

Washoe County Health District
Air Quality Management Division
2015 Ambient Air Monitoring Network Assessment

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Acronyms and Abbreviations

AQI	Air Quality Index
AQMD	Washoe County Health District - Air Quality Management Division
AQS	Air Quality System
BAM	Beta Attenuation Monitor
CARB	California Air Resources Board
CASAC	Clean Air Scientific Advisory Committee
CFR	Code of Federal Regulations
CO	Carbon Monoxide
DMV	Department of Motor Vehicles
EPA	U.S. Environmental Protection Agency
FEM	Federal Equivalent Method
FRM	Federal Reference Method
GAL	Galletti
HA 87	Hydrographic Area 87
INC	Incline
LEM	Lemmon Valley
MSA	Metropolitan Statistical Area
NAAQS	National Ambient Air Quality Standards
NAMS	National Air Monitoring Station
NCDC	National Climate Data Center
NCORE	National Core multipollutant monitoring station
NDOT	Nevada Department of Transportation
NO ₂	Nitrogen Dioxide
NO _y	Reactive Oxides of Nitrogen
O ₃	Ozone
PAMS	Photochemical Assessment Monitoring Station
PLM	Plumb-Kit
PM _{2.5}	Particulate Matter less than or equal to 2.5 microns in aerodynamic diameter
PM ₁₀	Particulate Matter less than or equal to 10 microns in aerodynamic diameter
PM _{coarse}	PM ₁₀ minus PM _{2.5}
ppb	Parts per Billion
ppm	Parts per Million
RNO	Reno
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Station
SO ₂	Sulfur Dioxide
SPK	Sparks
SPM	Special Purpose Monitoring
SRN	South Reno
STN	Speciation Trends Network
SUN	Sun Valley
TBD	To be determined
TOL	Toll

Introduction

Purpose

The U.S. Environmental Protection Agency (EPA) finalized amendments to the ambient air monitoring regulations on October 17, 2006 (71 FR 61236). The amendments revise the technical requirements for certain types of ambient air monitoring sites, add provisions for monitoring of PM_{coarse}, and reduce certain monitoring requirements for criteria pollutants. Monitoring agencies must also conduct network assessments every five years as required by 40 CFR 58.10(d) which states,

The State, or where applicable local, agency shall perform and submit to the EPA Regional Administrator an assessment of the air quality surveillance system every 5 years to determine, at a minimum, if the network meets the monitoring objectives defined in appendix D to this part, whether new sites are needed, whether existing sites are no longer needed and can be terminated, and where new technologies are appropriate for incorporation in the ambient air monitoring network. The network assessment must consider the ability of existing and proposed sites to support air quality characterization for areas with relatively high populations of susceptible individuals (e.g., children with asthma), and, for any sites that are being proposed for discontinuance, the effect on data users other than the agency itself, such as nearby States and Tribes or health effects studies. For PM_{2.5}, the assessment also must identify needed changes to population-oriented sites. The State, or where applicable local, agency must submit a copy of this 5-year assessment, along with a revised annual network plan to the Regional Administrator. The first assessment is due July 1, 2010.

Agency Contacts

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Regional Description

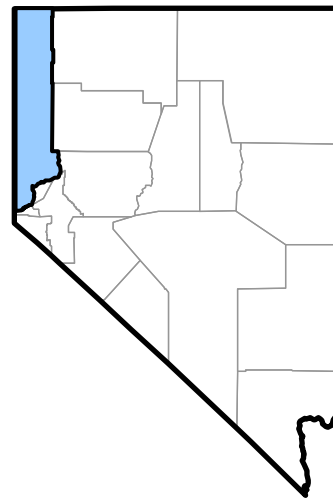
Washoe County is located in the northwest portion of Nevada and is bounded by California, Oregon, and the counties of Humboldt, Pershing, Storey, Churchill, Lyon, and Carson City (Figure 1). The Truckee Meadows is approximately 200 square miles in size and situated in the southern portion of Washoe County. It is geographically identified as Hydrographic Area 87 (HA 87) as defined by the State of Nevada Division of Water Resources. Much of Washoe County's population lives in the Truckee Meadows. Because anthropogenic activities such as automobile use and residential wood combustion are also concentrated here, this assessment will concentrate on the geographic area of southern Washoe County.

Topography and Climate¹

The Truckee Meadows is located in far-west central Nevada. It sits at an elevation of 4,400 feet above mean sea level in a semi-arid plateau lying in the lee of the Sierra Nevada Mountain Range. To the west, the Sierras rise to elevations of 9,000 to 11,000 feet. Hills to the east reach 6,000 to 7,000 feet. The Truckee River, flowing from the Sierras eastward, drains into Pyramid Lake to the northeast of the Truckee Meadows. The daily temperatures on the whole are mild, but the difference between the high and low often exceeds 45 degrees. While the afternoon high may exceed 90 degrees, a light jacket is often needed shortly after sunset. Nights with low temperatures over 60 degrees are rare. Afternoon temperatures in winter are moderate. Based on the 1971-2000 period, the average first occurrence of 32 degrees in the fall is October 3 and the average last occurrence in the spring is May 21. More than half of the precipitation occurs mainly as mixed rain and snow, and falls from December to March.

Although there is an average of about 25 inches of snow a year, it seldom remains on the ground for more than three or four days at a time. Summer rain comes mainly as brief thunderstorms in the middle and late afternoons. While precipitation is scarce, considerable water is available from the high altitude reservoirs in the Sierra Nevada, where precipitation is heavy. Humidity is very low during the summer months and moderately low during the winter. Fogs are rare, and are usually confined to the early morning hours of midwinter. Sunshine is abundant throughout the year.

Figure 1
Washoe County, Nevada



¹ [US Department of Commerce, NCDC; "2014 Local Climatological Data, Annual Summary with Comparative Data, Reno, Nevada \(KRNO\)"; 2014.](#)

Population and Demographic Trends

The Reno, NV Core Based Statistical Area (CBSA) includes Washoe County and Storey County. The CBSA population has consistently increased through the last two decades. Although the population decreased 1.7 percent in 2009, the net increase since 1990 has been 58.9 percent (Table 1). Much of this growth has occurred in southern Washoe County, specifically the area in and adjacent to the Truckee Meadows.

Table 1
Reno, NV CBSA Population Trends (1990, 2005-2014)²

Population (1,000's)	1990	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Washoe County	257.1	396.8	409.1	418.1	423.8	416.6	417.4	421.6	427.7	432.3	436.8
Storey County	2.5	4.0	4.1	4.3	4.4	4.3	4.2	4.1	4.1	4.0	4.0
CBSA Total	259.6	400.8	413.2	422.4	428.2	420.9	421.6	425.7	431.8	436.3	440.8

Three announcements have been made that may greatly impact population trends in the Reno, NV CBSA over the next 10 years. The most significant announcement was that there had been successful negotiations between the Nevada Governor's Office of Economic Development and Tesla Motors for their Gigafactory. The Nevada State Legislature approved changes to state statutes that cleared the path for this project to move forward. The other announcements were the relocation of approximately 1,000 jobs by Amazon.com from Lyon to Washoe County and the relocation of Ashima Devices to Washoe County from California by 2018.

Table 2
Reno, NV CBSA Population Forecasts (2015-2024)

Population (1,000's)	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Washoe County	450.7	458.8	467.6	476.0	484.3	492.4	500.4	508.3	516.1	523.7
Storey County	4.0	4.1	4.1	4.1	4.1	4.2	4.2	4.2	4.3	4.3
CBSA Total	454.7	462.9	471.7	480.1	488.4	496.6	504.6	512.5	520.4	528.0

² Nevada State Demographer, "Governor Certified Population Estimates of Nevada's Counties, Cities and Towns 2000 to 2014", 2014.

Current Air Quality Attainment Status

Table 3 lists the attainment status for each National Ambient Air Quality Standard (NAAQS) by pollutant, averaging time, and geographic area in Washoe County. Attainment designations are codified in [40 CFR 81.329](#). Additional detailed ambient air monitoring data may be found in the “Washoe County, Nevada Air Quality Trends (2005-2014)”. This report is prepared annually and summarizes the ambient air monitoring data collected by the AQMD.

Table 3
Attainment Status

Pollutant	Averaging Time	Concentration	Geographic Area	Attainment Status
CO	1-hour	35 ppm	HA 87	Attainment
			Remainder of county	Unclassifiable/Attainment
	8-hour	9 ppm	HA 87	Attainment
			Remainder of county	Unclassifiable/Attainment
PM ₁₀	24-hour	150 µg/m ³	HA 87	“Serious” Non-Attainment ³
			Remainder of county	Unclassifiable
PM _{2.5}	24-hour	35 µg/m ³	HA 87	Attainment
			Remainder of county	Unclassifiable/Attainment
	Annual	12.0 µg/m ³	HA 87	Attainment
			Remainder of county	Unclassifiable/Attainment
O ₃	8-hour	0.075 ppm	Entire county	Unclassifiable/Attainment
All other pollutants	All averaging times	All concentrations	All geographic areas	Unclassifiable/Attainment

³ In July 2009, a revision to the PM10 State Implementation Plan (SIP) was submitted to EPA Region IX requesting redesignation of HA 87 to Attainment/Maintenance of the 24-hour NAAQS. In May 2010, EPA published a finding of adequacy for the motor vehicle emissions budget portion of the maintenance plan (75 FR 27776), but has not taken final action on the entire SIP submittal.

Monitoring Network History

The AQMD has operated an ambient air monitoring network since the 1970's. By multi-agency cooperative agreement, the California Air Resources Board (CARB) monitored PM_{2.5} and NO₂ at the Incline site from 1999-2002. Table 4 lists the parameters monitored by pollutant and site over the last 25 years.

Table 4
Historical Network Specifications

Parameter AQS Site ID (32-031-xxx)	90-04	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
O₃											
0016 (RNO)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0020 (SRN)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0022 (GAL)											
0025 (TOL)	96-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0030 (PLM)											
1005 (SPK)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2002 (INC)	93-04	✓			✓	✓	✓	✓	✓	✓	✓
2009 (LEM)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mustang	95-04	✓	✓	✓							
CO											
0016 (RNO)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0020 (SRN)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0022 (GAL)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0025 (TOL)	96-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0030 (PLM)											
1005 (SPK)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2002 (INC)	93-02										
2009 (LEM)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mustang	95-98										
NO₂											
0016 (RNO)	97-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2002 (INC)	99-02										

Table 4 (continued)
Historical Network Specifications

Parameter AQS Site ID (32-031-xxx)	90-04	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
PM₁₀											
0016 (RNO)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0020 (SRN)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0022 (GAL)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0025 (TOL)	96-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0030 (PLM)			✓	✓	✓	✓	✓	✓	✓	✓	✓
1005 (SPK)	90-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
2002 (INC)	93-02										
2006 (SUN)	90-04	✓									
Mustang	93-98										

PM_{2.5}											
0016 (RNO)	99-04	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
0022 (GAL)										✓	✓
1005 (SPK)									✓	✓	✓
2002 (INC)	99-02										

PM_{10-2.5}											
0016 (RNO)						✓	✓	✓	✓	✓	✓
0022 (GAL)										✓	✓
1005 (SPK)											✓

SO₂											
0016 (RNO)								✓	✓	✓	✓

Pb											

- 0016 (RNO) - Reno/2/3
- 0020 (SRN) - South Reno
- 0022 (GAL) - Galletti
- 0025 (TOL) - Toll
- 0030 (PLM) - Plumb-Kit
- 1005 (SPK) - Sparks
- 2002 (INC) - Incline
- 2006 (SUN) - Sun Valley
- 2009 (LEM) - Lemmon Valley

Statistical Analysis

Site-by-site analyses are those that assign a ranking to individual monitors based on a particular metric. These analyses are good for assessing which monitors might be candidates for modification or removal. Site-by-site analyses do not reveal the most optimized network or how good a network is as a whole. In general, the metrics at each monitor are independent of the other monitors in the network. Several steps are involved in site-by-site analysis:

1. Determine which monitoring purposes are most important
2. Assess the history of the monitor (including original purposes)
3. Select a list of site-by-site analysis metrics based on purposes and available resources
4. Weight metrics based on importance of purpose
5. Score monitors for each metric
6. Sum scores and rank monitors
7. Examine lowest ranking monitors for possible resource reallocation

The low-ranking monitors should be examined carefully on a case-by-case basis. There may be regulatory or political reasons to retain a specific monitor. Also, the site could be made potentially more useful by monitoring a different pollutant or using a different technology. This assessment includes seven site-by-site statistical analyses - Number of Other Parameters Monitored; Trends Impact; Measured Concentrations; Deviation from the NAAQS; Area Served; Population Served, and Population Change.

Number of Other Parameters Monitored

Monitors that are collocated with other measurements at a particular air quality site are likely more valuable than sites that measure fewer parameters, particularly for source apportionment and other air quality studies. In addition, the operating costs can be leveraged among several instruments at these sites. Sites are ranked by the number of parameters (or instruments) that are collected at the particular site.

This analysis is performed by counting the number of other parameters that are measured at the physical site. Sites with many parameters measured are ranked highest. The metric addresses two aspects of monitor value. First, collocated measurements of several pollutants are valuable for many air quality analyses, such as source apportionment, model evaluation, and emission inventory reconciliation. Second, having a single site with multiple measurements is more cost-effective to operate than having monitors scattered at several sites.

Table 5
Classification and Number of Parameters Monitored

AQS Site ID (32-031-xxxx)	Monitor Classifications	Number of Parameters Measured
0016 (RNO)	SLAMS	11
	NCore	18
	Speciation Trends	65
0020 (SRN)	SLAMS	3
0025 (TOL)	SLAMS	4
0030 (PLM)	SLAMS	2
1005 (SPK)	SLAMS	6
2002 (INC)	SLAMS	1
2009 (LEM)	SLAMS	2
Spanish Springs (Proposed)	SPM/SLAMS	5

Trends Impact

Monitors that have a long historical record are valuable for tracking trends. In this analysis, sites are ranked based on the duration of the continuous measurement record. The analysis can be as simple as ranking the available monitors based on the length of the continuous sampling record. This technique places the most importance on sites with the longest continuous trend record.

Determining the trends impact of a monitor can be done simply. One approach is to rank sites based on their length of continuous sampling. Sites with the longest term of operation would score higher than those with shorter records, since they would be more useful for long-term trend analysis. Additional factors that could be used to adjust the simple ranking scale include: 1) The magnitude and direction of trends observed to date at the site, 2) the suitability of a site's location for monitoring trends after a significant event (i.e., enactment of a specific control measure), or 3) proximity of another monitor that could be used to continue the trend record. A site may be weighted as less important if changes in sampling and analysis methodology lead to a discontinuous record. Weighing these factors would require consideration of the overall goals of the monitoring network and the importance of the historical record.

Table 6
Years of Data

AQS Site ID (32-031-xxxx)	Monitor Classifications	Years of Data
0016 (RNO)	SLAMS	41
	NCore	
	Speciation Trends	
0020 (SRN)	SLAMS	25
0025 (TOL)	SLAMS	18
0030 (PLM)	SLAMS	10
1005 (SPK)	SLAMS	35
2002 (INC)	SLAMS	20
2009 (LEM)	SLAMS	27
Spanish Springs (Proposed)	SPM/SLAMS	0

Measured Concentrations

Individual sites are ranked based on the concentration of pollutants they measure. Monitors that measure high concentrations or design values are ranked higher than monitors that measure low concentrations. Results can be used to determine which monitors are less useful in meeting the selected objective.

Sites that measure high concentrations are important for assessing NAAQS compliance, population exposure, and performing model evaluations. The analysis is relatively straightforward, requiring only the site design values or highest concentrations. The greater the design value or concentration, the higher the site rank. If more than one standard exists for a pollutant (i.e., 24-hr and annual averages), monitors can be scored for each standard.

Figure 2
8-hr O₃ Design Values
(2005-2014)



* Monitor was offline from Dec 2005 through May 2008 due to remodeling of the INC facility. Design Values for 2006-2010 include less than three years of complete data, and those years cannot be compared to the NAAQS.

Figure 3
1-hr CO Design Values
(2005-2014)

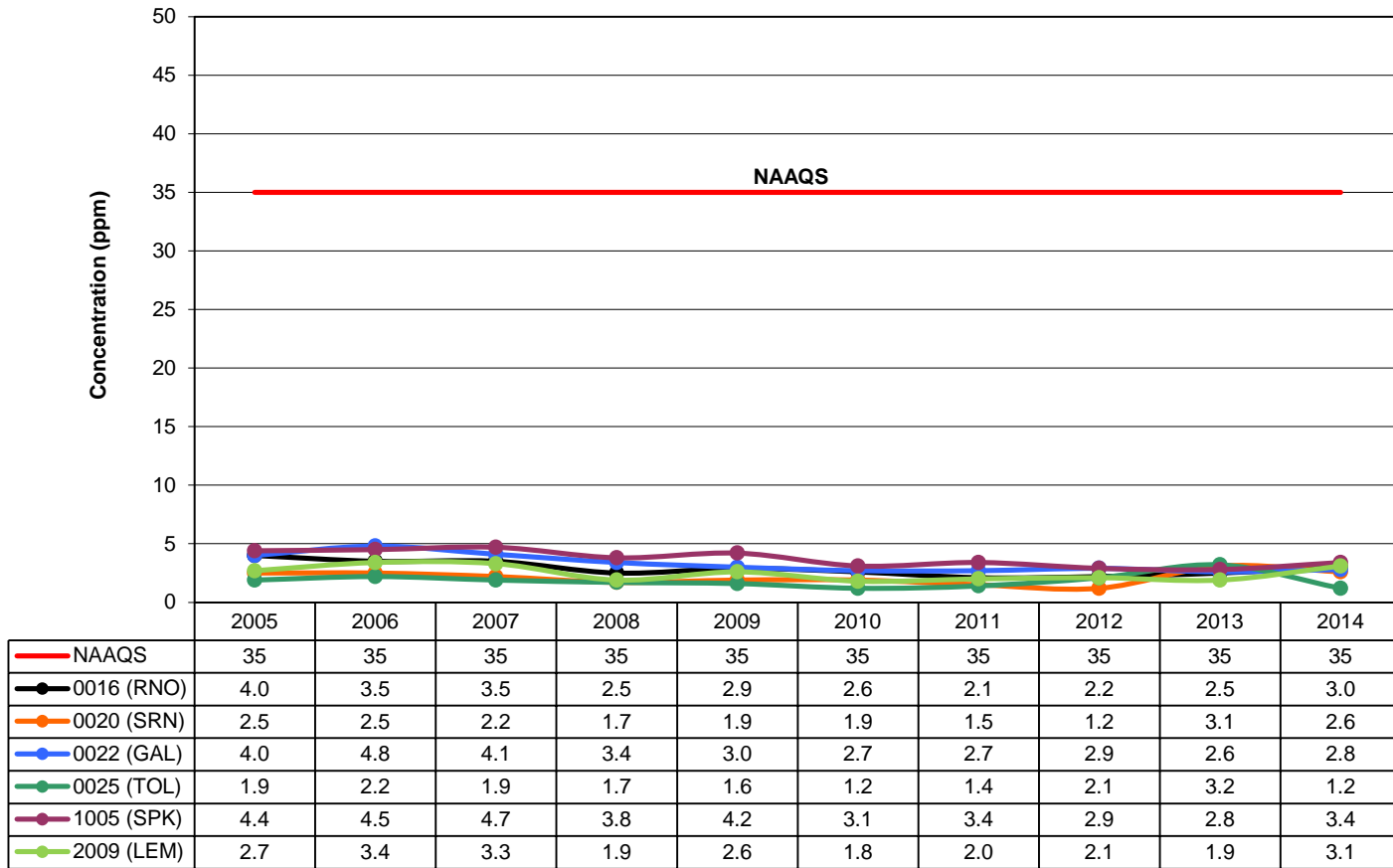


Figure 4
8-hr CO Design Values
(2005-2014)

