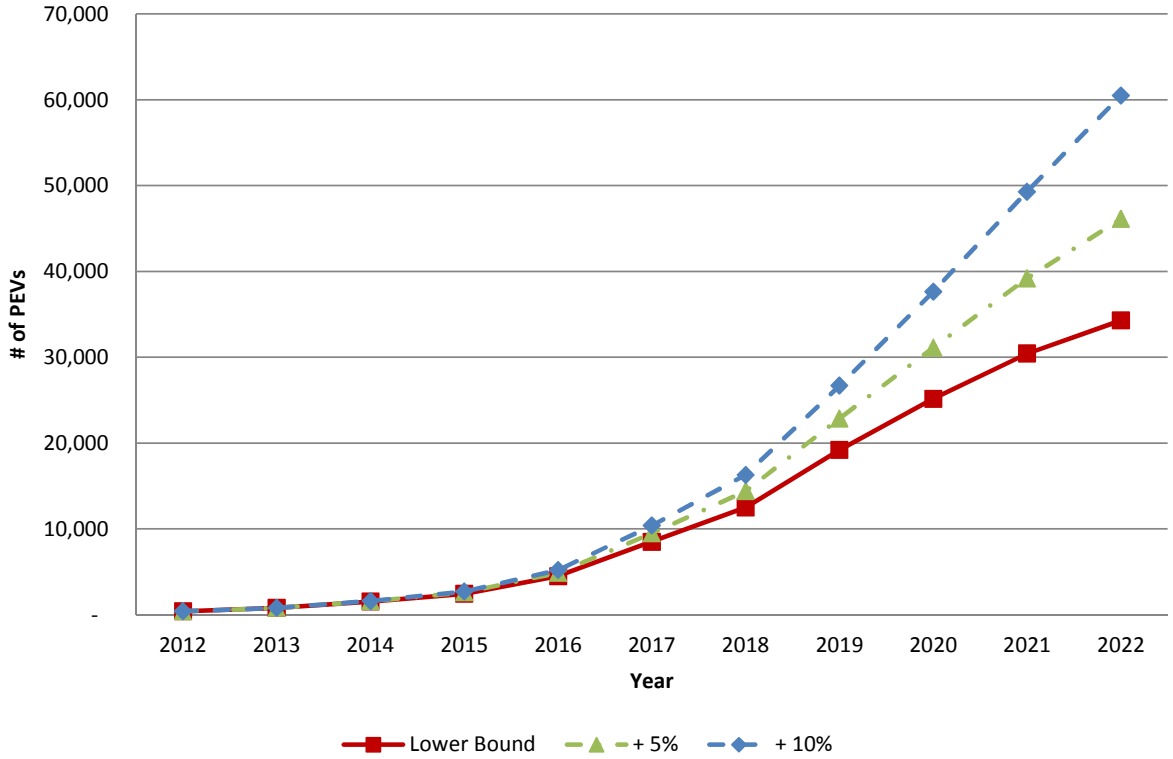
Stand-alone Parking Facilities



Western Riverside Council of Governments

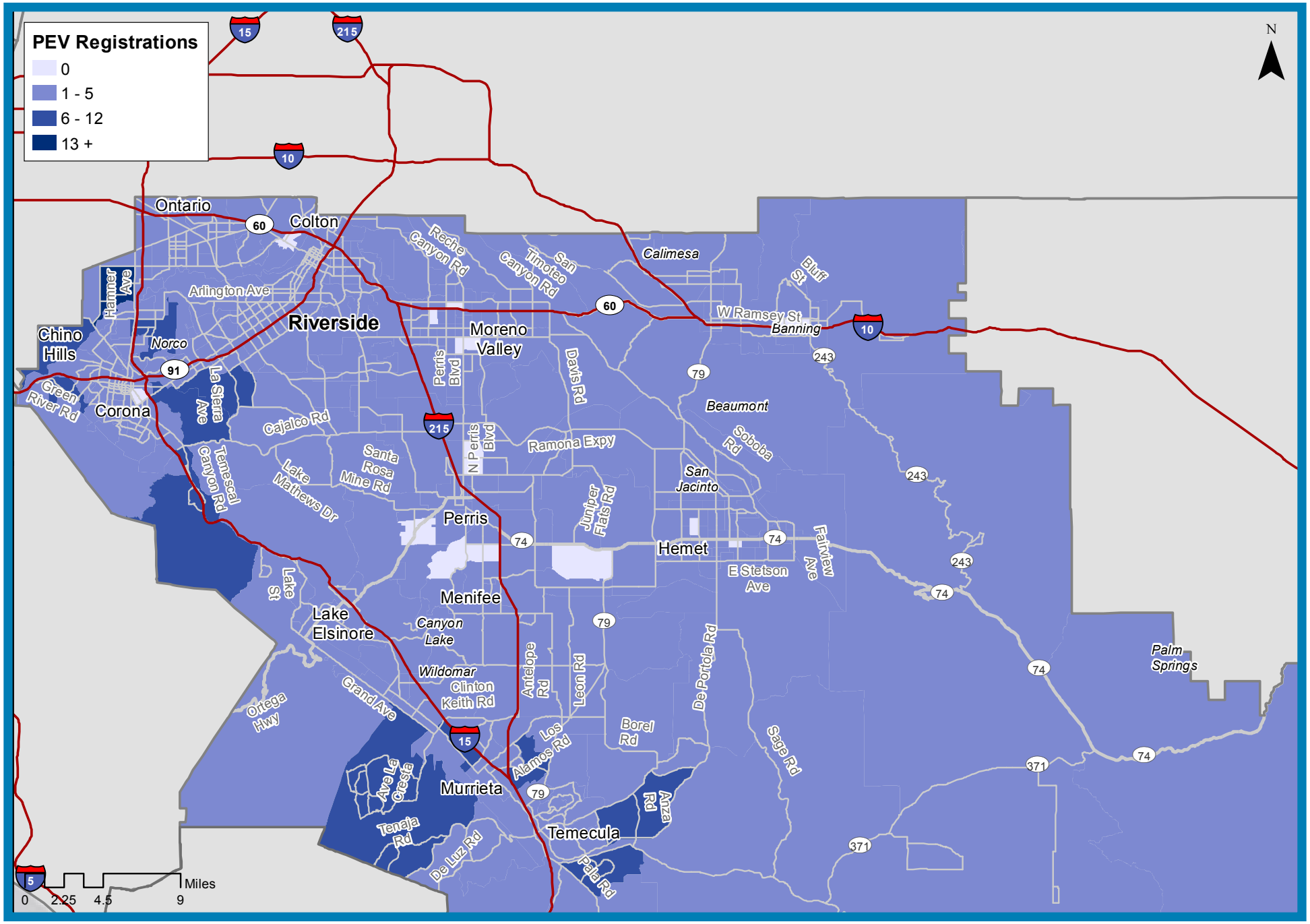
PEV Growth

Year	Cumulative PEV registrations*		
	Lower Bound	+ 5%	+ 10%
2012	398	398	398
2013	796	796	796
2014	1,537	1,577	1,592
2015	2,446	2,589	2,693
2016	4,488	4,878	5,209
2017	8,500	9,484	10,387
2018	12,480	14,398	16,290
2019	19,192	22,860	26,678
2020	25,154	31,106	37,635
2021	30,423	39,177	49,281
2022	34,290	46,115	60,473

