2025 SOUTH SACRAMENTO-FLORIN COMMUNITY AIR MONITORING REPORT

Air Monitoring Plan Development in Partnership with: South Sacramento-Florin Community Steering Committee

SAC METRO AIR DISTRICT

CLEAN AIR FOR ALL

Executive Summary

The California Air Resources Board (CARB) created a Community Air Protection Program in response to the passage of Assembly Bill (AB) 617. In 2018, CARB selected 10 initial communities across the state for AB 617 community monitoring and/or emission reduction programs. The South Sacramento-Florin community was one of the first ten communities selected and was selected to develop a community air monitoring plan (CAMP). The primary goals of the CAMP are to (1) improve the current understanding of air pollution within the community, (2) provide information for the development of a community emissions reduction program, or CERP, and (3) educate the community on air pollution. The Sacramento Metropolitan Air Quality Management District (District) and the South Sacramento-Florin Community Steering Committee (Steering Committee) jointly developed a CAMP for the South Sacramento-Florin community, which was adopted in July 2020. The primary air monitoring objectives of the South Sacramento-Florin CAMP are:

1. Monitoring for traffic-related air pollutants. Determine the spatial distribution of pollution from traffic on Highway 99 and whether these emissions are significant at schools and hospitals.

2. Determine which source categories the emissions are coming from and whether the emissions from the sources contribute significantly to poor air quality in nearby areas.

3. Determine air quality at sensitive receptor locations and whether air quality changes by season and location for these sensitive receptors.

4. Increase air quality awareness in the community by making air quality information readily accessible and easy to understand.

The CAMP provides the process for achieving community air monitoring goals and objectives. The South Sacramento-Florin CAMP has three phases of monitoring. Phase 1 and Phase 2 monitoring included 26 different monitoring sites across the South Sacramento-Florin community. **Phase 1 and Phase 2 monitoring provided air quality information on different areas of the community and provided screening information for the third phase of monitoring.** Phase 3 monitoring deployed professional and regulatory-grade monitoring equipment in a portable laboratory. The results and conclusions in this report are based upon the air monitoring data collected from Phase 1 and Phase 2 monitoring for 2020 through 2023. Phase 3 monitoring results are not included in this report.

The following summarizes the main conclusions from the data results of Phase 1 and Phase 2 monitoring:

- Fine particulate matter ($PM_{2.5}$) levels captured by Phase 1 monitoring were generally the greatest at the site closest to Highway 99. The $PM_{2.5}$ levels captured by Phase 2 monitoring were greatest at the site located north centrally in the initial South Sacramento-Florin CAMP boundary that was near a combination of potential sources that include Highway 99, arterial roads, truck routes, scrap yard, and residential woodsmoke.

- Coarse (PM_{10}) particulate matter levels were greatest in the northwest corner of the initial South Sacramento-Florin CAMP boundary.

- Black carbon, a component of particulate matter, was at the greatest levels at the site in the northwest corner of the initial South Sacramento-Florin CAMP boundary. This site is near Highway 99, arterial roads, truck routes, distribution centers, and industrial zones.

- Black carbon levels in the South Sacramento-Florin community were sometimes greater than that at District monitoring sites.

- Elevated black carbon levels over holidays, weekends, and evenings in colder months suggest a contribution from residential wood burning in addition to mobile emissions.

- The air toxic acrolein was at levels in the South Sacramento-Florin community that have possible noncancer health impacts. Acrolein levels in the South Sacramento-Florin community were lower than that of the California statewide average. No other air toxics were measured at levels expected to have noncancer health impacts.

- Of the cancer-causing agents (carcinogens) measured, acetaldehyde and benzene generally had the greatest associated cancer risk at monitoring sites in the South Sacramento-Florin community. However, these carcinogens are likely minor contributors to the overall cancer risk from ambient air and diesel particulate matter is expected to contribute the most to the cancer risk of ambient air.

- Levels of the carcinogen acetaldehyde in the South Sacramento-Florin community were greater than that of the District monitoring site in Arden-Arcade and the California statewide average, potentially indicating levels are especially elevated in the community. Benzene levels in the South Sacramento-Florin community were similar or lower compared to that of the District monitoring site in Arden-Arcade and the California statewide average.

- Pollution levels of $PM_{2.5}$, PM_{10}, black carbon, and some carcinogens at sensitive receptor sites were sometimes similar or greater compared to other areas of the South Sacramento-Florin community.

Depending upon the results of ongoing and future monitoring, the conclusions presented in this report may be expanded or revised. Phase 2 monitoring over 2020 and 2021 may have been influenced by the Covid-19 pandemic. As a result, Phase 2 monitoring may not be reflective of long-term trends.

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$\mu g/m^3$	microgram per cubic meter
AB	Assembly Bill
AQ-SPEC	Air Quality Sensor Performance Evaluation Center
AQI	Air Quality Index
Average	arithmetic mean
BAM	beta attenuation monitor
Blueprint	Community Air Protection Blueprint
BTX	benzene, toluene, and xylenes
CAAQS	California Ambient Air Quality Standard
CalTrans	California Department of Transportation
CAMP	Community Air Monitoring Plan
CARB	California Air Resources Board
CATA	California Air Toxics Assessment
CEPAM	California Emission Projection Analysis Model
CERP	Community Emissions Reduction Program
continuous	multiple measurements per hour
District	Sacramento Metropolitan Air Quality Management District
GC-MS	gas chromatography-mass spectrometry
GC/FID/MS	gas chromatography/flame ionization detection with mass selective
NAAQS	National Ambient Air Quality Standard
NATTS	National Air Toxics Trends Station
NO_x	nitrogen oxides
NO_2	nitrogen dioxide
OEHHA	Office of Environmental Health Hazard Assessment
O_3	Ozone
$PM_{2.5}$	particulate matter with aerodynamic diameter less than 2.5 micrometers
PM_{10}	particulate matter with aerodynamic diameter less than 10 micrometers
R^2	coefficient of determination
REL	Reference Exposure Level
SACOG	Sacramento Area Council of Governments
SMAQMD	Sacramento Metropolitan Air Quality Management District
SOP	Standard Operating Procedure
STAA	Surface Transportation Assistance Act
Steering	South Sacramento-Florin Community Steering Committee
TAC	Toxic Air Contaminant
Teflon	polytetrafluoroethylene
TSP	Total Suspended Particles
U.S. EPA	United States Environmental Protection Agency
VOC	volatile organic compound
XRF	x-ray fluorescence

1. Introduction

1.1. Development of the Community Air Monitoring Plan (CAMP)

Assembly Bill (AB) 617 provides a new community-focused framework to improve air quality in communities with high cumulative exposure burdens to air pollution (C. Garcia 2017). While AB 617 recognizes that California air quality has improved tremendously in recent decades, some communities are still more burdened by poor air quality than others. AB 617 builds on the foundation of existing air quality legislation and programs and takes a bottom-up approach by working with community members and providing additional resources to communities disproportionately impacted by air pollution. Participating AB 617 communities are selected by the California Air Resources Board (CARB) to develop either air monitoring plans, emissions reduction plans, or both. The South Sacramento-Florin community was selected by CARB to develop a community air monitoring plan (CAMP). The goals of community air monitoring are to improve our understanding of pollution impacts within communities, support the effective implementation of emissions reduction programs, and educate the community on air pollution.

The South Sacramento-Florin CAMP was developed collaboratively by the South Sacramento-Florin Community Steering Committee (Steering Committee) and the Sacramento Metropolitan Air Quality Management District (District) with the support of community members within the South Sacramento-Florin community. The Steering Committee's in-depth knowledge and input about their community was a vital part of developing the CAMP from December 2018 through June 2020. Steering Committee input included: air quality concerns, desired outcomes, priority monitoring areas, and best practices for engaging with the community and disseminating information.

1.2. Evaluating CAMP implementation

Successful implementation of the CAMP will be determined based on the progress toward achieving the four objectives that guided the initial development of the plan. The following objectives were developed based on the Steering Committee's four highest-priority air quality concerns:

1. **Objective A**
   Monitoring for traffic-related air pollutants. Determine the spatial distribution of pollution from traffic on Highway 99 and whether these emissions are significant at schools and hospitals.

2. **Objective B**
   Determine which source categories the emissions are coming from and whether the emissions from the sources contribute significantly to poor air quality in nearby areas.

3. **Objective C**
   Determine air quality at sensitive receptor locations and whether air quality changes by season and location for these sensitive receptors.

4. **Objective D**
   Increase air quality awareness in the community by making air quality information readily accessible and easy to understand.

This report will evaluate the District's completed and ongoing efforts to meet the four objectives listed above and identify next steps to accomplish any remaining objectives (**Chapter 6**). The monitoring results provided in this report are intended to provide the community with a better understanding of its air quality and the associated health risks.

1.3. Current progress of CAMP implementation

Since the adoption and approval of the CAMP in July 2020, the District has continued to engage with the Steering Committee to build partnerships with potential partner organizations and agencies, to review and discuss air monitoring data results, and to discuss how to improve community engagement with members of the public. The District has allocated significant resources toward the procurement, installation, and deployment of air monitoring equipment in the South Sacramento-Florin community.