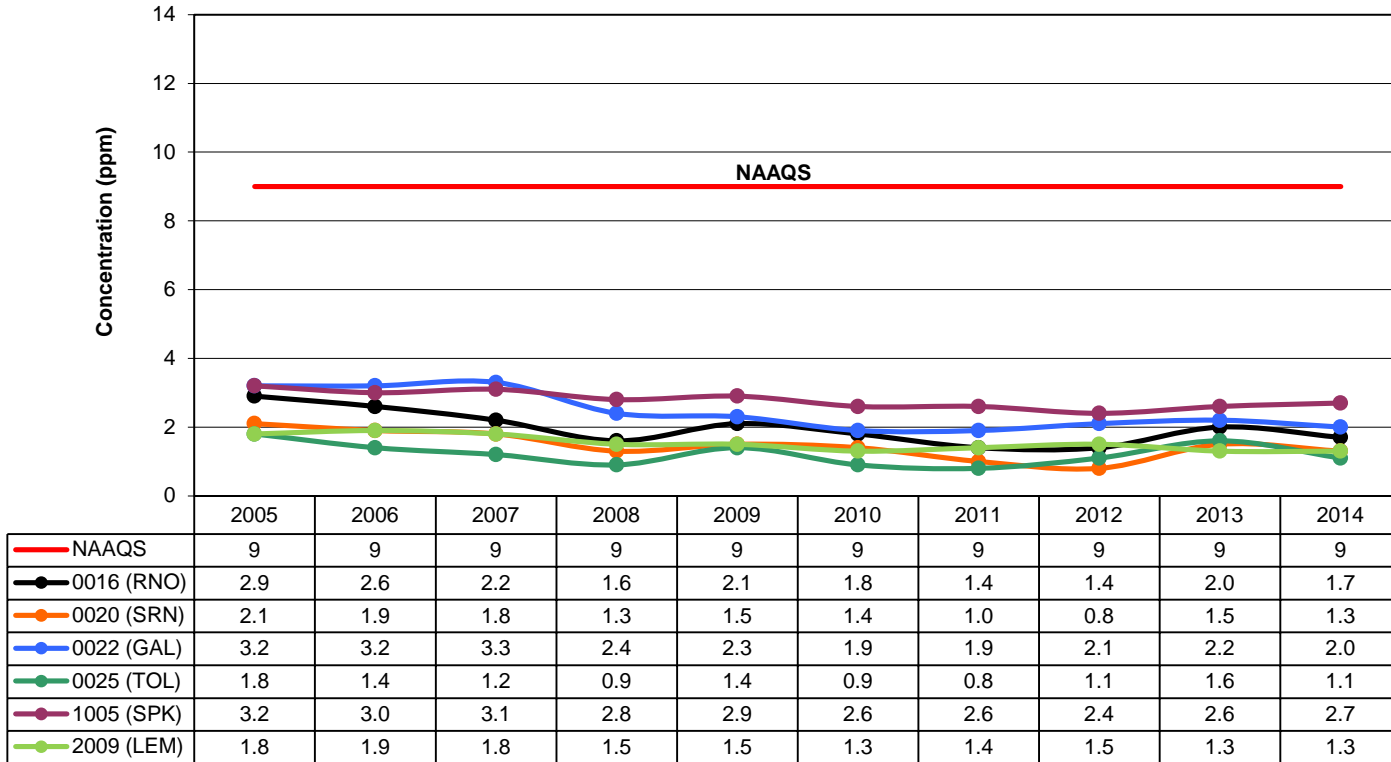


Figure 5
1-hr NO₂ Design Values
(2005-2014)

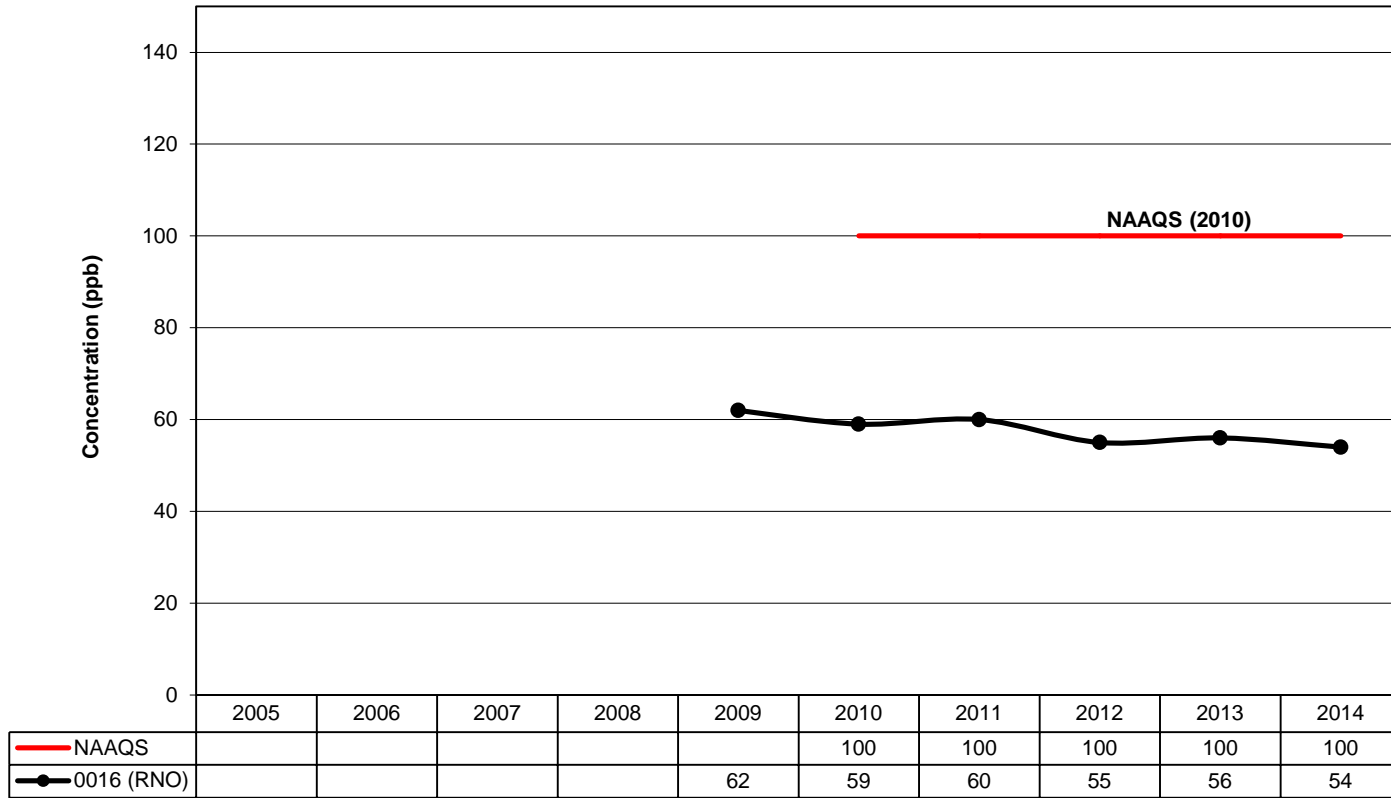


Figure 6
Annual NO₂ Design Values
(2005-2014)

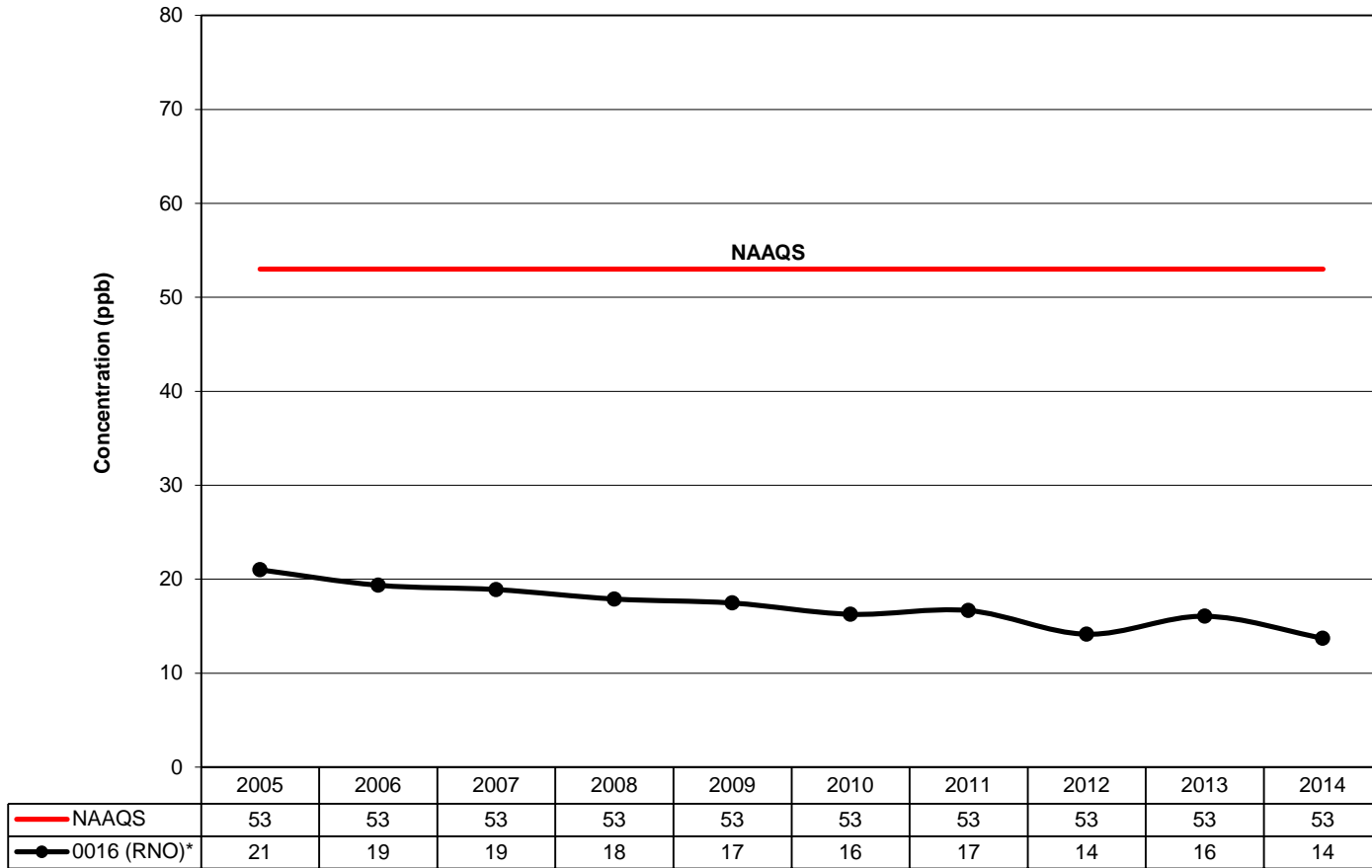


Figure 7
 1-hr SO₂ Design Values
 (2005-2014)

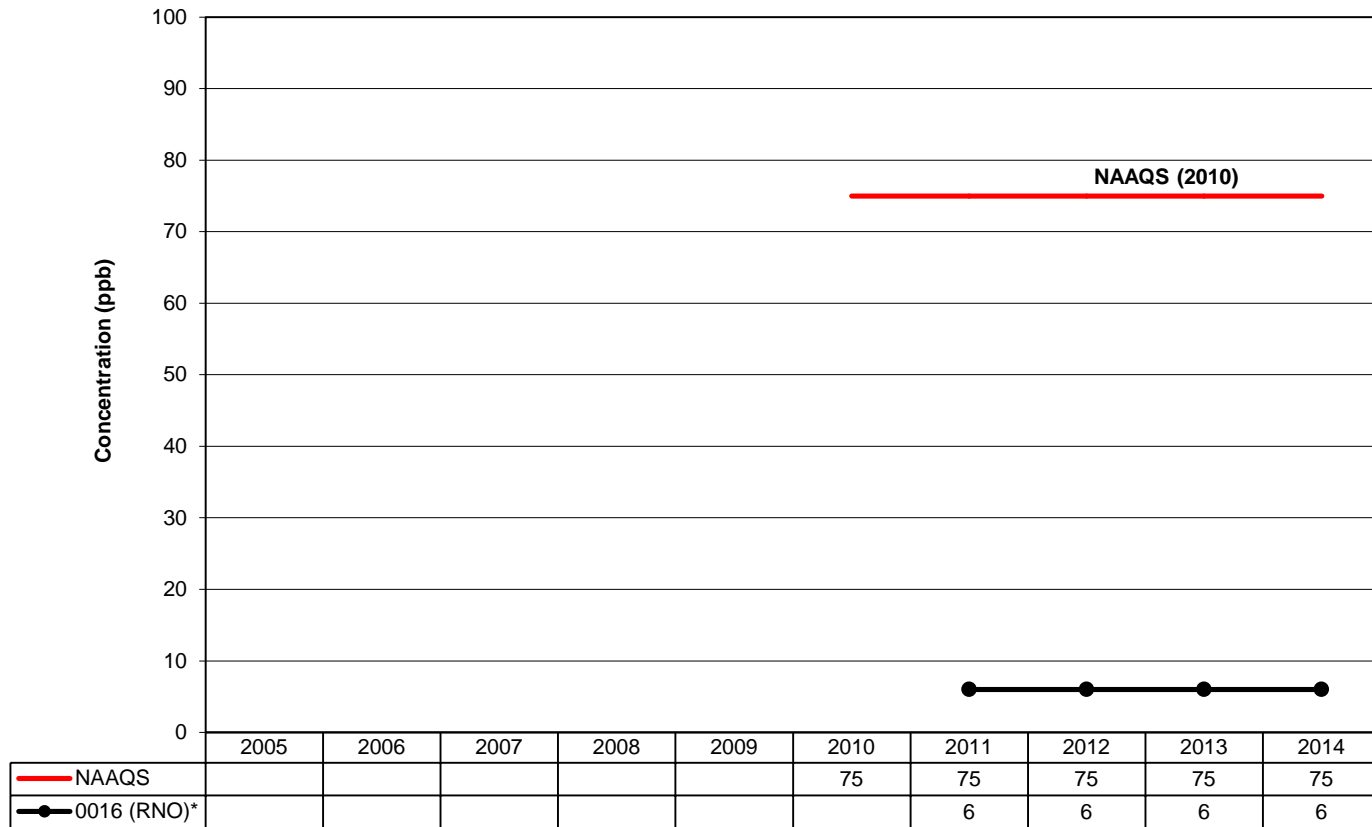
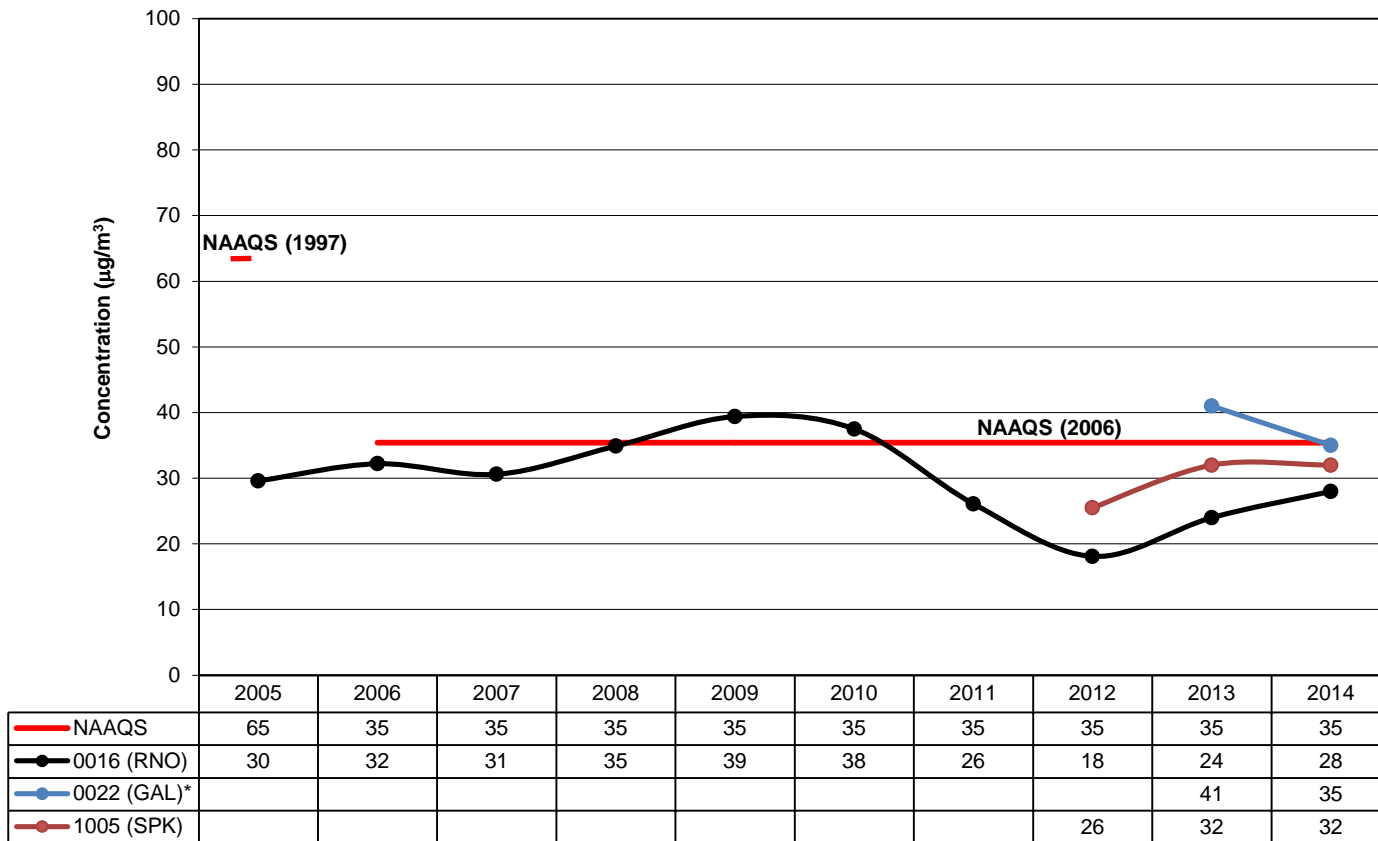
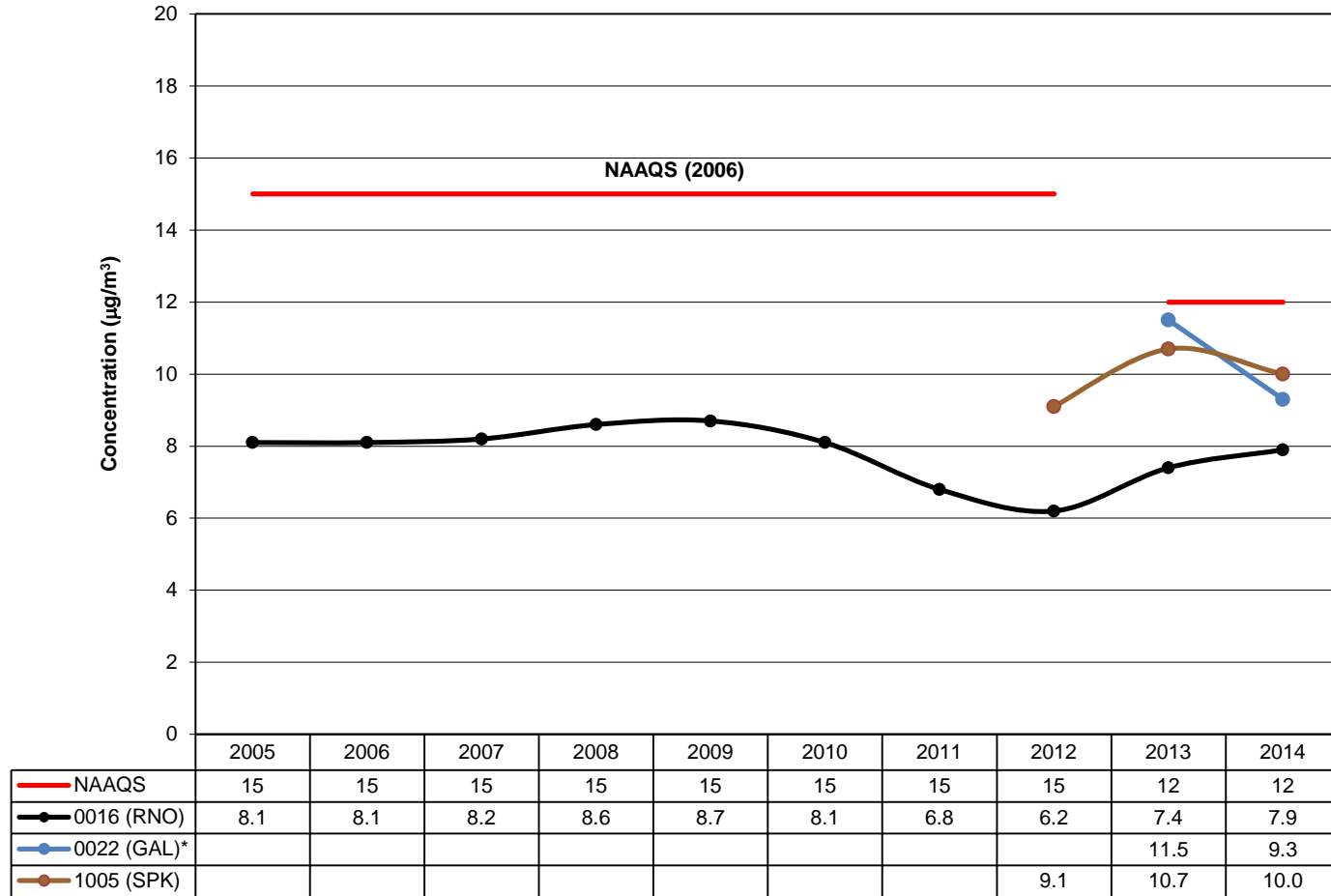