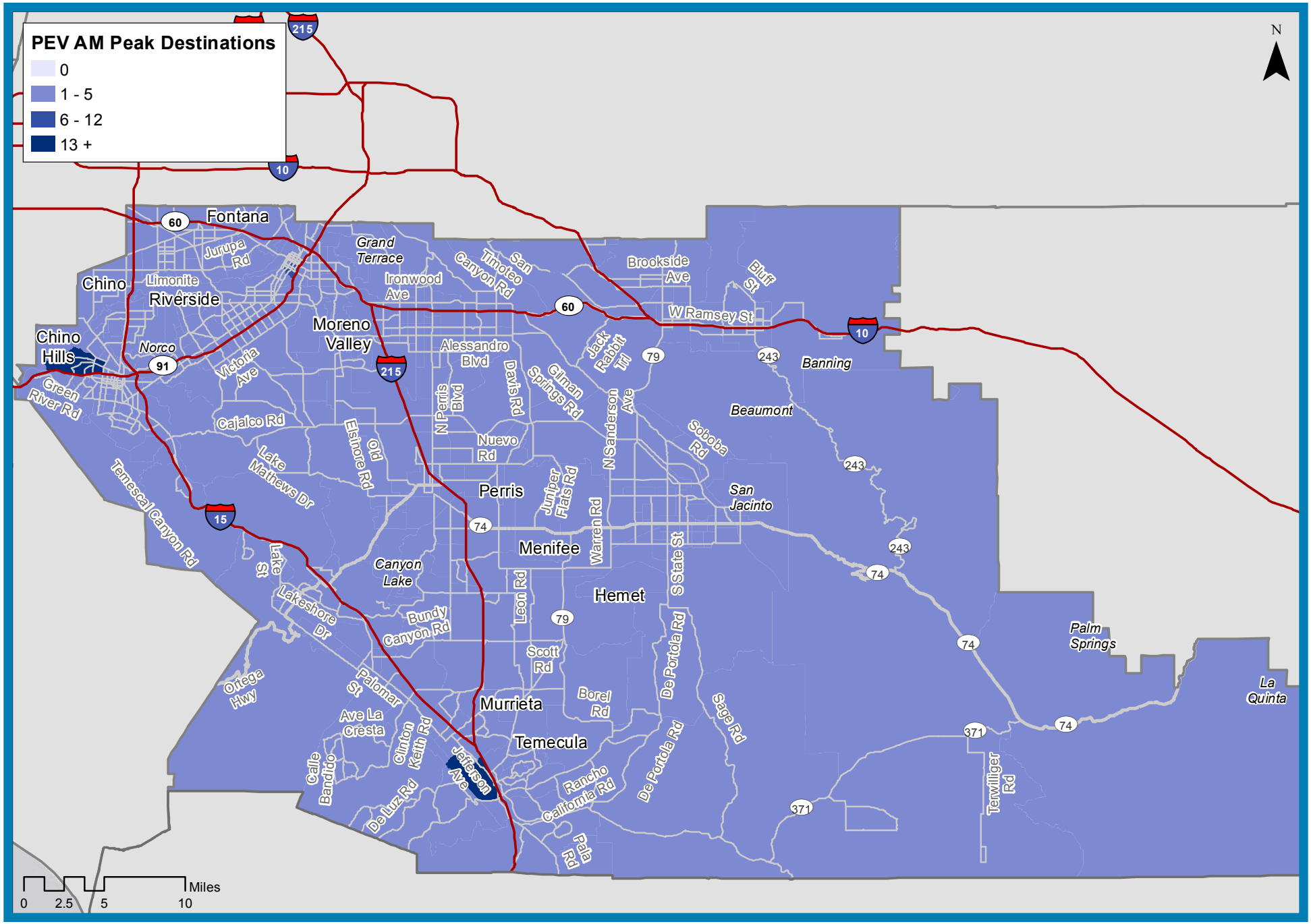


** The +5% and +10% projections begin in 2014, when uncertainty becomes greater.*

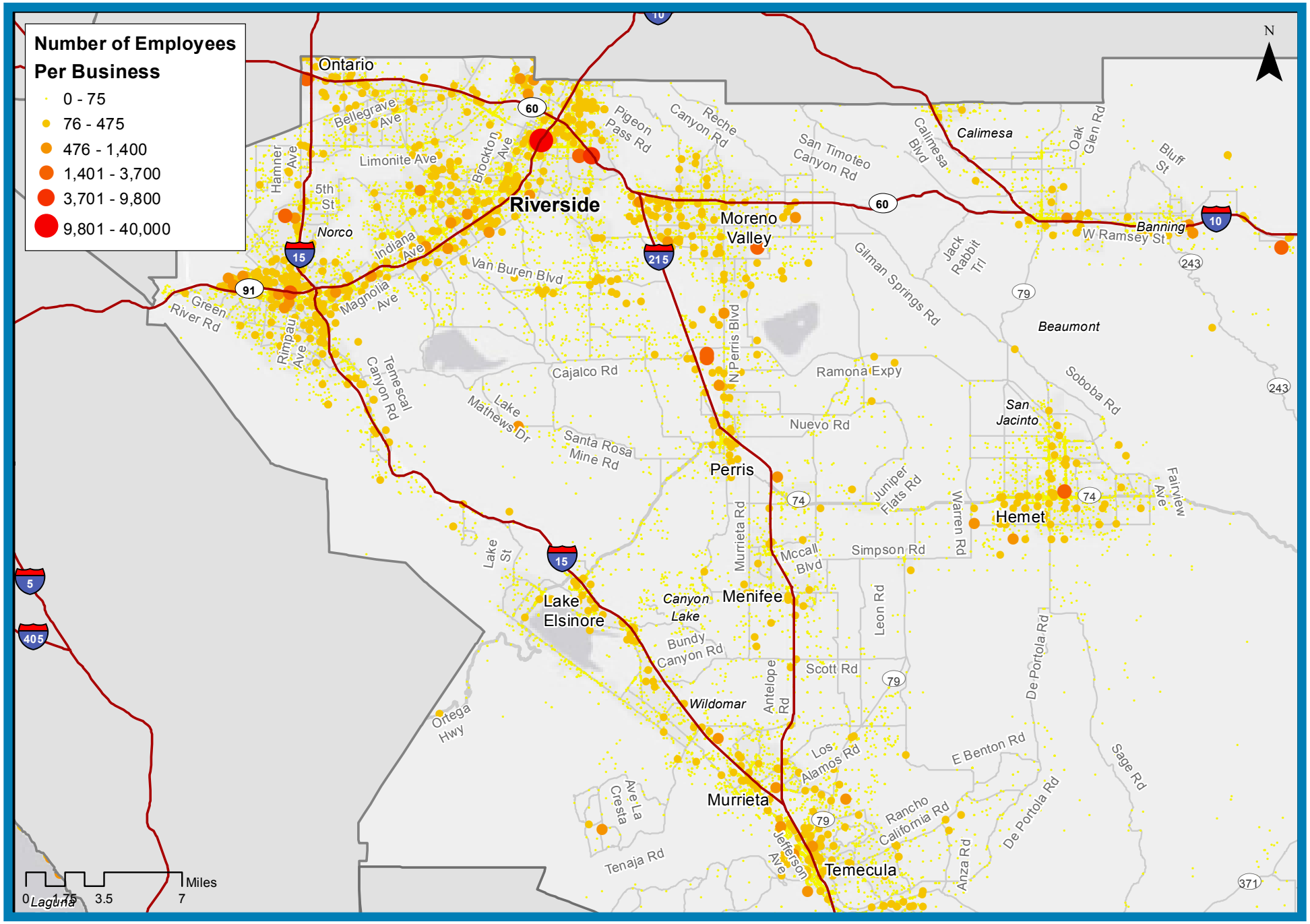
Plug-in Electric Vehicle Registrations



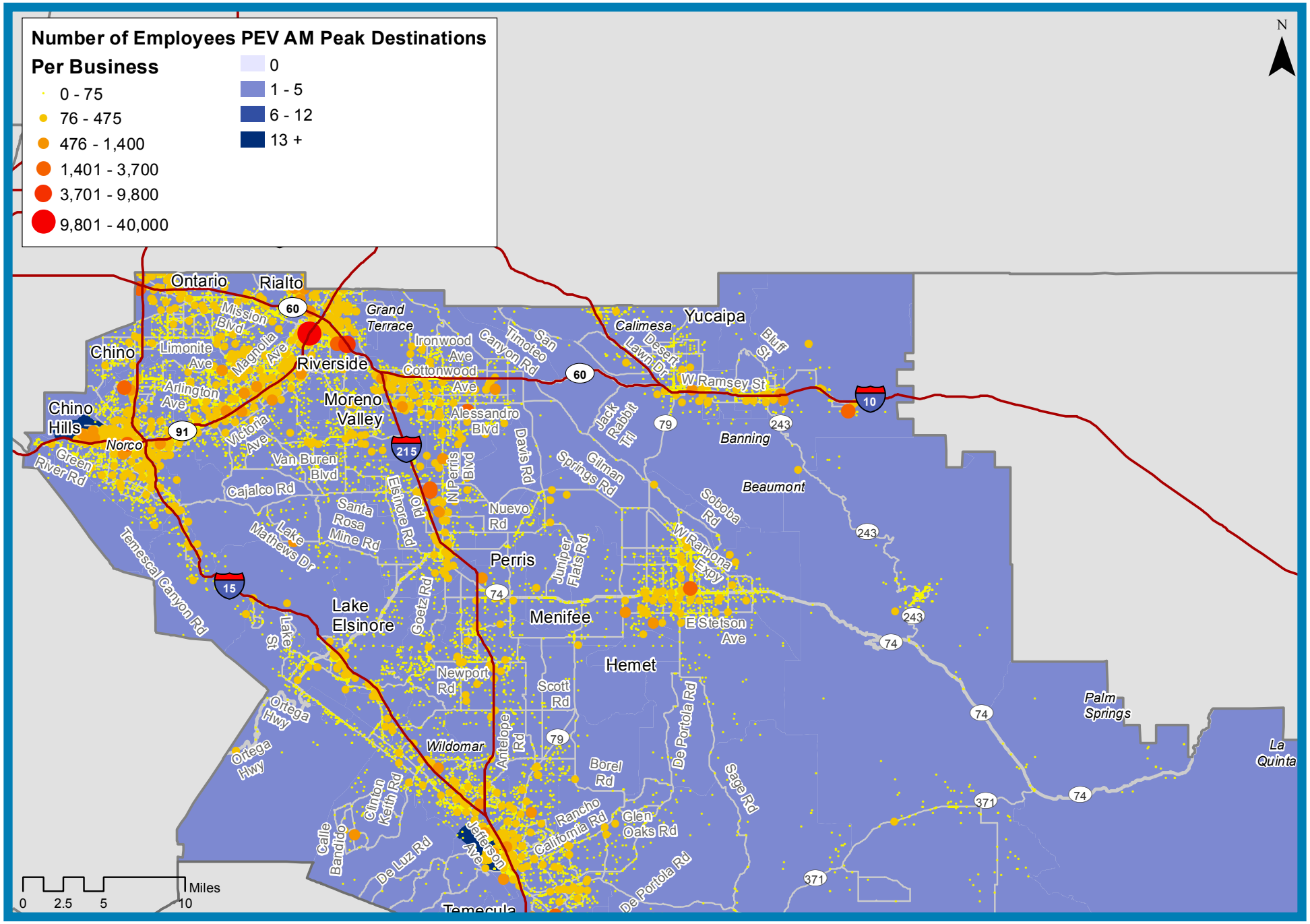
Plug-in Electric Vehicle Morning Peak Destinations