Phase 1 monitoring is ongoing, Phase 2 monitoring has been completed, and Phase 3 monitoring is currently in progress (**Chapter 3**). Phase 1 monitoring consists of a network of 21 sites measuring fine particulate matter ($PM_{2.5}$). Phase 2 monitoring consisted of six stand-alone monitors measuring black carbon, speciated $PM_{2.5}$ ($PM_{2.5}$ and its metals), speciated coarse particulate matter (PM_{10} and its metals), and volatile organic compounds (VOCs). Phase 1 and Phase 2 monitoring data results are presented in **Chapter 5**. Phase 3 monitoring is a portable air monitoring laboratory that was first deployed April 2023. The portable laboratory monitored air quality in the same location until March 2025.

1.4. Overview of report contents

The following report outlines the accomplishments, progress, and ongoing work towards implementation of the South Sacramento-Florin CAMP from July 2020 to the publishing of this report. An evaluation of the CAMP objectives will determine whether the initial goals have been achieved and identify any remaining work needed to meet the goals of both the CAMP and community members. Based on the guidelines set forth in the CARB Community Air Protection Blueprint (Blueprint), this report includes the following:

- Background
- Air Monitoring Goals and Timeline
- Data Methods
- Community Air Monitoring Data Results
- Evaluation of Progress on Achieving Four Objectives
- Communicating the Results
- Conclusions and Next Steps

2. Background

2.1. The Community Air Monitoring Plan (CAMP)

Historically, state and local air agencies have focused their efforts on improving air quality at the regional scale, using a top-down approach to implement air quality strategies. The AB 617 (C. Garcia 2017) legislation shifted that paradigm and provided an innovative pathway to address air quality challenges by using a bottom-up approach, where policy discussions are initiated at the community level. To support and provide guidelines to local air districts implementing AB 617, CARB developed the Blueprint, which outlines the requirements that air districts and Steering Committees must meet to develop and implement a CAMP. According to the AB 617 Blueprint, a CAMP must include planned community-level monitoring, intended usage of the data results, and an explanation of the collaborative development process of the plan itself. The South Sacramento-Florin CAMP is available on the District website[1].

The South Sacramento-Florin CAMP is a commitment to establishing and maintaining a community-scale air monitoring network to address the concerns of the community members. Air monitoring data gathered from the CAMP implementation will provide the public with a better understanding of existing air quality conditions in the South Sacramento-Florin community. Additionally, air monitoring data may help identify local pollution "hot spots" and time-related pollution trends. The data can also inform future implementation of emissions and exposure reduction strategies to reduce the air pollution-related health risks of the community.

2.2. The South Sacramento-Florin community

The initial boundaries of the South Sacramento-Florin CAMP were centered around Highway 99 about 5 miles southeast of downtown Sacramento. Potential local pollution sources include Highway 99, truck routes, arterial roadways (high-capacity urban roads), rail transport, industrial zones, stationary sources (such as industrial and commercial facilities operating under a District permit), and areawide sources (such as small businesses that do not require a District permit and residential wood burning). Based on the California Department of Transportation (CalTrans) Traffic Census, Highway 99 annual average daily traffic ranges from 140,000 to 180,000 and annual average daily truck traffic ranges from 9,100 to 12,800 (5-8% of total traffic) within the initial South Sacramento-Florin CAMP boundaries[2]. The community is largely residential and contains many sensitive receptor sites (locations where individuals who are most vulnerable to air pollution congregate), such as hospitals, daycares, and schools (**Figure 2-2**).

The community of South Sacramento-Florin was prioritized by the District based on a technical analysis of quantitative factors as well as feedback received from community members. South

[1] https://www.airquality.org/CAM
[2] Based on 2022 estimates from CalTrans. Available at: https://dot.ca.gov/programs/traffic-operations/census

Sacramento-Florin was one of the two highest priority communities identified by the District in the *Final Assessment of Proposed Monitoring Locations for AB 617 Community Air Protection Action*[1] report submitted to CARB in July 2018 . This analysis included the following community factors: exposure to air pollution and related health risk impact, proportion of pollution burdened and low-income residents, presence of sensitive populations, and socioeconomic factors. On September 27th, 2018, the South Sacramento-Florin community was selected by the CARB as a first-year AB 617 air monitoring community for the development of a CAMP. The District and Steering Committee collaborated to finalize the boundaries of the South Sacramento-Florin community in February 2019, which were expanded from the original proposal to include additional areas of concern (the arterial roadway Franklin Blvd as well as industrial zones and rail transport on the east side of the community). The CAMP boundaries were expanded further in July 2024 and are the same boundaries as the South Sacramento-Florin Community Emissions Reduction Program (CERP).

2.3. Monitoring locations and project design

The design of the community air monitoring network was developed in collaboration with the Steering Committee and members of the public over a series of discussions and community listening sessions. The monitoring strategy consists of three phases:

- **Phase 1:**
  An initial screening to provide increased spatial information and real-time air quality data with portable sensors.
- **Phase 2:**
  Enhanced screening with stand-alone monitors.
- **Phase 3:**
  Professional-grade monitoring within a portable laboratory.

The locations for all phases of the project were influenced by a combination of technical analysis, collaboration with the Steering Committee, and feedback from members of the public. Many monitoring sites were located at or near sensitive populations (daycares, hospitals, schools) or near major roadways of concern. The majority of the Phase 1 monitors, all the Phase 2 monitors, and the Phase 3 laboratory were located inside the four priority areas originally identified by the Steering Committee (described in Element 8 of the CAMP). The monitoring locations and the priority areas are shown in **Figure 2-1**. Sensitive receptor sites within the initial South Sacramento-Florin CAMP boundaries are shown in **Figure 2-2**.

[1]Available at:
https://www.airquality.org/ProgramCoordination/Documents/SMAQMD%20Final%20Recommendations-Report.pdf

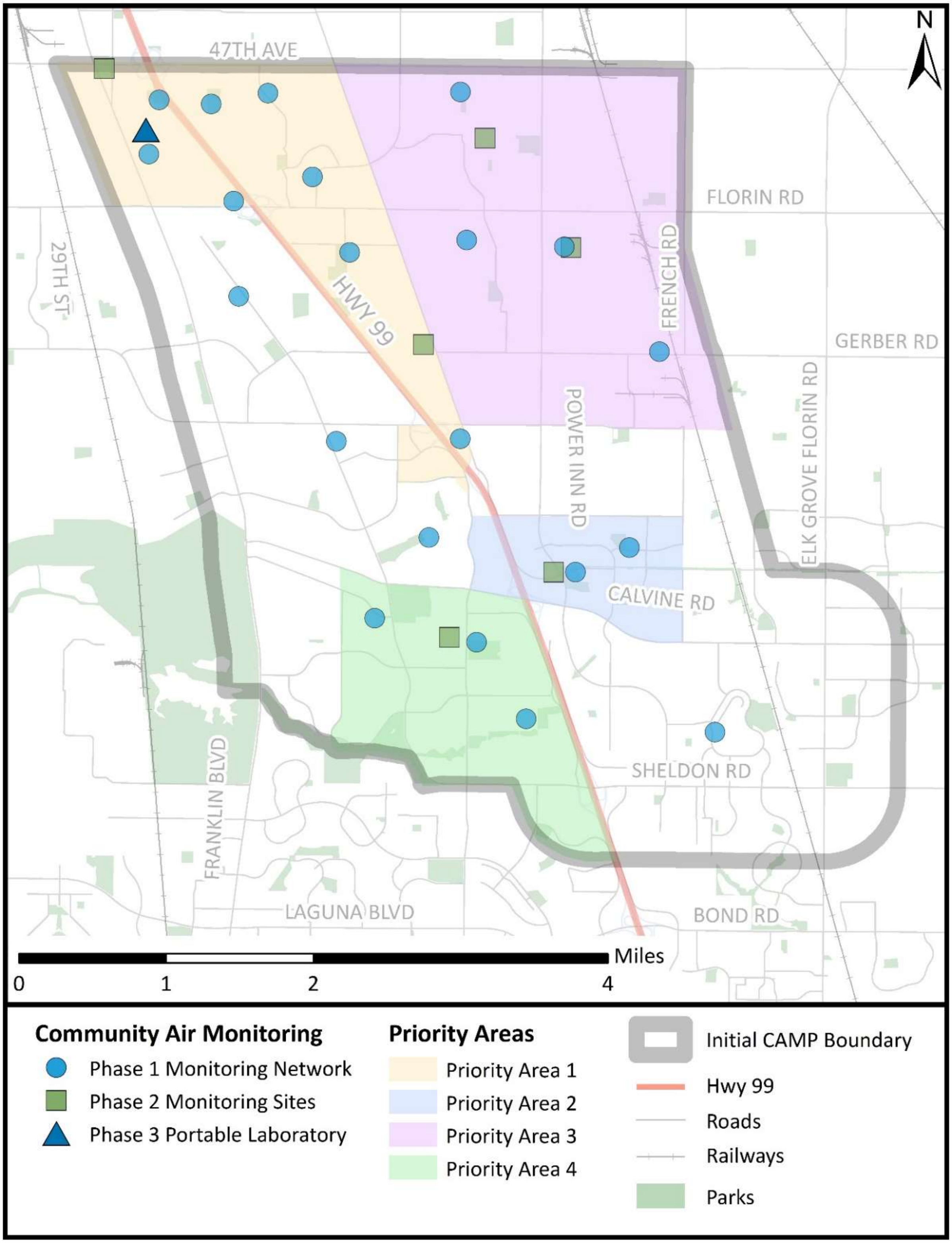

Figure 2-1. Community air monitoring locations in South Sacramento-Florin.

