WASHOE COUNTY
HEALTH DISTRICT
ENHANCING QUALITY OF LIFE

2020 Ambient Air Monitoring Network Assessment

June 26, 2020

Public Health
Prevent. Promote. Protect.

WASHOE COUNTY
HEALTH DISTRICT
ENHANCING QUALITY OF LIFE

Public Health
Prevent. Promote. Protect.

VISION

A healthy community

MISSION

To protect and enhance the well-being and quality of life for all in Washoe County.

Table of Contents

Appendices

Tables

Figures

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
CBSA	Core Based Statistical Area
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
NAAQS	National Ambient Air Quality Standards
NAMS	National Air Monitoring Station
NCDC	National Climatic 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
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
SLAMS	State and Local Air Monitoring Station
SO_2	Sulfur Dioxide
SPK	Sparks
SPM	Special Purpose Monitoring
SPS	Spanish Springs
SRN	South Reno
STN	Speciation Trends Network
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

For information or questions regarding the 2020 Ambient Air Monitoring Network Assessment, please contact the following individuals of the Washoe County Health District - Air Quality Management Division (AQMD).

Francisco Vega, Division Director
(775) 784-7211, or fvega@washoecounty.us

Daniel Inouye, Branch Chief, Monitoring and Planning
(775) 784-7214, or dinouye@washoecounty.us

Craig Petersen, Senior Air Quality Specialist
(775) 784-7233, or cpetersen@washoecounty.us

Daniel Timmons, Air Quality Specialist
(775) 784-7205, or drtimmons@washoecounty.us

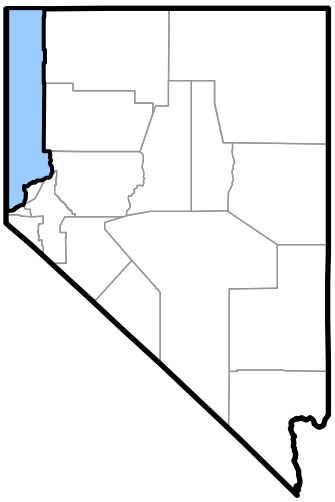
Michael Crawford, Air Quality Specialist
(775) 784-7221, or mcrawford@washoecounty.us

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 Climate[1]

Figure 1
Washoe County, Nevada



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.

[1] US Department of Commerce, NCDC; "2019 Local Climatological Data, Annual Summary with Comparative Data, Reno, Nevada (KRNO)"; 2019.

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. The net increase since 2000 has been approximately 40.7 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 (2000, 2010-2019)[2]

Population (1,000's)	2000	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Washoe County	333.6	417.4	421.6	427.7	432.3	436.8	441.9	448.3	451.9	460.2	469.8
Storey County	3.4	4.2	4.1	4.1	4.0	4.0	4.0	4.0	4.1	4.2	4.3
CBSA Total	337.0	421.6	425.7	431.8	436.3	440.8	445.9	452.3	456.0	464.4	474.1

The Reno, NV CBSA population projections (Table 2) include the impacts of the Tesla Gigafactory project and the relative housing prices for Clark and Washoe Counties. The projection also includes information from the Northeastern Nevada Regional Development Authority and the Governors' Office of Economic Development on mining as well as the Pumpkin Hollow Project. The net population increase is projected to be approximately 12.5 percent over the next 10 years.

Table 2
Reno, NV CBSA Population Projections (2020-2029)[3]

Population (1,000's)	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Washoe County	479.3	488.3	497.0	505.0	512.3	518.7	524.5	529.8	534.6	538.9
Storey County	4.5	4.6	4.7	4.8	5.0	5.1	5.2	5.4	5.5	5.6
CBSA Total	483.8	492.9	501.7	509.8	517.3	523.8	529.7	535.2	540.1	544.5

[2] Nevada State Demographer, "Governor Certified Population Estimates of Nevada's Counties, Cities and Towns 2000 to 2019", 2019.
[3] Nevada State Demographer, "Nevada County Population Projections 2019 to 2038", 2019.

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 (2009-2018)". 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 $\mu g/m^3$	HA 87	Attainment
			Remainder of county	Unclassifiable
$PM_{2.5}$	24-hour	35 $\mu g/m^3$	HA 87	Attainment
			Remainder of county	Unclassifiable/ Attainment
	Annual	12.0 $\mu g/m^3$	HA 87	Attainment
			Remainder of county	Unclassifiable/ Attainment
O_3	8-hour	0.070 ppm	Entire county	Unclassifiable/ Attainment
All other pollutants	All averaging times	All concentrations	All geographic areas	Unclassifiable/ Attainment

Monitoring Network History

The AQMD has operated an ambient air monitoring network since the 1960's. By multi-agency cooperative agreement, the California Air Resources Board (CARB) monitored $PM_{2.5}$ and NO_2 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 Monitoring Operations

AQS Site Name (AQS Site ID)	Ozone	$PM_{2.5}$	PM_{10}	TSP	HC	CO	NO_2	SO_2	Lead
Incline (32-031-2002)	93-19	99-02	99-02			99-02	99-02		
Lemmon Valley (32-031-2009)	87-19		87			87-16			
Reno3 (32-031-0016)	82-19	99-19	88-19			83-19	84-19	11-19	
Plumb-Kit (32-031-0030)			06-17						
South Reno (32-031-0020)	88-19		11-17			88-14			
Sun Valley (32-031-2006)			88-05						
Sparks (32-031-1005)	79-19	12-19	88-19			80-19			
Galletti (32-031-0022)		13-14	88-14			88-14			
Toll (32-031-0025)	02-19	19	02-19			02-16			
Spanish Springs (32-031-1007)	17-19	17-19	17-19						

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 Name (AQS Site ID)	Monitor Classifications	Number of Parameters Measured
Reno3 (32-031-0016)	SLAMS/NCore	19
	Speciation Trends	65
South Reno (32-031-0020)	SLAMS	4
Toll (32-031-0025)	SLAMS	7
Sparks (32-031-1005)	SLAMS	8
Spanish Springs (32-031-1007)	SLAMS	7
Incline (32-031-2002)	SLAMS	1
Lemmon Valley (32-031-2009)	SLAMS	1
West Reno (Future)	SPM/SLAMS	7

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

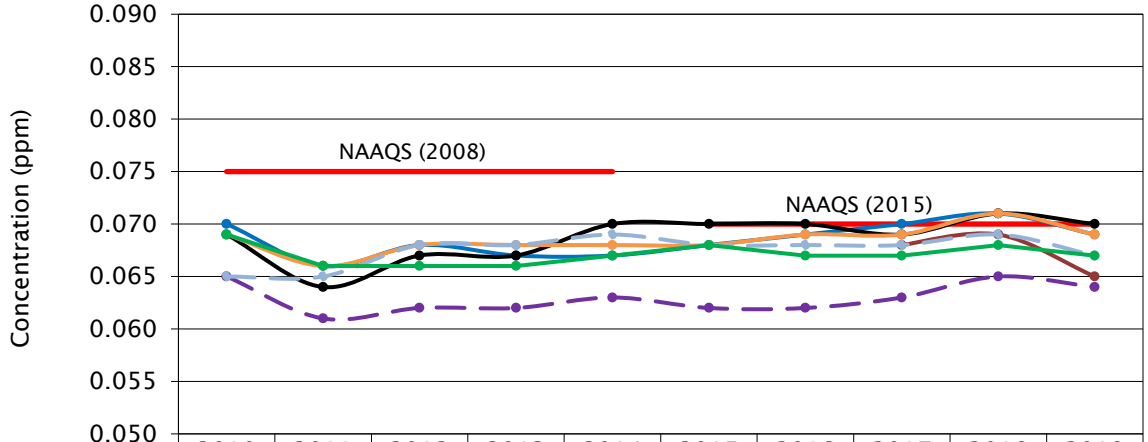
AQS Site Name (AQS Site ID)	Monitor Classifications	Years of Data
Reno3 (32-031-0016)	SLAMS/NCore Speciation Trends	38
South Reno (32-031-0020)	SLAMS	32
Toll (32-031-0025)	SLAMS	18
Sparks (32-031-1005)	SLAMS	41
Spanish Springs (32-031-1007)	SLAMS	3
Incline (32-031-2002)	SLAMS	27
Lemmon Valley (32-031-2009)	SLAMS	33
West Reno (Future)	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.

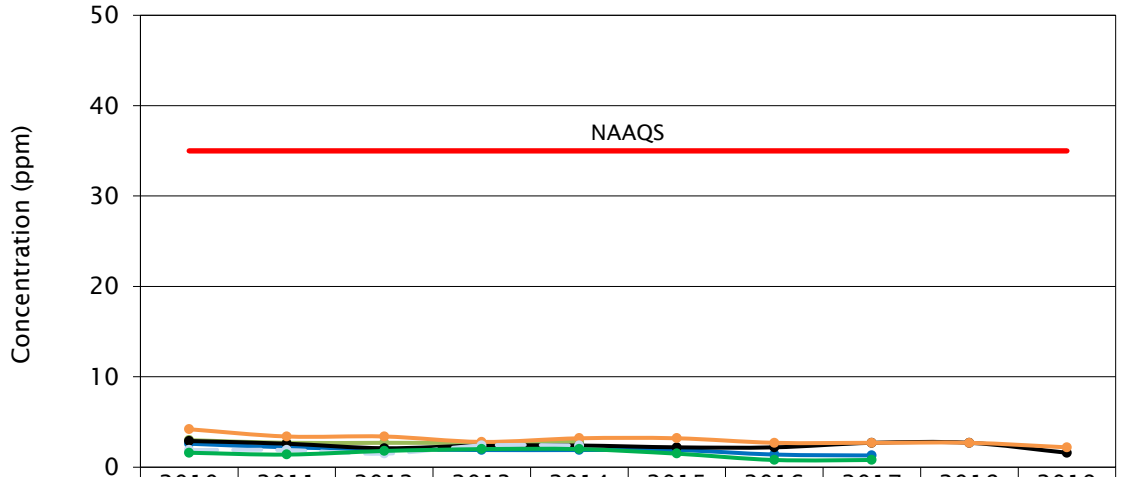
Sites that measure high concentrations are important for assessing NAAQS compliance, population exposure, and performing model evaluations. The analysis is relatively straightforward, requiring only the site design values or highest concentrations. The greater the design value or concentration, the higher 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 O_3 Design Values
(2010-2019)



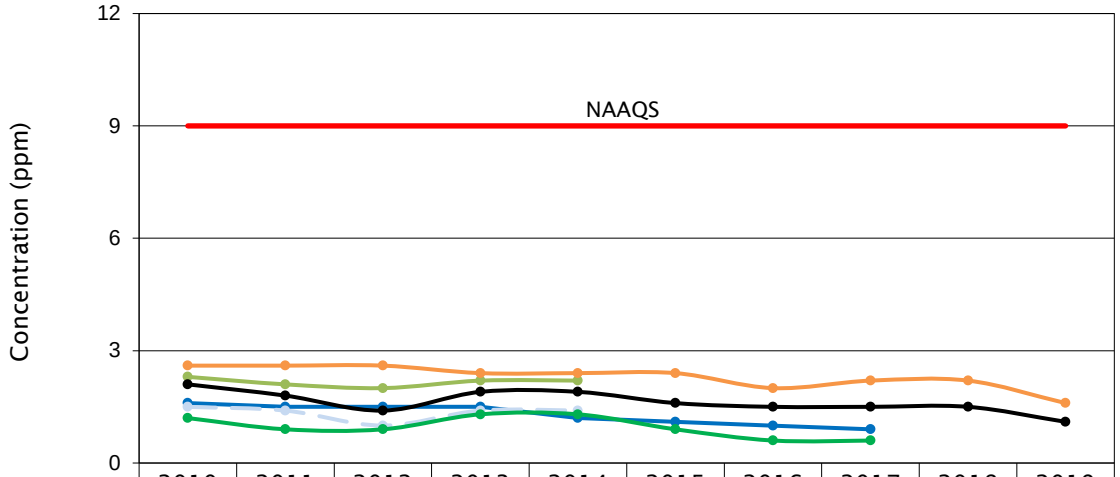
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NAAQS	0.075	0.075	0.075	0.075	0.075	0.070	0.070	0.070	0.070	0.070
INC (2002)	0.065	0.061	0.062	0.062	0.063	0.062	0.062	0.063	0.065	0.064
LEM (2009)	0.070	0.066	0.068	0.067	0.067	0.068	0.069	0.070	0.071	0.069
RNO (0016)	0.069	0.064	0.067	0.067	0.070	0.070	0.070	0.069	0.071	0.070
SPK (1005)	0.069	0.066	0.068	0.068	0.068	0.068	0.069	0.069	0.071	0.069
SPS (1007)								0.068	0.069	0.065
SRN (0020)	0.065	0.065	0.068	0.068	0.069	0.068	0.068	0.068	0.069	0.067
TOL (0025)	0.069	0.066	0.066	0.066	0.067	0.068	0.067	0.067	0.068	0.067