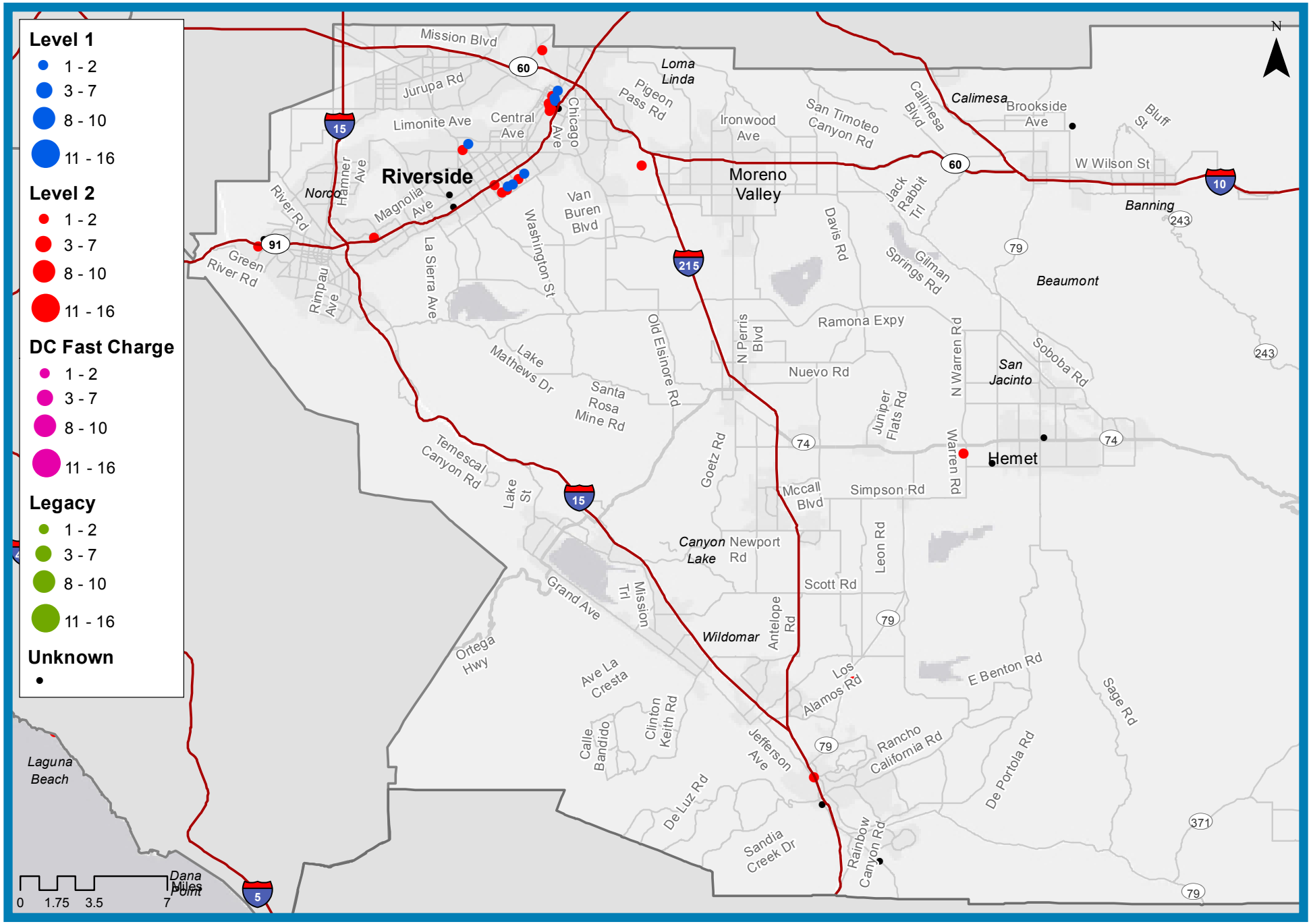
Workplaces by Number of Employees



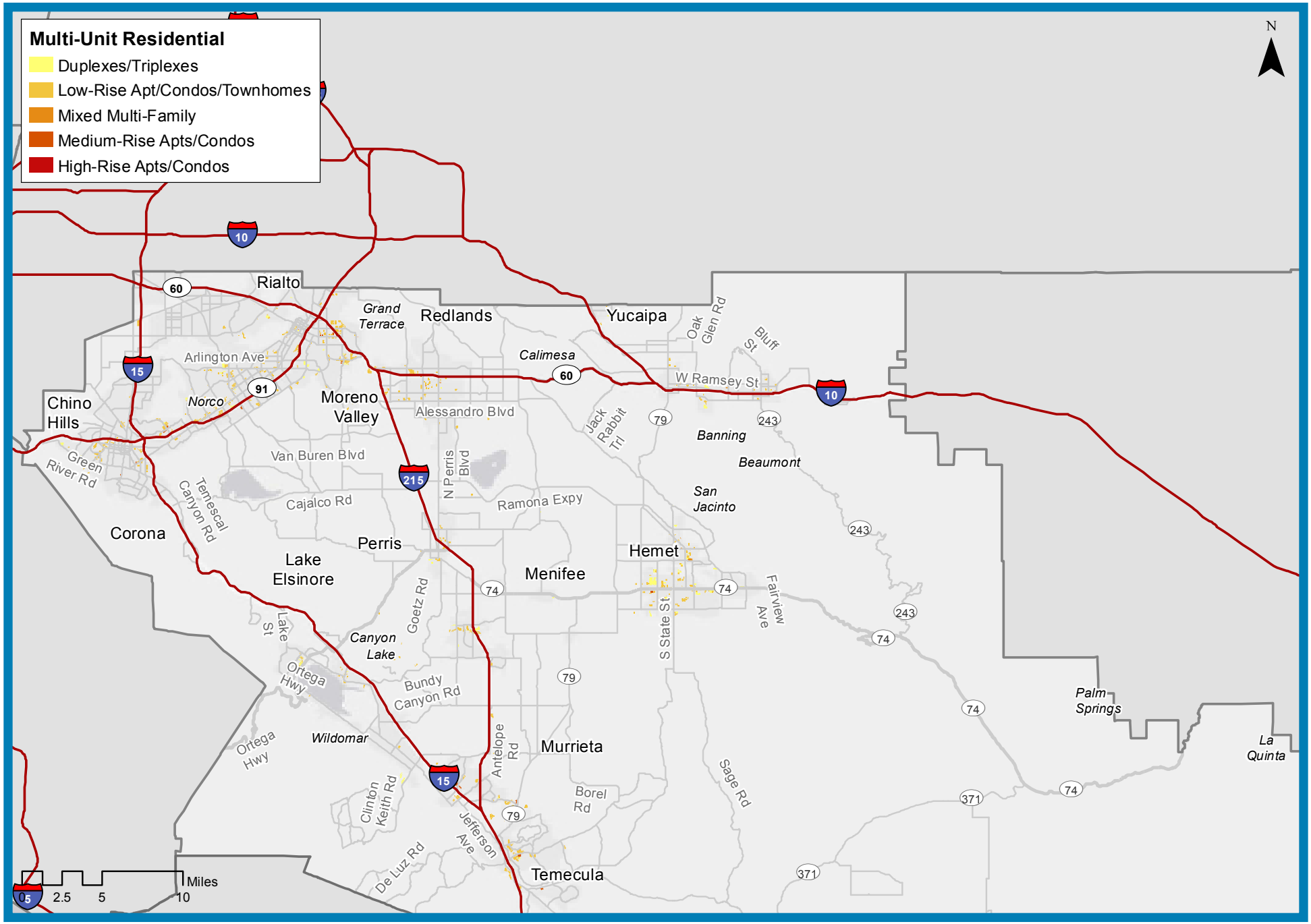
PEV Morning Peak Destinations and Workplaces