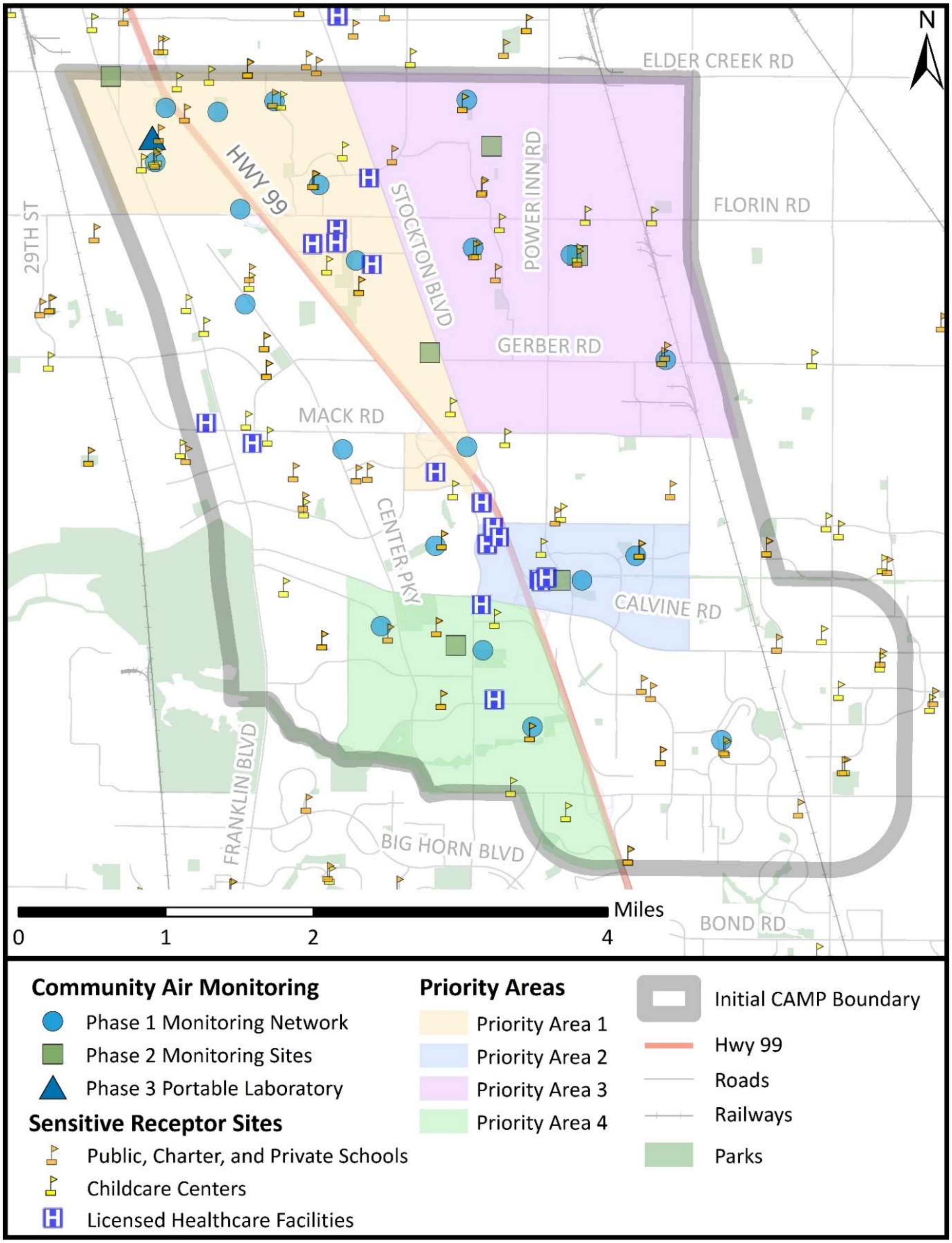

Figure 2-2. Sensitive receptor locations in South Sacramento-Florin.

2.4. Introduction to air pollutants

The three phases of monitoring described by the CAMP measure a variety of air pollutants. Measuring different air pollutants allows for a more comprehensive understanding of air pollution in the South Sacramento-Florin community. The following air pollutants were measured during Phase 1 and Phase 2 monitoring: fine particulate matter ($PM_{2.5}$), coarse particulate matter (PM_{10}), black carbon, metals, and volatile organic compounds (VOCs). To provide background for the monitoring results provided in this report (**Chapter 5**), these pollutants are described in the following sections.

2.4.1. Fine particulate matter ($PM_{2.5}$)

Fine particulate matter, or $PM_{2.5}$, is defined as any particulate matter in the air with an aerodynamic diameter less than 2.5 micrometers (**Figure 2-3**). These airborne particles can be inhaled and deposited deep into the lungs. The pollutant has respiratory and cardiovascular health impacts, including triggering asthma attacks. Due to its health impacts, the U.S. EPA sets federal health standards to protect public health. Emission sources include any type of fuel combustion (such as vehicles and industry) as well as road dust, construction/demolition activities, and agricultural activities. Residential wood burning is considered to contribute about half of direct $PM_{2.5}$ emissions in the wintertime for the Sacramento region . Chemical reactions of gases can also produce $PM_{2.5}$. These gases are mainly emitted by human-caused activities, including fuel combustion and industrial processes.

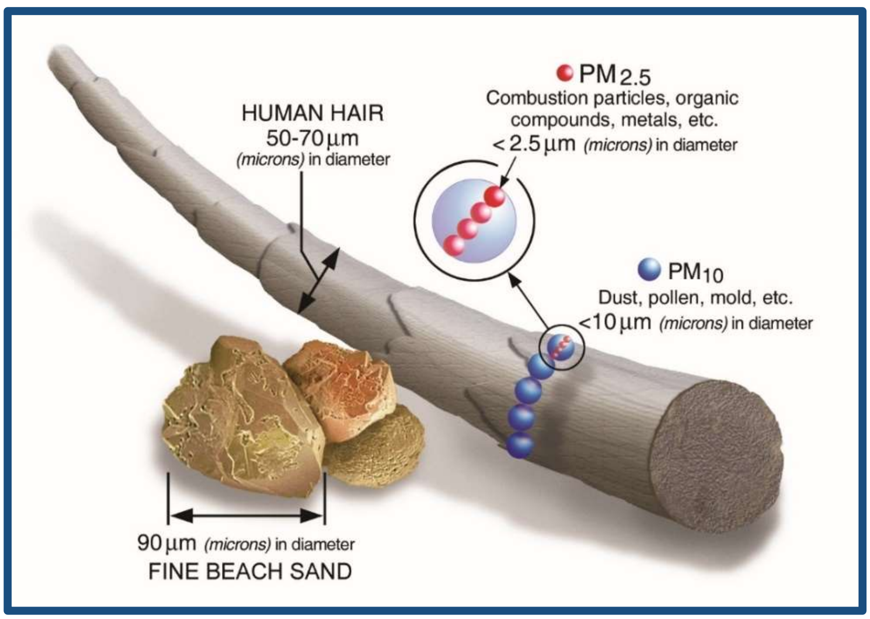

Figure 2-3. Particle size comparison.

Image sourced from the United States Environmental Protection Agency (U.S. EPA).

2.4.2. Coarse particulate matter (PM_{10})

Coarse particulate matter, or PM_{10}, is a measurement of any particulate matter with an aerodynamic diameter less than 10 micrometers and includes $PM_{2.5}$ (**Figure 2-3**). All PM_{10} particles are small enough to be inhaled into the lungs and can cause adverse health impacts. The pollutant PM_{10} has respiratory health impacts including aggravating asthma. The U.S. EPA sets federal health standards for PM_{10} to protect public health. Emission sources for the coarser fraction of PM_{10} can differ from $PM_{2.5}$, and include construction, landfills, agriculture, wildlands, and industry. Combustion sources (such as fuel combustion and wood burning) also emit PM_{10}. According to CARB's California Emission Projection Analysis Model (CEPAM)[1], over half of PM_{10} emissions in Sacramento County are estimated to come from construction/demolition activities and paved road dust (v1.03, 2019). Another major source is residential wood smoke, accounting for about 12% of PM_{10} emissions.

2.4.3. Black carbon

Black carbon is part of particulate matter. The main sources of black carbon are forms of combustion, including forest fires, combustion engines (such as for vehicles and industry), wood burning, and agricultural burning. Wildfires are generally the greatest source of black carbon emissions in the state of California. Diesel trucks historically were a major contributor to black carbon levels in California. The implementation of a particulate filter requirement for diesel trucks beginning in 2012 has resulted in diesel trucks becoming a less significant source in California, with emissions from residential woodsmoke, off-road equipment, and industrial sources becoming more prominent . The current understanding is that black carbon contributes to the adverse health effects associated with $PM_{2.5}$ exposure, but there is currently no public health standard for black carbon. Black carbon contributes to climate change by absorbing solar radiation .