Figure 8
24-hr PM_{2.5} Design Values
(2005-2014)



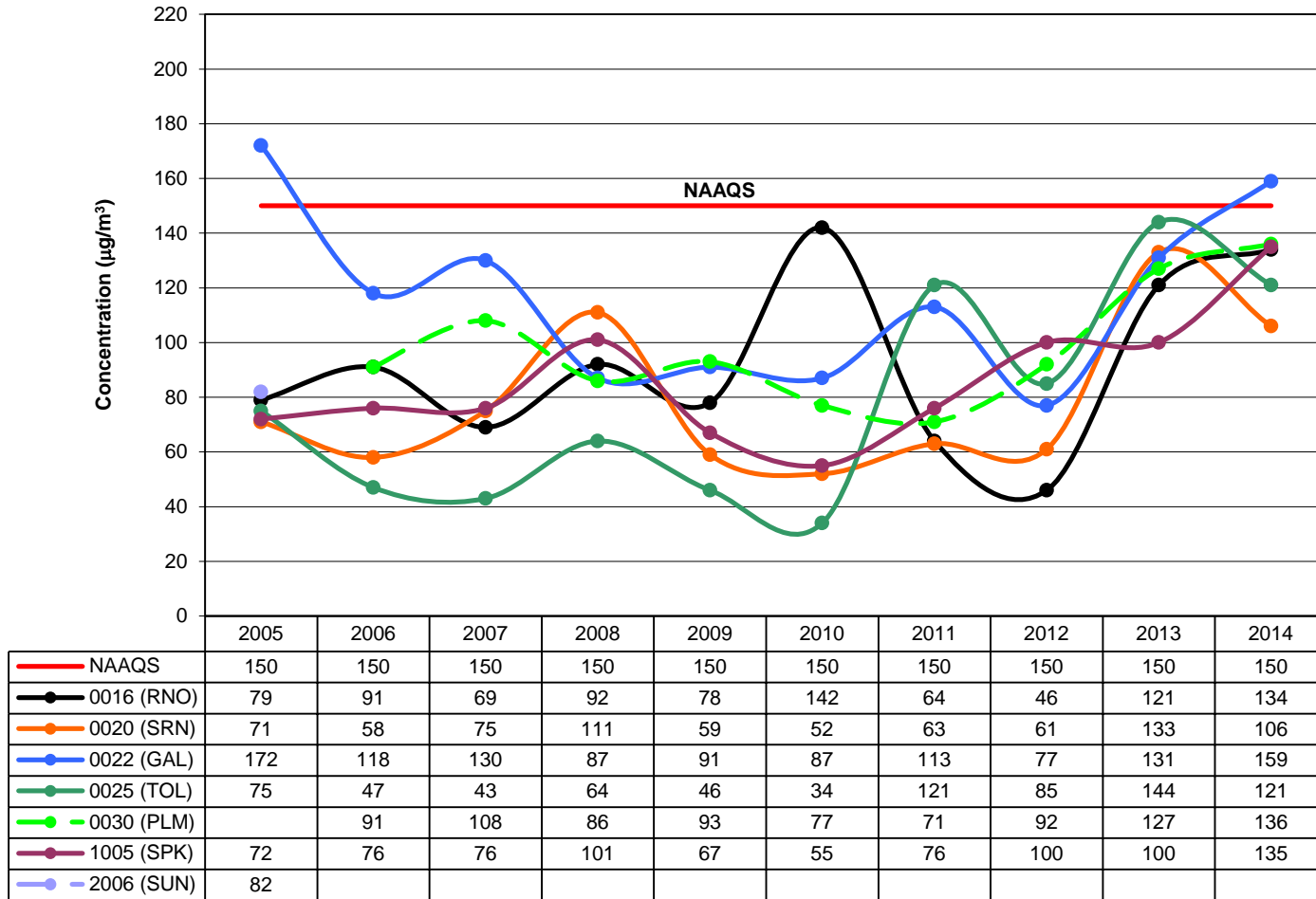
* PM_{2.5} monitoring at GAL began on January 1, 2013 and was discontinued on November 18, 2014. Because less than three years of data are available, GAL cannot be used for comparison against the NAAQS.

Figure 9
Annual PM_{2.5} Design Values
(2005-2014)



* PM_{2.5} monitoring at GAL began on January 1, 2013 and was discontinued on November 18, 2014. Because less than three years of data are available, GAL cannot be used for comparison against the NAAQS.

Figure 10
24-hr PM₁₀ First Highs
(2005-2014)



Deviation from the NAAQS

Sites that measure concentrations that are very close to the NAAQS exceedance threshold are ranked highest in this analysis. These sites may be considered more valuable for NAAQS compliance evaluation. Sites well above or below the threshold do not provide as much information in terms of NAAQS compliance.

This technique contrasts the difference between the standard and actual measurements or design values. It is a simple way to assess a monitor's value for evaluating compliance. The design values for each pollutant should be calculated as they impact regulatory compliance. If a pollutant has more than one standard (i.e., 24-hr and annual averages), monitors can be scored for each standard. The measured design value percentage of the NAAQS can be used to score each monitor. Monitors with the highest percentage will rank as most important.

Table 7
2014 Design Values vs. NAAQS
(Percentage of the NAAQS)

AQS Site ID (32-031-xxxx)	O ₃	CO		NO ₂		SO ₂	Pb		PM _{2.5}		PM ₁₀
	(8-hr)	(1-hr)	(8-hr)	(1-hr)	(Annual)	(1-hr)	(Rolling 3-mo)	(Quarterly)	(24-hr)	(Annual)	(24-hr First Highs)
0016 (RNO)	0.93	0.09	0.19	0.54	0.26	0.08	---	---	0.80	0.66	0.89
0020 (SRN)	0.92	0.07	0.14	---	---	---	---	---	---	---	0.71
0022 (GAL)	---	0.08	0.22	---	---	---	---	---	1.00*	0.78*	1.06
0025 (TOL)	0.89	0.03	0.12	---	---	---	---	---	---	---	0.81
0030 (PLM)	---	---	---	---	---	---	---	---	---	---	0.91
1005 (SPK)	0.91	0.10	0.30	---	---	---	---	---	0.91	0.83	0.90
2002 (INC)	0.84	---	---	---	---	---	---	---	---	---	---
2009 (LEM)	0.89	0.09	0.13	---	---	---	---	---	---	---	---

--- = n/a

 = ≥80% of NAAQS

* PM_{2.5} monitoring at GAL began on January 1, 2013 and was discontinued on November 18, 2014. Because less than three years of data are available, GAL cannot be used for comparison against the NAAQS.

Inter-Site Correlation Analysis for Ozone and PM_{2.5}

Measured concentrations at one monitor are compared to concentrations at other monitors to determine if concentrations correlate temporally. Monitors with concentrations that correlate well (e.g., $r^2 > 0.8$) with concentrations at another monitor may be redundant. Conversely, a monitor with concentrations that do not correlate with other nearby monitored concentrations may be unique and have more value for spatial monitoring objectives.

Lake Michigan Air Director Consortium's (LADCO) correlation analysis tool was applied for pairs of sites in Washoe County to produce static analysis results. A graphical matrix plot for ozone and PM_{2.5} and a corresponding csv file were produced. Two key metrics were generated: Pearson squared correlation coefficient and average relative difference. The correlation coefficient for two sites represents the 'degree of relatedness' between the two sites, and the average relative difference represents the overall measurement similarity between the two sites.

Flatter ellipses indicate highly correlated sites. Paler yellow and white colors indicate sites with low average relative difference, meaning concentrations are similar in magnitude.

Figure 11
8-hr Daily Max Ozone Correlation Matrix

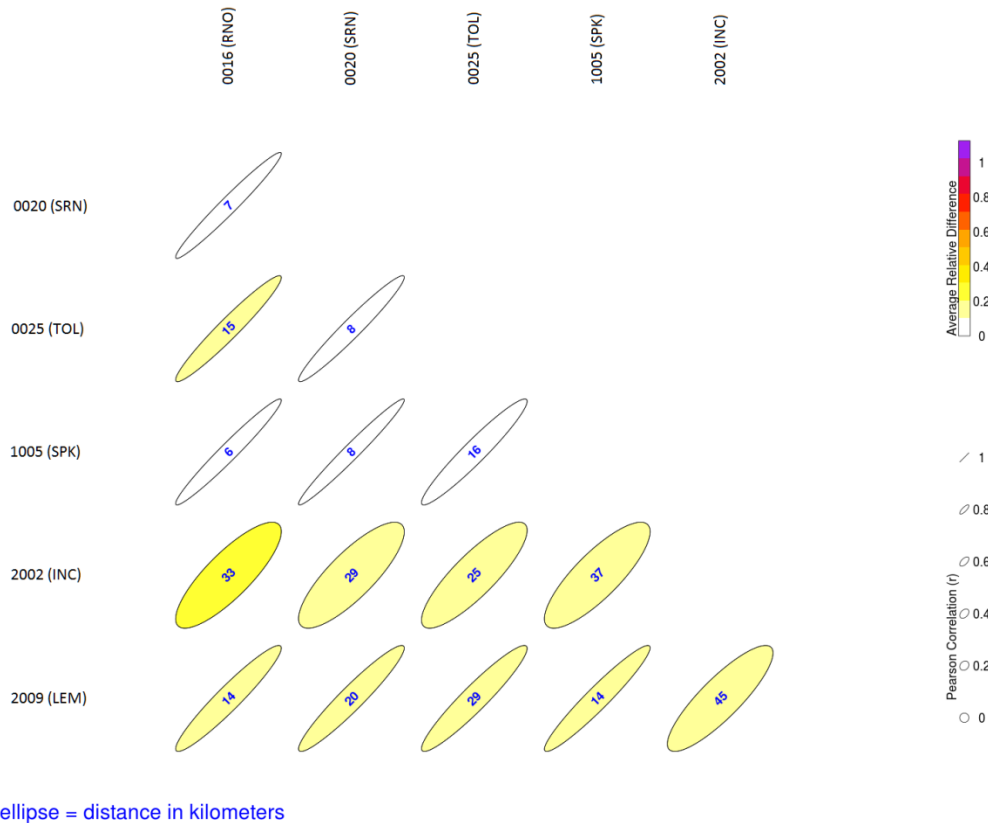
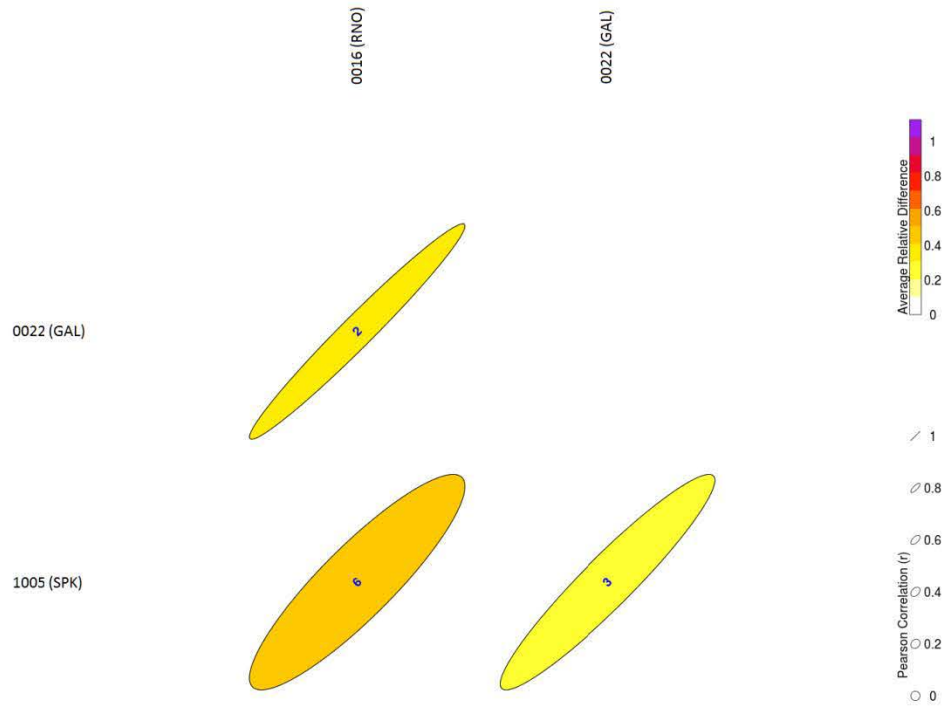


Figure 12
Daily PM_{2.5} Correlation Matrix



values in ellipse = distance in kilometers

Area Served

Area served was one of five site-by-site criteria used in the national-scale network assessment. In the National Assessment, the “area served” metric was used as a proxy for the spatial coverage of each monitor. Thiessen polygons are applied as a standard technique in geography to assign a zone of influence or representativeness to the area around a given point. These polygons can be determined using a GIS package. Calculating Thiessen polygons is one of the simplest quantitative methods for determining an area of representation around sites (see Appendix A). However, it is not a true indication of which site is most representative in concentration to a given area. Meteorology (including pollutant transport), topography, and proximity to population or emission sources are not considered, so some areas assigned to a particular monitor may actually be better represented by a different monitor. More accurate determinations of representative monitors require a more sophisticated spatial analysis technique, such as suitability modeling, photochemical modeling, or parameter weighted distance.

Table 8
Area Served (2014)

AQS Site ID (32-031-xxxx)	Any Pollutant	Area Served (square miles) by Pollutant					
		O ₃	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}
0016 (RNO)	85	91	126	6,542	6,542	142	447
0020 (SRN)	60	64	---	---	---	72	---
0025 (TOL)	116	116	290	---	---	255	---
0030 (PLM)	11	---	---	---	---	11	---
1005 (SPK)	44	44	417	---	---	43	76
2002 (INC)	151	151	---	---	---	---	---
2009 (LEM)	4,675	4,675	5,708	---	---	---	---
Spanish Springs (Proposed)	1,400	1,400	---	---	---	6,019	6,019

Population Served

Large populations are associated with high emissions. Sites are ranked based on the number of people they represent. Area of representation can be determined using the Thiessen polygons. Populations at the census-tract or block-group level that fall within the area of representation of a monitor are assigned to that monitor (see Appendix A). This technique gives the most weight to sites that are in areas of high population and have large areas of representation.

Calculating the population served by a particular monitor requires two steps: 1) Determine the area of representation for each monitor; and 2) determine the population within each area of representation. Step 1 can be performed most simply using the Thiessen polygons technique; however, a more sophisticated method that takes into account distance, meteorology, topography, etc. could also be applied. Sites that score high with this metric are important for assessing population exposure. This technique was one of five site-by-site criteria used in the national-scale network assessment. Thiessen polygons are applied as a standard technique in geography to assign a zone of influence or representativeness to the area around a given point. The “population served” method can also be applied to assess the importance of monitors from an environmental justice perspective. The technique is the same, except populations of specific groups (i.e., low income or disadvantaged) are used instead of total population.

Table 9
Population Served (2014)

AQS Site ID (32-031-XXXX)	Any Pollutant	Population Served (1,000’s) by Pollutant					
		O ₃	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}
0016 (RNO)	122.1	144.2	170.2	426.6	426.6	144.1	258.8
0020 (SRN)	53.5	54.0	---	---	---	46.5	---
0025 (TOL)	36.6	36.6	73.5	---	---	56.2	---
0030 (PLM)	30.0	---	---	---	---	30.0	---
1005 (SPK)	76.2	76.7	123.1	---	---	76.2	94.3
2002 (INC)	19.7	19.7	---	---	---	---	---
2009 (LEM)	41.5	41.5	59.8	---	---	---	---
Spanish Springs (Proposed)	54.0	54.0	---	---	---	73.5	73.5

Population Change

High rates of population increase are associated with increased potential emissions activity and exposure. Sites are ranked based on population increase in the area of representation. Area of representation can be determined using the Thiessen polygons technique or a more sophisticated method. The total population change at the census-tract or block-group level that falls within the area of coverage of a monitor is assigned to that monitor (see Appendix B). This technique gives most weight to sites in areas with high rates of population growth and large areas of representation.

Determining the population change near a particular monitor requires two steps: 1) Identify the area of responsibility for each monitor; and 2) determine the percent change in population within each area of responsibility. Step 1 can be done most simply using the Thiessen polygons technique; however, a more sophisticated method that takes into account distance, meteorology, topography, etc. can also be applied. Step 2 can be performed using U.S. Census population data at a variety of geographic levels (i.e., census block group, census tract). However, because census boundaries change over time, it is difficult and time-intensive to link localized census boundary data. The link between census boundary files is necessary to join the comparison population values and find an accurate percent change in population. One way to accomplish this is by gridding both data sets to a common grid scale. Sites that score high with this metric are important for assessing population exposure and tracking future emissions growth. The population change method can also be applied to assess the importance of monitors from an environmental justice perspective. The technique is the same, except population changes of specific groups (i.e., low income or minority) are calculated instead of total population. Population change can also be applied as a bottom-up technique. Using the census data, areas of rapid growth can be located and considered as potential locations for new monitors.