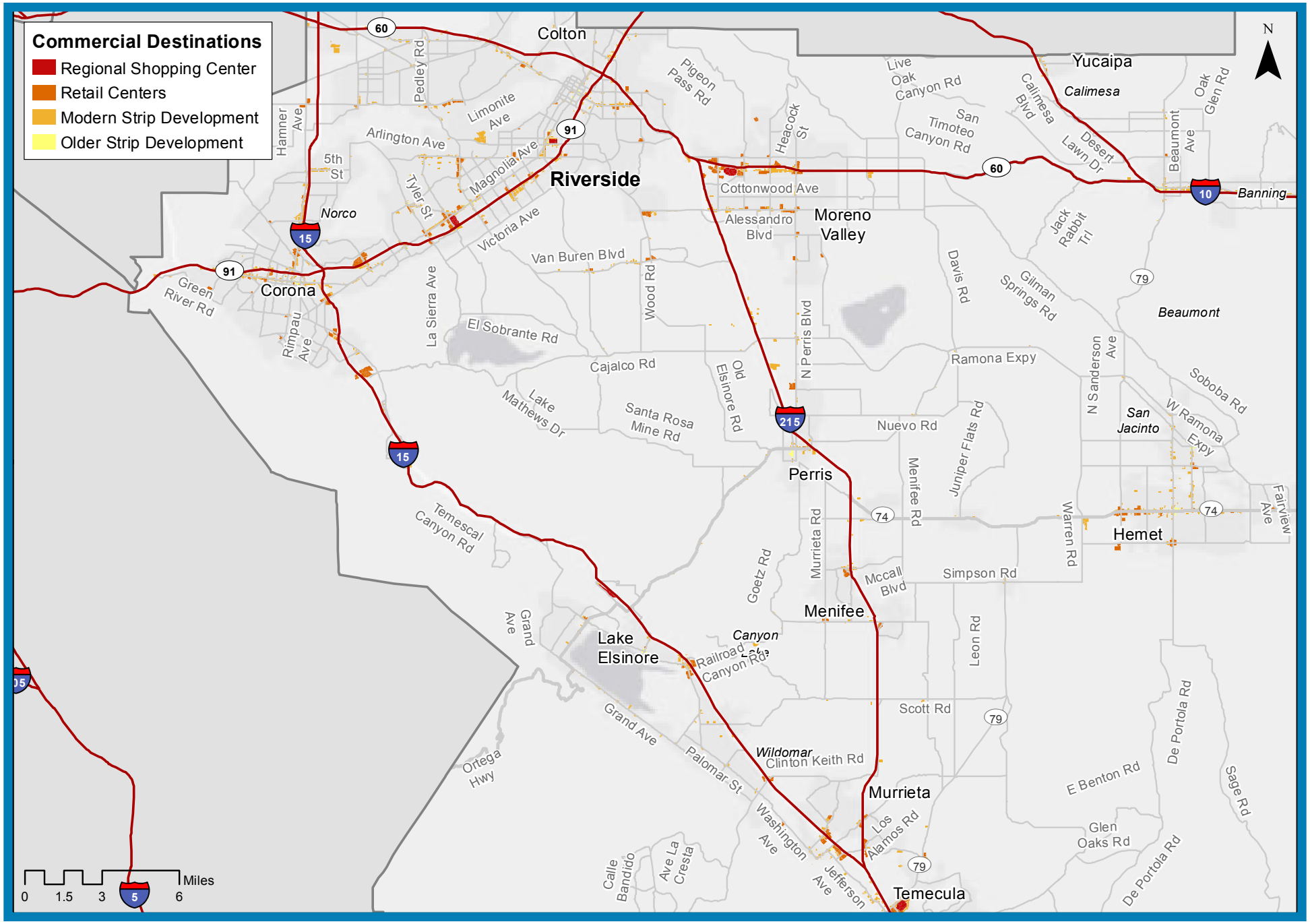
Publicly-Accessible Charging Stations (Summer/Fall 2012)