Figure 3
1-hr CO Design Values
(2010-2019)



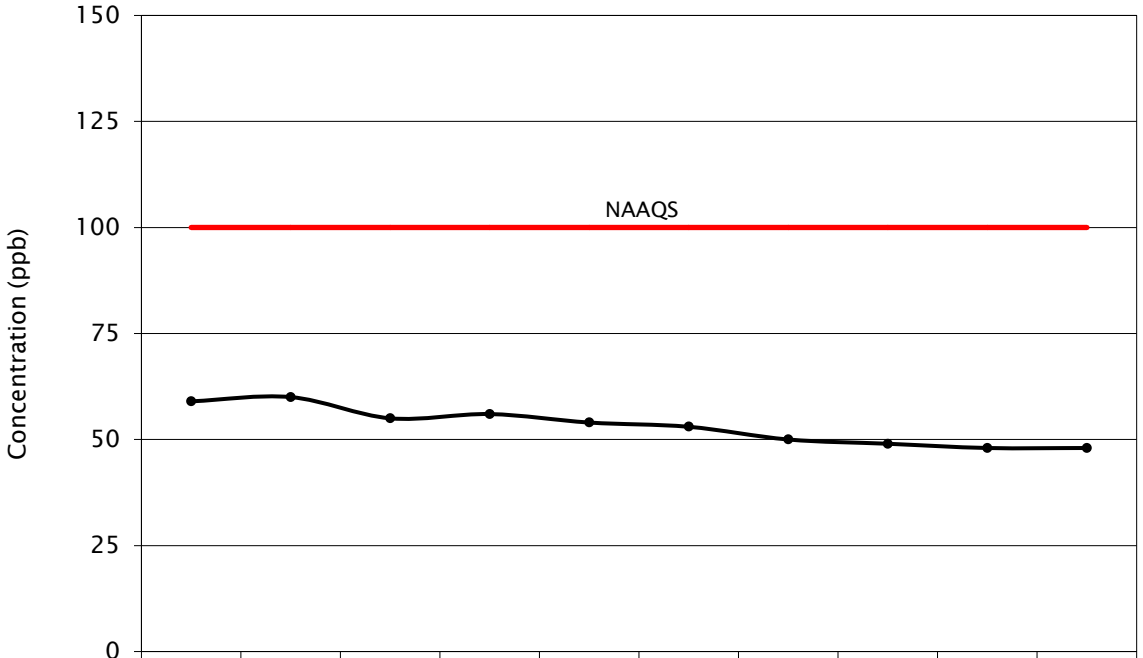
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NAAQS	35	35	35	35	35	35	35	35	35	35
GAL (0022)	3.0	2.7	2.7	2.7	2.8					
LEM (2009)	2.6	2.2	2.0	1.9	1.9	1.9	1.4	1.3		
RNO (0016)	2.9	2.6	2.1	2.4	2.4	2.2	2.2	2.7	2.7	1.6
SPK (1005)	4.2	3.4	3.4	2.8	3.2	3.2	2.7	2.7	2.7	2.2
SRN (0020)	1.9	1.9	1.5	2.4	2.4					
TOL (0025)	1.6	1.4	1.8	2.0	2.0	1.5	0.8	0.8		

Figure 4
8-hr CO Design Values
(2010-2019)



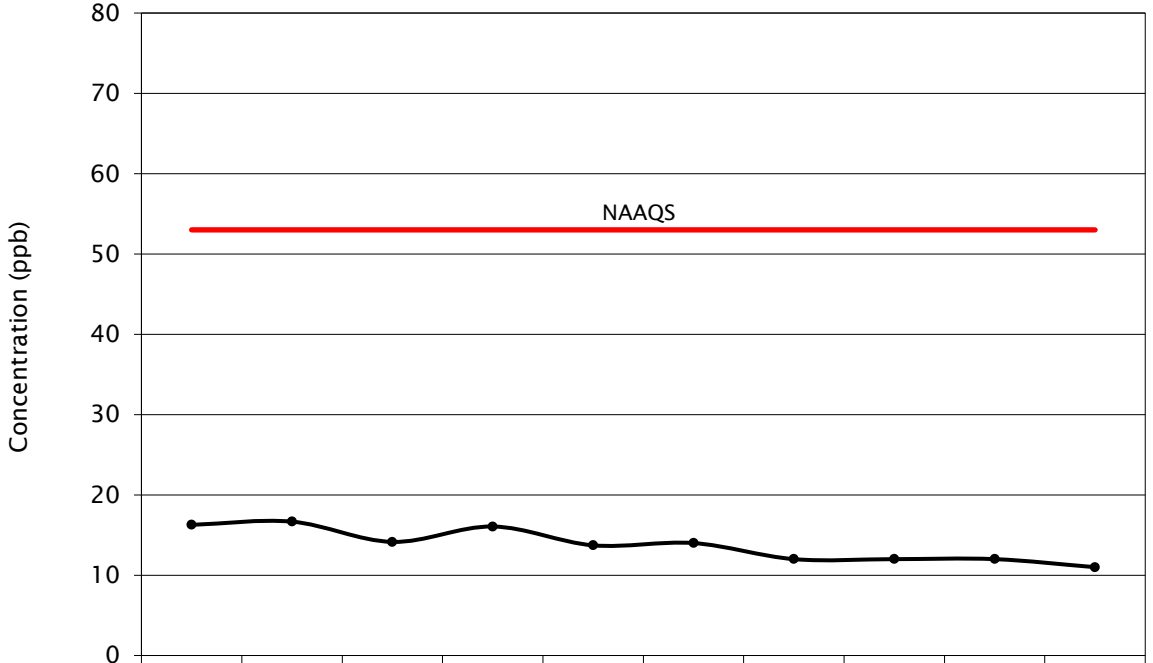
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NAAQS	9	9	9	9	9	9	9	9	9	9
GAL (0022)	2.3	2.1	2.0	2.2	2.2					
LEM (2009)	1.6	1.5	1.5	1.5	1.2	1.1	1.0	0.9		
RNO (0016)	2.1	1.8	1.4	1.9	1.9	1.6	1.5	1.5	1.5	1.1
SPK (1005)	2.6	2.6	2.6	2.4	2.4	2.4	2.0	2.2	2.2	1.6
SRN (0020)	1.5	1.4	1.0	1.4	1.4					
TOL (0025)	1.2	0.9	0.9	1.3	1.3	0.9	0.6	0.6		

Figure 5
1-hr NO_2 Design Values
(2010-2019)



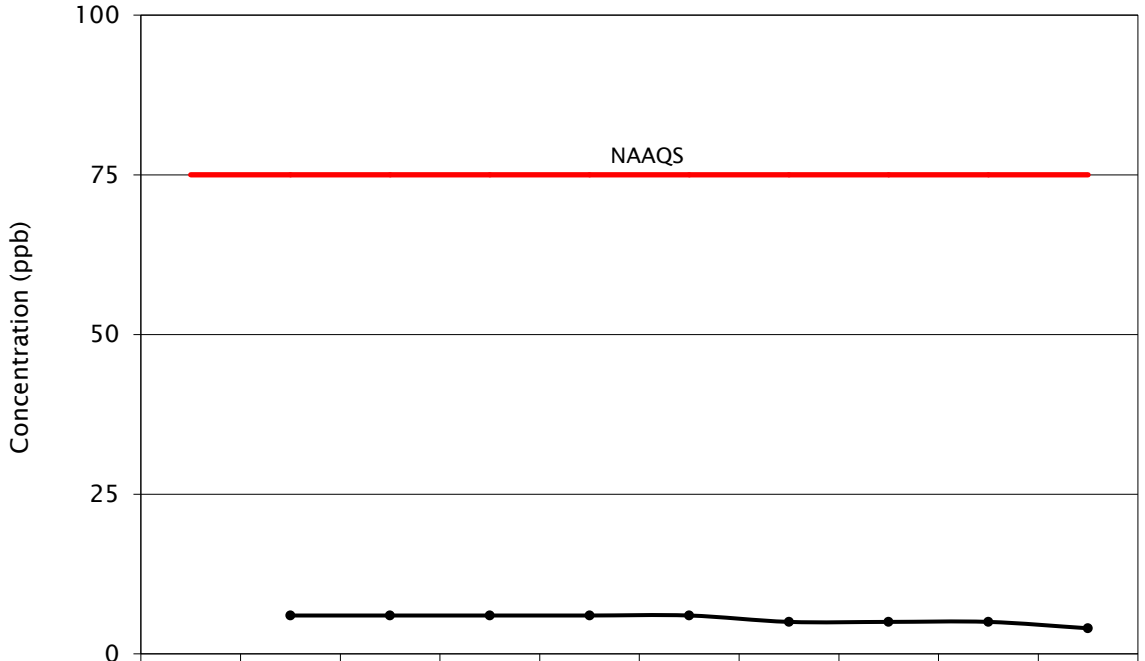
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NAAQS	100	100	100	100	100	100	100	100	100	100
RNO (0016)	59	60	55	56	54	53	50	49	48	48

Figure 6
Annual NO_2 Design Values
(2010-2019)



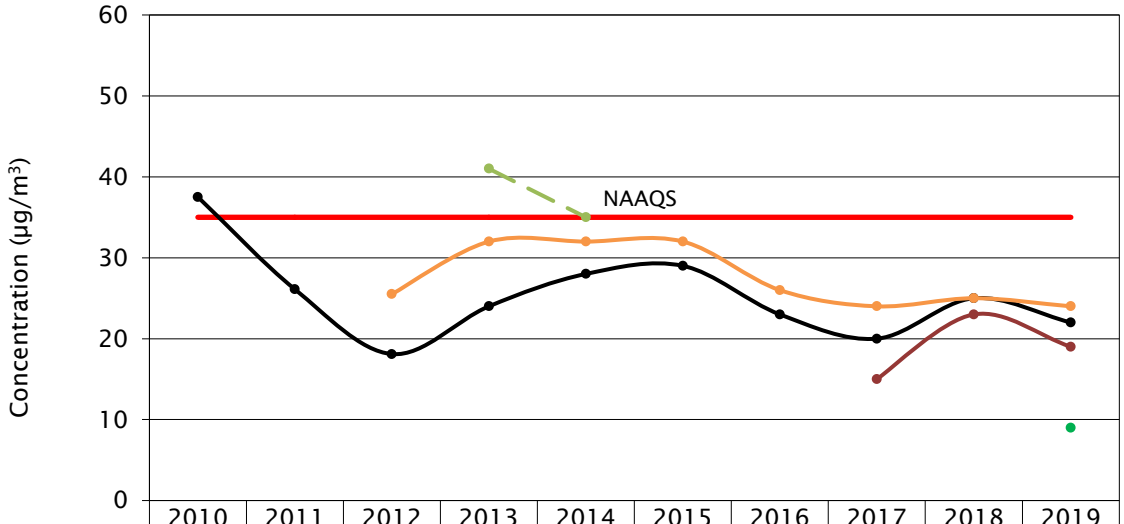
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NAAQS	53	53	53	53	53	53	53	53	53	53
RNO (0016)	16	17	14	16	14	14	12	12	12	11

Figure 7
1-hr SO_2 Design Values
(2010-2019)