Table 10
Change in Population Served (2009-2014)

AQS Site ID (32-031-xxxx)	Any Pollutant	Change in Population Served by Pollutant					
		O ₃	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}
0016 (RNO)	6,496	7,484	7,571	9,295	9,295	6,938	9,960
0020 (SRN)	1,904	1,324	---	---	---	1,904	---
0025 (TOL)	2,318	2,318	3,173	---	---	2,277	---
0030 (PLM)	419	---	---	---	---	419	---
1005 (SPK)	686	697	1,643	---	---	686	2,263
2002 (INC)	-41	-41	---	---	---	---	---
2009 (LEM)	682	682	1,209	---	---	---	---
Spanish Springs (Proposed)	1,133	1,137	---	---	---	1,377	1,372

Situational Analysis

Situational analysis considers the entire ambient air monitoring network and individual monitors in more detail and may take into account criteria such as research, policy, and resource needs. This analysis reviewed a scenario that added one monitoring site (West Reno/Verdi). The site under consideration for addition would monitor for O₃, PM₁₀, PM_{2.5} and surface meteorology. Thiessen Polygons were used to determine Area Served, Population Served, and Change in Population served with the addition of the West Reno/Verdi monitoring site (see Appendix C). The site-by-site situational analyses are summarized in the next three tables, and can be compared to the analyses without the new site addition, in Tables 8, 9, and 10.

Table 11
Area Served (2014) with West Reno/Verdi Site Addition

AQS Site ID (32-031-xxxx)	Any Pollutant	Area Served (square miles) by Pollutant					
		O ₃	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}
0016 (RNO)	39	45	126	6,542	6,542	57	238
0020 (SRN)	60	52	---	---	---	48	---
0025 (TOL)	116	116	290	---	---	242	---
0030 (PLM)	11	---	---	---	---	11	---
1005 (SPK)	44	44	417	---	---	43	76
2002 (INC)	144	144	---	---	---	---	---
2009 (LEM)	4,661	4,661	5,708	---	---	---	---
Spanish Springs (Proposed)	1,400	1,400	---	---	---	6,004	6,004
West Reno/ Verdi (Future)	80	80	---	---	---	135	223

Table 12
Population Served (2014) with West Reno/Verdi Site Addition

AQS Site ID (32-031-XXXX)	Any Pollutant	Population Served (1,000's) by Pollutant					
		O ₃	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}
0016 (RNO)	111.5	133.6	170.2	426.6	426.6	128.3	224.4
0020 (SRN)	53.5	54.0	---	---	---	46.5	---
0025 (TOL)	36.6	36.6	73.5	---	---	56.2	---
0030 (PLM)	30.0	---	---	---	---	30.0	---
1005 (SPK)	76.2	76.7	123.1	---	---	76.2	94.3
2002 (INC)	19.7	19.7	---	---	---	---	---
2009 (LEM)	41.5	41.5	59.8	---	---	---	---
Spanish Springs (Proposed)	54.0	54.0	---	---	---	69.4	69.4
West Reno/ Verdi (Future)	10.6	10.6	---	---	---	19.9	38.5

Table 13
Change in Population Served (2009-2014) with West Reno/Verdi Site Addition

AQS Site ID (32-031-XXXX)	Any Pollutant	Change in Population Served by Pollutant					
		O ₃	CO	NO _x	SO ₂	PM ₁₀	PM _{2.5}
0016 (RNO)	5,427	6,416	7,571	9,295	9,295	5,997	9,068
0020 (SRN)	1,904	1,324	---	---	---	1,904	---
0025 (TOL)	2,318	2,318	3,173	---	---	2,277	---
0030 (PLM)	419	---	---	---	---	419	---
1005 (SPK)	686	697	1,643	---	---	686	2,263
2002 (INC)	-41	-41	---	---	---	---	---
2009 (LEM)	682	682	1,209	---	---	---	---
Spanish Springs (Proposed)	1,133	1,137	---	---	---	1,354	1,349
West Reno/ Verdi (Future)	1,068	1,068	---	---	---	964	915

Suggested Modifications to the Monitoring Network

The AQMD network assessment focused primarily on the population and geography of HA 87 and directly adjacent areas. Consequently, the recommendations developed as a result of this assessment will concentrate on the southern portion of Washoe County as described in the Regional Description section of this document. The analyses provided an objective assessment of the current AQMD network and the recommendations offered in this section do not necessarily indicate how AQMD will eventually act to meet its objectives.

To meet the objectives of the AQMD network assessment, a suite of analyses was performed. The results of the individual analyses were summarized into a complete set of conclusions and recommendations. Recommendations were developed for the AQMD network as a whole and for individual monitoring sites within the network. The remainder of this section summarizes the overall AQMD network recommendations and the site-specific recommendations.

Recommendations for the Overall AQMD Monitoring Network

- *Consider placing a neighborhood scale monitoring site in the West Reno/Verdi area.* Currently, the downtown Reno 3 monitoring site covers a large population. By placing an additional monitoring site just west of the HA 87 boundary, population exposure of PM₁₀, PM_{2.5}, PM_{10-2.5}, O₃, and surface meteorology could be collected. This would cover a dense population situated at a slightly higher elevation at the base of the Sierra Nevada foothills.

Site-Specific Recommendations

Table 14 summarizes the current monitoring objective of each site in the AQMD network and includes a summary of the recommended modifications to each site. The recommendations were developed by examining the results of the assessment as a whole.

Table 14
Summary of Recommended Modifications to the Existing AQMD Network

AQS Site ID (32-031-xxxx)	Current Monitoring Objective	Recommended Modifications
0016 (RNO)	<p>This downtown site began operation in January 2002 to replace the Reno site. Both a residential neighborhood and a commercial growth area surround this site. In December 2010, this site became an NCore site. The site monitors for population exposure of PM₁₀, PM_{2.5}, PM_{10-2.5}, PM_{2.5} speciation, O₃, Trace CO, NO₂, Trace NO_y, Trace SO₂, wind speed, wind direction, ambient temperature, and relative humidity. The monitoring objectives are Public information, NAAQS comparison and Research support.</p>	<p><u>Site objective:</u> No recommended changes.</p> <p><u>Parameters measured:</u> Add a solar radiation sensor.</p> <p><u>Other recommendations:</u> No recommended changes.</p>
0020 (SRN)	<p>Located on the NV Energy property at 4110 Delucchi Lane, this site is in a transitional environment between open fields and office buildings. The site monitors for population exposure of PM₁₀, O₃, wind speed, wind direction, and ambient temperature. The monitoring objectives are Public information and NAAQS comparison.</p>	<p><u>Site objective:</u> No recommended changes.</p> <p><u>Parameters measured:</u> Consider discontinuing PM₁₀ monitoring.</p> <p><u>Other recommendations:</u> No recommended changes.</p>
0022 (GAL)	<p>This site was located southeast of the Interstate 80 - US Highway 395 interchange in a commercial/industrial area. The Galletti site was closed in November 2014 due to an emergency paving project by the Nevada Department of Transportation. The site monitored for highest concentrations of PM₁₀, PM_{2.5}, PM_{10-2.5}, and CO, and population exposure of wind speed, wind direction, and ambient temperature. The monitoring objectives were Public information and NAAQS comparison.</p>	<p><u>Site objective:</u> Site closed.</p> <p><u>Parameters measured:</u> Site closed.</p> <p><u>Other recommendations:</u> Site closed.</p>

Table 14 (continued)
Summary of Recommended Modifications to the Existing AQMD Network

AQS Site ID (32-031-xxxx)	Current Monitoring Objective	Recommended Modifications
0025 (TOL)	The Toll Road site is located at 684A State Route 341 (Geiger Grade), one-half mile east of US Highway 395. The site is near the edge of a residential neighborhood and adjacent to an area that may become commercially developed. Due to the distance from the probe to the nearest roadway, this is a middle scale site for CO. This site monitors for source oriented CO, and population exposure of O ₃ , wind speed, wind direction, and ambient temperature.	<p><u>Site objective</u>: No recommended changes.</p> <p><u>Parameters measured</u>: Consider discontinuing CO monitoring.</p> <p><u>Other recommendations</u>: No recommended changes.</p>
0030 (PLM)	The Plumb-Kit site is located on the northeast corner of Plumb Lane and Kietzke Lane. The site is surrounded by both residential and commercial properties as well as a school. The site monitors for population exposure of PM ₁₀ , wind speed, wind direction, and ambient temperature. The monitoring objectives are Public information and NAAQS comparison.	<p><u>Site objective</u>: No recommended changes.</p> <p><u>Parameters measured</u>: No recommended changes.</p> <p><u>Other recommendations</u>: No recommended changes.</p>
1005 (SPK)	The Sparks site is located on US Postal Service property at 750 Fourth Street. The site is surrounded by commercial property, a residential neighborhood and is adjacent to Dilworth Middle School. This site monitors highest concentration s of PM _{2.5} , PM _{10-2.5} , O ₃ , and CO and population exposure of PM ₁₀ , wind speed, wind direction, and ambient temperature. The monitoring objectives are Public information and NAAQS comparison.	<p><u>Site objective</u>: No recommended changes.</p> <p><u>Parameters measured</u>: No recommended changes.</p> <p><u>Other recommendations</u>: No recommended changes.</p>

Table 14 (continued)
Summary of Recommended Modifications to the Existing AQMD Network

AQS Site ID (32-031-xxxx)	Current Monitoring Objective	Recommended Modifications
2002 (INC)	This site is located in a Washoe County office building at 855 Alder Avenue and is outside HA 87. It is located in a residential/commercial neighborhood. This site only monitors for population exposure of O ₃ . The monitoring objective is NAAQS comparison.	<p><u>Site objective:</u> No recommended changes.</p> <p><u>Parameters measured:</u> No recommended changes.</p> <p><u>Other recommendations:</u> No recommended changes.</p>
2009 (LEM)	Located at the Boys and Girls Club at 325 Patrician Drive, this site is outside HA 87. It is in a transitional area among residences, parks, and open fields. The site monitors for population exposure of O ₃ and CO. The monitoring objective is NAAQS comparison.	<p><u>Site objective:</u> No recommended changes.</p> <p><u>Parameters measured:</u> Consider discontinuing CO monitoring and adding surface meteorological measurements.</p> <p><u>Other recommendations:</u> No recommended changes.</p>
Spanish Springs (Proposed)	EPA has approved the addition of this site to the network. AQMD has received approval from the County Parks Commission, and is awaiting final approval from the Board of County Commissioners. This site will be located on the north side of Lazy 5 Park in Spanish Springs. It will be in area among residences, parks, and open fields. This SPM site will monitor for PM ₁₀ , PM _{2.5} , PM _{10-2.5} , O ₃ , wind speed, wind direction, and ambient temperature. The monitoring objectives will be Public information and eventually NAAQS comparison.	<p><u>Site objective:</u> Initiate monitoring for Public information and NAAQS comparison.</p> <p><u>Parameters measured:</u> Initiate PM₁₀, PM_{2.5}, PM_{10-2.5}, O₃, wind speed, wind direction, and ambient temperature monitoring.</p> <p><u>Other recommendations:</u> Initiate as a SPM site with the intention of conversion to SLAMS.</p>

Future Monitoring Requirements

Near-Road NO₂ Monitoring

On February 9, 2010, the U.S. Environmental Protection Agency (EPA) promulgated new minimum monitoring requirements for the nitrogen dioxide (NO₂) monitoring network in support of a newly revised 1-hour NO₂ National Ambient Air Quality Standards (NAAQS) and the retained annual NAAQS. In the new monitoring requirements, state and local air monitoring agencies are required to install near-road NO₂ monitoring stations at locations where peak hourly NO₂ concentrations are expected to occur within the near-road environment in larger urban areas. Specifically, Title 40 CFR 58, Appendix D, Section 4.3.2 requires one near-road NO₂ monitoring station in each CBSA with populations over 500,000 people

The 2014 population estimate from the Nevada State Demographer's Office for the Reno, NV CBSA is 440,771. According to population projections from the Nevada State Demographer's Office, the Reno, NV CBSA will reach the 500,000 people threshold in approximately 2021-2022.

Pb Monitoring at NCore Sites

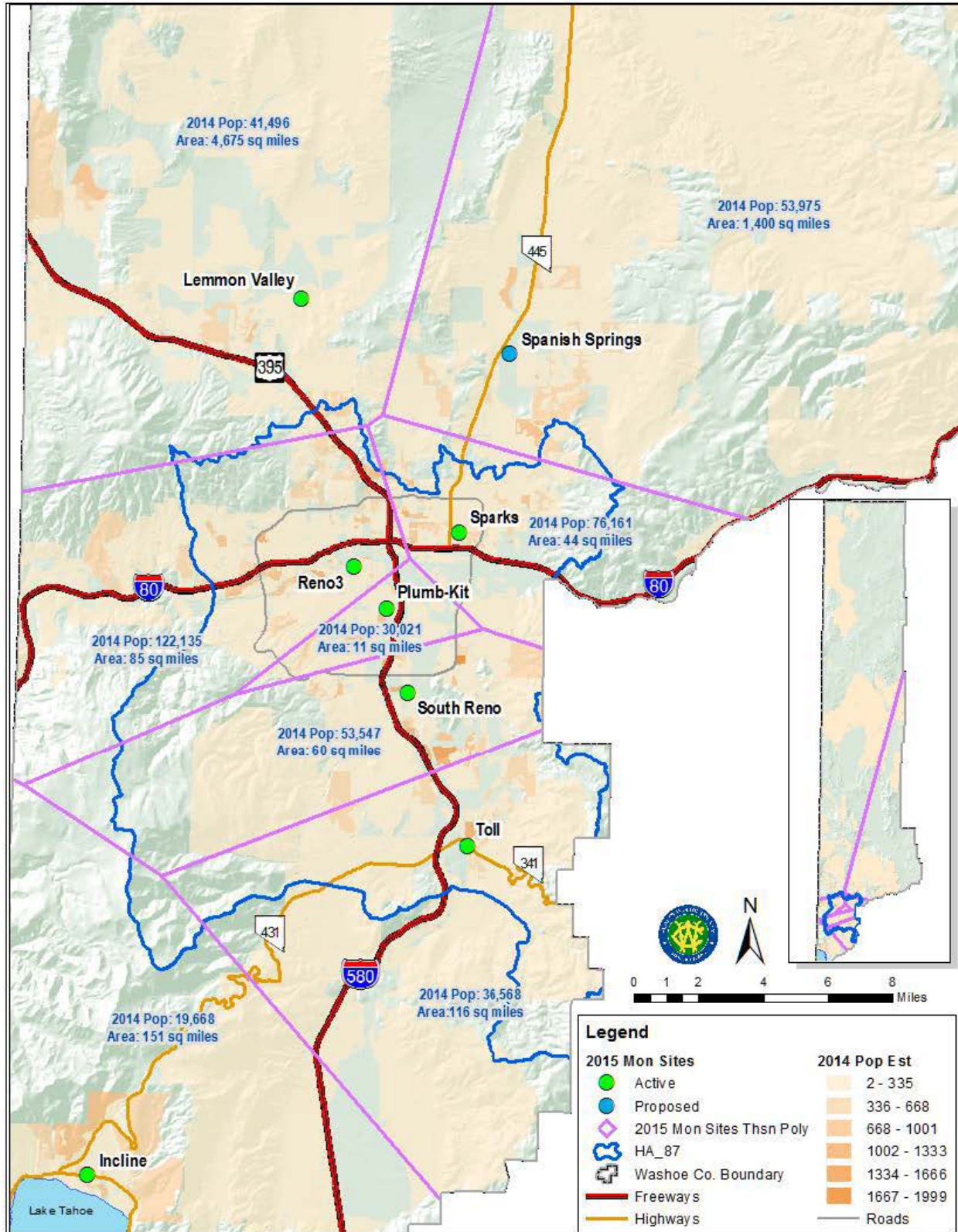
Title 40 CFR 58, Appendix D, Section 3(b) requires Pb monitoring for NCore sites in CBSAs with a population of 500,000 people or greater.

The 2014 population estimate from the Nevada State Demographer's Office for the Reno, NV CBSA is 440,771. According to population projections from the Nevada State Demographer's Office, the Reno, NV CBSA will reach the 500,000 people threshold in approximately 2021-2022.

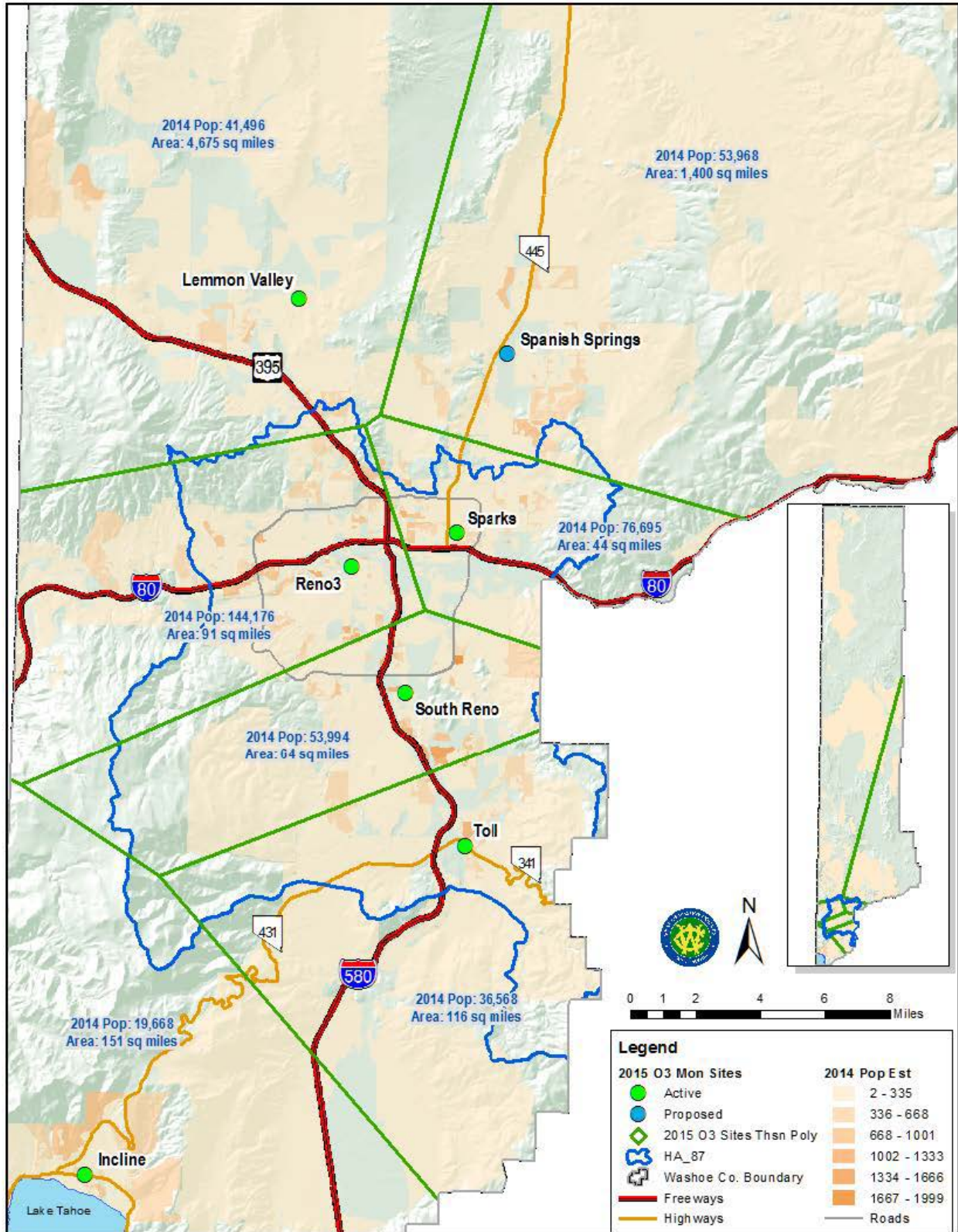
Appendix A

Statistical Analysis (Area Served and Population Served Analyses)