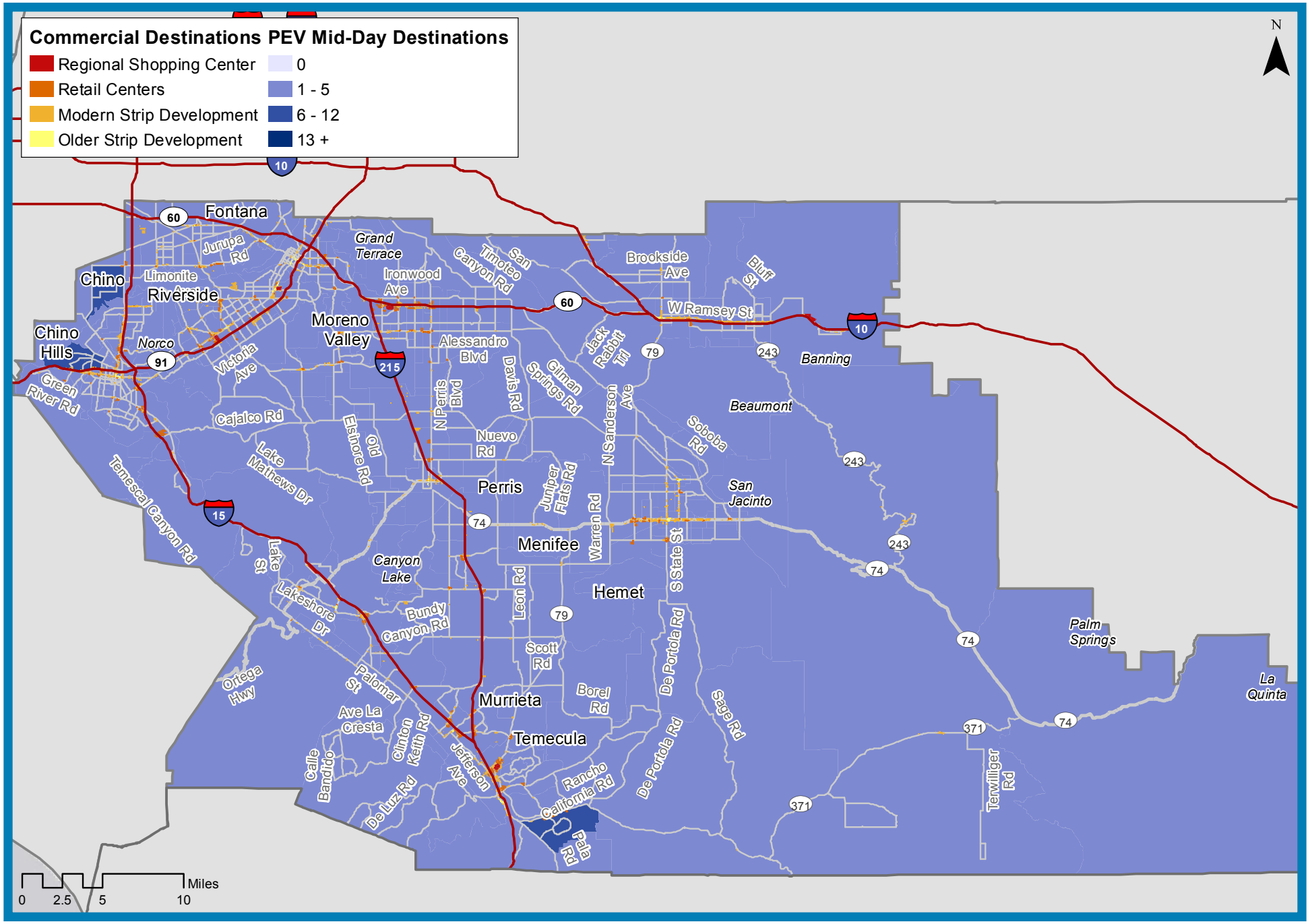
Multi-Unit Residential



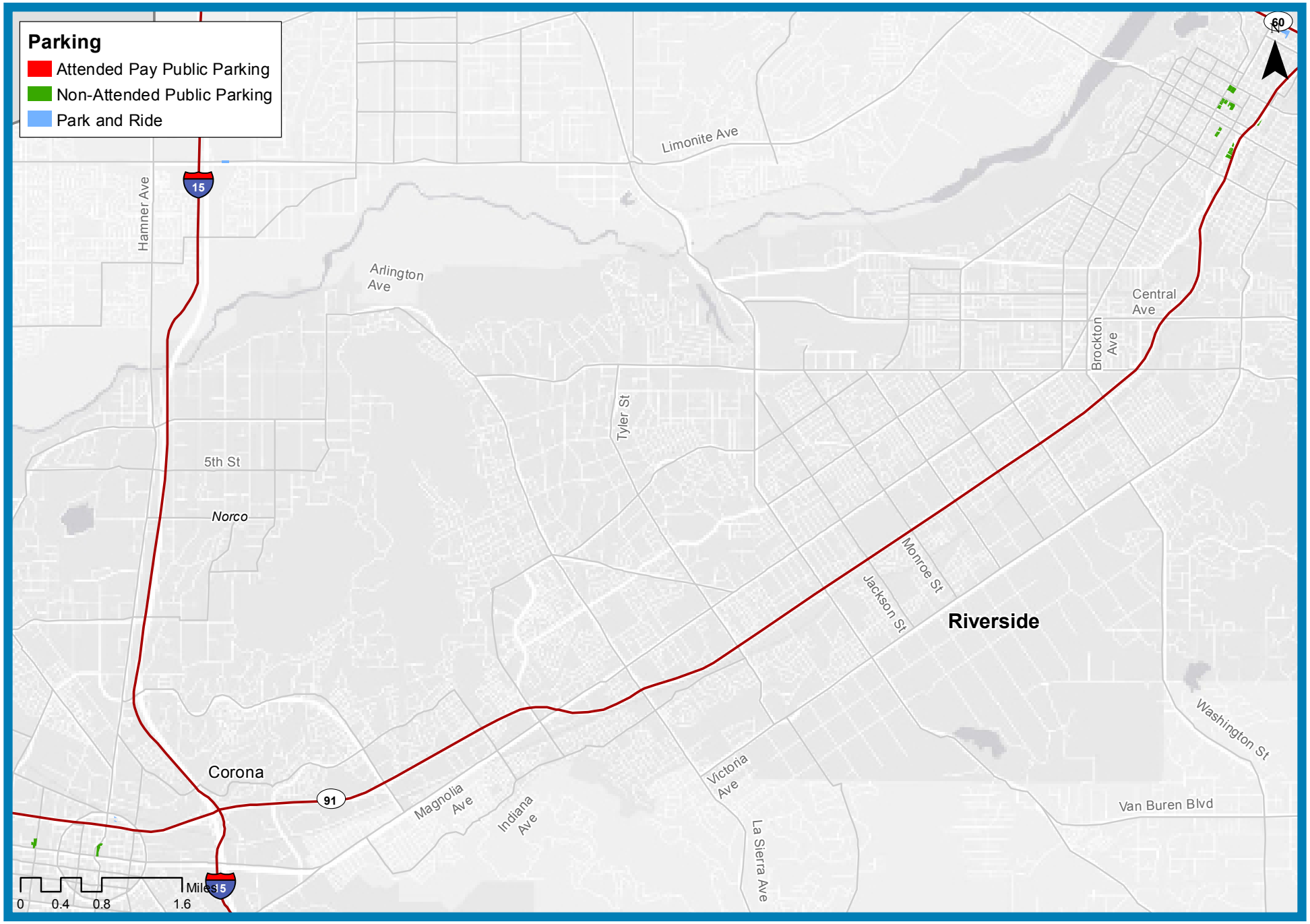
Commercial (Retail) Destinations



PEV Mid-Day Destinations and Commercial (Retail) Locations



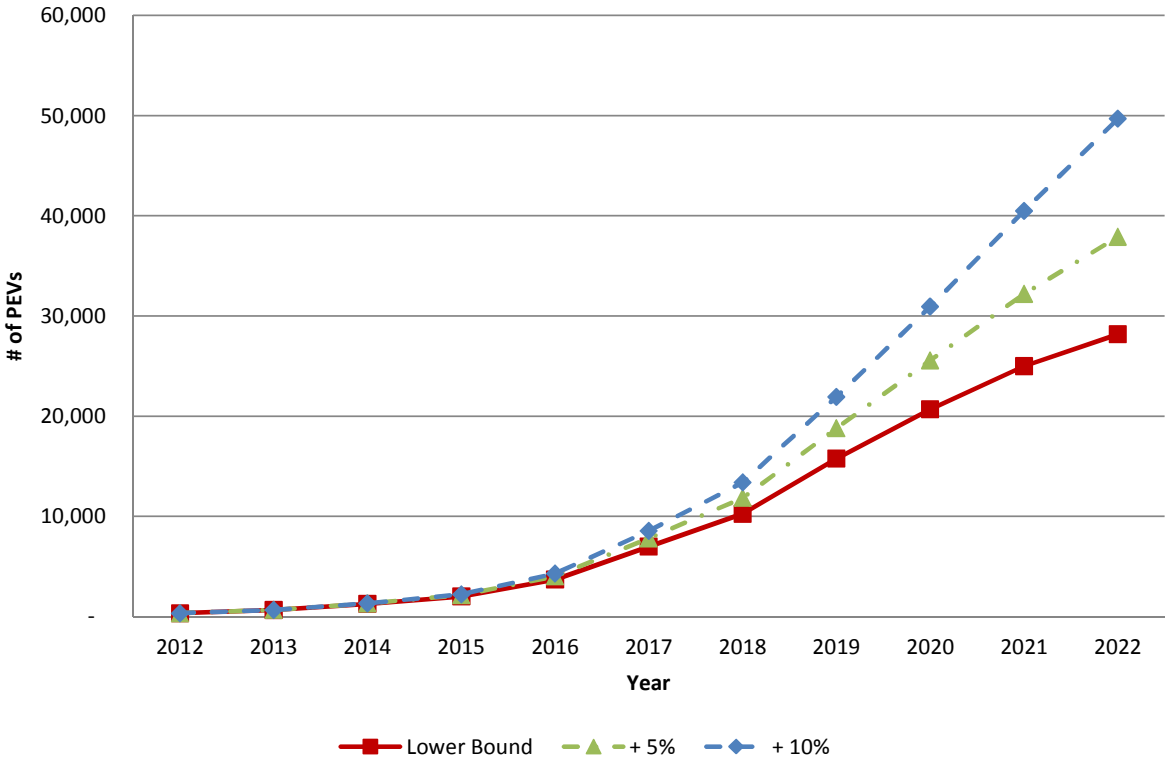
Stand-alone Parking Facilities



Westside Cities Council of Governments

PEV Growth

Year	Cumulative PEV registrations*		
	Lower Bound	+ 5%	+ 10%
2012	327	327	327
2013	654	654	654
2014	1,263	1,296	1,308
2015	2,010	2,127	2,212
2016	3,687	4,008	4,280
2017	6,984	7,792	8,534
2018	10,254	11,830	13,384
2019	15,768	18,782	21,919
2020	20,667	25,557	30,921
2021	24,996	32,188	40,490
2022	28,173	37,888	49,685