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NAAQS	75	75	75	75	75	75	75	75	75	75
RNO (0016)		6	6	6	6	6	5	5	5	4

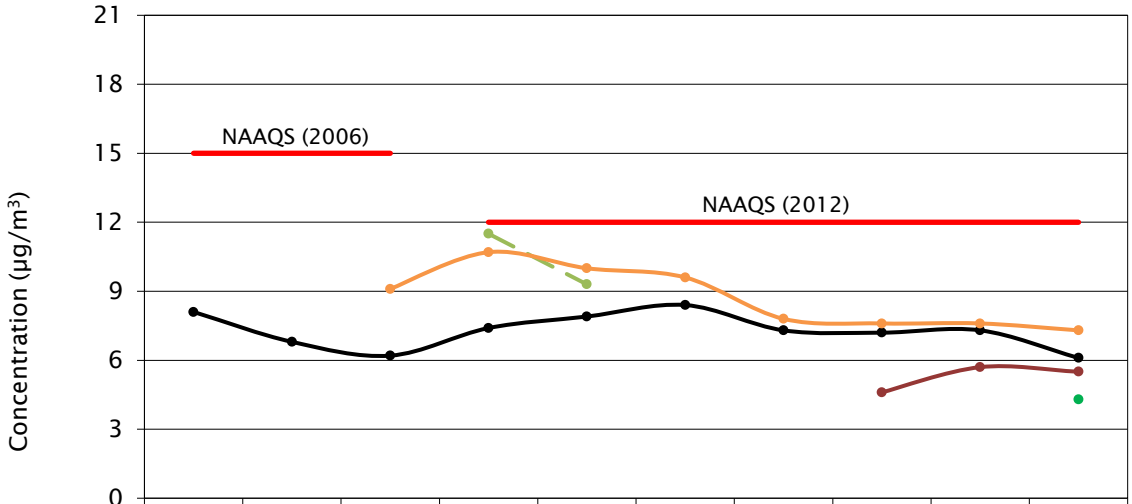
Figure 8
24-hr $PM_{2.5}$ Design Values
(2010-2019)



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NAAQS	35	35	35	35	35	35	35	35	35	35
GAL (0022)				41	35					
RNO (0016)	38	26	18	24	28	29	23	20	25	22
SPK (1005)			26	32	32	32	26	24	25	24
SPS (1007)								15	23	19
TOL (0025)										9

* $PM_{2.5}$ 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.

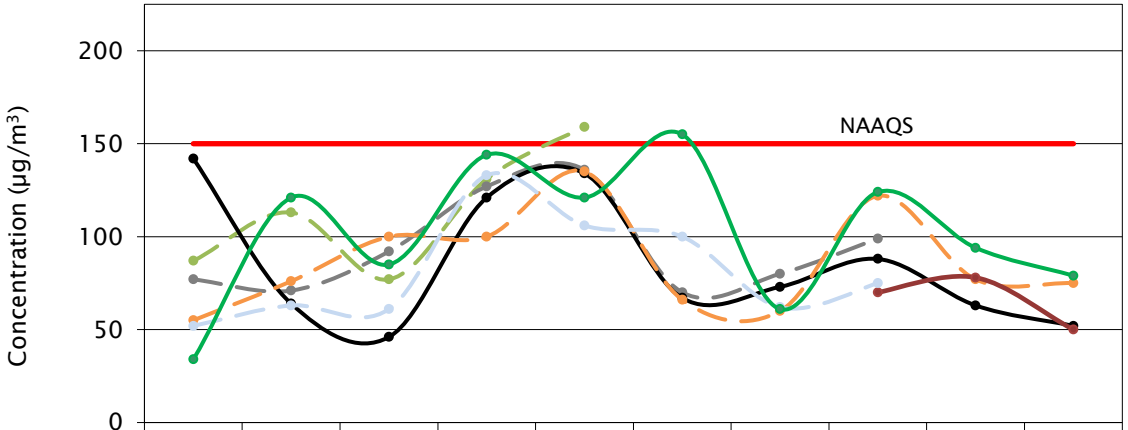
Figure 9
Annual $PM_{2.5}$ Design Values
(2010-2019)



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NAAQS	15.0	15.0	15.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
GAL (0022)				11.5	9.3					
RNO (0016)	8.1	6.8	6.2	7.4	7.9	8.4	7.3	7.2	7.3	6.1
SPK (1005)			9.1	10.7	10.0	9.6	7.8	7.6	7.6	7.3
SPS (1007)								4.6	5.7	5.5
TOL (0025)										4.3

* $PM_{2.5}$ 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 PM_{10} First Highs
(2010-2019)



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
NAAQS	150	150	150	150	150	150	150	150	150	150
GAL (0022)	87	113	77	131	159					
PLM (0030)	77	71	92	127	136	70	80	99		
RNO (0016)	142	64	46	121	134	67	73	88	63	52
SPK (1005)	55	76	100	100	135	66	60	122	77	75
SPS (1007)								70	78	50
SRN (0020)	52	63	61	133	106	100	62	75		
TOL (0025)	34	121	85	144	121	155	61	124	94	79

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
2019 Design Values vs. NAAQS
(Percentage of the NAAQS)

AQS Site Name (AQS Site ID)	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)
Reno3 32-031-0016	1.00	0.05	0.12	0.48	0.21	0.05	---	---	0.63	0.51	0.59
South Reno 32-031-0020	0.97	---	---	---	---	---	---	---	---	---	---
Toll 32-031-0025	0.96	---	---	---	---	---	---	---	0.26*	0.36*	0.83
Sparks 32-031-1005	0.99	0.06	0.18	---	---	---	---	---	0.69	0.61	0.81
Spanish Springs 32-031-1007	0.96	---	---	---	---	---	---	---	0.54	0.46	0.52
Incline 32-031-2002	0.91	---	---	---	---	---	---	---	---	---	---
Lemmon Valley 32-031-2009	1.00	---	---	---	---	---	---	---	---	---	---

--- = n/a

= ≥80% of NAAQS

*Toll began monitoring $PM_{2.5}$ on January 1, 2019, therefore does not have 3 years of data to calculate a design value.

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

The NetAssess2020 app was developed by EPA's Office of Air Quality Planning and Standards (OAQPS). It is an update of the NetAssess app developed by LADCO for the 2015 5-year Ambient Air Monitoring Network Assessments. The Pearson Correlation Matrix Tool within the NetAssess2020 app was used for the Inter-Site Correlation Analysis for Ozone and $PM_{2.5}$.

The following figures give you information about how concentrations at monitors within the Reno, NV CBSA compare to one another. Each monitor comparison is represented by a square in the chart. The blue squares in the bottom-left corner show the correlation between each pair of monitors, with text indicating the number of days used in the calculation. The red squares in the top-right corner show the mean absolute difference in concentrations between each pair of monitors, with text indicating the distance in kilometers between each pair of monitors. The numbers along the diagonal indicate the most recent design value for each monitor.

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., $R > 0.8$) 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.

Figure 11
8-hr Daily Max Ozone Correlation Matrix

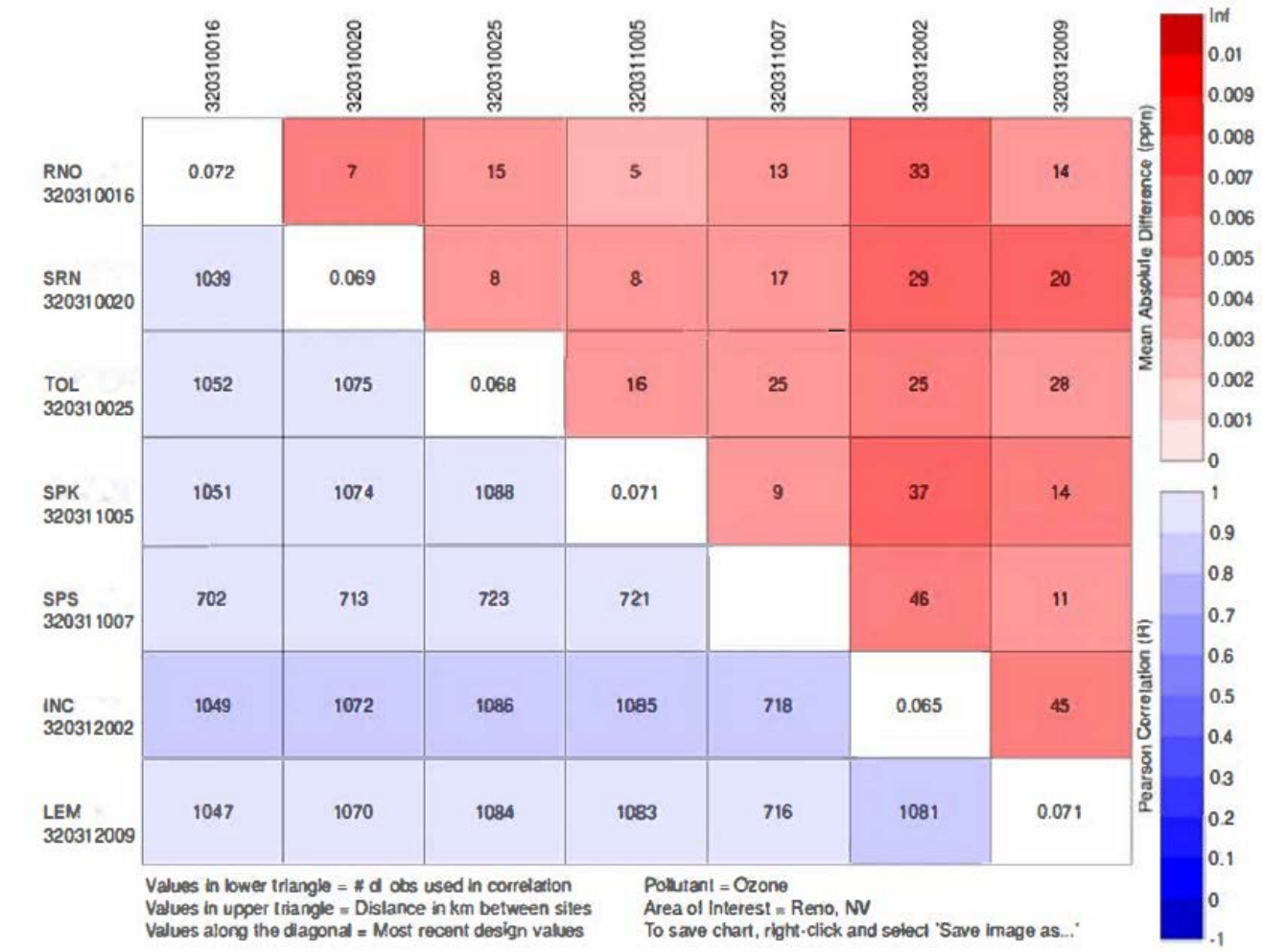
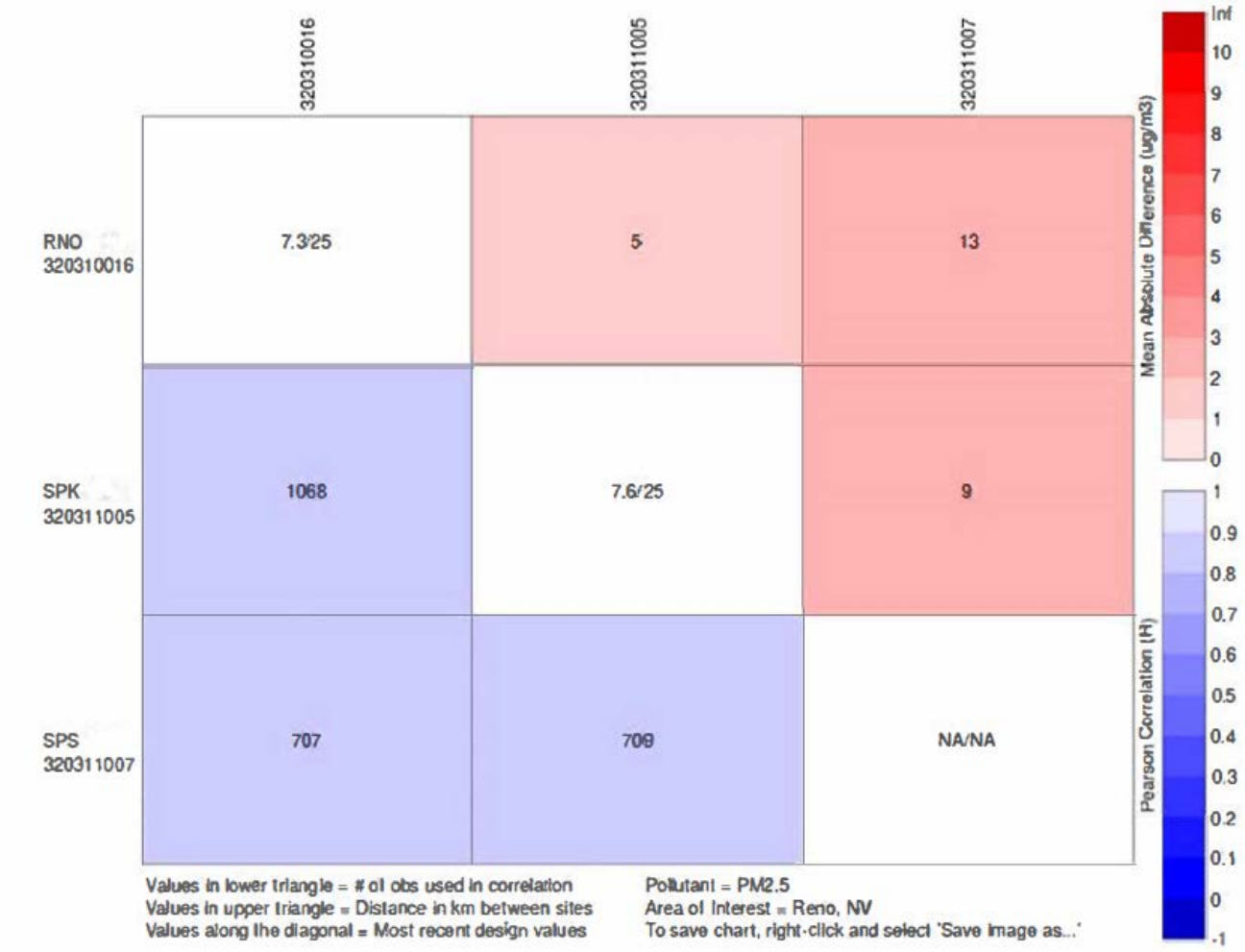