2.4.4. Air toxics

Air toxics are a diverse group of pollutants that may cause or contribute to noncancer and cancer health impacts. CARB currently recognizes over 200 substances and groups of substances as a toxic air contaminant, or TAC. A wide variety of sources can emit air toxics. Sources include wildfires, residential woodsmoke, industrial processes, gas stations, vehicle exhaust, painting operations, and consumer products. Some air toxics can also be formed from chemical reactions in the air. The CAMP uses the U.S. EPA's National Air Toxics Trends Station (NATTS) Network as a model for air toxics monitoring and targeted the same air toxics monitored through this network. Phase 2 monitoring of air toxics included measuring metals in particulate matter as well as measuring volatile organic compound (VOC) gases. Some air toxics highlighted in **section 5.2.3** for their potential harmful effects include acrolein, acetaldehyde,

[1] Available at: https://ww2.arb.ca.gov/criteria-pollutant-emission-inventory-data

and benzene. Acetaldehyde and acrolein sources include mobile sources, wood combustion (e.g., residential woodsmoke, wildfires), and photochemical reactions. Benzene emissions are generally associated with vehicle exhaust and gas stations but are also found in residential woodsmoke and wildfire smoke .

3. Air Monitoring Goals and Timeline

3.1. Community air monitoring design

Phase 1 monitoring consists of a portable sensor monitoring network across 21 original sites (**Figure 3-1**). The monitoring network provides $PM_{2.5}$ levels throughout the community with multiple measurements per hour. The monitoring network was intended to be an air quality awareness and a screening tool for Phase 2 and Phase 3 monitoring locations. As summarized in **Table 3-1**, the monitoring network was designed to address the primary monitoring objectives outlined by the Steering Committee by:

- including sensitive receptor sites (schools) as monitoring locations
- monitoring at many sites allows for spatial analysis of the traffic-related pollutant $PM_{2.5}$
- providing monitoring over multiple years allows for pollution levels to be compared seasonally
- providing real-time information of $PM_{2.5}$ levels to the public through Clarity OpenMap[1] since deployment started in 2019 (**Table 3-2**)

Phase 2 monitoring measured additional pollutants besides $PM_{2.5}$ and included six sites in total, only one of which was shared with Phase 1 monitoring (**Table 3-3**, **Figure 3-2**). Phase 2 monitoring was an additional screening tool for choosing the location of the Phase 3 monitoring portable laboratory. Phase 2 monitoring was designed to address the primary monitoring objectives of the Steering Committee by:

- including two sensitive receptor sites as monitor locations (Florin Elementary School and the monitor at Consumnes River College was near the Child Development Center daycare on campus)
- monitoring at different sites allows for spatial analysis of traffic-related pollutants (such as black carbon, $PM_{2.5}$, PM_{10}, some VOCs and metals)
- measuring speciated $PM_{2.5}$ and PM_{10} (metals in $PM_{2.5}$ and PM_{10}) to potentially identify sources
- monitoring over fifteen months allows for pollution levels to be compared seasonally
- providing validated monitoring data to the public through the District community air protection webpage[2]

Phase 3 monitoring consists of a portable laboratory with professional and regulatory-grade equipment. Phase 3 monitoring measures additional pollutants beyond those measured in Phase 1 and Phase 2 monitoring (**Table 3-3**). The portable laboratory was designed to address the primary monitoring objectives of the Steering Committee by:

[1] https://openmap.clarity.io/
[2] https://www.airquality.org/CAM

- locating the portable laboratory at a sensitive receptor site (a middle school adjacent to an elementary school)
- using professional-grade equipment to measure traffic-related pollutants [such as $PM_{2.5}$, PM_{10}, black carbon, nitrogen oxides (NO_x), ozone (O_3), and some VOCs and metals]
- measuring speciated $PM_{2.5}$ ($PM_{2.5}$ and its components) and speciated PM_{10} (PM_{10} and its metals) to potentially identify sources
- collecting meteorological information (such as wind speed and wind direction) to provide additional information on potential pollution sources and processes
- providing monitoring for over a year allows for pollution levels to be compared seasonally
- providing monitoring data to the public through the District community air protection webpage and CARB's AQview website[1].

Table 3-1. Steering Committee air quality objectives addressed by three phases of monitoring.

Steering Committee Air Monitoring Objectives	**Phase 1** Monitoring network	**Phase 2** Enhanced screening	**Phase 3** Portable laboratory
Objective A Monitoring for traffic-related air pollutants. Determine the spatial distribution of pollution from traffic on Highway 99 and whether these emissions are significant at schools and hospitals.	✓	✓	✓
Objective B Determine which source categories the emissions are coming from and whether the emissions from the sources contribute significantly to poor air quality in nearby areas.	N/A	✓	✓
Objective C Determine air quality at sensitive receptor locations and whether air quality changes by season and location for these sensitive receptors.	✓	✓	✓
Objective D Increase air quality awareness in the community by making air quality information readily accessible and easy to understand.	✓	✓	✓

[1] https://aqview.arb.ca.gov/

3.2. Monitoring equipment deployment timeline

Air monitoring goals set out in the CAMP for Phase 1 and Phase 2 monitoring were met and sometimes exceeded (**Table 3-2**). A total of 22 portable sensors were deployed for the portable sensor monitoring network by the anticipated deadline of summer 2020 (21 Clarity Node-S monitors and 1 Aeroqual AQY 1 monitor). Phase 2 monitoring began in late summer 2020 as planned. Phase 2 monitoring exceeded fifteen months, which was beyond the minimum six months planned. Phase 2 monitoring was extended from a Community-Scale Air Toxics Ambient Monitoring grant awarded by the U.S. EPA in September 2020.

Table 3-2. Community Air Monitoring Plan goals and progress to date.

Community Air Monitoring Plan Goal	Progress
Deploy 22 portable monitors by summer 2020	✓ Deployed Clarity Node-S monitors at 21 different sites in the community by March 2020 ✓ Deployed one Aeroqual AQY 1 monitor summer 2020[1]
Leave portable monitors in place for a year	✓ Original 21 sites had a Clarity Node-S monitor for at least one year ✓ Clarity Node-S monitors are still deployed at 17[2] of the original sites (**Table 4-1**)
Deploy enhanced screening monitors at six sites by summer/fall 2020. Monitor for six months.	✓ Enhanced screening (Phase 2 monitoring) began August 2020 at six different locations ✓ Monitored for 15 months
Deploy one portable air monitoring laboratory for 12 months	✓ Portable laboratory deployed since April 2023

3.3. Measurement frequency

The measurement frequencies of the three phases of community air monitoring are described in **Table 3-3**. The three phases of monitoring include both continuous measurements (taken at least once per hour) and 24-hour measurements. Continuous measurements included the Phase 1 monitoring of $PM_{2.5}$; Phase 2 monitoring of black carbon; and Phase 3 monitoring of $PM_{2.5}$, black carbon, total carbon, NO_x, O_3, and meteorological conditions. Speciated $PM_{2.5}$,

[1] Monitoring using the Aeroqual AQY 1 was discontinued due to lack of a suitable location for power needs (**section 4.2.1**).
[2] Four sites no longer have a Clarity Node-S monitor because the monitor started malfunctioning, likely due to reaching the end of its operational lifetime.

speciated PM_{10}, and VOC monitoring are 24-hour measurements taken every one-in-six days during Phase 2 and Phase 3 monitoring. Speciated $PM_{2.5}$, speciated PM_{10}, and VOC samples are analyzed by a laboratory following collection (**Chapter 4**).

Table 3-3. Sampling frequency for the three phases of monitoring.

Monitoring equipment	Pollutant measured	Measurement frequency
Phase 1 monitoring		
Clarity Node-S[1]	$PM_{2.5}$	Continuous
Aeroqual AQY 1	$PM_{2.5}$	Continuous
Phase 2 monitoring		
Airmetrics MiniVol	Speciated[2] $PM_{2.5}$	24-hour sample every 1 in 6 days
	Speciated[1] PM_{10}	
microAeth MA200, Magee Scientific AE33[3]	Black carbon	Continuous
Silonite canister	VOCs	24-hour sample every 1 in 6 days
Phase 3 monitoring		
Met One BAM 1020	$PM_{2.5}$	Continuous
Met One SASS	Speciated[1] $PM_{2.5}$	24-hour sample every 1 in 6 days
Airmetrics MiniVol	Speciated[1] PM_{10}	24-hour sample every 1 in 6 days
Magee Scientific AE33	Black carbon	Continuous
Magee Scientific TCA-08	Total carbon	Continuous
TAPI Model T200UP	NO_x ($NO + NO_2$)	Continuous
TAPI Model T400	O_3	Continuous
ATEC 8001-2P	VOCs	24-hour sample every 1 in 6 days
ATEC 8000-2	Carbonyl VOCs	24-hour sample every 1 in 6 days
Met One Weather Station	Wind direction	Continuous
	Wind speed	
	Ambient temperature	
	Relative humidity	
	Barometric pressure	

[1] The Clarity Node-S also measures NO_2. The monitors generally did not meet data quality objectives for this pollutant and the results are not included in this report.
[2] Phase 2 monitoring speciation was for metal components. The Phase 3 monitoring expanded speciation of $PM_{2.5}$ to include ionic compounds, elemental carbon, and organic carbon.
[3]The Magee Scientific AE33 was used for the Sacramento Fire Department Station 56 site only.

3.4. Current progress of community air monitoring

Phase 1 and Phase 2 monitoring results are presented in **Chapter 5**. The portable laboratory was deployed at its original location until March 2025. Monitoring in South Sacramento-Florin through at least the end of 2025 is expected based on current committed funding levels.