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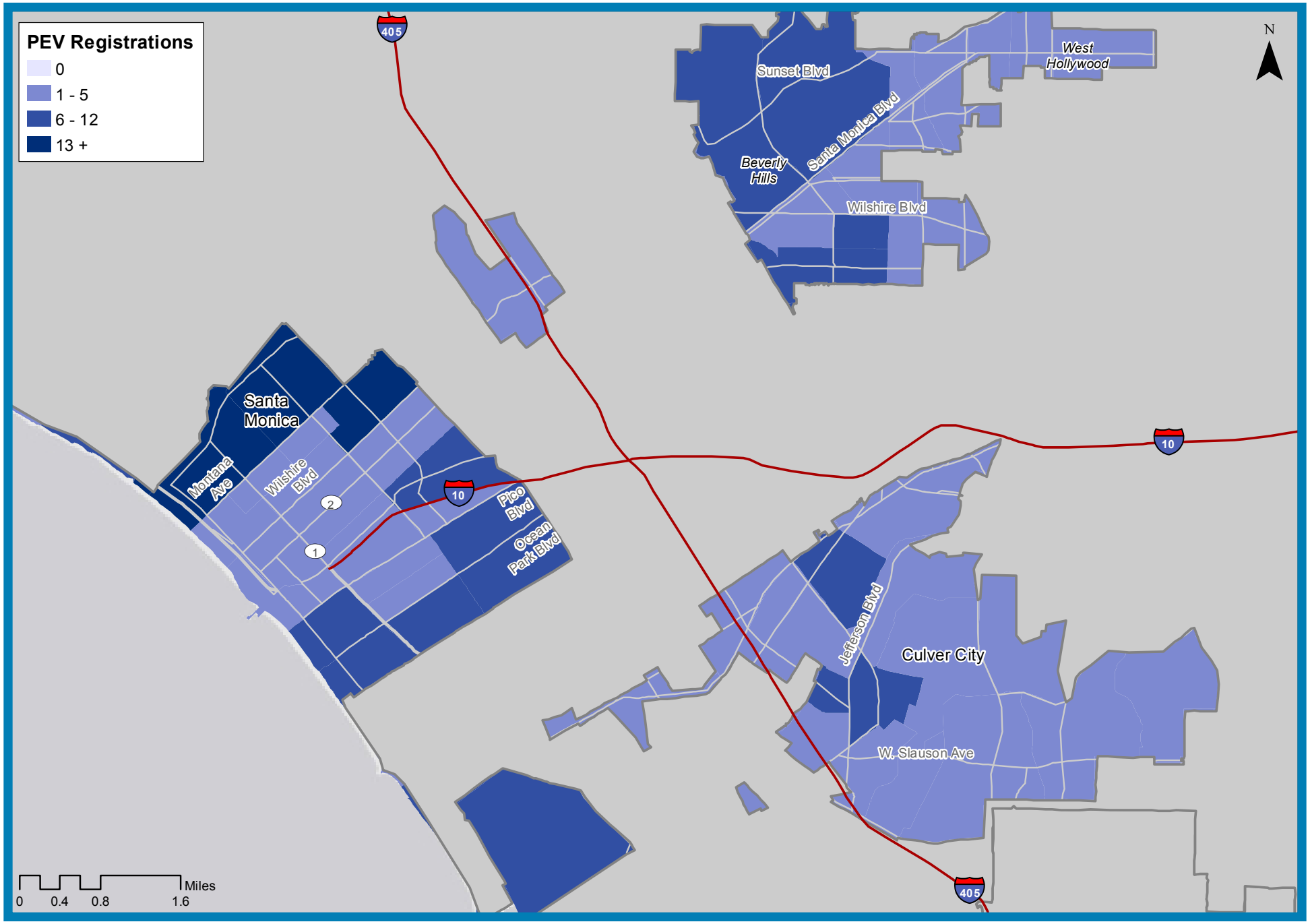
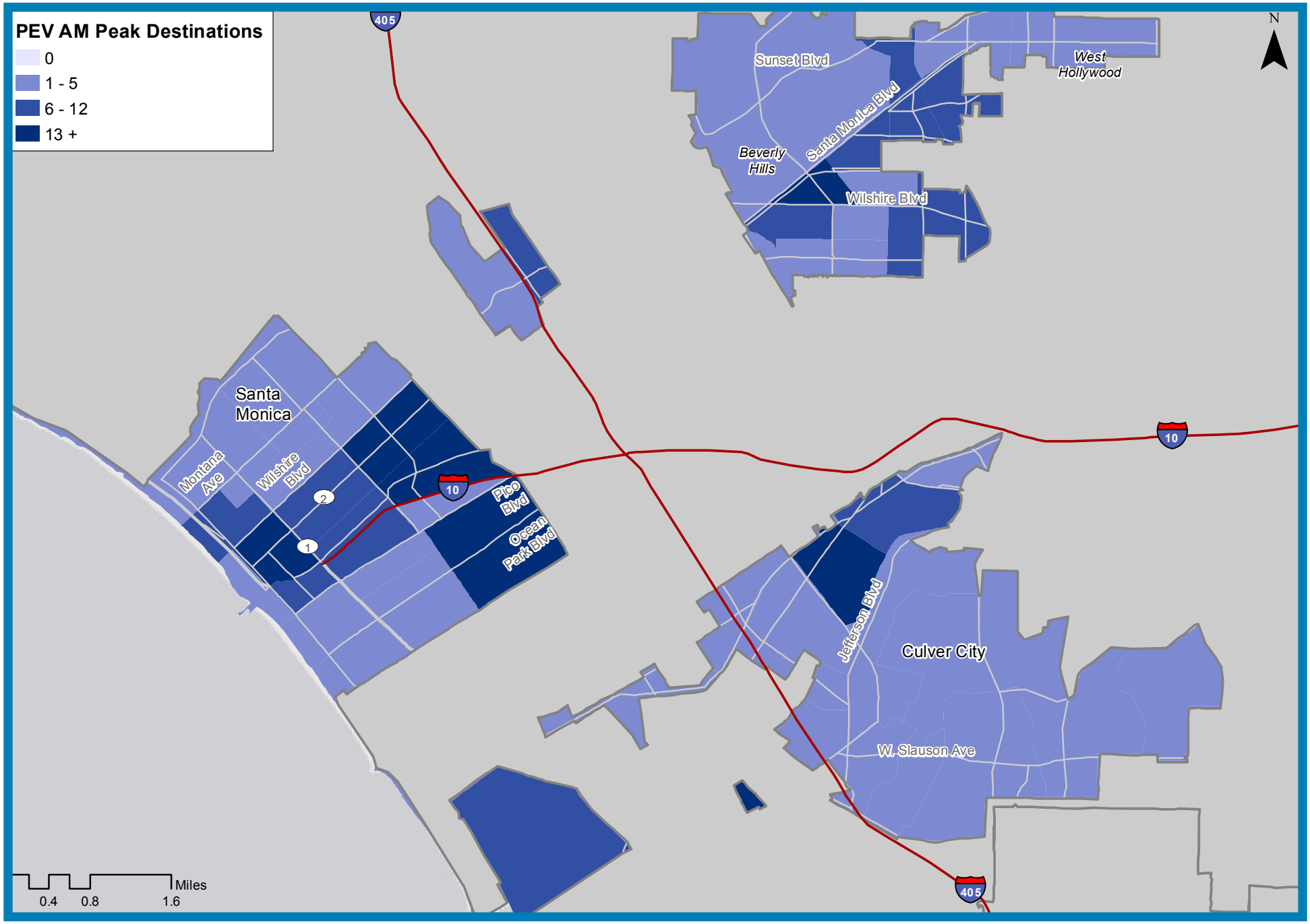
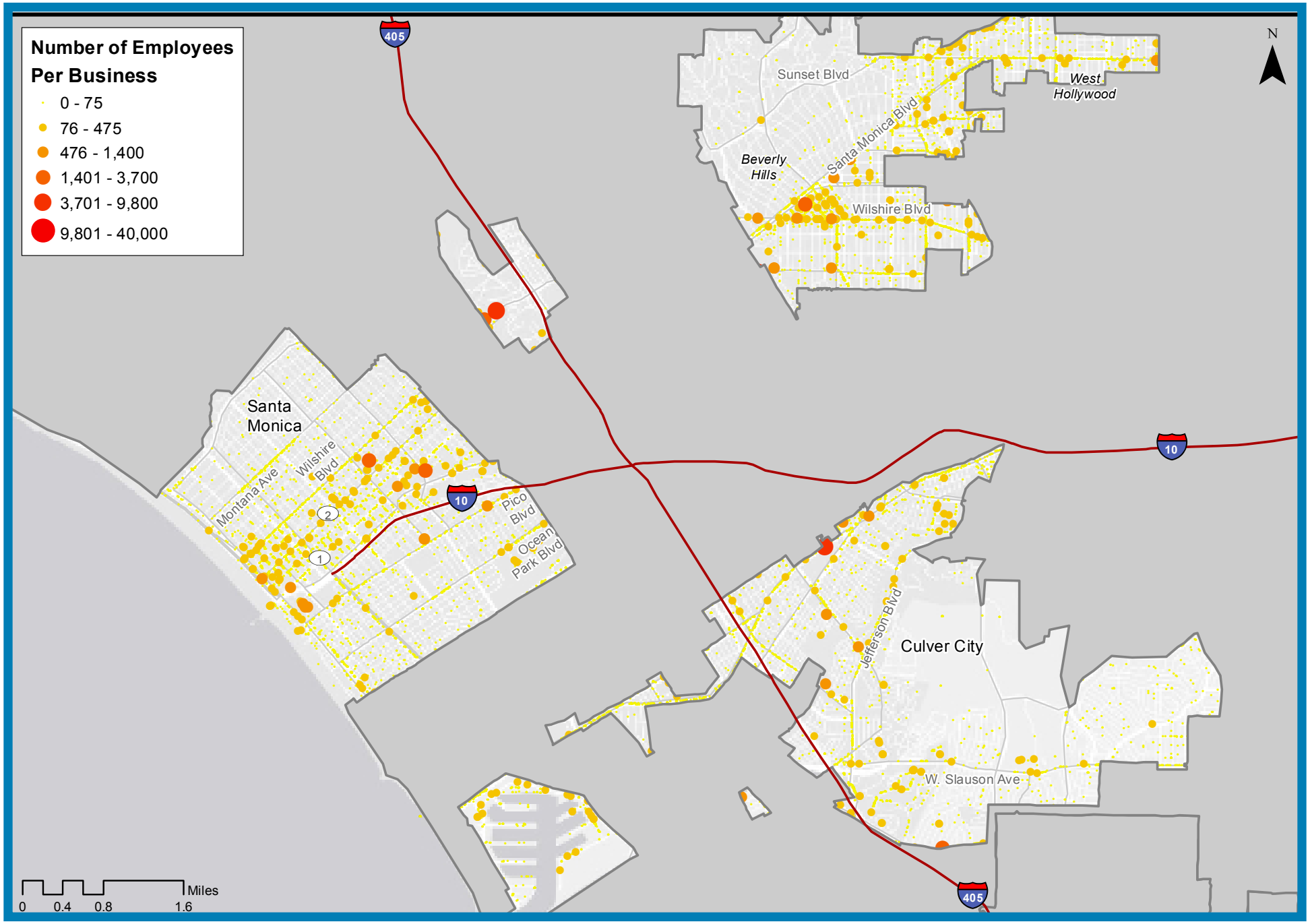
Plug-in Electric Vehicle Registrations