Figure 12
Daily $PM_{2.5}$ Correlation Matrix



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 EPA's NetAssess2020 app. 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 (2019)

AQS Site Name (AQS Site ID)	Area Served (square miles) by Pollutant					
	O_3	CO	NO_2	SO_2	PM_{10}	$PM_{2.5}$
Reno3 (32-031-0016)	73	432	6,532	6,532	227	227
South Reno (32-031-0020)	36	---	---	---	---	---
Toll (32-031-0025)	357	---	---	---	457	457
Sparks (32-031-1005)	30	6,100	---	---	38	38
Spanish Springs (32-031-1007)	645	---	---	---	5,811	5,811
Incline (32-031-2002)	184	---	---	---	---	---
Lemmon Valley (32-031-2009)	5,208	---	---	---	---	---

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 (2019)

AQS Site Name (AQS Site ID)	Population Served (1,000's) by Pollutant					
	O_3	CO	NO_2	SO_2	PM_{10}	$PM_{2.5}$
Reno3 (32-031-0016)	154.1	258.6	425.4	425.4	205.7	205.7
South Reno (32-031-0020)	47.3	---	---	---	---	---
Toll (32-031-0025)	35.1	---	---	---	64.1	64.1
Sparks (32-031-1005)	68.7	166.8	---	---	79.6	79.6
Spanish Springs (32-031-1007)	60.7	---	---	---	76.0	76.0
Incline (32-031-2002)	11.6	---	---	---	---	---
Lemmon Valley (32-031-2009)	47.9	---	---	---	---	---

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), removing one monitoring site (South Reno), and relocating an existing site to a new location (Reno3 to Reno4). The site under consideration for addition would monitor for O_3, PM_{10}, $PM_{2.5}$, $PM_{10-2.5}$, and surface meteorology. Thiessen Polygons were used to determine Area Served and Population Served with the addition of the West Reno/Verdi monitoring site, removal of the South Reno monitoring site, and relocation of the Reno3 monitoring site to Reno4 (see Appendix B). The site-by-site situational analyses are summarized in the next two tables, and can be compared to the analyses without the new site addition, site removal, and site relocation in Tables 8 and 9.

Table 10
Area Served (2019) with West Reno/Verdi Site Addition, South Reno Removal, and Reno3 Relocation to Reno4

AQS Site Name (AQS Site ID)	Area Served (square miles) by Pollutant					
	O_3	CO	NO_2	SO_2	PM_{10}	$PM_{2.5}$
Reno4 (32-031-0031)	49	442	6,532	6,532	65	65
Toll (32-031-0025)	377	---	---	---	449	449
Sparks (32-031-1005)	34	6,090	---	---	34	34
Spanish Springs (32-031-1007)	645	---	---	---	5,811	5,811
Incline (32-031-2002)	184	---	---	---	---	---
Lemmon Valley (32-031-2009)	5,212	---	---	---	---	---
West Reno/Verdi (Future)	32	---	---	---	174	174

Table 11
Population Served (2019) with West Reno/Verdi Site Addition, South Reno Removal, and Reno3 Relocation to Reno4

AQS Site Name (AQS Site ID)	Population Served (1,000's) by Pollutant					
	O_3	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$
Reno4 (32-031-0031)	156.3	272.2	425.4	425.4	179.7	179.7
Toll (32-031-0025)	52.5	---	---	---	61.8	61.8
Sparks (32-031-1005)	76.1	153.2	---	---	76.1	76.1
Spanish Springs (32-031-1007)	60.7	---	---	---	76.0	76.0
Incline (32-031-2002)	11.6	---	---	---	---	---
Lemmon Valley (32-031-2009)	54.4	---	---	---	---	---
West Reno/Verdi (Future)	13.9	---	---	---	31.8	31.8

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

1. *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 PM_{10}, $PM_{2.5}$, $PM_{10\text{-}2.5}$, O_3, 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.

2. *Consider discontinuing all monitoring and closing the South Reno monitoring site.* Removing the South Reno monitoring site from the network would build capacity to initiate monitoring in West Reno/Verdi. The area and population served by the South Reno monitoring site would be absorbed primarily by the Toll monitoring site. The daily maximum 8-hour ozone concentration is highly correlated to both the Reno3 and Toll ozone monitor, thus having a low removal bias.

Site-Specific Recommendations

Table 12 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 12
Summary of Recommended Modifications to the Existing AQMD Network

AQS Site Name (AQS Site ID)	Current Monitoring Objective	Recommended Modifications
Reno3 (32-031-0016)	This downtown site began operation in January 2002 to replace the Reno2 site. Both a residential neighborhood and a commercial growth area surrounded this site. In December 2010, this site became an NCore site. The site monitored for population exposure of PM_{10}, $PM_{2.5}$, $PM_{10\text{-}2.5}$, $PM_{2.5}$ speciation, O_3, Trace CO, NO_2, Trace NO_y, Trace SO_2, wind speed, wind direction, ambient temperature, and relative humidity. The monitoring objectives were Public information, NAAQS comparison and Research support. In December 2019, Reno3 was relocated to Libby C. Booth Elementary School.	Site objective: Site relocated. Parameters measured: Site relocated. Other recommendations: Site relocated.
South Reno (32-031-0020)	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 O_3, wind speed, wind direction, and ambient temperature. The monitoring objectives are Public information and NAAQS comparison.	Site objective: Consider discontinuing all monitoring and closing site. Parameters measured: Consider discontinuing all monitoring and closing site. Other recommendations: Consider discontinuing all monitoring and closing site.
Toll (32-031-0025)	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. This site monitors for population exposure of PM_{10}, $PM_{2.5}$, $PM_{10\text{-}2.5}$, O_3, wind speed, wind direction, and ambient temperature.	Site objective: No recommended changes. Parameters measured: No recommended changes. Other recommendations: No recommended changes.

Table 12 (continued)
Summary of Recommended Modifications to the Existing AQMD Network

AQS Site Name (AQS Site ID)	Current Monitoring Objective	Recommended Modifications
Plumb-Kit (32-031-0030)	The Plumb-Kit site was located on the northeast corner of Plumb Lane and Kietzke Lane. The site was surrounded by both residential and commercial properties as well as a school. It was closed in December 2017 to build capacity to initiate monitoring at a new station in Spanish Springs. Before closure, the site monitored for population exposure of PM_{10}, wind speed, wind direction, and ambient temperature. The monitoring objectives were Public information and NAAQS comparison.	Site objective: Site closed. Parameters measured: Site closed. Other recommendations: Site closed.
Reno4 (32-031-0031)	Located at Libby C. Booth Elementary School at 1450 Stewart Street in Reno, this site is near the northern edge of the playground and bus loading/unloading zone. Reno4 began monitoring in January 2020 as a relocation of the Reno3 site. Reno4 is an NCore site and monitors for O_3, PM_{10}, $PM_{2.5}$, PM_{coarse}, Trace CO, Trace SO_2, NO_x, and Trace NO_Y. Meteorological parameters including ambient temperature, relative humidity, wind speed, and wind direction are also monitored. This site is also part of EPA's national Speciation Trends Network (STN).	Site objective: No recommended changes. Parameters measured: Add a solar radiation sensor. Other recommendations: No recommended changes.
Sparks (32-031-1005)	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 concentrations 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.	Site objective: No recommended changes. Parameters measured: No recommended changes. Other recommendations: No recommended changes.

Table 12 (continued)
Summary of Recommended Modifications to the Existing AQMD Network

AQS Site Name (AQS Site ID)	Current Monitoring Objective	Recommended Modifications
Spanish Springs (32-031-1007)	This site is located on the north side of Lazy 5 Park in Spanish Springs. It will be in area among residences, parks, and open fields. This site monitors for PM_{10}, $PM_{2.5}$, $PM_{10-2.5}$, O_3, wind speed, wind direction, and ambient temperature. The monitoring objectives are Public information and NAAQS comparison.	Site objective: No recommended changes. Parameters measured: No recommended changes. Other recommendations: No recommended changes.
Incline (32-031-2002)	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.	Site objective: No recommended changes. Parameters measured: No recommended changes. Other recommendations: No recommended changes.
Lemmon Valley (32-031-2009)	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. The monitoring objective is NAAQS comparison.	Site objective: No recommended changes. Parameters measured: No recommended changes. Other recommendations: No recommended changes.
West Reno/Verdi (Future)	Consider placing a neighborhood scale monitoring site in the West Reno/Verdi area. Currently, the downtown Reno3 monitoring site covers a large population. By placing an additional monitoring site just west of the HA 87 boundary, population exposure of PM_{10}, $PM_{2.5}$, $PM_{10-2.5}$, O_3, 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. A formal request stating this proposal will be submitted prior to any modifications to follow the 40 CFR 58.14 criteria.	Site objective: Initiate monitoring for Public information and NAAQS comparison. Parameters measured: Initiate PM_{10}, $PM_{2.5}$, $PM_{10-2.5}$, O_3, wind speed, wind direction, and ambient temperature monitoring. Other recommendations: Initiate as a SPM site with the intention of conversion to SLAMS

Future Monitoring Requirements

None at this time.