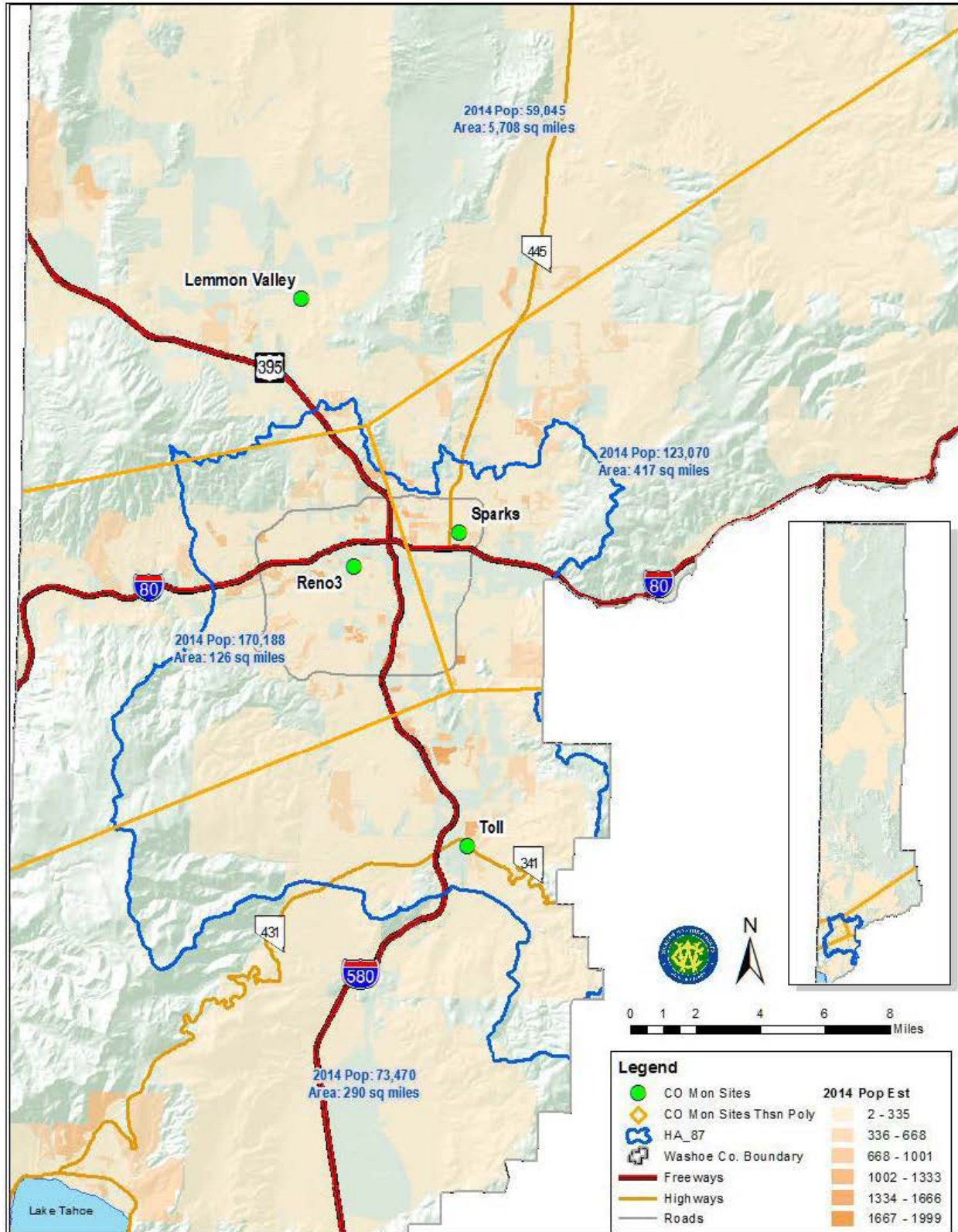
Thiessen Polygons for AQMD's Current and Proposed Monitoring Sites Area Served and 2014 Population Served Estimates



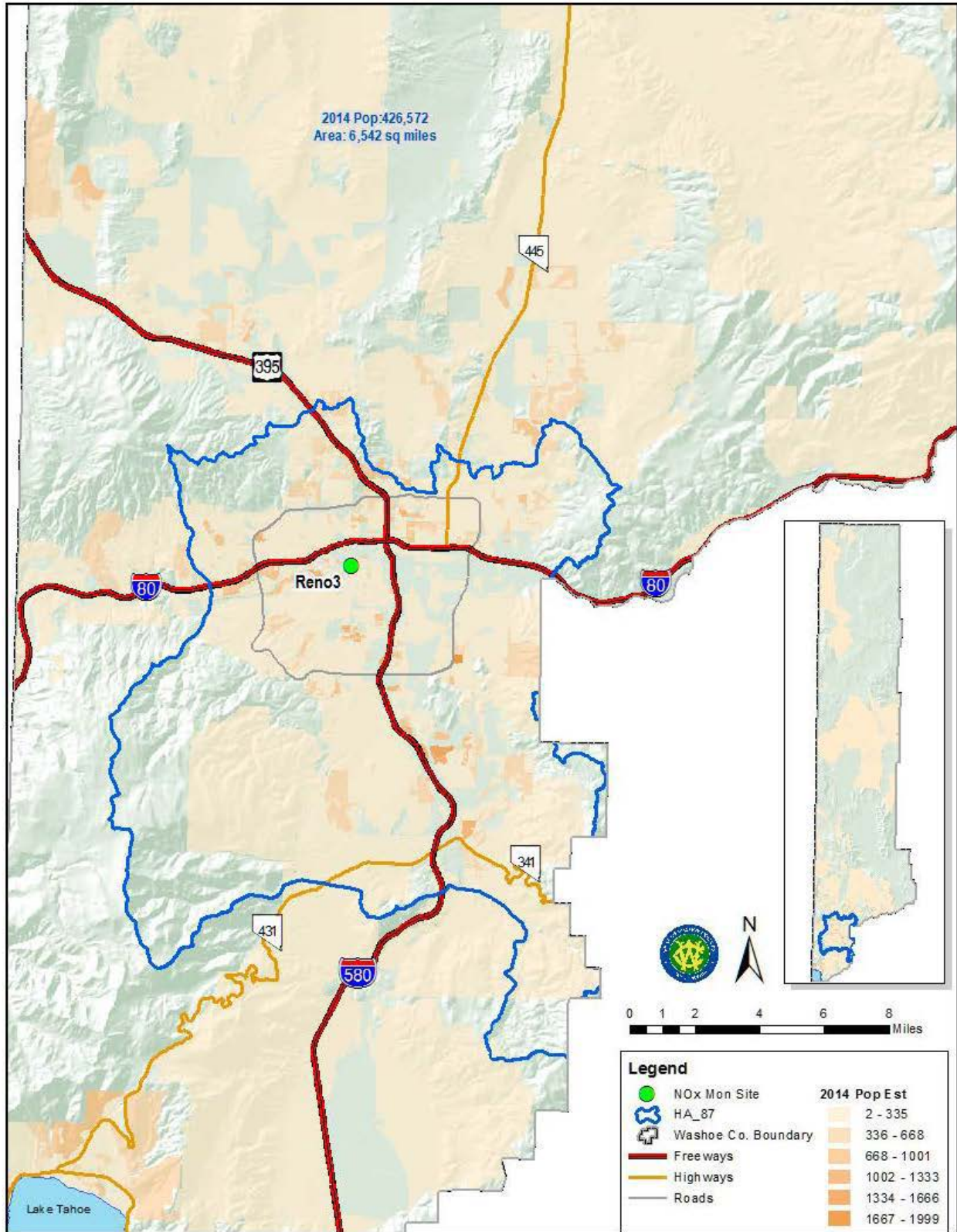
Thiessen Polygons for AQMD's Current and Proposed O₃ Monitoring Sites Area Served and 2014 Population Served Estimates



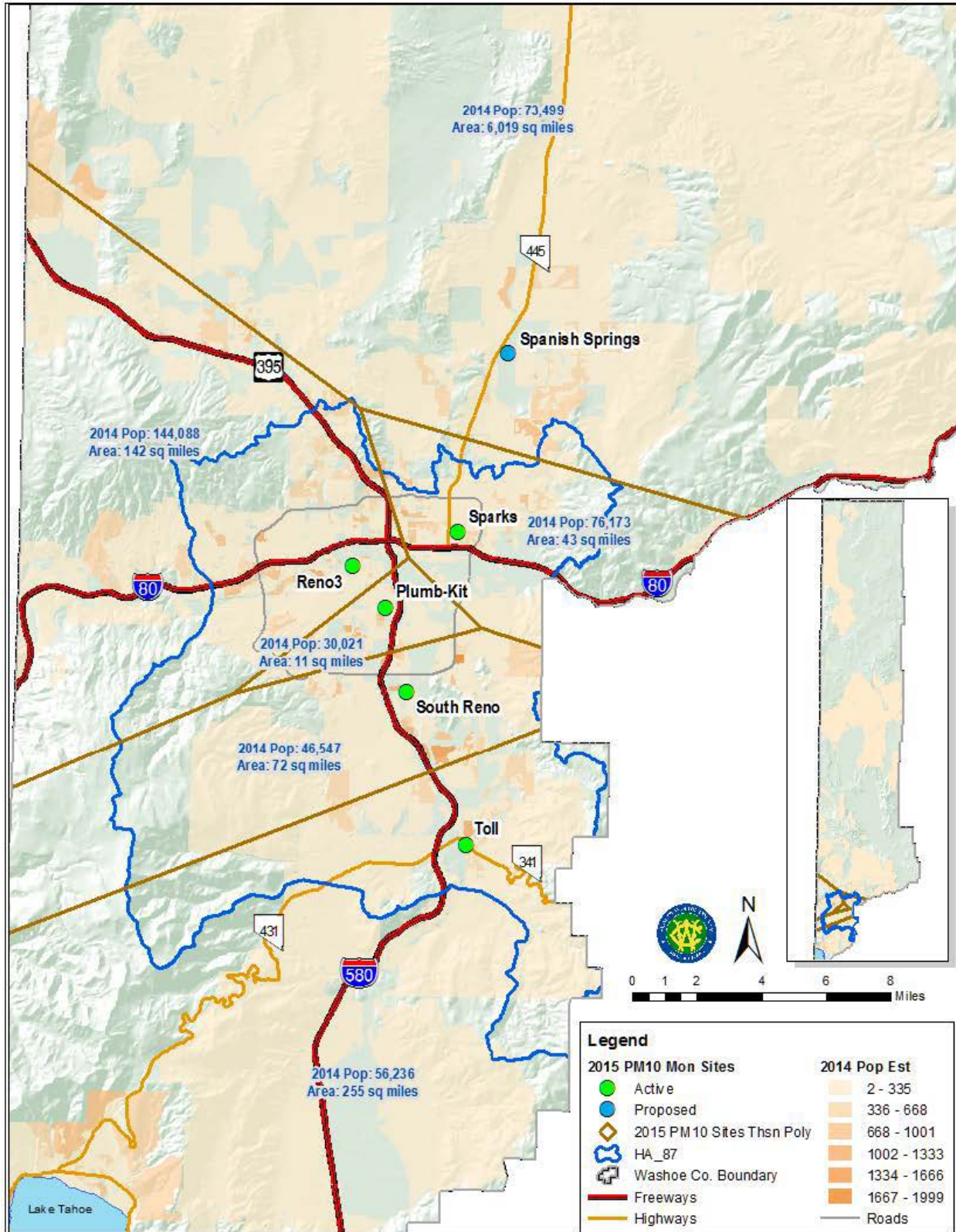
Thiessen Polygons for AQMD's Current CO Monitoring Sites Area Served and 2014 Population Served Estimates



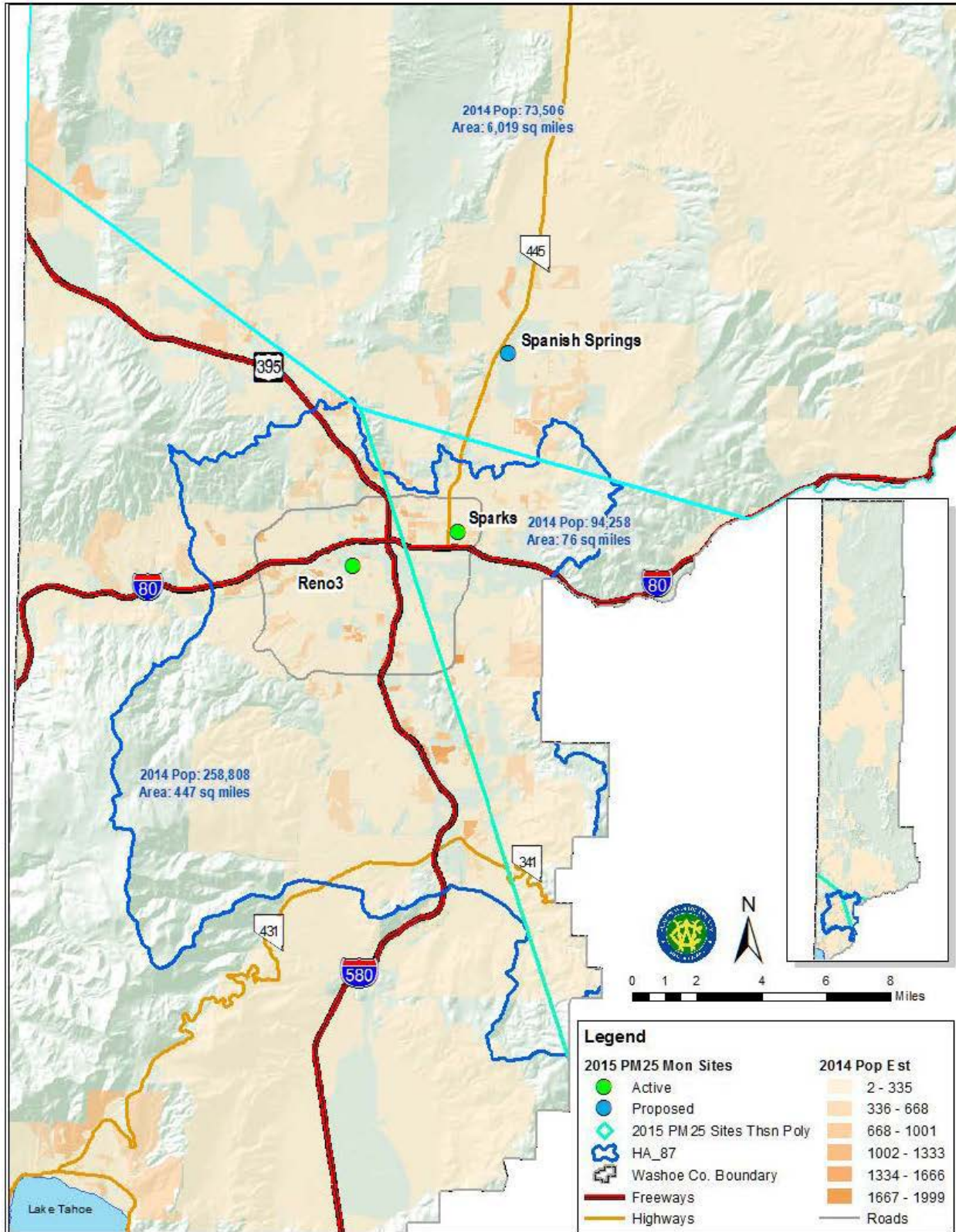
Thiessen Polygons for AQMD's Current NO_x Monitoring Sites Area Served and 2014 Population Served Estimates



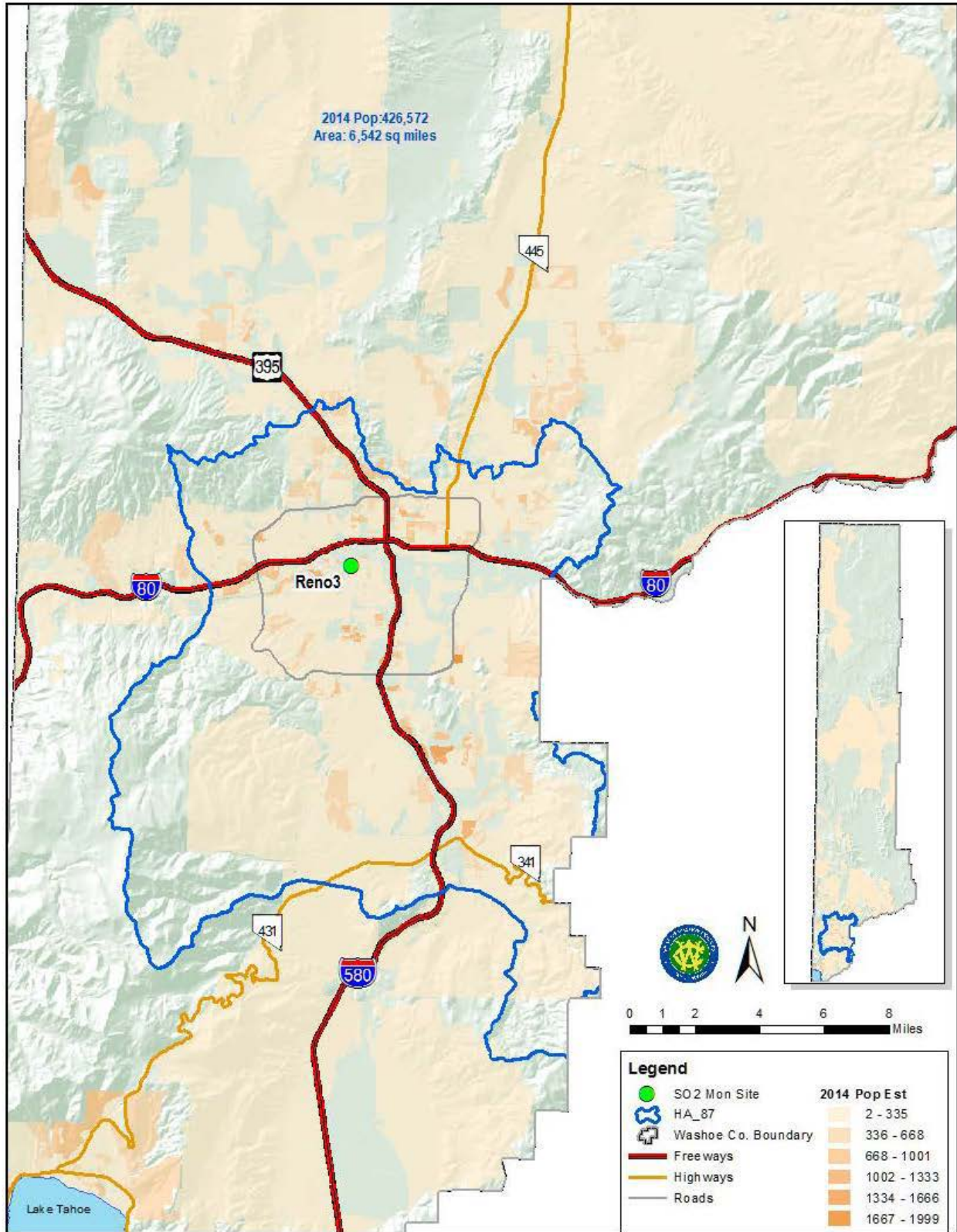
Thiessen Polygons for AQMD's Current and Proposed PM₁₀ Monitoring Sites Area Served and 2014 Population Served Estimates



Thiessen Polygons for AQMD's Current and Proposed PM_{2.5} Monitoring Sites Area Served and 2014 Population Served Estimates