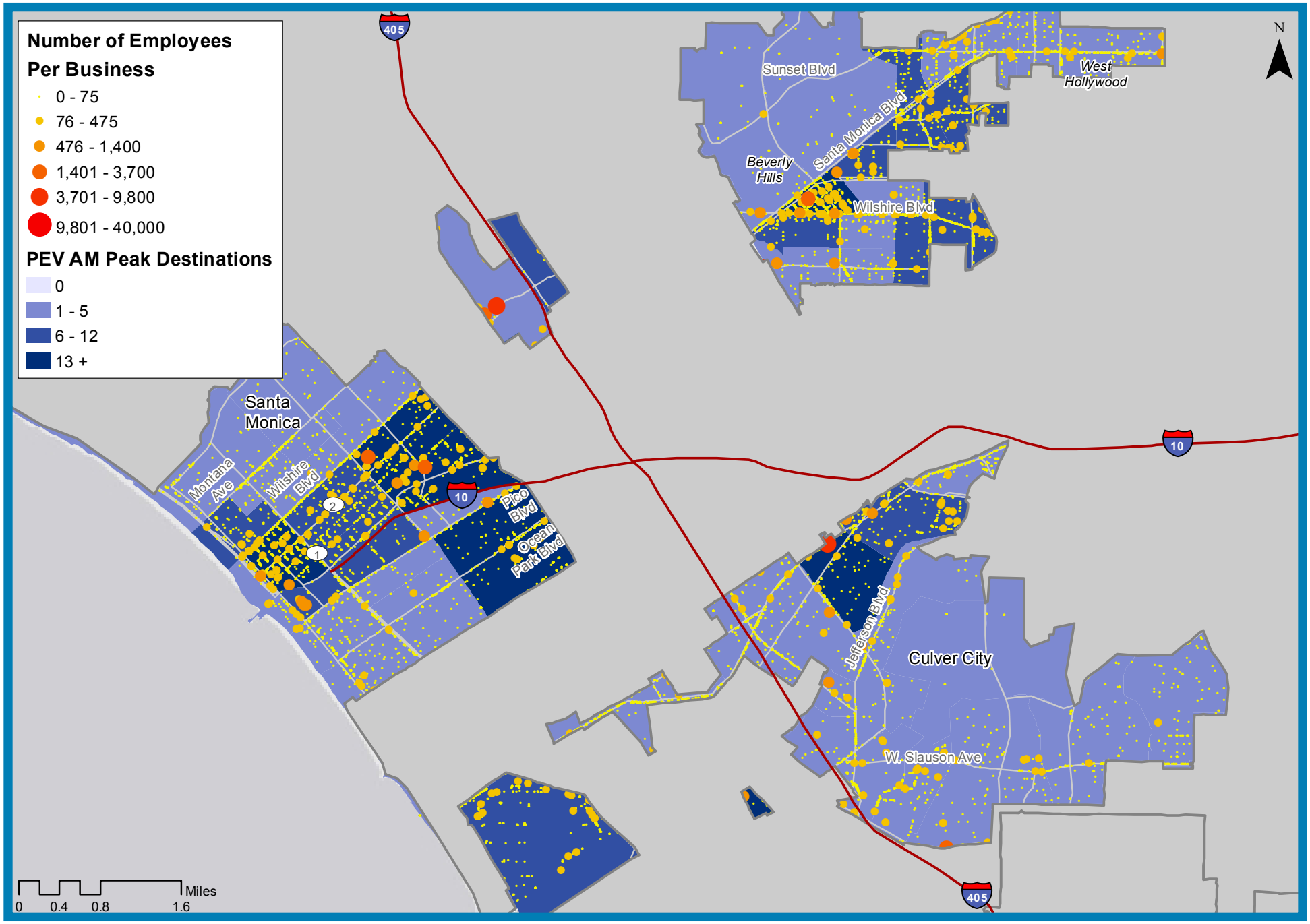
Plug-in Electric Vehicle Morning Peak Destinations



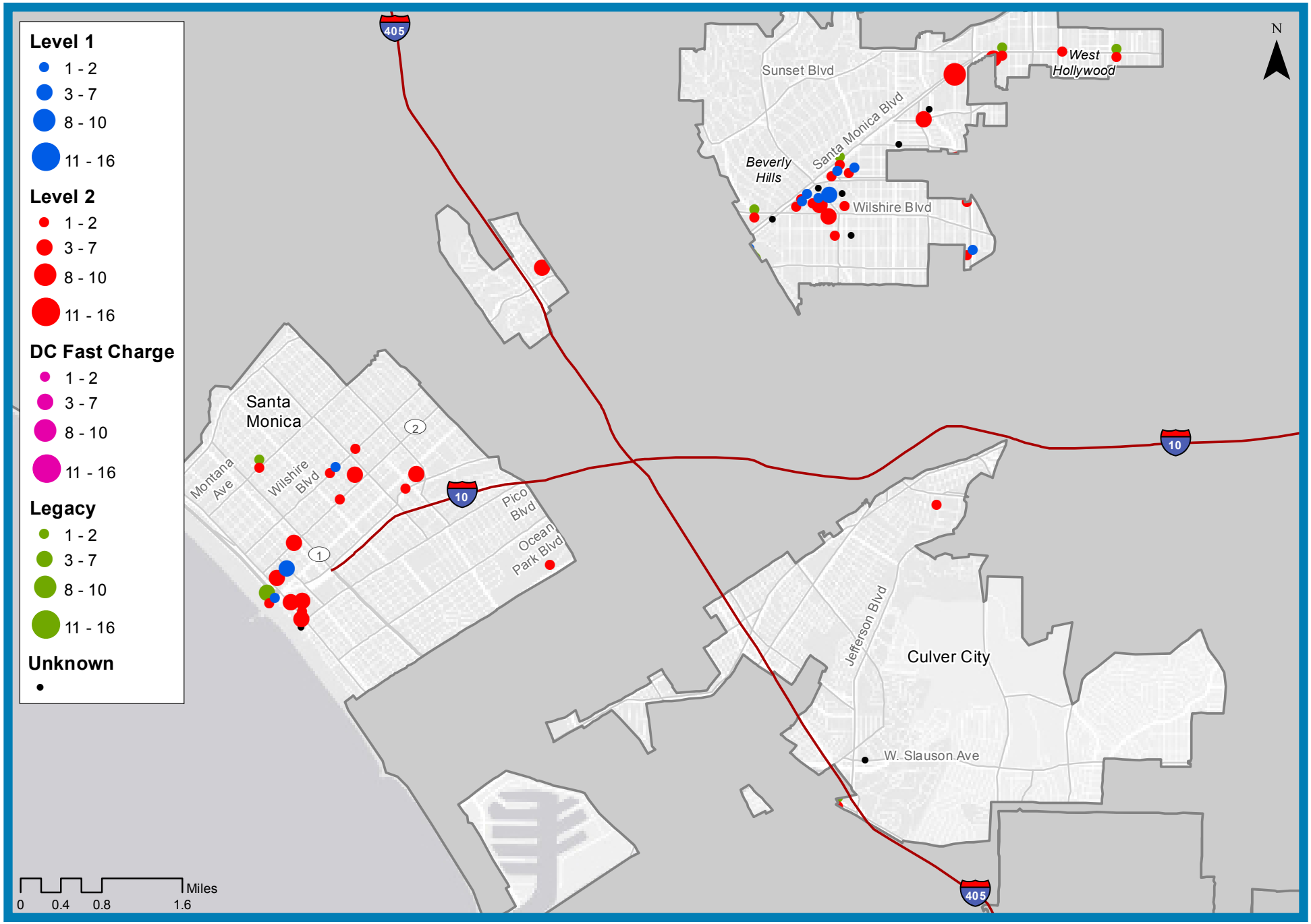
Workplaces by Number of Employees



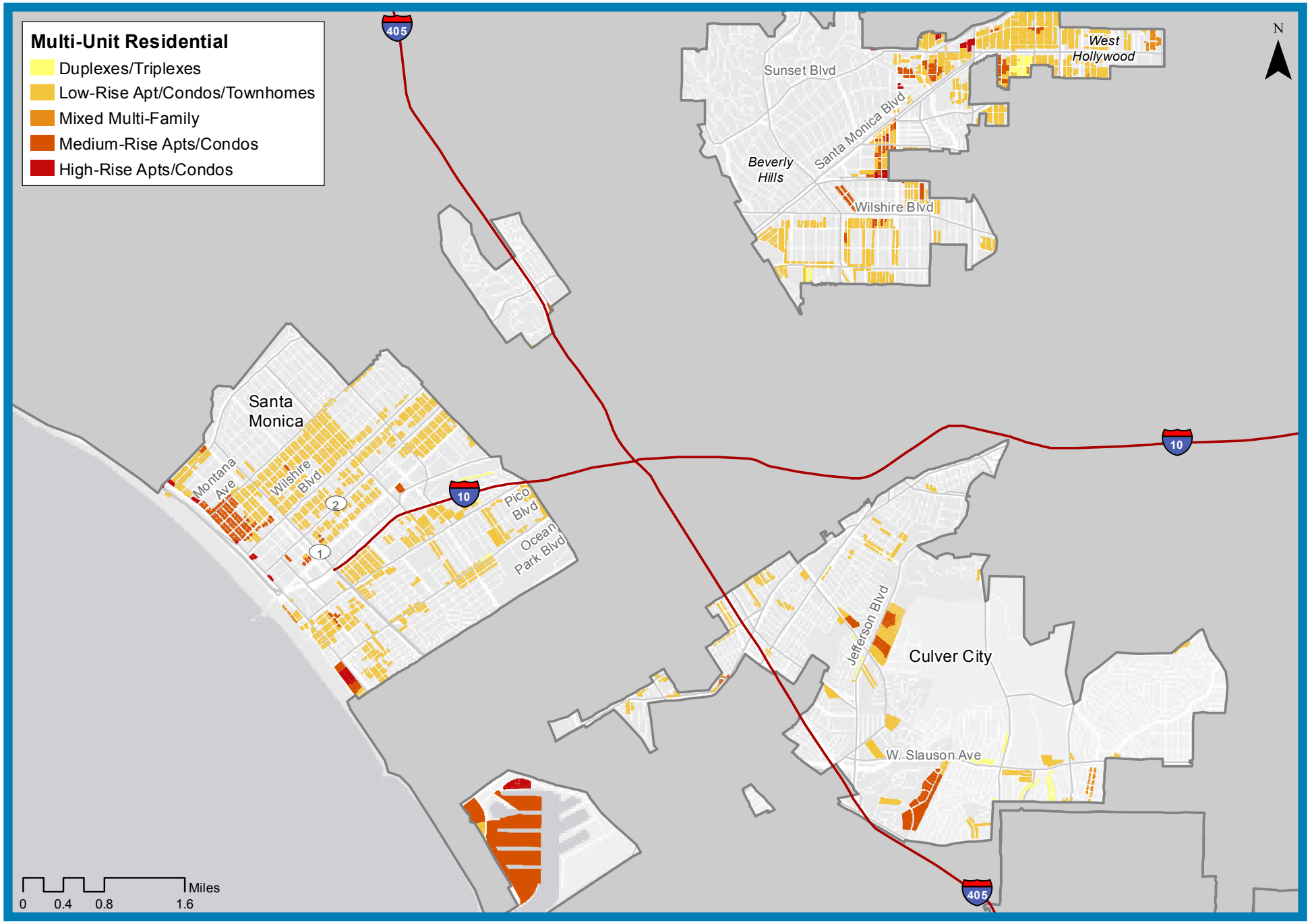
PEV Morning Peak Destinations and Workplaces