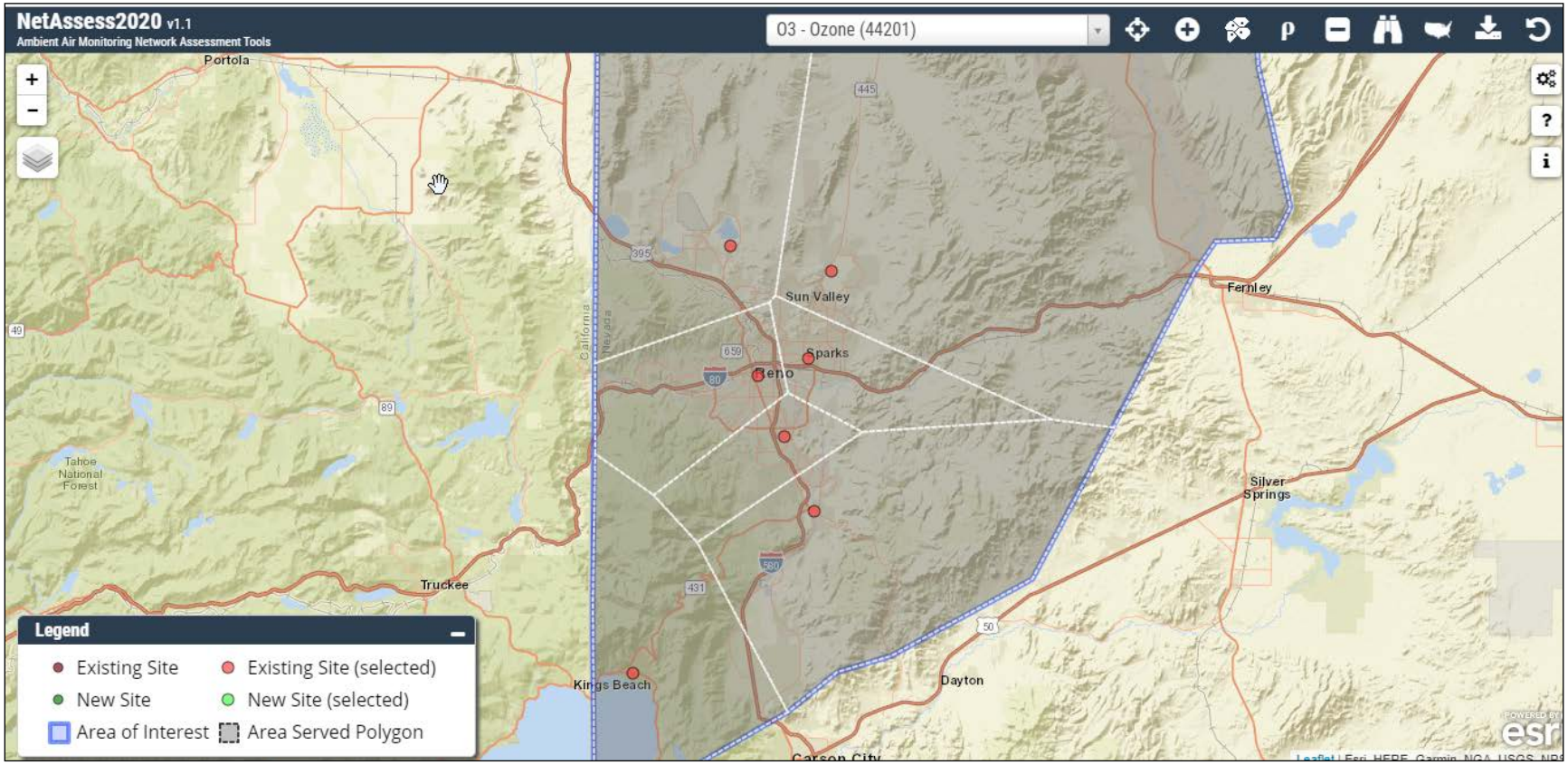
WASHOE COUNTY
HEALTH DISTRICT
ENHANCING QUALITY OF LIFE

Please contact Daniel Inouye for
questions or comments at
dinouye@washoecounty.us

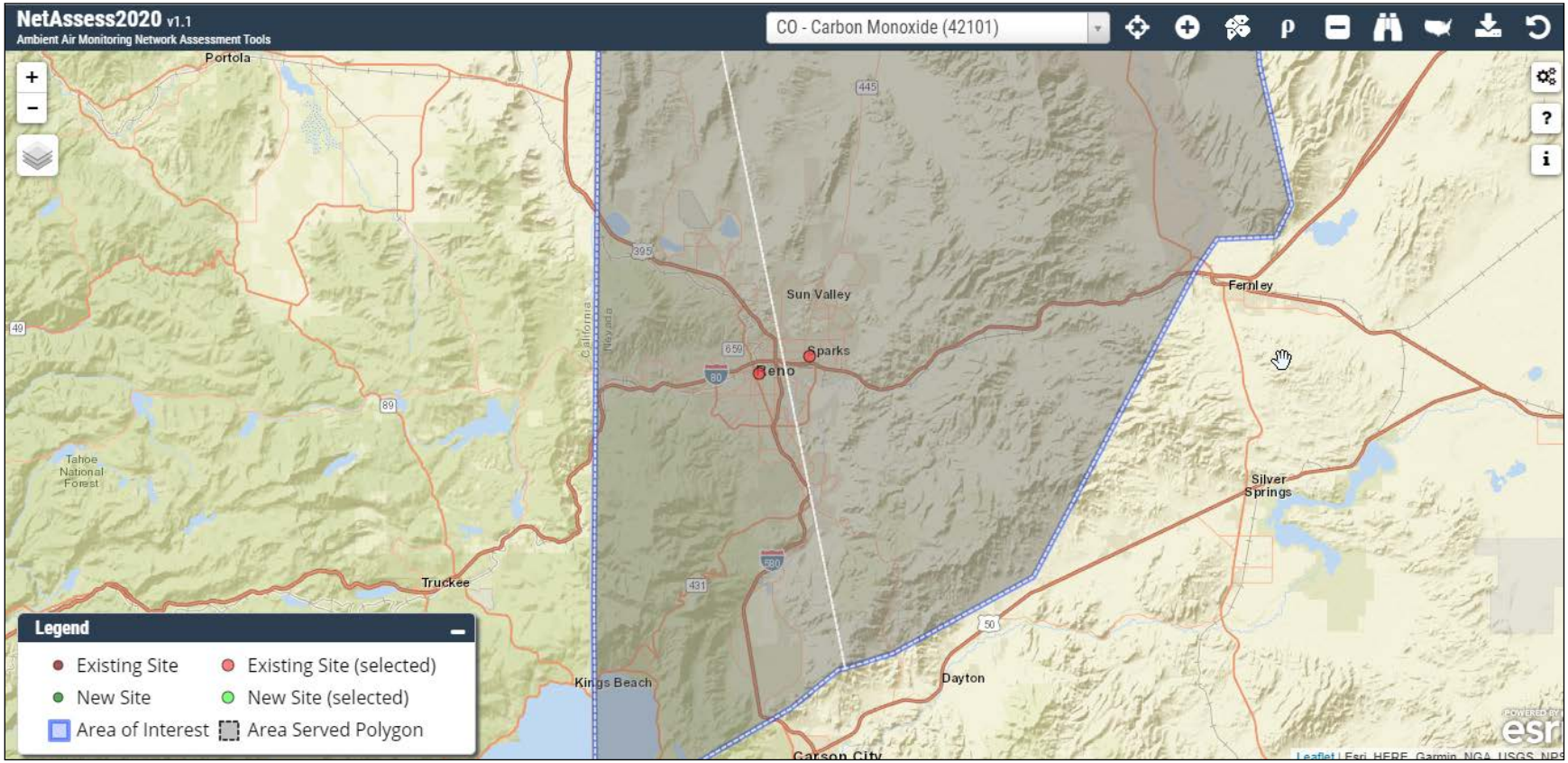
Appendix A

Statistical Analysis
(Area Served and Population Served Analyses)

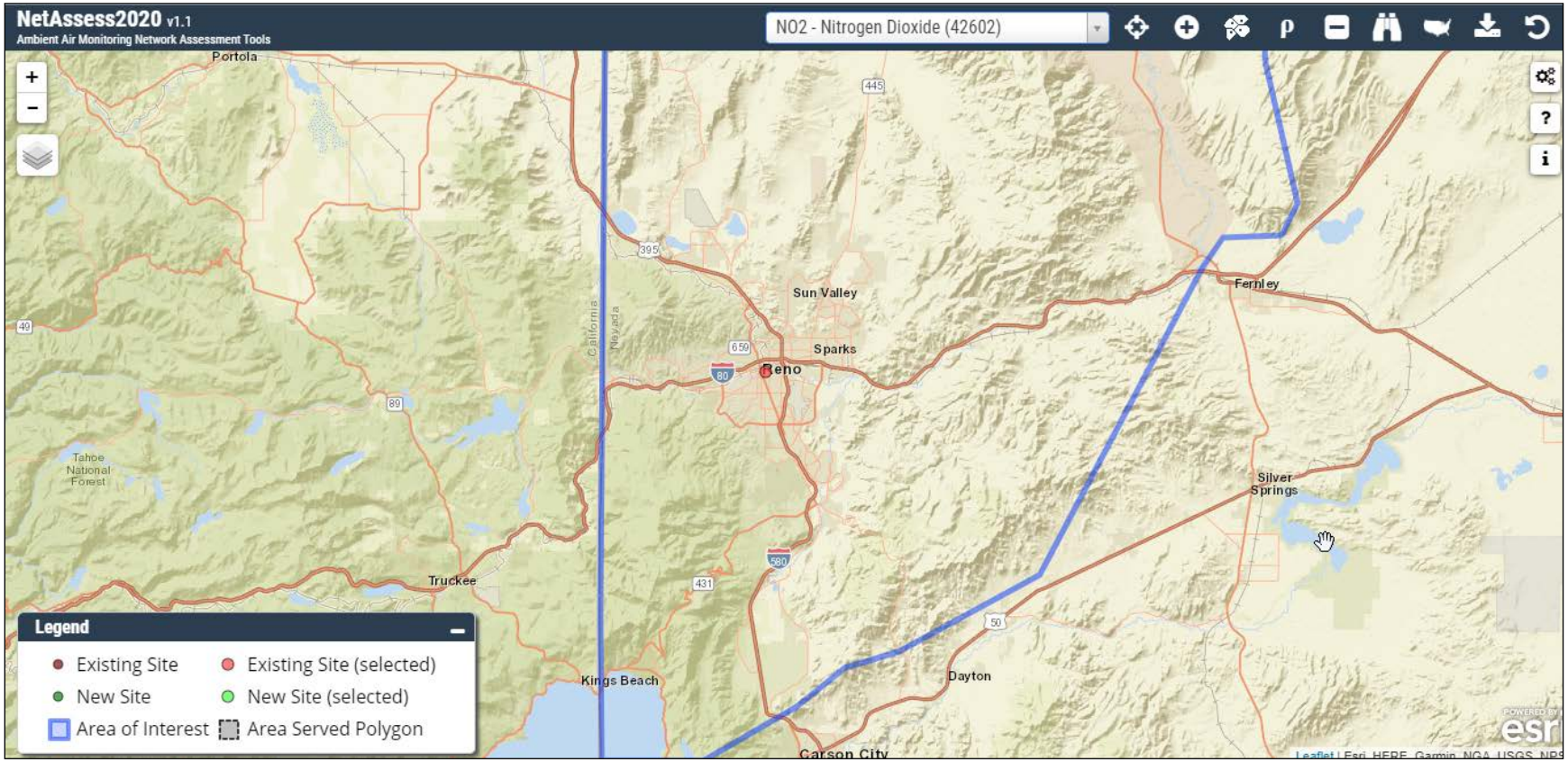
Thiessen Polygons for AQMD's Current O_3 Monitoring Sites