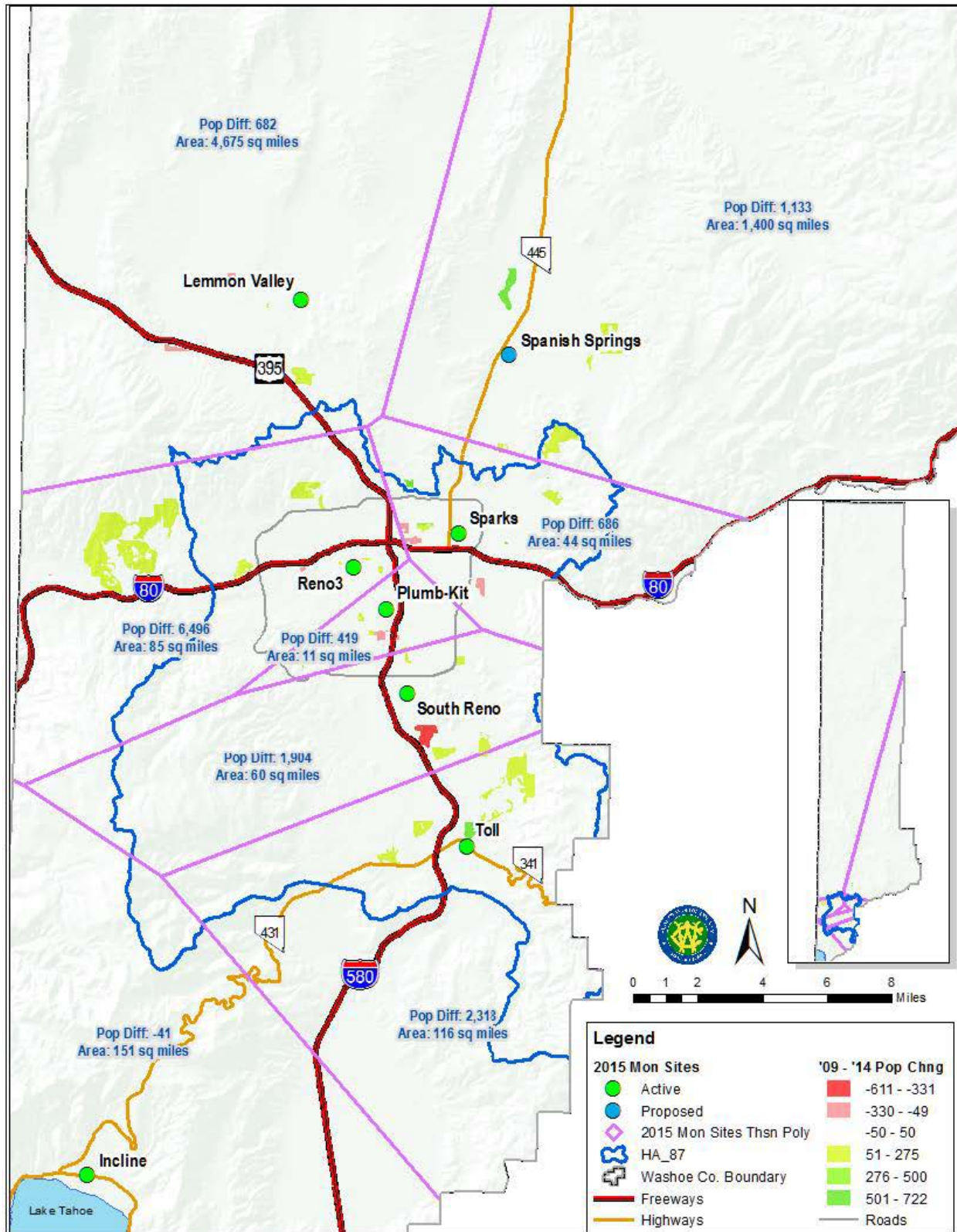
**Thiessen Polygons for AQMD's Current SO₂ Monitoring Sites
Area Served and 2014 Population Served Estimates**



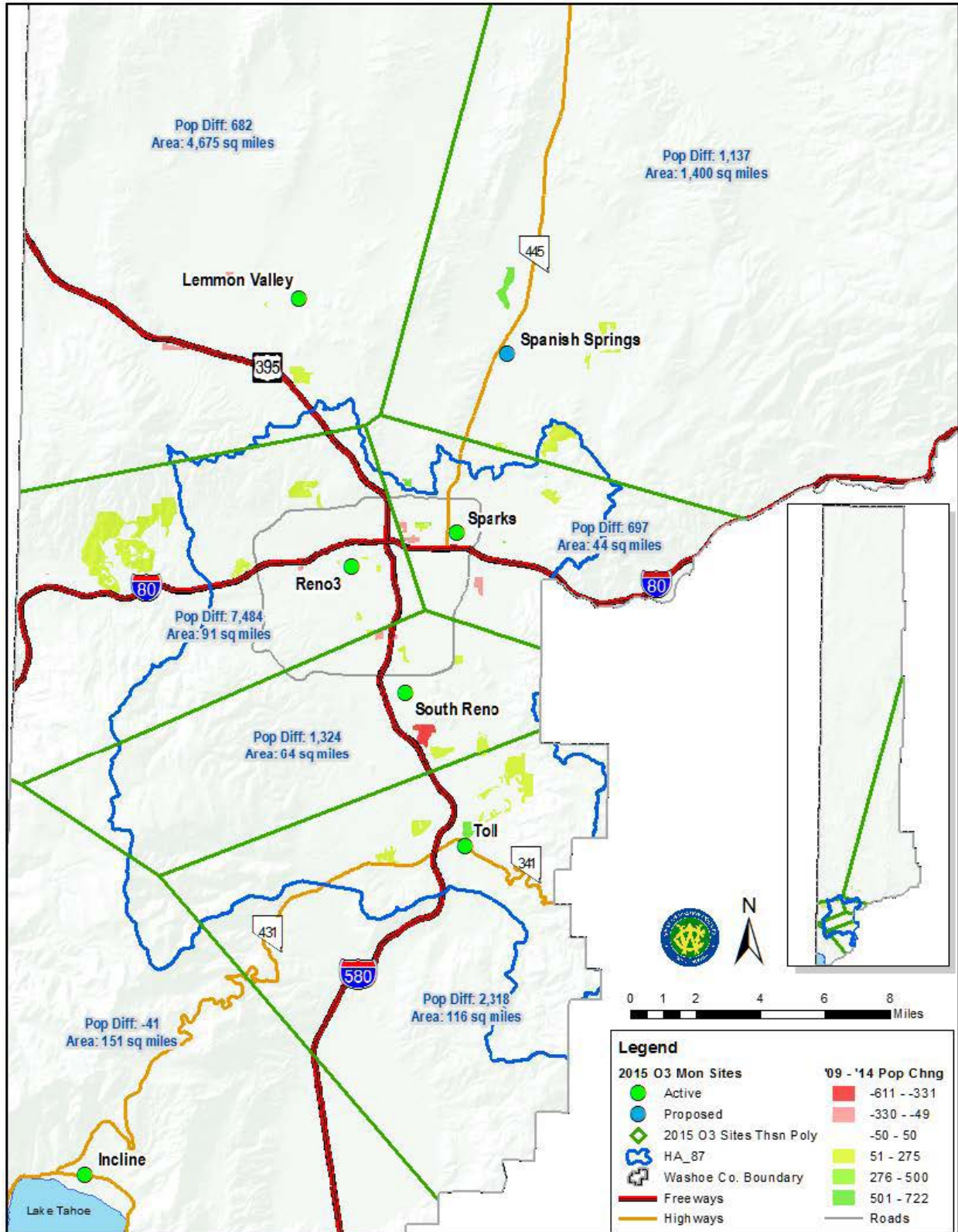
Appendix B

Statistical Analysis (Population Change Analyses)

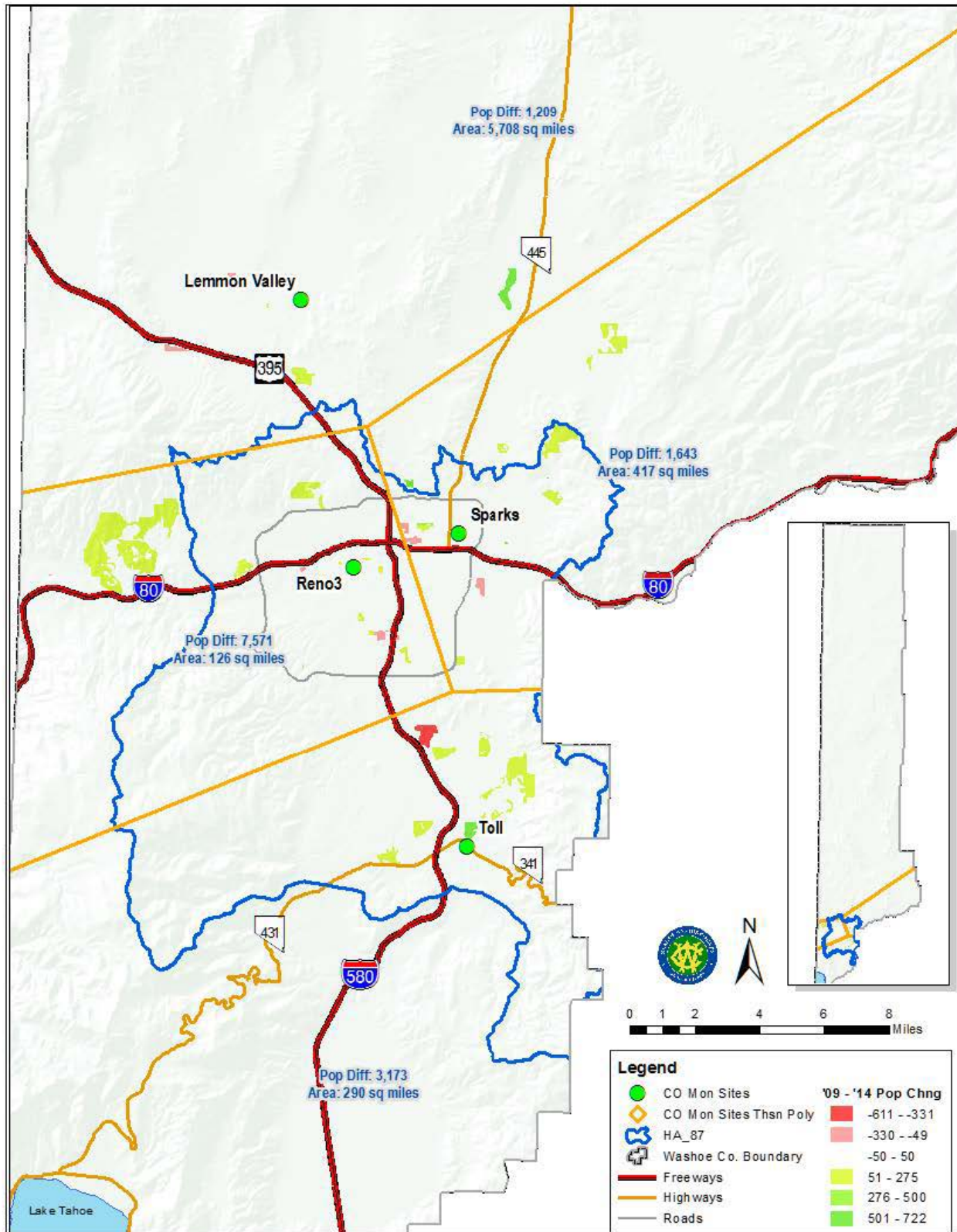
Thiessen Polygons for AQMD's Current and Proposed Monitoring Sites Population Change between 2009 and 2014



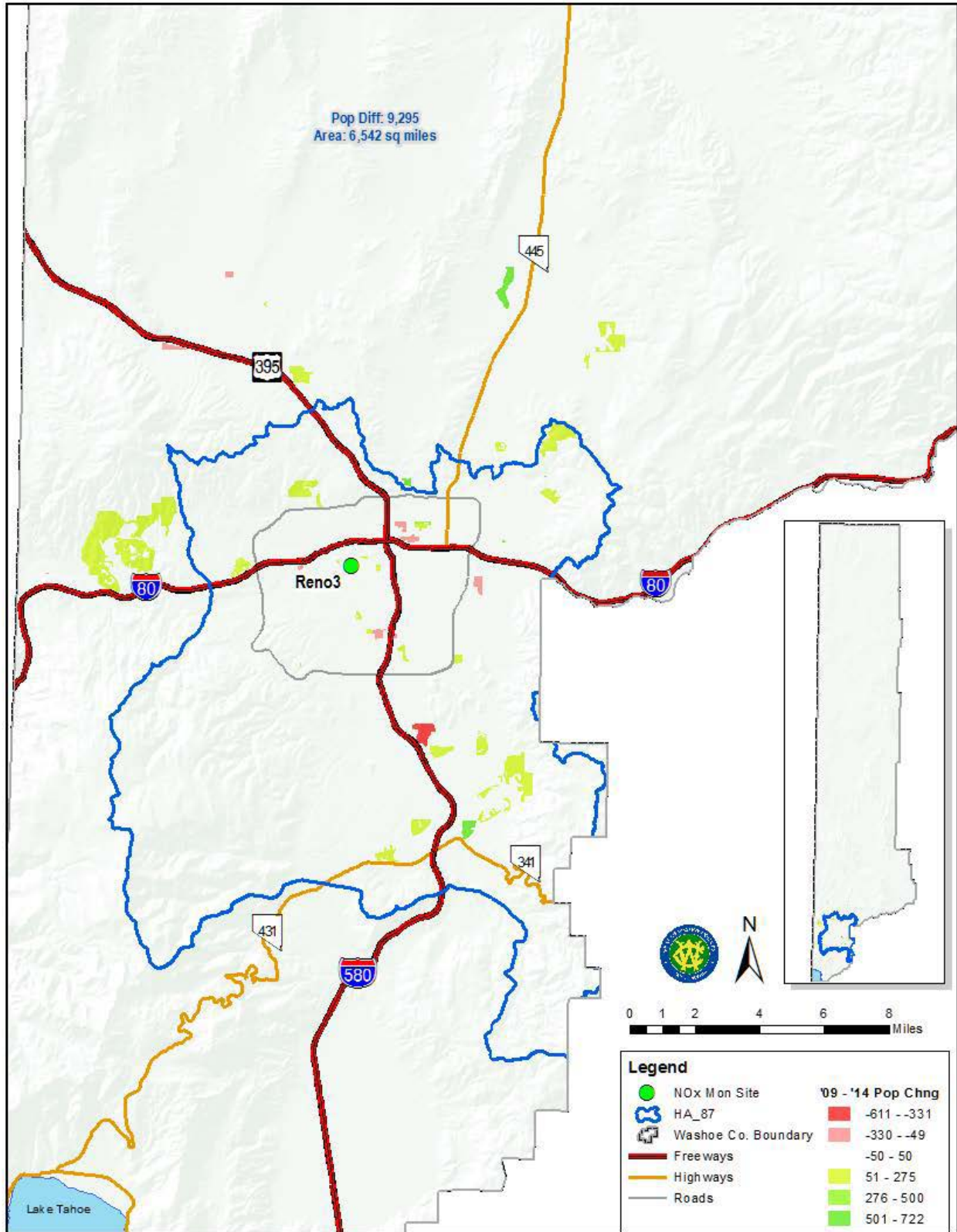
Thiessen Polygons for AQMD's Current and Proposed O₃ Monitoring Sites Population Change between 2009 and 2014



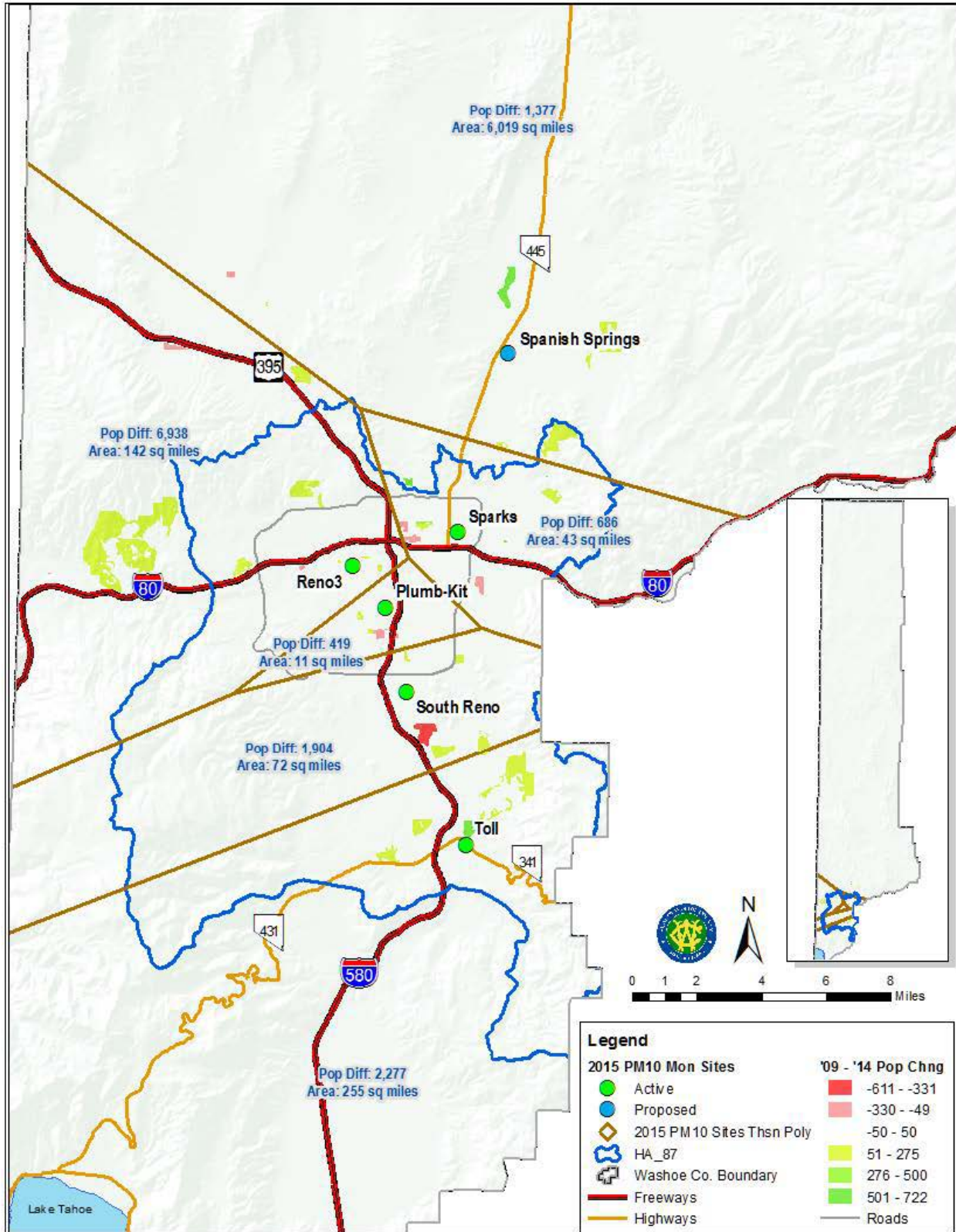
Thiessen Polygons for AQMD's Current CO Monitoring Sites Population Change between 2009 and 2014