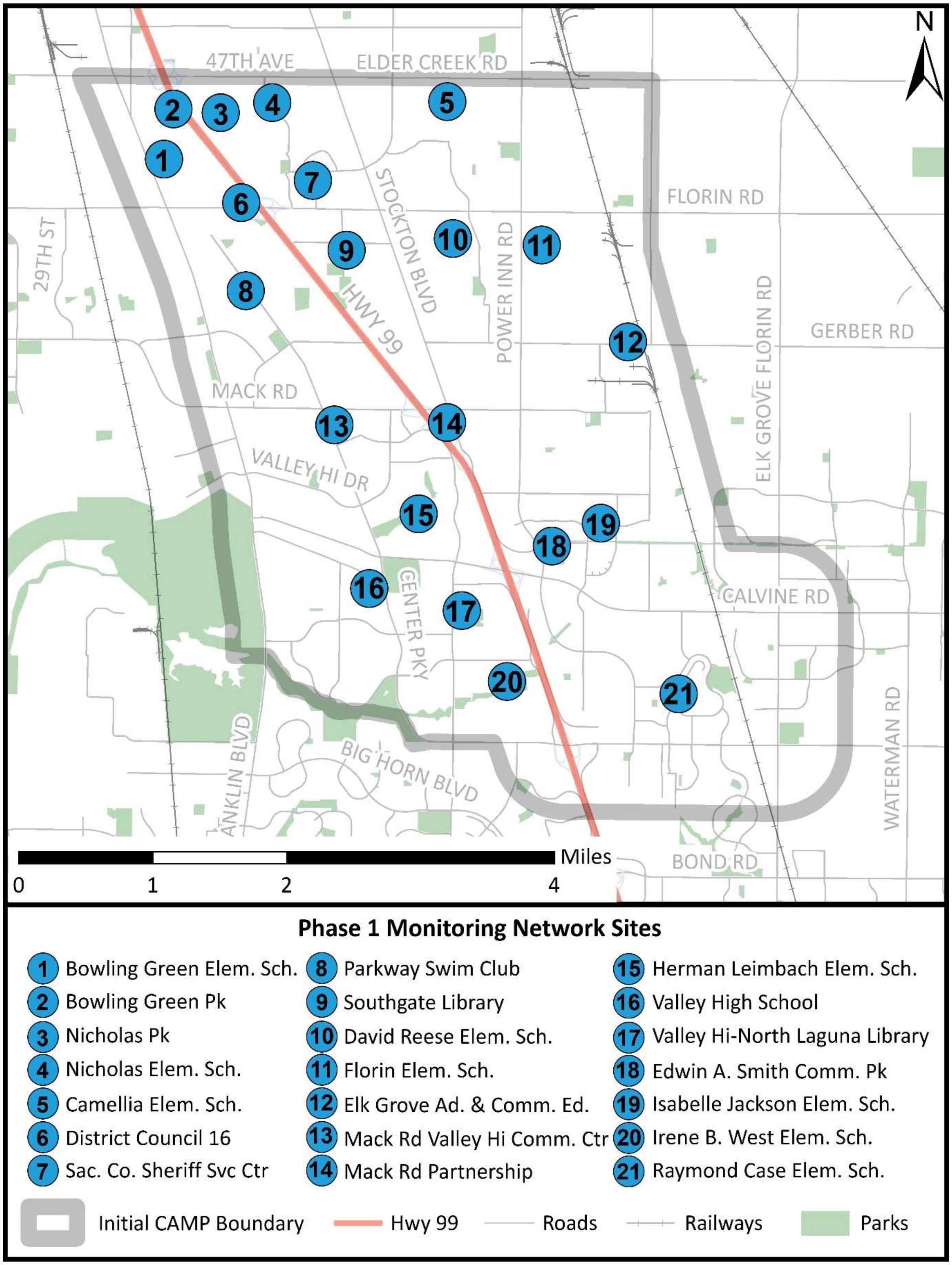

Figure 3-1. Phase 1 monitoring network sites.

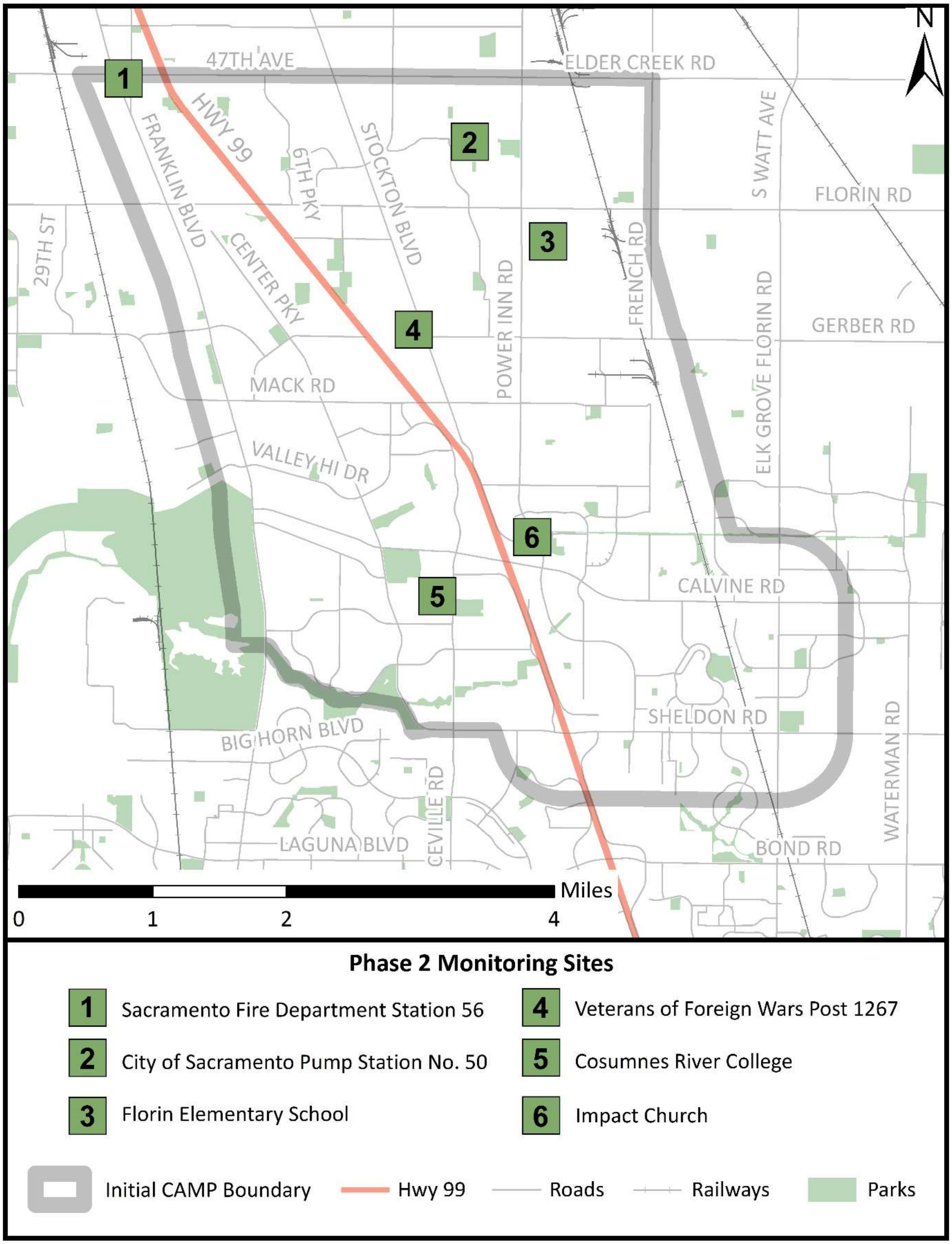

Figure 3-2. Phase 2 monitoring sites.

4. Data Methods

The methodology for Phase 1 and Phase 2 monitoring data collection and analysis is presented in this chapter. Methodology is organized by the different phases of monitoring and the types of pollutants. Pollutants were introduced in **section 2.4**. The data results are presented in **Chapter 5**.

4.1. Introduction to linear regression

Monitors are compared throughout this chapter using linear regression. Linear regression can be used to evaluate precision, accuracy, and bias between monitors. A linear regression measures the relationship between two variables. For the purposes of this chapter, the two variables will be the measurements of two different monitors. The simultaneous pairs of measurement values of two monitors are plotted on a graph. A trendline, or linear regression line, is applied that best fits the measurement pairs. This linear trendline is described by the equation:

$$y = m(x) + b$$

where x and y are the variables,
m is equal to the slope of the line (ratio of change in y to change in x),
and b is equal to the y-intercept of the line (value of y when x is equal to 0).

The closer the slope is to 1, the greater the agreement in measurement values between two monitors. The y-intercept value may be the bias of the monitor plotted on the y-axis in relation to the monitor plotted on the x-axis. The R^2 value (coefficient of determination) for the trendline is a measure of how closely the data points fit the trendline. The R^2 value ranges from 0 to 1. A greater R^2 value indicates greater agreement in the trends measured by the two monitors. A perfect agreement between two monitors is shown in **Figure 4-1**, where the slope of the line is equal to 1, the y-intercept is 0, and the R^2 value is equal to 1. For more information on using linear regression to evaluate monitors, see *Community in Action: A Comprehensive Guidebook on Air Quality Sensors*[1] (Polidori et al., 2021).