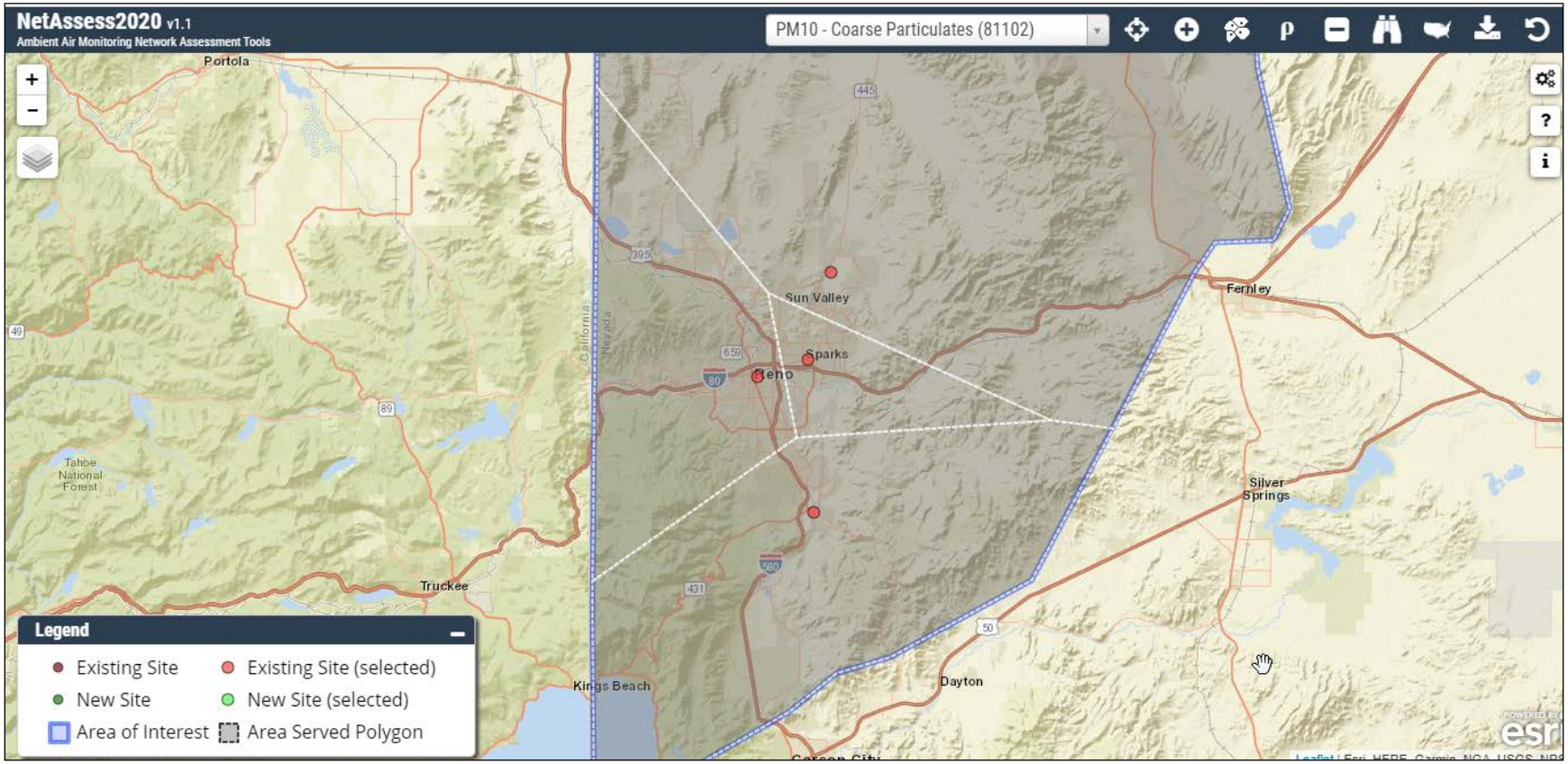
Thiessen Polygons for AQMD's Current CO Monitoring Sites



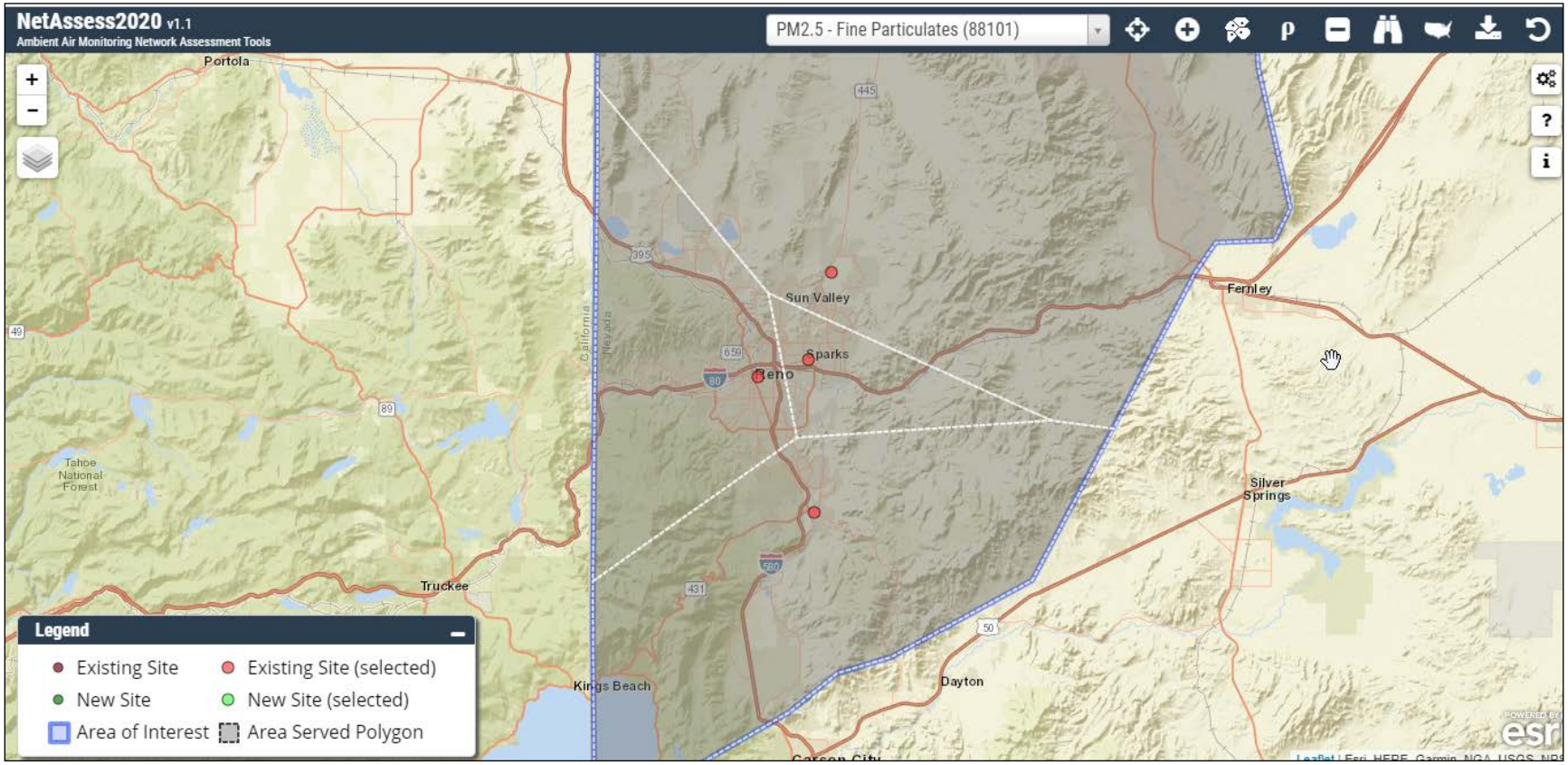
Thiessen Polygons for AQMD's Current NO_2 Monitoring Sites



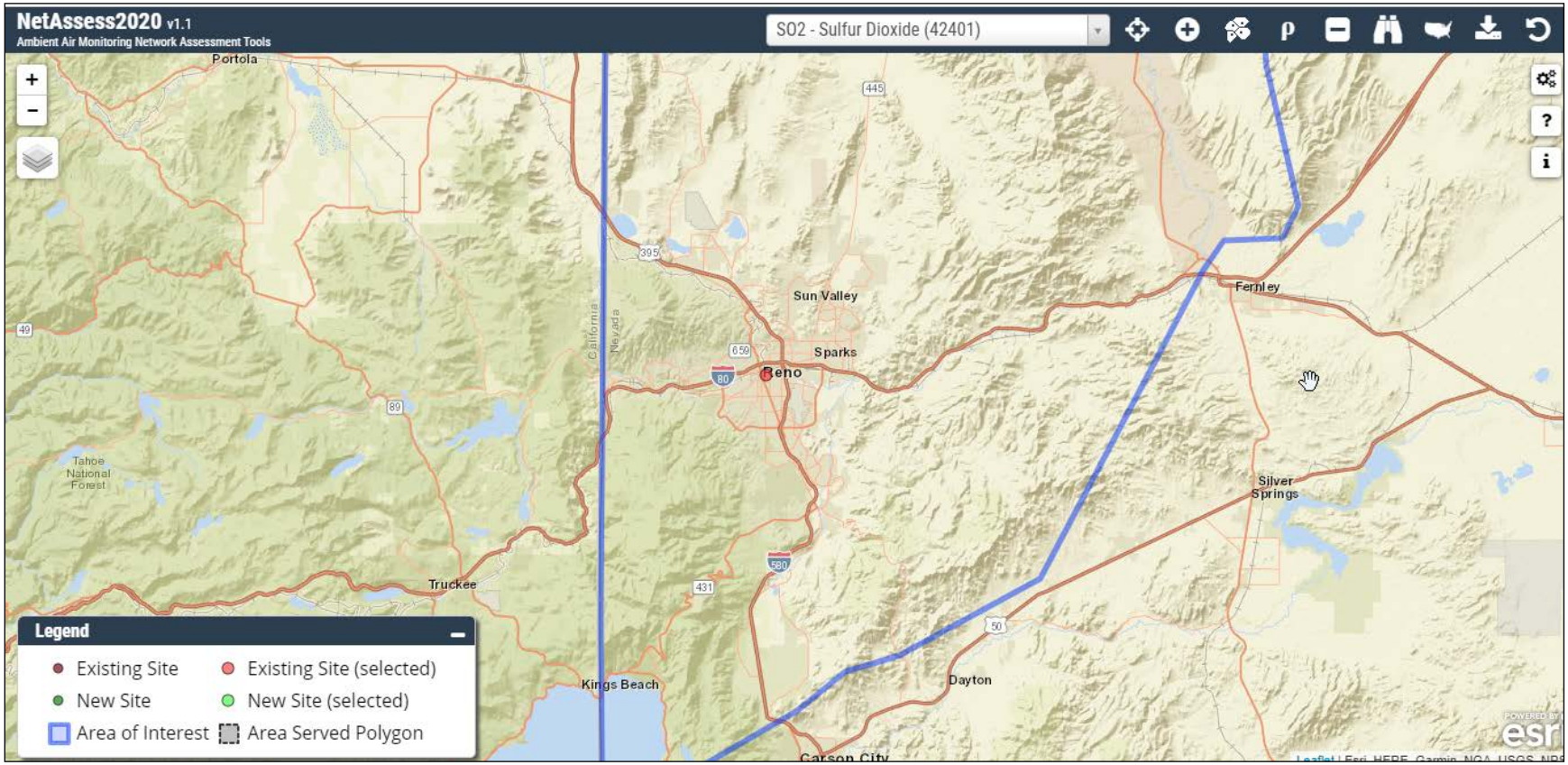
Thiessen Polygons for AQMD's Current PM_{10} Monitoring Sites