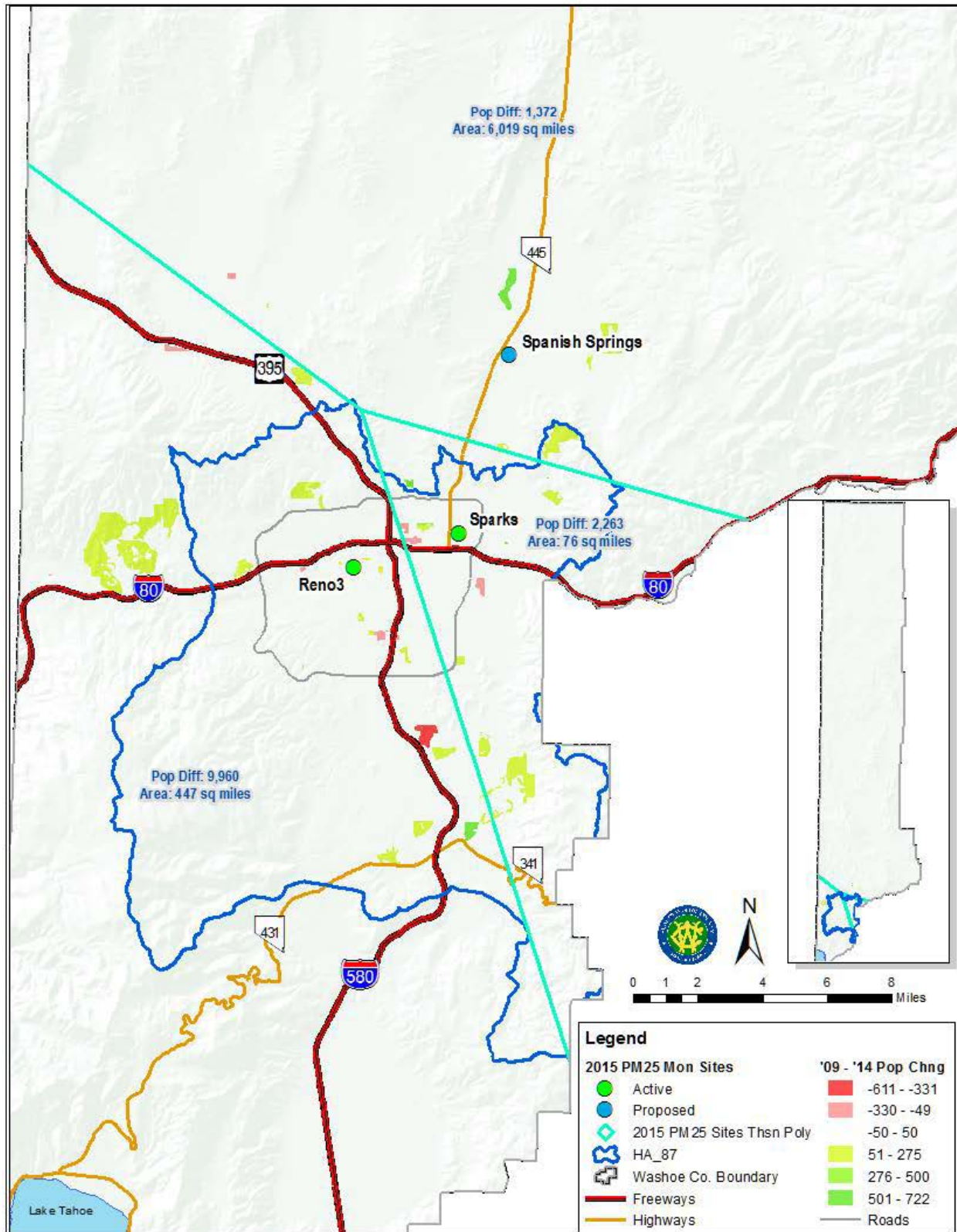
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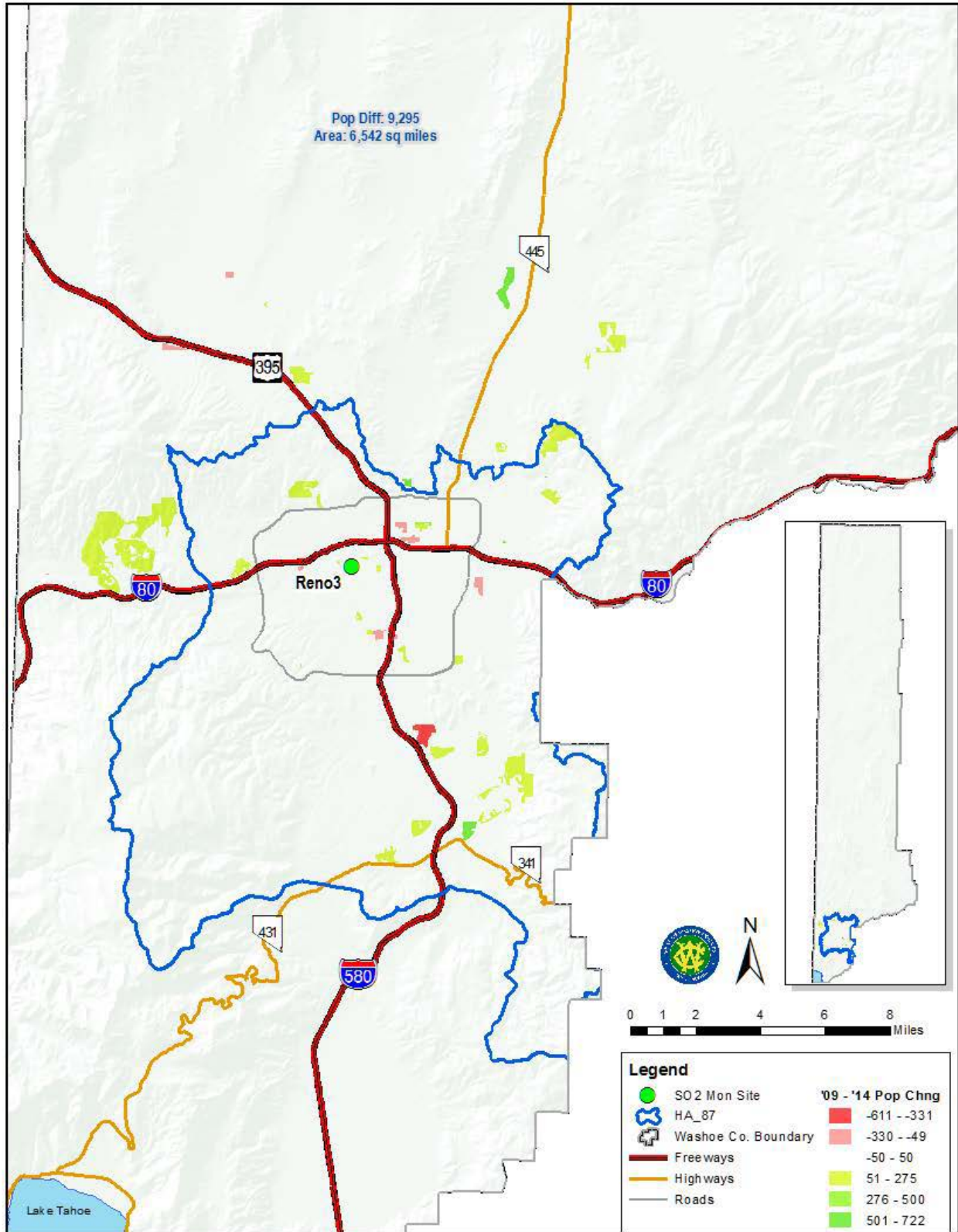
Thiessen Polygons for AQMD's Current and Proposed PM₁₀ Monitoring Sites Population Change between 2009 and 2014



Thiessen Polygons for AQMD's Current and Proposed PM_{2.5} Monitoring Sites Population Change between 2009 and 2014



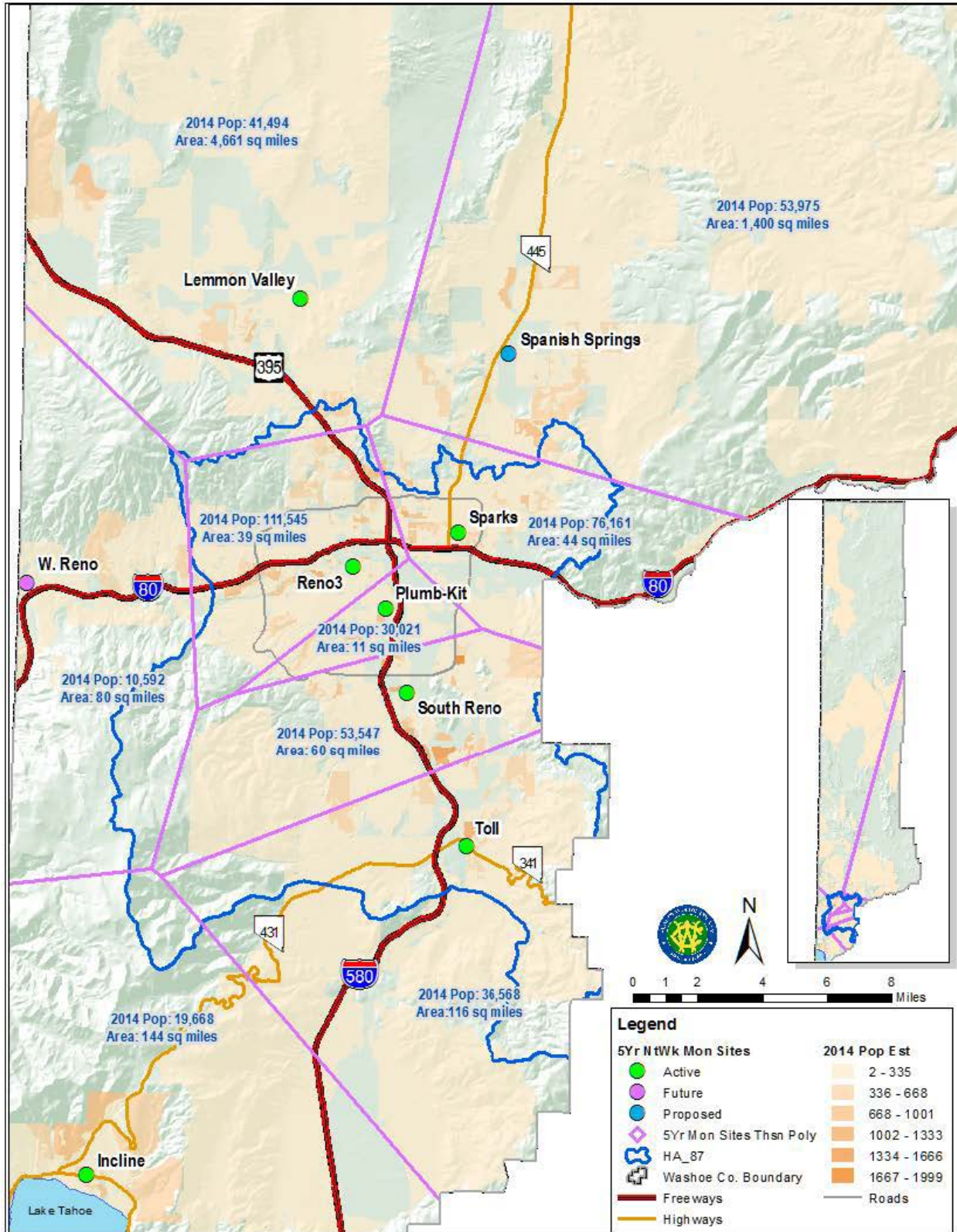
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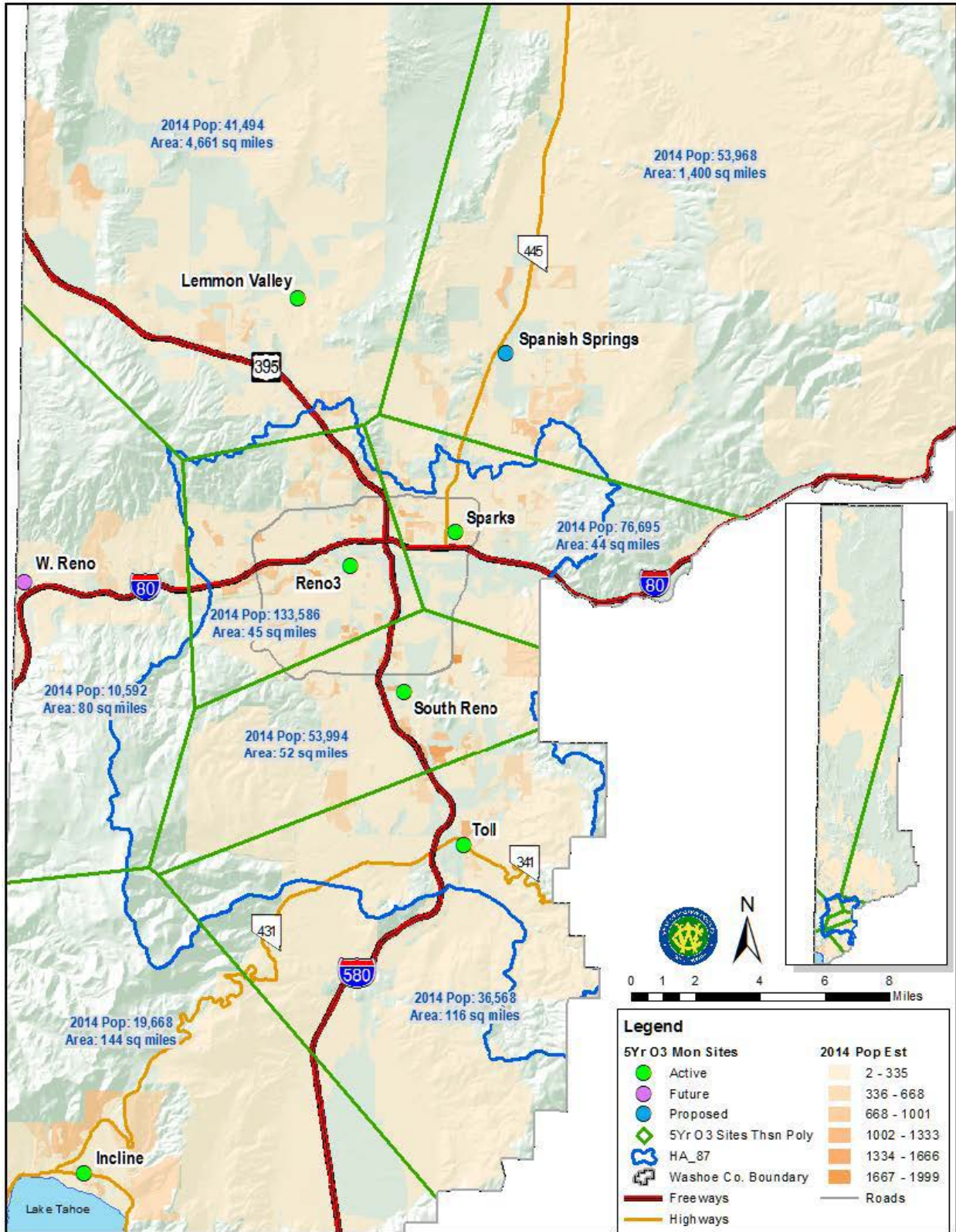
Appendix C

Situational Analysis (Area Served and Population Served Analyses)

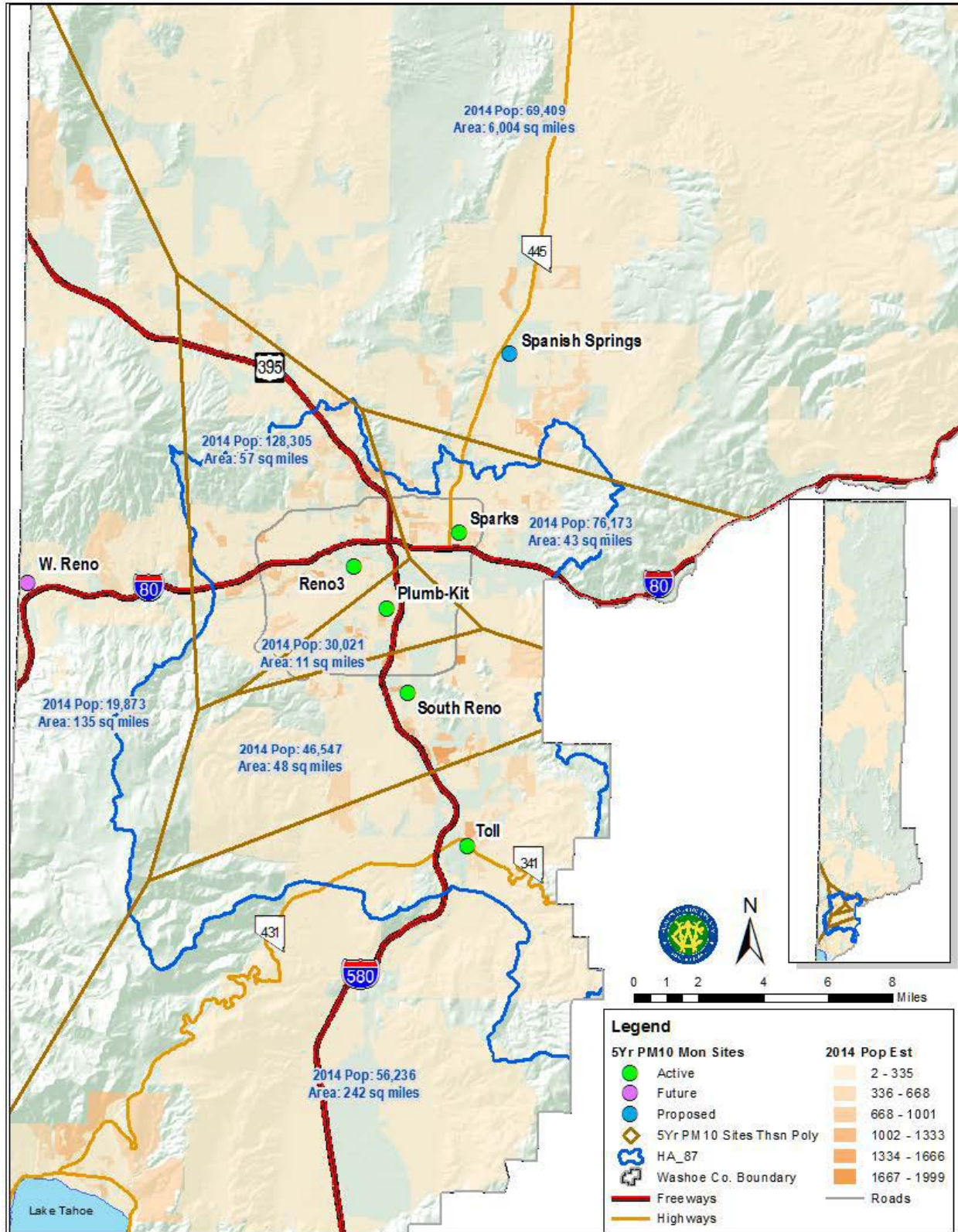
Thiessen Polygons for AQMD's Current, Proposed, and Future Monitoring Sites Area Served and 2014 Population Served Estimates