[1] Available at: *http://www.aqmd.gov/aq-spec/special-projects/star-grant*

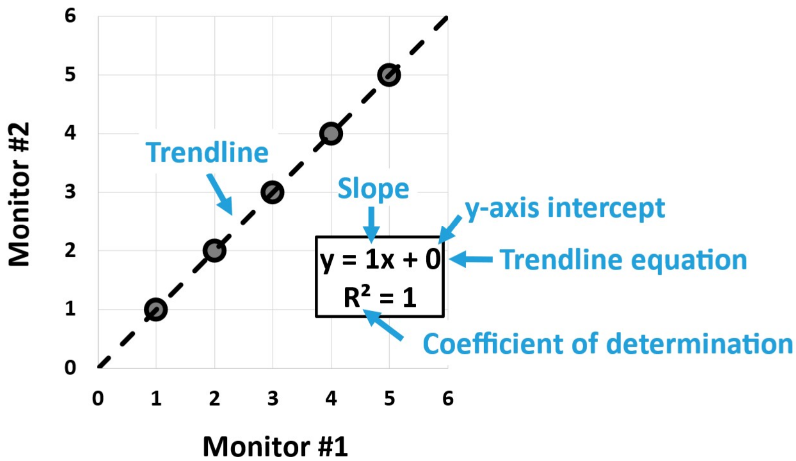

Figure 4-1. Linear regression explanation.

4.2. Phase 1 Monitoring

4.2.1. Monitoring network summary

Clarity Node-S monitors and an Aeroqual AQY 1 monitor were used for the Phase 1 monitoring network. The Clarity Node-S monitor takes continuous measurements of $PM_{2.5}$. It also measures nitrogen dioxide (NO_2), but the monitors often did not meet the data quality objectives of the CAMP for NO_2. The Clarity Node-S monitor measures $PM_{2.5}$ using a Plantower PMS6003 sensor that utilizes laser light scattering technology. Per the manufacturer, the monitor measures to the nearest 1 µg/m^3 (microgram per cubic meter) and can measure within the range of 0 to 1,000 µg/m^3 $PM_{2.5}$. To investigate the utility of an alternative portable air sensor, an Aeroqual AQY 1 monitor was deployed in July 2020 at a location shared with a Clarity Node-S monitor. The Aeroqual AQY 1 required a power source, while the deployed Clarity Node-S monitors have a built-in solar panel. The Aeroqual AQY 1 monitor only recorded measurements during the nighttime due to a timer on the local power source. Another suitable location was not found for the Aeroqual AQY 1 and it was not redeployed. As there was not a meaningful amount of data collected with the Aeroqual AQY 1, the results from this monitor are not included in this report.

4.2.2. Monitoring network deployment

A schedule of deployment for the Clarity Node-S monitors is shown in **Table 4-1**. The Clarity Node-S monitors were installed and registered according to the Standard Operating Procedures (SOPs) developed by the District . The monitors were installed about 10’ to 16’ above ground level to avoid tampering. Monitors were usually installed on lampposts. One site had the monitor installed on a building (Camellia Elementary School). Monitors were generally installed at least 20’ distance from any obvious pollution sources (such as exhaust vents). Monitors were often installed in parking lots or green spaces. See **Figure 4-2** for examples of deployed Clarity

Node-S monitors. The monitors generally require no regular service after installation. The manufacturer would notify the District if a monitor appeared to be malfunctioning and required a site visit. If the manufacturer or District staff identified a monitor as malfunctioning and it could not be repaired, it was removed from the network. Malfunctioning monitors were replaced until late 2022. Additionally, the first five monitors deployed in June 2019 were replaced in 2020 with a monitor that could measure NO_2 (see **Table 4-1** for sites that received replacement monitors).

Table 4-1. Deployment timeline of Phase 1 monitoring network.

Clarity Node-S monitors still deployed do not have a deployment end date listed. Additional Clarity Node-S monitors listed for the same site are replacement monitors.

Monitor ID	Deployment		Monitor ID	Deployment	
	Start date	End date		Start date	End date
Bowling Green Elementary School			Mack Road Partnership		
SMAQMD 9	9/18/19		SMAQMD 5	6/25/19	2/25/20
Bowling Green Park			SMAQMD 23	2/25/20	
SMAQMD 1	6/20/19	2/25/20	Mack Road Valley Hi Community Center		
SMAQMD 25	2/25/20	10/8/20	SMAQMD 15	10/17/19	9/11/24
SMAQMD 31	10/8/20		Nicholas Elementary School		
Camellia Elementary School			SMAQMD 7	9/18/19	8/23/23[1]
SMAQMD 14	10/16/19	12/6/22	Nicholas Park		
David Reese Elementary School			SMAQMD 3	6/20/19	2/25/20
SMAQMD 11	10/16/19		SMAQMD 26	2/25/20	11/4/22
District Council 16			Parkway Swim Club		
SMAQMD 10	10/2/19		SMAQMD 12	10/30/19	
Edwin A. Smith Community Park			Raymond Case Elementary School		
SMAQMD 21	11/14/19	7/6/22	SMAQMD 30[2]	10/8/20	
SMAQMD 32	7/27/22		Sacramento County Sheriff Service Center		
Elk Grove Adult & Community Education			SMAQMD 4	6/24/19	2/25/20
SMAQMD 13	10/16/19		SMAQMD 24	2/25/20[3]	
Florin Elementary School			Southgate Library		
SMAQMD 6	9/18/19		SMAQMD 22	11/14/19	
Herman Leimbach Elementary School			Valley High School		
SMAQMD 20	10/17/19		SMAQMD 16	10/17/19	
Irene B. West Elementary School			Valley Hi-North Laguna Library		
SMAQMD 18	10/17/19		SMAQMD 27	3/12/20	10/8/20
Isabelle Jackson Elementary School			SMAQMD 29	10/8/20	7/6/22
SMAQMD 8	9/18/19		SMAQMD 33	7/27/22	

[1] Monitor was taken down due to reconstruction project at the school.

[2] This monitor replaced another monitor (SMAQMD 19) that was deployed on October 17th, 2019 at this location. The SMAQMD 19 monitor was more sensitive to wildfire impacted pollution (greater $PM_{2.5}$ measurements) compared to the rest of the monitoring network, while the SMAQMD 30 monitor was more similar to rest of the network. Only the SMAQMD 30 monitor was used for the results presented in this report.

Figure 4-2. Deployed Clarity Node-S monitors.

4.2.3. Monitor calibration

A Clarity Node-S monitor has been collocated with (at the same location as) a regulatory $PM_{2.5}$ monitor at the District's Sacramento-Del Paso Manor monitoring site during the Phase 1 monitoring network deployment. The collocation has been used by the manufacturer to develop a custom calibration for the Clarity Node-S $PM_{2.5}$ measurements. The manufacturer has applied the custom calibration profile to the monitoring network so that the values would be more similar to what a regulatory-grade monitor would measure. For the purposes of this report, a single calibration was applied to measured $PM_{2.5}$ values (sometimes referred to as raw values by the manufacturer). This is the same calibration that is applied by the manufacturer to the entire Phase 1 monitoring network as of February 1st, 2024. The calibration equation was applied to the $PM_{2.5}$ measurements before averaging. The calibration equation is as follows:

$$\text{Calibrated} = (\text{Measured} \times 0.555) + 0.044$$

The calibrated values are compared to the regulatory monitor in **Figure 4-3** and **Table 4-2**. See **Figure 4-1** for guidance on interpreting **Figure 4-3**. The calibrated 1-hour and 24-hour average (arithmetic mean) meet the data quality objectives of the CAMP: the root mean square error was less than the standard deviation of the regulatory monitor and the R^2 was greater than 0.7 (**Table 4-2**). The 24-hour average performed better than the 1-hour average overall, as the mean absolute error and root mean square error were smaller (**Table 4-2**). An evaluation of the Clarity Node-S monitor by the South Coast Air Quality Management District's Air Quality Sensor

Performance Evaluation Center (AQ-SPEC) similarly found better correlation to a regulatory-grade monitor for a 24-hour average compared to a 1-hour average .

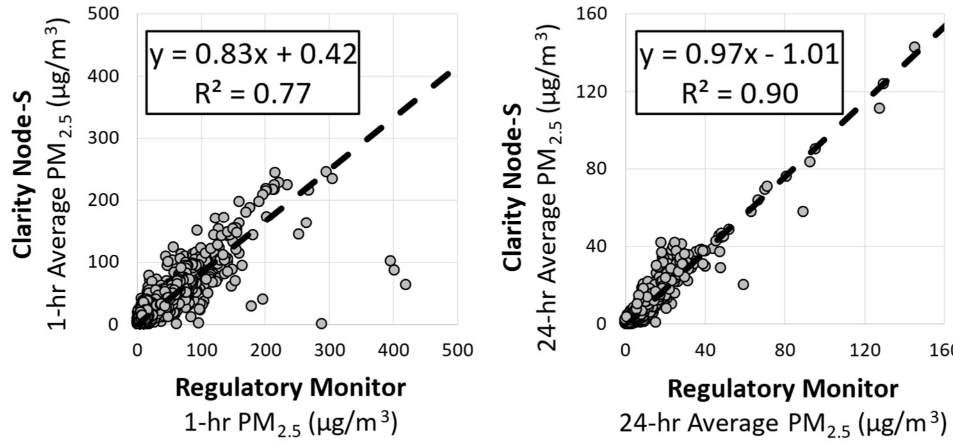

Figure 4-3. Comparison of calibrated Clarity Node-S monitor measurements with regulatory monitor.

Includes measurements from July 1st, 2019, through September 2nd, 2021, and August 2nd, 2023 through December 31st, 2023. The regulatory monitor takes a measurement every hour while the Clarity Node-S monitor takes a measurement every 15 minutes to 17 minutes.