Thiessen Polygons for AQMD's Current $PM_{2.5}$ Monitoring Sites



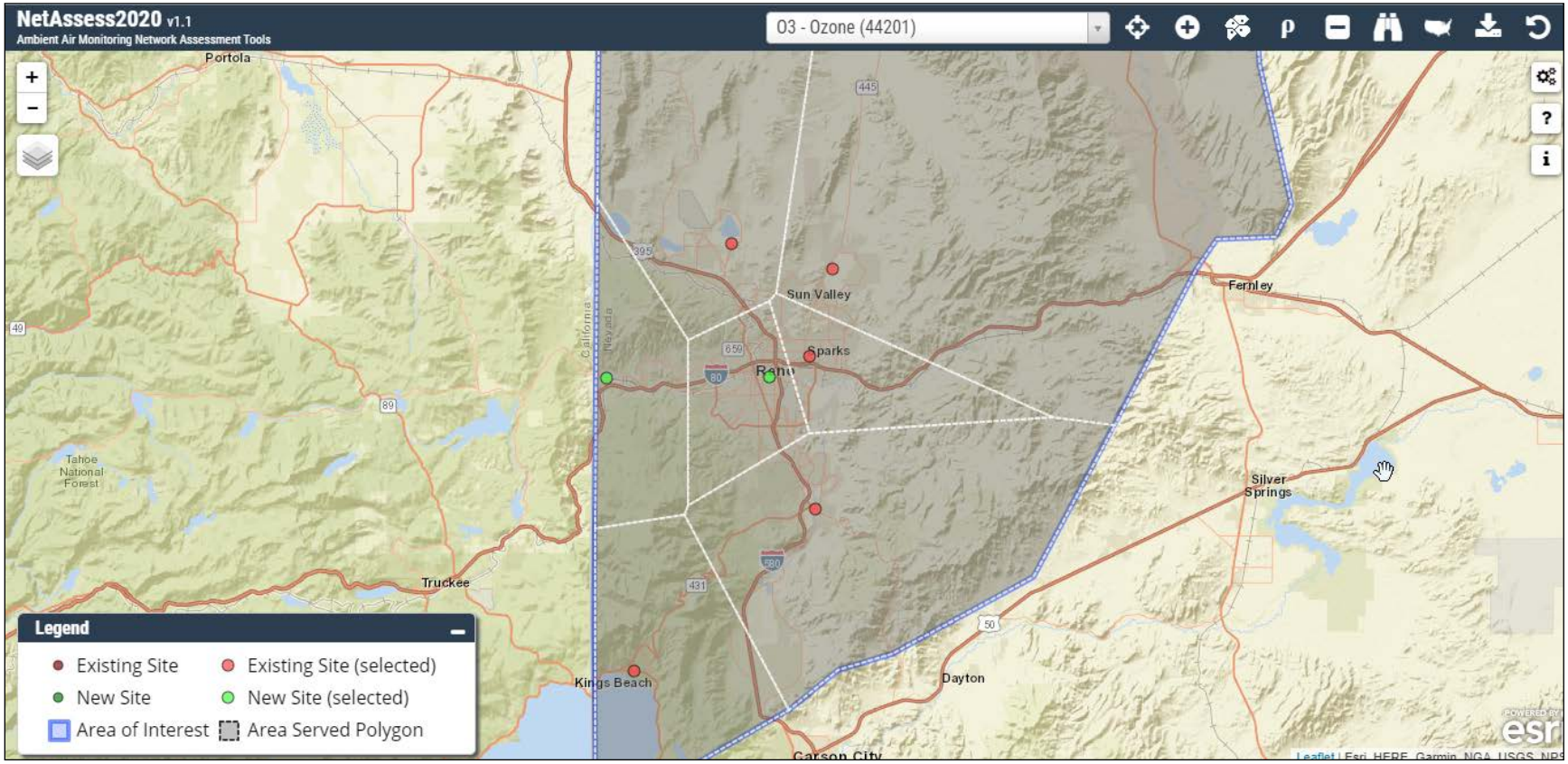
Thiessen Polygons for AQMD's Current SO_2 Monitoring Sites



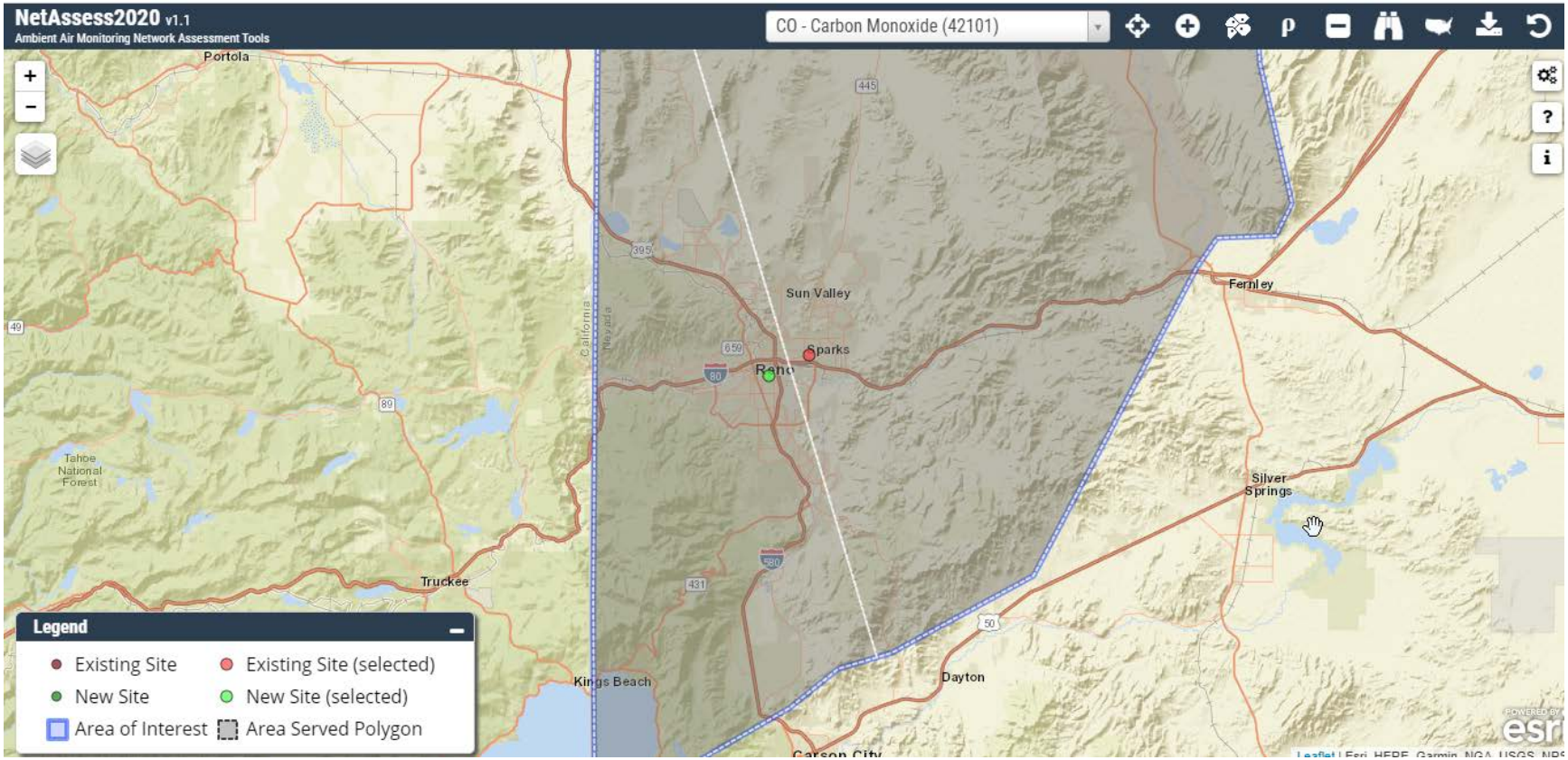
Appendix B

Situational Analysis
(Area Served and Population Served Analyses)

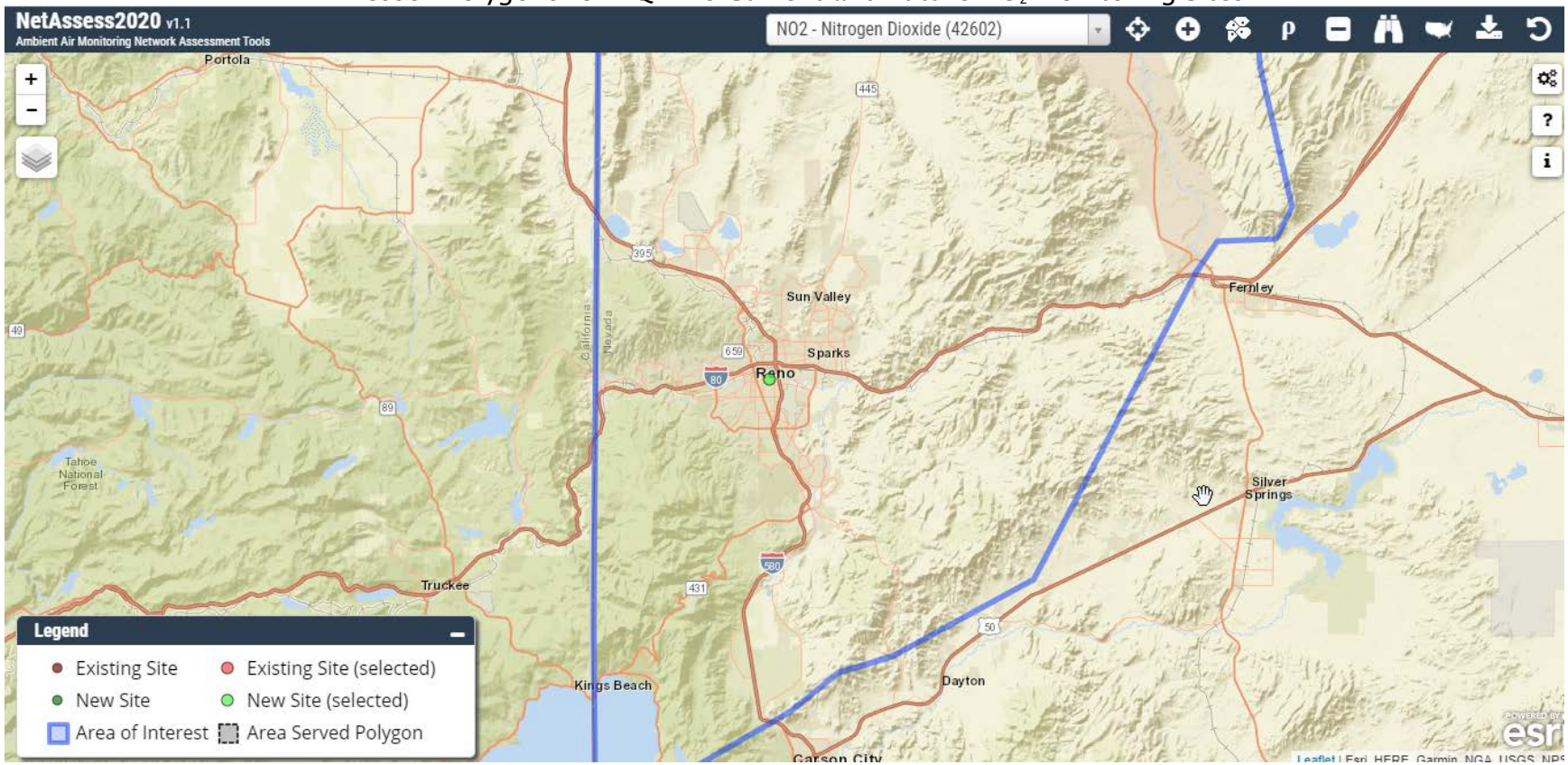
Thiessen Polygons for AQMD's Current and Future O_3 Monitoring Sites