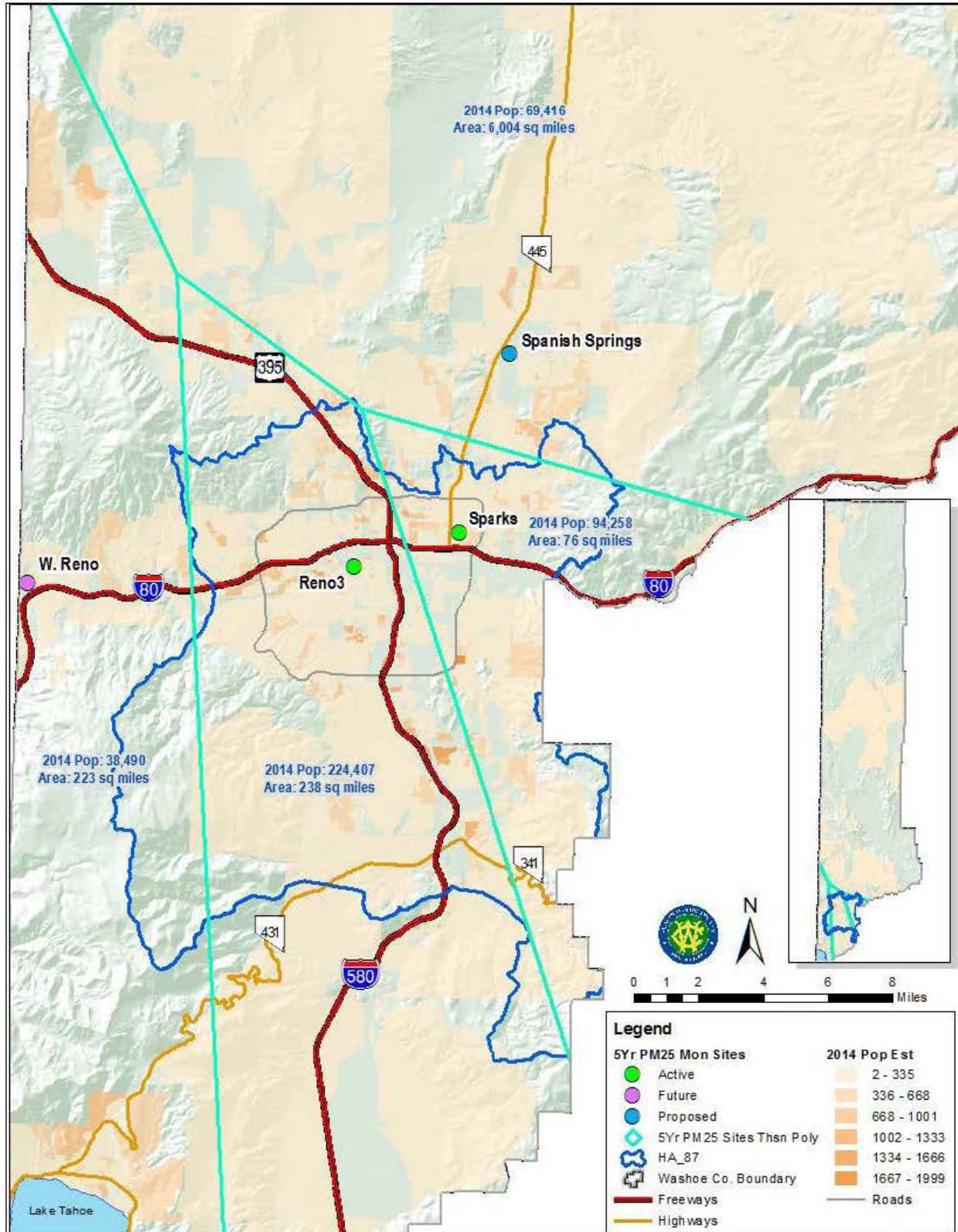
Thiessen Polygons for AQMD's Current, Proposed, and Future O₃ Monitoring Sites Area Served and 2014 Population Served Estimates



Thiessen Polygons for AQMD's Current, Proposed, and Future PM₁₀ Monitoring Sites Area Served and 2014 Population Served Estimates



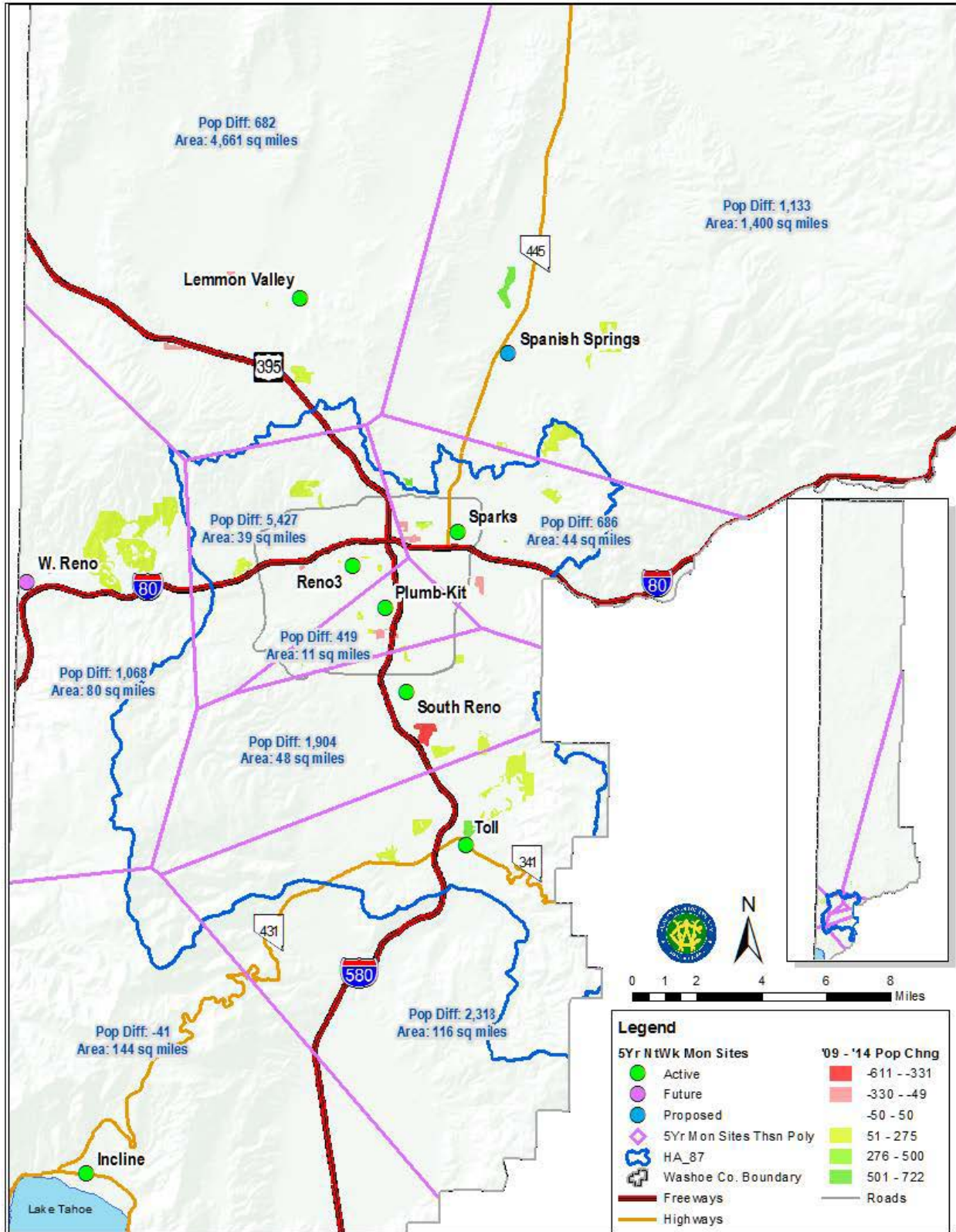
Thiessen Polygons for AQMD's Current, Proposed, and Future PM_{2.5} Monitoring Sites Area Served and 2014 Population Served Estimates



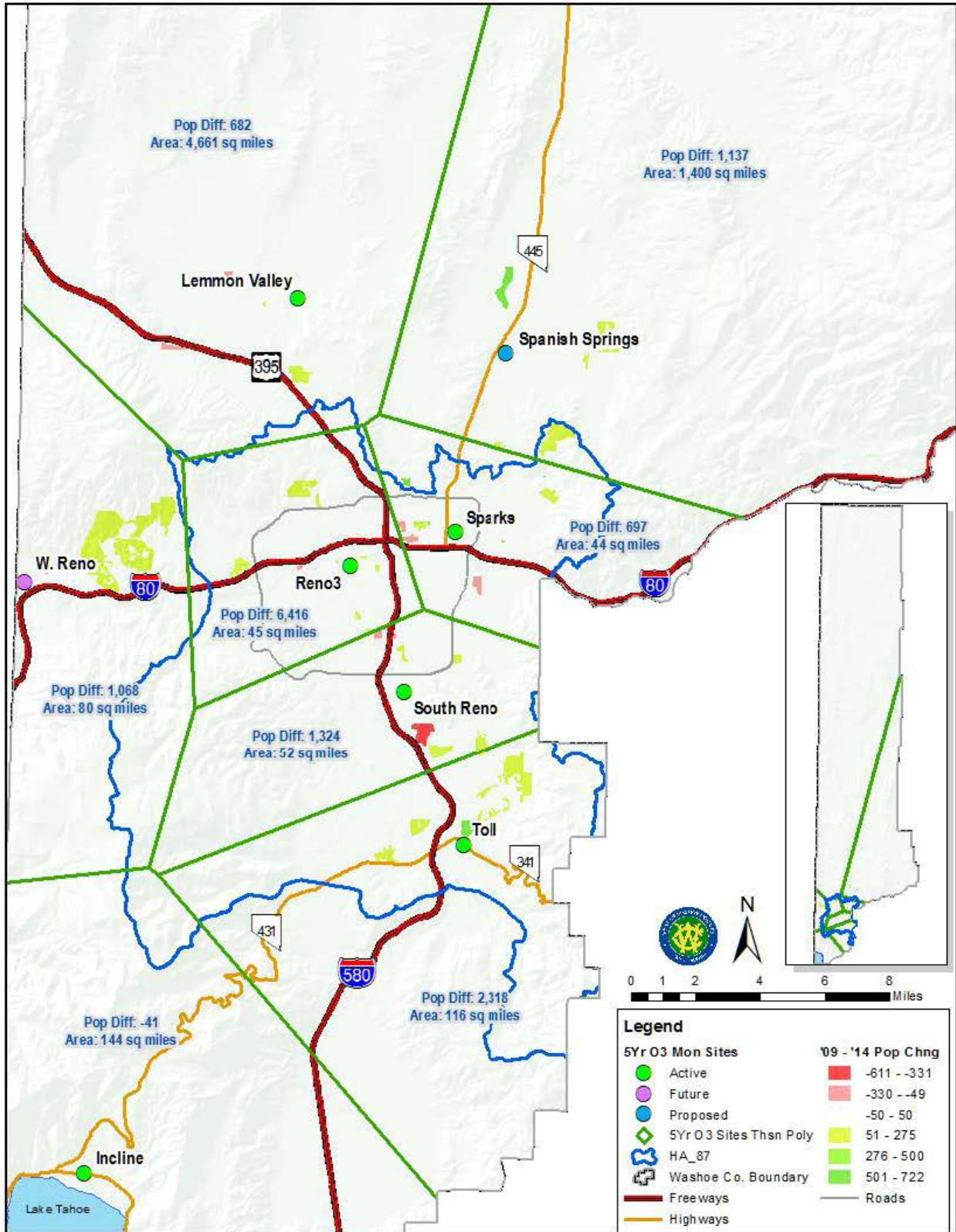
Appendix D

Situational Analysis (Population Change Analyses)

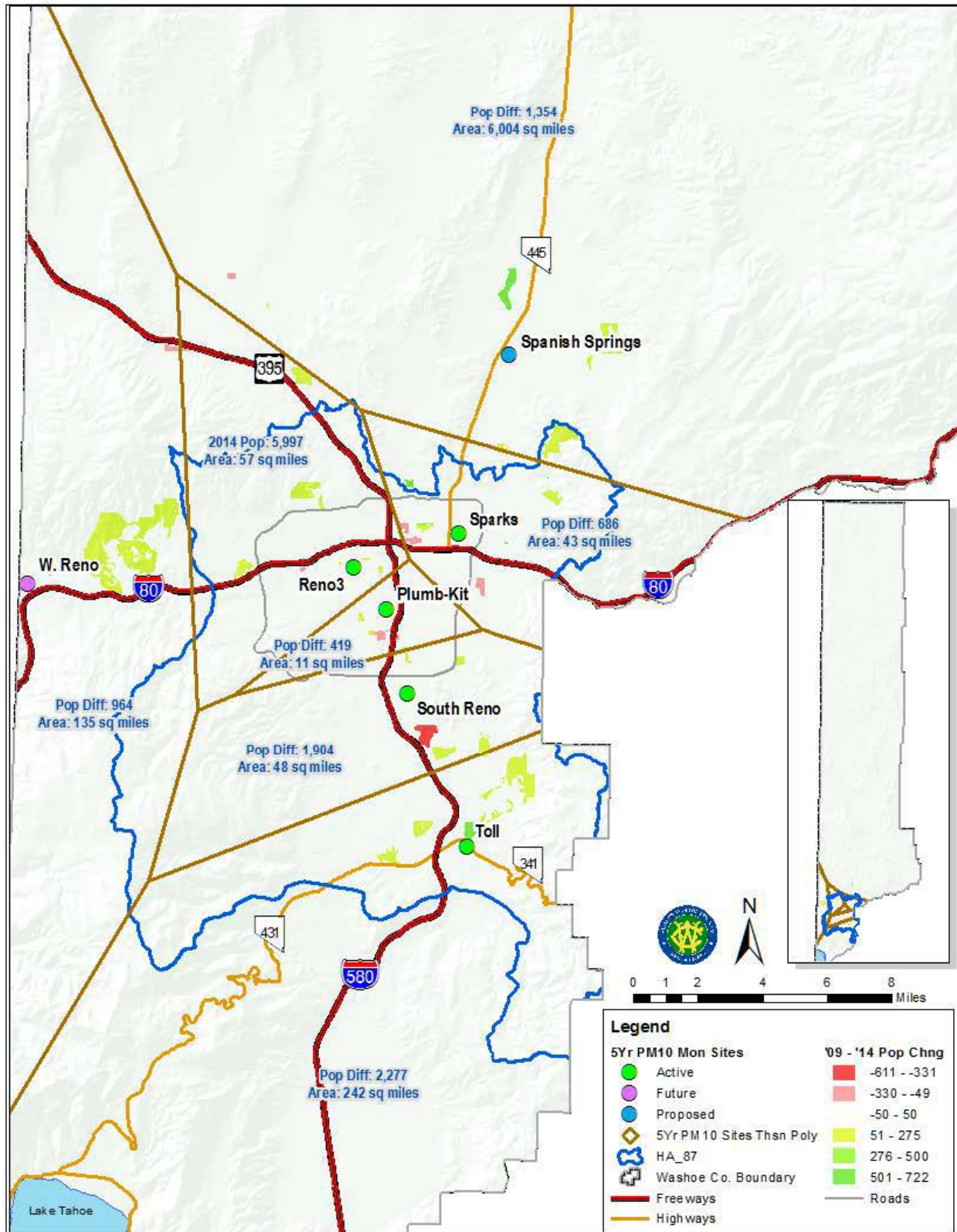
Thiessen Polygons for AQMD's Current, Proposed, and Future Monitoring Sites Population Change between 2009 and 2014



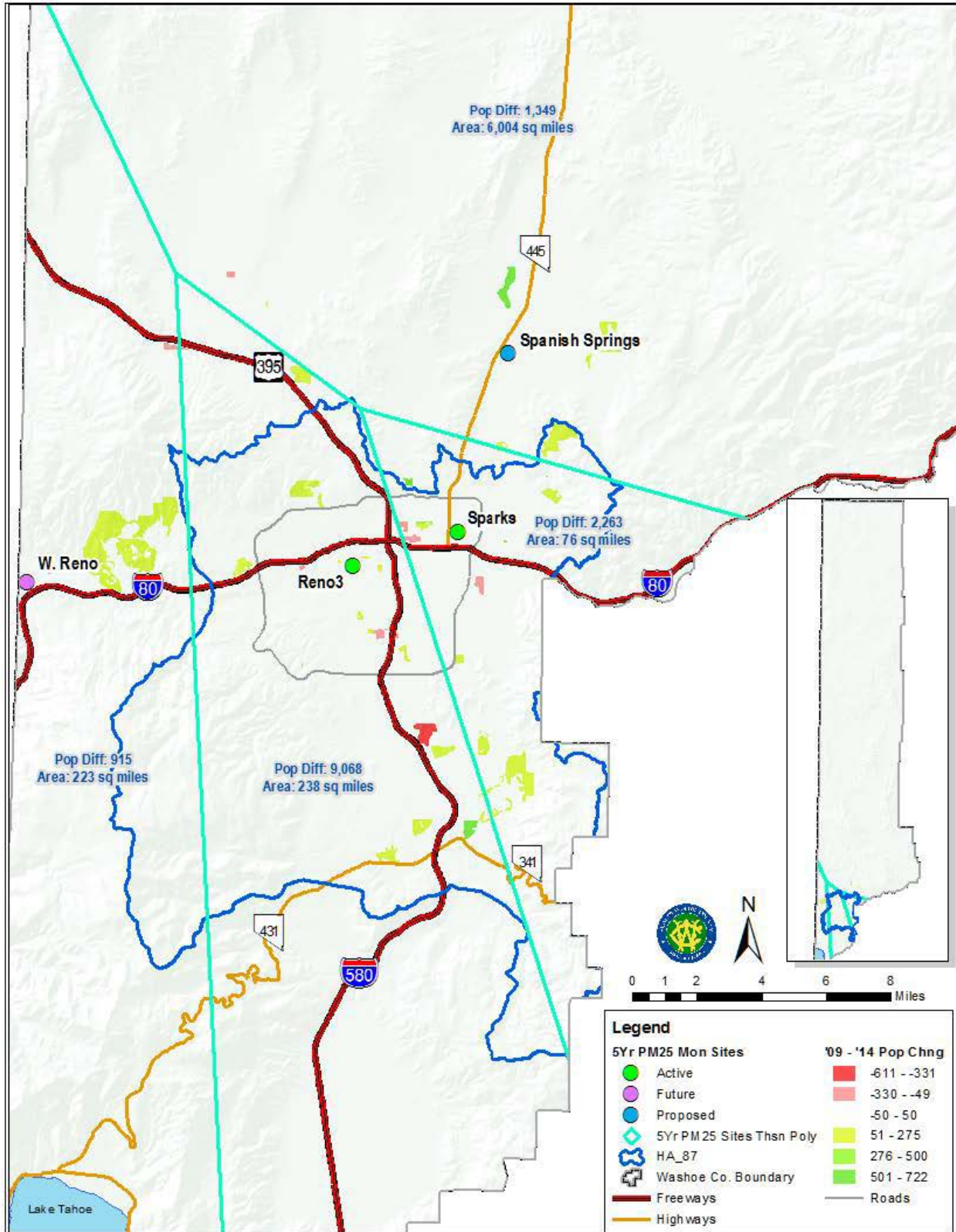
Thiessen Polygons for AQMD's Current, Proposed, and Future O₃ Monitoring Sites Population Change between 2009 and 2014



Thiessen Polygons for AQMD's Current, Proposed, and Future PM₁₀ Monitoring Sites Population Change between 2009 and 2014



Thiessen Polygons for AQMD's Current, Proposed, and Future PM_{2.5} Monitoring Sites Population Change between 2009 and 2014



Appendix E
NAAQS Summary

NAAQS Summary

Pollutant	Primary Standard	Secondary Standard	Status of Current NAAQS Review	Proposed Changes	Date of Final Rule
CO	35 ppm (1-hr)	None	Complete	Retained existing NAAQS with revisions to monitoring requirements.	August 31, 2011
	9 ppm (8-hr)	None			
PM ₁₀	150 µg/m ³ (24-hr)	Same as primary	EPA issued a call for information on the recent research relating to the health and welfare effects of PM.	TBD	TBD
PM _{2.5}	35 µg/m ³ (24-hr)	Same as primary			
	12.0 µg/m ³ (Annual)	15.0 µg/m ³ (Annual)			
O ₃	0.075 ppm (8-hr)	Same as primary	Proposed rule published in Federal Register on December 17, 2014	0.065 - 0.070 ppm	November 2015
Pb	0.15 µg/m ³ (Rolling 3-month)	Same as primary	Complete	Retained existing NAAQS without revision.	January 5, 2015
NO ₂	100 ppb (1-hr)	Same as primary	Complete	Added 1-hr standard; retained annual standard	February 9, 2010
	0.053 ppm (Annual)				
SO ₂	75 ppb (1-hr)	0.5 ppm (3-hr)	Complete	Revised the primary NAAQS by establishing a new 1-hr standard.	June 22, 2010

Appendix F

Public Inspection Plan

Public Inspection Plan

This monitoring network assessment was available for public inspection from June 1 to June 30, 2015 at the AQMD website (OurCleanAir.com). A hardcopy of the plan was also available at the AQMD office. All comments received during this inspection period are outlined below.

1. No comments received.