Table 4-2. Clarity Node-S monitor performance statistics compared to regulatory monitor.

Includes measurements from July 1st, 2019, through September 2nd, 2021, and August 2nd, 2023 through December 31st, 2023.

Calibrated $PM_{2.5}$ ($\mu g/m^3$)	Mean Absolute Error (MAE)	Root Mean Square Error (RMSE)	Standard Deviation for Regulatory Monitor	Coefficient of variation (R^2)
1-hour Averages	4.3	7.9	14.5	0.77
24-hour Averages	3.1	4.3	10.8	0.90

4.2.4. Data gaps

Data gaps present in the Phase 1 monitoring data are shown in **Figure 4-4**. Monitor malfunctioning resulted in some data gaps, some of which may have been from the sensor reaching the end of its lifespan. Other data gaps resulted from data not uploading to the District database Envista Air Resources Manager (Envitech, LTD, version 7.7.251). Data gaps were left in the dataset and were not addressed by extrapolation or substitution. There was about 85% data completeness for the 24-hour averages and the 1-hour averages for January 1st, 2020 through December 31st, 2023 (as in, about 85% of potential daily measurements from the 21 monitors were valid and about 85% of potential hourly measurements from the 21 monitors were valid from January 1st, 2020 through December 31st, 2023). Site comparisons in **section 5.1.2** addressed data gaps by excluding datasets with less than all 21 monitors reporting.

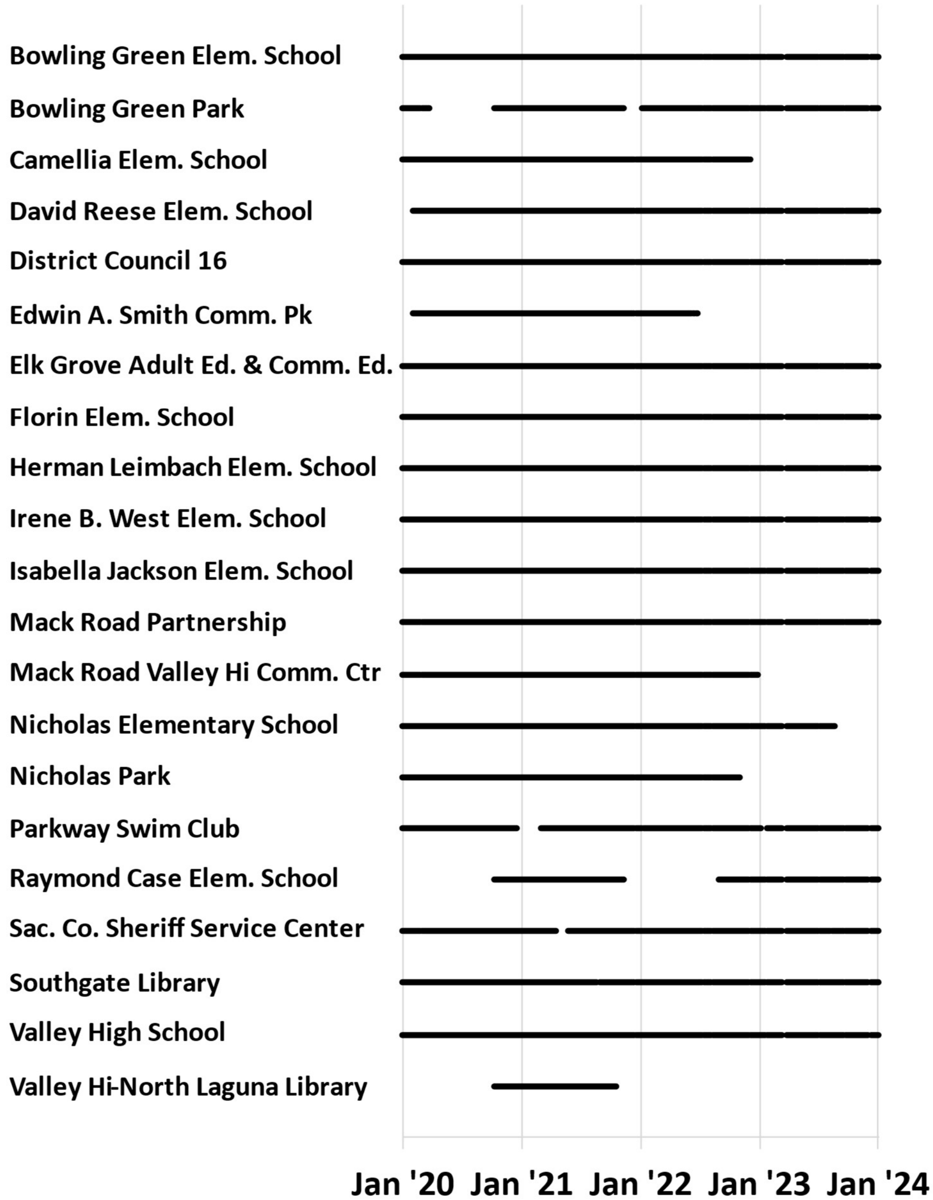

Figure 4-4. Timeline of valid Phase 1 monitoring $PM_{2.5}$ data.

Time periods with valid $PM_{2.5}$ data are shown by a solid black line.

4.2.5. Data validation and analysis

The Clarity Node-S measured $PM_{2.5}$ values were exported from the District's Envista Air Resources Manager database at 15-minute intervals for each Phase 1 monitoring site. Regulatory monitoring data shown in **section 4.2.3** were downloaded from the Envista Air

Resources Manager database at 1-hour interval. The calibration equation described in **section 4.2.3** was applied to the Clarity Node-S measured $PM_{2.5}$ values. Based upon the greater agreement to the regulatory monitor for the 24-hour average (**Figure 4-3** and **Table 4-2**), the data results in **section 5.1** use calibrated 24-hour averages. An exception is the time-of-day trends analysis that used calibrated 1-hour averages. At least 75% data completeness was required for an average to be a valid, reportable value (at least 3 measurements per hour and 18 hourly measurements in a day).

Monitoring network data presented in **section 5.1** were generally limited to January 1st, 2020, through December 31st, 2023. All 21 monitors presented in **section 5.1** were operational by January 1st, 2020. Using data across whole calendar years allows for the inclusion of seasonal variation. When data were analyzed separately by season, each season was designated as follows: winter included the months of December, January, and February; spring included the months of March, April, and May; summer included the months of June, July, and August; and fall included the months of September, October, and November. Potentially wildfire smoke impacted dates were identified as follows: August 17th through October 10th, 2020; July 25th through October 4th, 2021; August 21st through September 17th, 2022; August 30th through 31st, 2023; and September 20th through 24th, 2023. The same definitions for seasons and potentially wildfire smoke impacted dates were applied to the Phase 2 monitoring data results in **section 5.2**.

Outlier values, likely due to sensor malfunctioning, were excluded from the results presented in this report. It was suspected that the sensor was malfunctioning if the upper detection limit (1,000 µg/m^3) was exceeded for an extended period (over 1 hour). Any date with readings exceeding the upper detection limit for an extended period were excluded for both 1-hour and 24-hour averages (listed in **Table 4-3**).

Table 4-3. Dates excluded from Phase 1 monitoring data analysis due to suspected sensor malfunctioning.

Monitoring site	Dates excluded
Edwin A. Smith Community Park	6/9/22-6/11/22, 6/18/22-6/19/22, 6/26/22-7/6/22[1]
Sacramento County Sheriff Service Center	4/15/21-4/22/21[2], 12/2/21, 8/8/23-8/10/23
Southgate Library	8/20/21-8/27/21
Mack Rd Valley Hi Community Center	2/23/20, 2/26/20-2/27/20, 12/30/22-1/27/23

[1] Monitor taken offline after this date.
[2] Monitor taken offline and cleaned on 4/22/21. After monitor was put back in operation on 5/21/21 it resumed functioning without exceeding the upper detection limit.

The following analyses described in Element 13 of the CAMP are provided in **section 5.1**. The related air monitoring objective is noted in parentheses (**section 1.2**).

- Site comparisons of $PM_{2.5}$ levels
  (*Objective A*)
- Plotting of different averaging intervals for $PM_{2.5}$ levels
  (*Objective C*)
- Comparison of $PM_{2.5}$ levels to the U.S. EPA NAAQS
  (*Objective D*)

4.3. Phase 2 Monitoring

Phase 2 monitoring included measurements of black carbon, speciated $PM_{2.5}$ ($PM_{2.5}$ and its metals), speciated PM_{10} (PM_{10} and its metals), and VOCs. Each of these pollutants or group of pollutants is described separately in the following sections. An example of an installed Phase 2 stand-alone monitor unit is shown in **Figure 4-5**. Phase 2 monitoring consisted of six sites across the initial South Sacramento-Florin CAMP boundary, shown in **Figure 3-2**. These sites were new community monitoring sites apart from the Florin Elementary School site, which is also a Phase 1 monitoring site. The Phase 2 monitoring period began August 2020 and concluded in December 2021. The monitoring period for each pollutant is shown in **Table 4-4**.

Figure 4-5. Phase 2 monitor stand-alone unit at the Veterans of Foreign Wars Post 1267 site.

Table 4-4. Timeline of Phase 2 monitoring by pollutant.