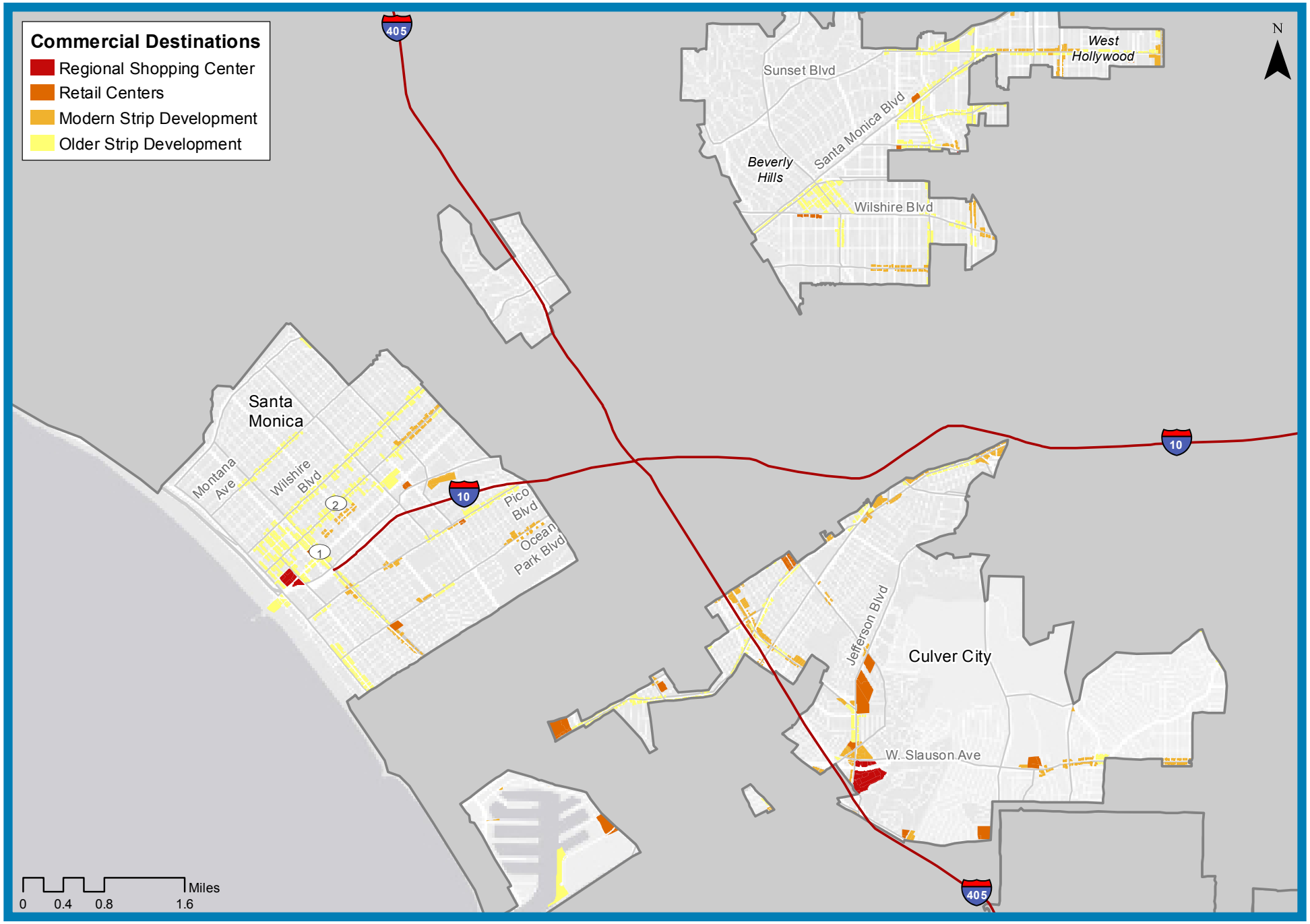
Publicly-Accessible Charging Stations (Summer/Fall 2012)



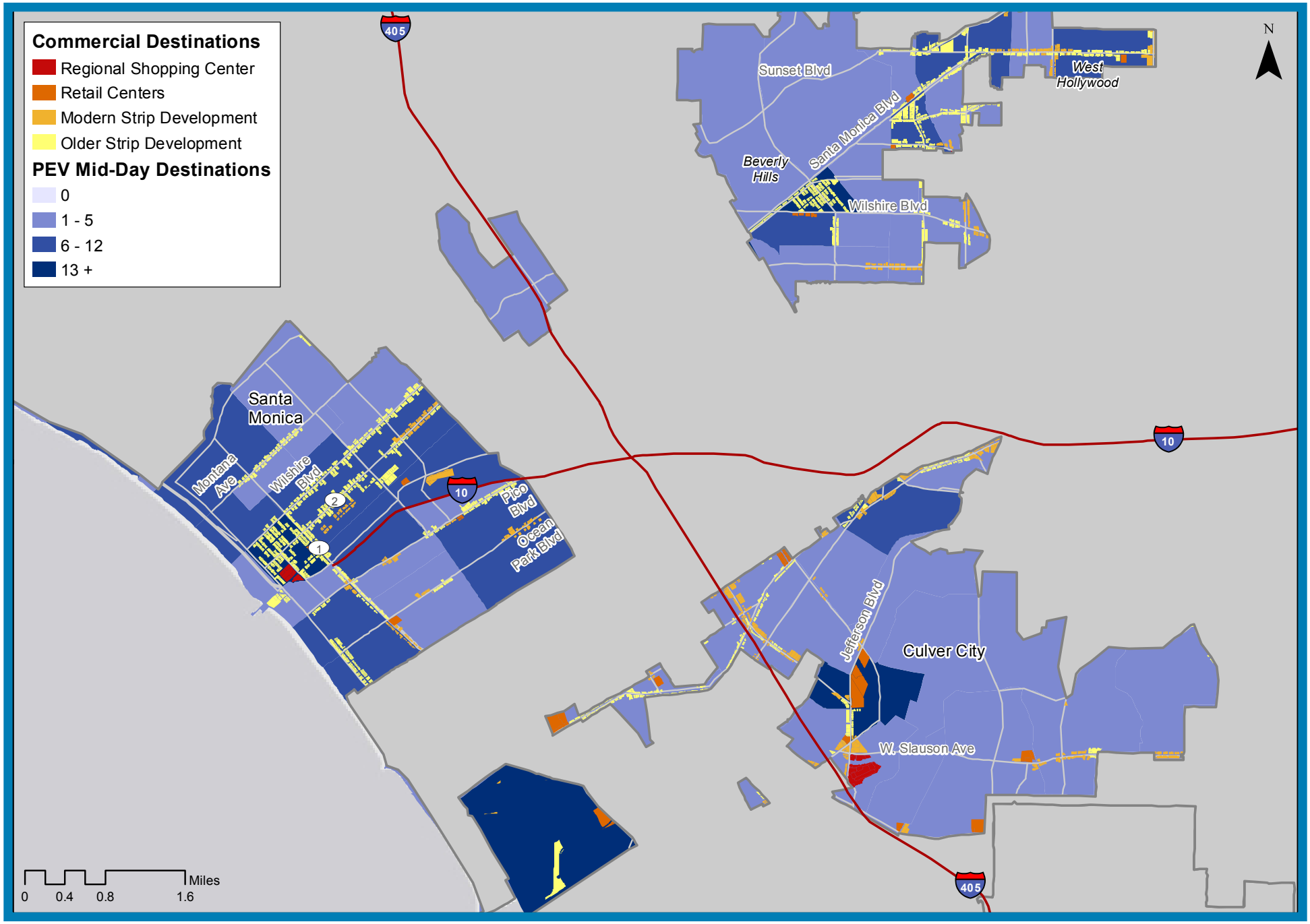
Multi-Unit Residential



Commercial (Retail) Destinations



PEV Mid-Day Destinations and Commercial (Retail) Destinations



Stand-alone Parking Facilities