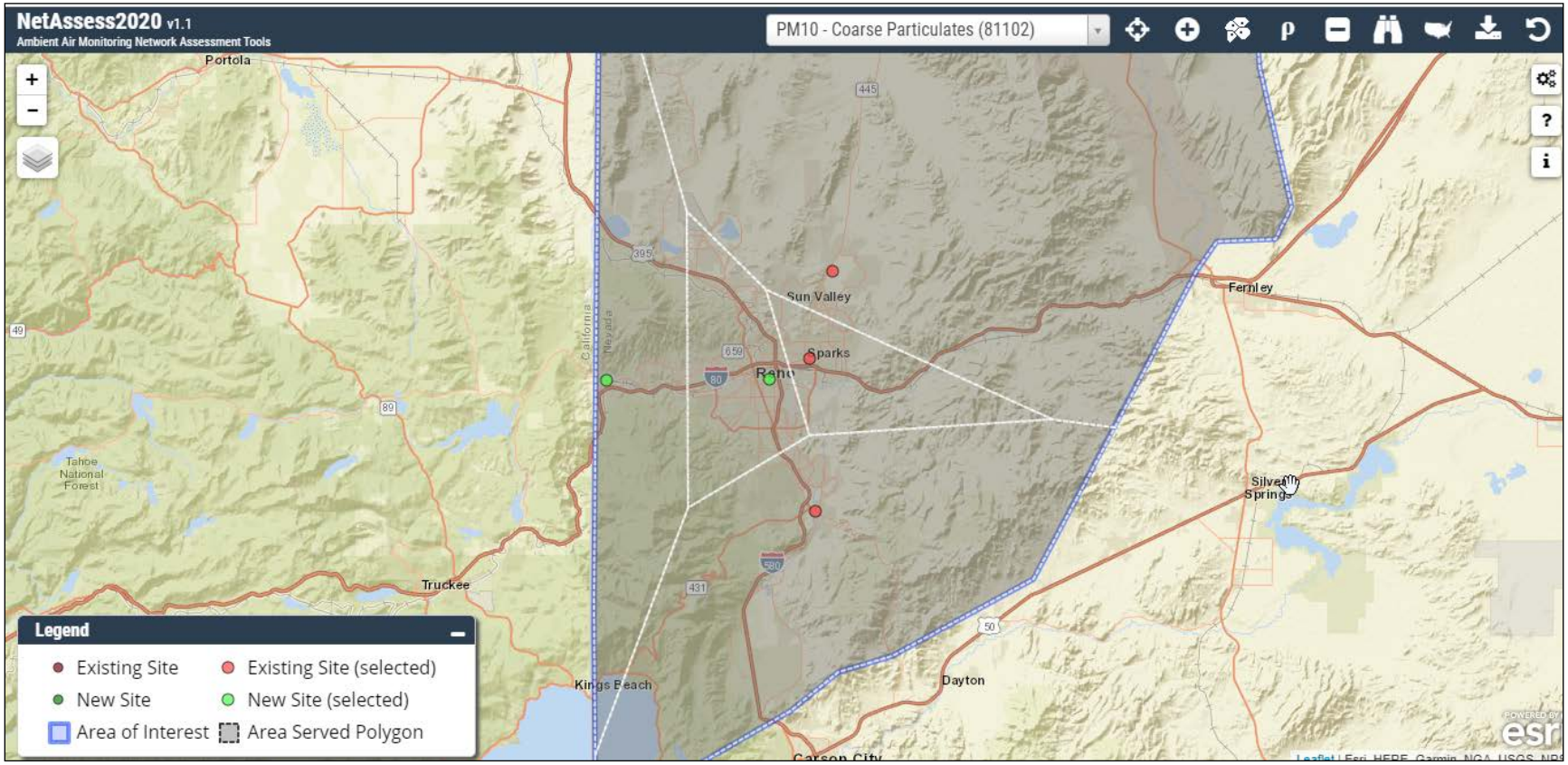
Thiessen Polygons for AQMD's Current and Future CO Monitoring Sites



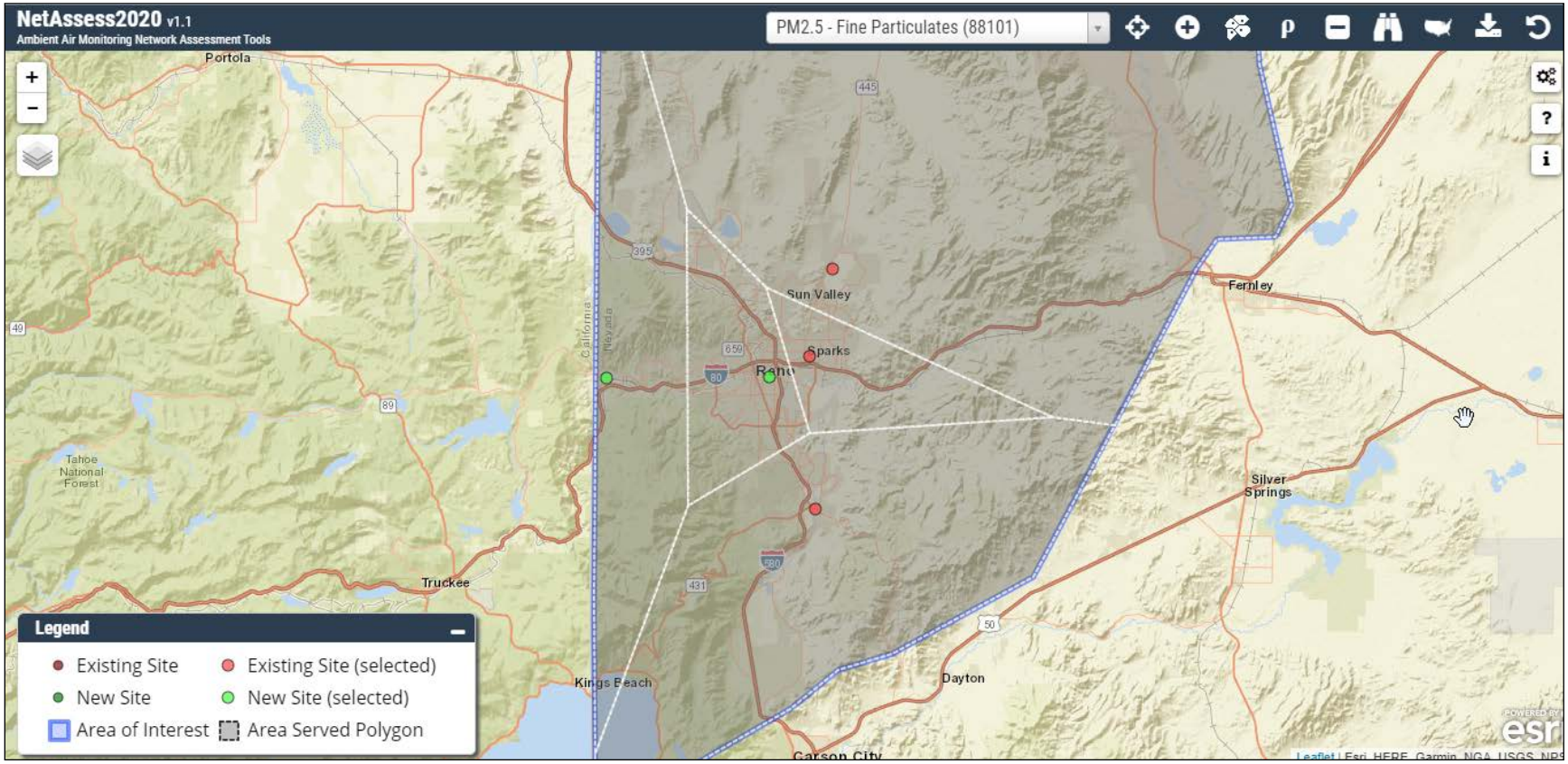
Thiessen Polygons for AQMD's Current and Future NO_2 Monitoring Sites



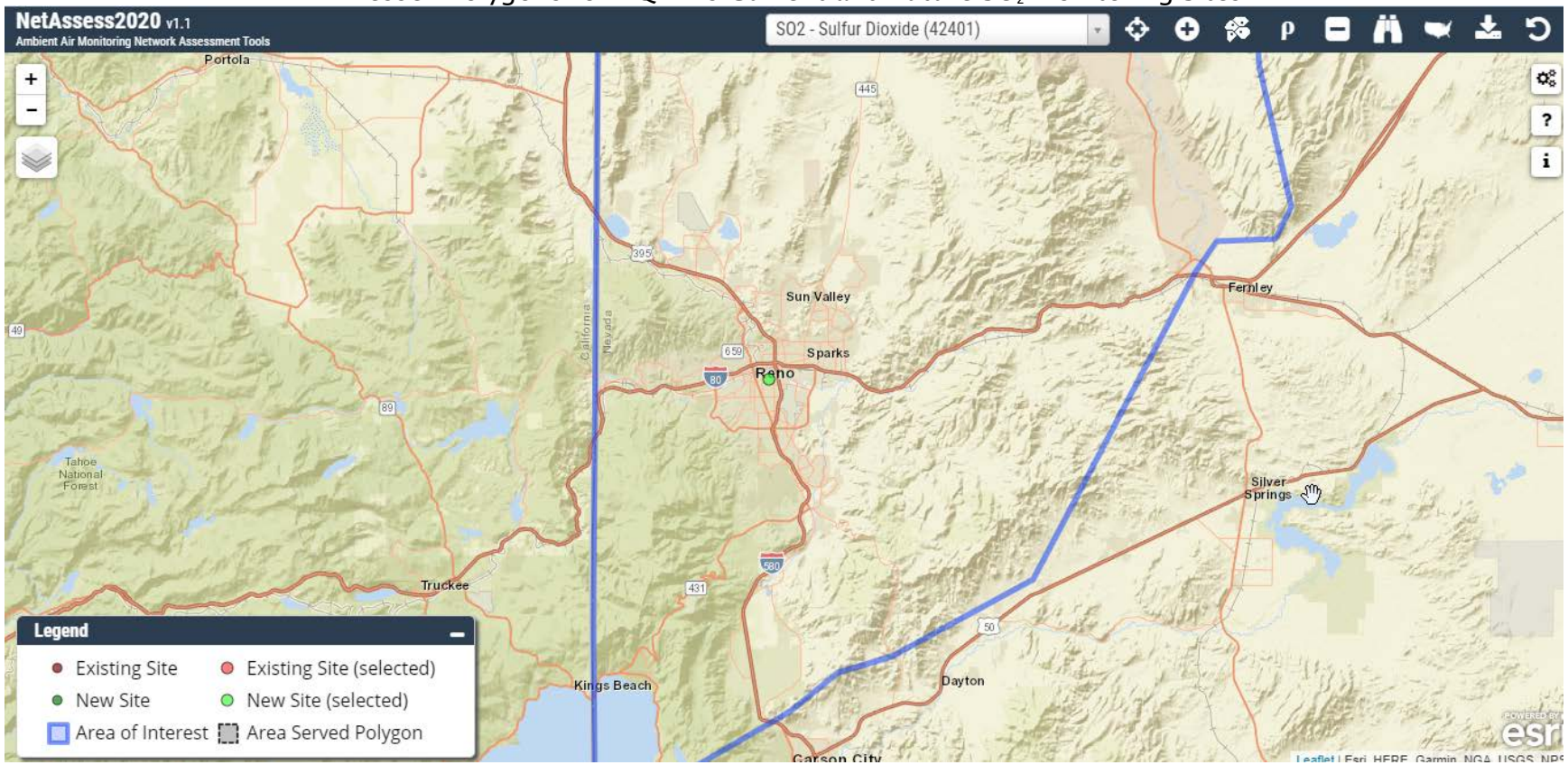
Thiessen Polygons for AQMD's Current and Future PM_{10} Monitoring Sites



Thiessen Polygons for AQMD's Current and Future $PM_{2.5}$ Monitoring Sites



Thiessen Polygons for AQMD's Current and Future SO_2 Monitoring Sites



Appendix C

NAAQS Review Status

NAAQS Review Status
(May 2019)

	Ozone	Lead	Primary NO_2	Primary SO_2	Secondary (Ecological) NO_2, SO_2, PM[1]	PM[2]	CO
Last Review Completed (final rule signed)	Oct 2015	Sep 2016	Apr 2018	Feb 2019	Mar 2012	Dec 2012	Aug 2011
Recent or Major Upcoming Milestone(s)	Sep 2019 Draft ISA[3] Oct 2019 Draft PA Summer 2020 Proposal Late 2020 Final	TBD[4]	TBD	TBD	TBD Final ISA; draft REA/PA	Dec 2019 Final ISA Jan 2020 Final PA April 30, 2020 Proposal Late 2020 Final	TBD

Additional information regarding current and previous NAAQS reviews is available at: https://www.epa.gov/naaqs

1 Combined secondary (ecological effects only) review of NO_2, SO_2, and PM
2 Combined primary and secondary (non-ecological effects) review of PM
3 IRP - Integrated Review Plan; ISA - Integrated Science Assessment; REA - Risk and Exposure Assessment; PA - Policy Assessment
4 TBD - To Be Determined

Appendix D

Public Inspection Plan

Public Inspection Plan

This monitoring network assessment was available for public inspection from May 19 to June 19, 2020 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.