Pollutant measured	Monitoring period
Black carbon	8/13/20 - 11/29/21
Speciated $PM_{2.5}$ ($PM_{2.5}$ and its metals)	8/19/20 - 11/24/21
Speciated PM_{10} (PM_{10} and its metals)	7/15/21 - 12/12/21
VOCs	8/19/20 - 11/24/21

4.3.1. Black carbon

4.3.1.1. Monitoring summary

Black carbon was measured using continuous monitoring instruments at the six locations shown in **Figure 3-2**. A microAeth MA200 monitor was deployed at five sites and a Magee Scientific Aethalometer AE33 was deployed at the sixth site (Sacramento Fire Department Station 56). The sixth monitor was planned for Phase 3 monitoring and was deployed as part of Phase 2 monitoring to reduce costs. The microAeth MA200 monitors are portable and operate on a battery. The Magee Scientific Aethalometer AE33 monitor is the same type of black carbon monitor used at the District's monitoring sites. The microAeth MA200 and the Magee Scientific Aethalometer AE33 monitors measure black carbon from the amount of light that passes through a filter tape. The Magee Scientific Aethalometer AE33 monitor uses a dual spot measurement by measuring two different spots on the filter tape, while the microAeth MA200 monitors were programmed for single spot measurements. The microAeth MA200 and the Magee Scientific Aethalometer AE33 monitors measure black carbon to the nearest 0.005 $\mu g/m^3$. The microAeth MA200 monitor can measure black carbon levels in the range of 0.03 $\mu g/m^3$ to 1000 $\mu g/m^3$. The Magee Scientific Aethalometer AE33 monitor can measure black carbon levels in the range of 0.01 to 100 $\mu g/m^3$.

4.3.1.2. Monitor collocation and deployment

The five microAeth MA200 monitors were collocated with a reference monitor for about two weeks from January 6th through January 18th, 2020. Two units – MA200-0214 and MA200-0215 – were collocated for four more days through January 22nd, 2020. The reference monitor was a Magee Scientific Aethalometer AE33 monitor at the District's Sacramento-Del Paso Manor monitoring site.

A total of three different Magee Scientific Aethalometer AE33 monitors were used at the Sacramento Fire Department Station 56 site. There were recurring problems with data collection for the initial monitor, and a loaner replacement unit was used intermittently before a permanent replacement was deployed (see **Table 4-6** for a timeline). The monitors could not be collocated at the same Sacramento-Del Paso Manor monitoring site that was used for the collocation of the microAeth MA200 monitors because there was insufficient room for the larger instrument. Each monitor was instead collocated with a reference monitor (also a Magee Scientific Aethalometer AE33) at the District's Sacramento-Bercut Dr. monitoring site before deployment.

Black carbon monitors were deployed between August and September 2020 and remained deployed until November 2021 (**Table 4-5**). The monitor at the Florin Elementary School site was not operational until April 1st, 2021, due to an equipment error that required service from the manufacturer. The microAeth MA200 monitors were operated in accordance with the user guide and the SOP developed by the District. The Magee Scientific Aethalometer AE33 monitor was operated in accordance with the SOP developed by the District .

Table 4-5. Deployment timeline for black carbon monitors.

Site	Monitor ID	Deployment	
		Start date	End date
Sacramento Fire Department Station 56	*See* Table 4-6	8/12/20	11/28/21
Veterans of Foreign Wars Post 1267	MA200-0214	8/17/20	11/28/21
City of Sacramento Pump Station No. 50	MA200-0204	8/13/20	11/29/21
Florin Elementary School	MA200-0217	8/17/20	11/28/21
Impact Church	MA200-0206	8/20/20	11/28/21
Cosumnes River College	MA200-0215	9/16/20	11/29/21

Table 4-6. Timeline of collocation and deployment for black carbon monitors at Sacramento Fire Department Station 56 site.

Monitor ID	Pre-deployment collocation		Deployment(s)	
	Start date	End date	Start date	End date
AE33-S08-00869	7/28/20	8/10/20	8/12/20 10/9/2020	10/6/2020 12/17/2020
AE33-S01-00068 (loaner unit)	9/23/20	10/5/20	10/6/2020 12/17/2020	10/9/2020 4/17/2021
AE33-S09-01168 (replacement)	3/19/21	4/6/21	4/17/2021	11/28/21

4.3.1.3. Monitor precision and accuracy

The results of the collocations for the five microAeth MA200 monitors are shown in **Figure 4-6** and **Figure 4-7**. Refer to **Figure 4-1** for guidance on how to interpret these figures. All five microAeth MA200 monitors meet the CAMP accuracy data quality objective of an R^2 greater than 0.7 for both the 1-hour average and 24-hour average (**Figure 4-6** and **Figure 4-7**). The 24-hour average performed better than the 1-hour average based upon the smaller mean absolute error for each monitor (**Table 4-7**). The microAeth MA200 monitors were also compared to each other, as they were collocated together at the same location. The mean absolute difference for 24-hour averages ranged from 0.03 to 0.13 µg/m^3 in pairwise comparisons between the deployed microAeth MA200 monitors (

Table 4-8).

The collocation results for the three deployed Magee Scientific Aethalometer AE33 monitors are shown in **Figure 4-8** and **Figure 4-9** (see **Table 4-6** for the timeline of monitor deployment). See **Figure 4-1** for guidance on how to interpret **Figure 4-8** and **Figure 4-9**. The first monitor deployed did not meet the CAMP quality objective of an R^2 greater than 0.7 for the 24-hour average (**Figure 4-9**). Besides the first AE33 monitor deployed, the monitors met the CAMP accuracy data quality objective of an R^2 greater than 0.7 (**Figure 4-8** and **Figure 4-9**). The 24-hour average performed better than the 1-hour average based upon the smaller mean absolute error for each monitor (**Table 4-7**). The mean absolute error for the 24-hour average measured by the deployed replacement monitor was 0.01 µg/m^3.

4.3.1.4. Addressing data gaps

Significant data gaps occurred over the monitoring period for all six sites. Time periods of valid data are shown for each site in **Figure 4-10**. There was about 62% data completeness for the 24-hour averages and about 64% completeness for the 1-hour averages over the monitoring period (as in, about 62% of potential daily measurements from the six monitors were valid and about 64% of potential hourly measurements from the six monitors were valid from August 12th, 2020 through November 29th, 2021). Common reasons for data gaps were equipment malfunction as well as issues with the filter tape and external battery. Data gaps were left in the dataset and were not addressed by extrapolation or substitution. Site comparisons in **section 5.2.1.1** addressed data gaps by excluding datasets with less than all six monitors reporting.

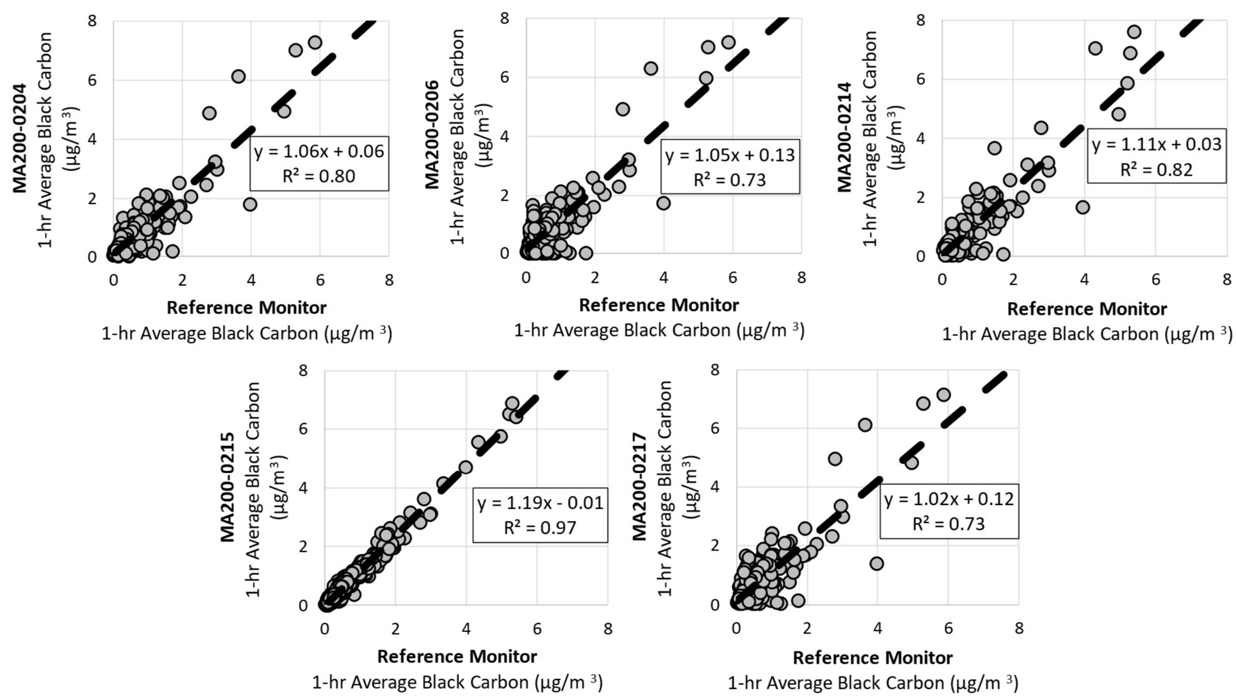

Figure 4-6. Hourly averages measured by black carbon monitors compared to reference monitor.

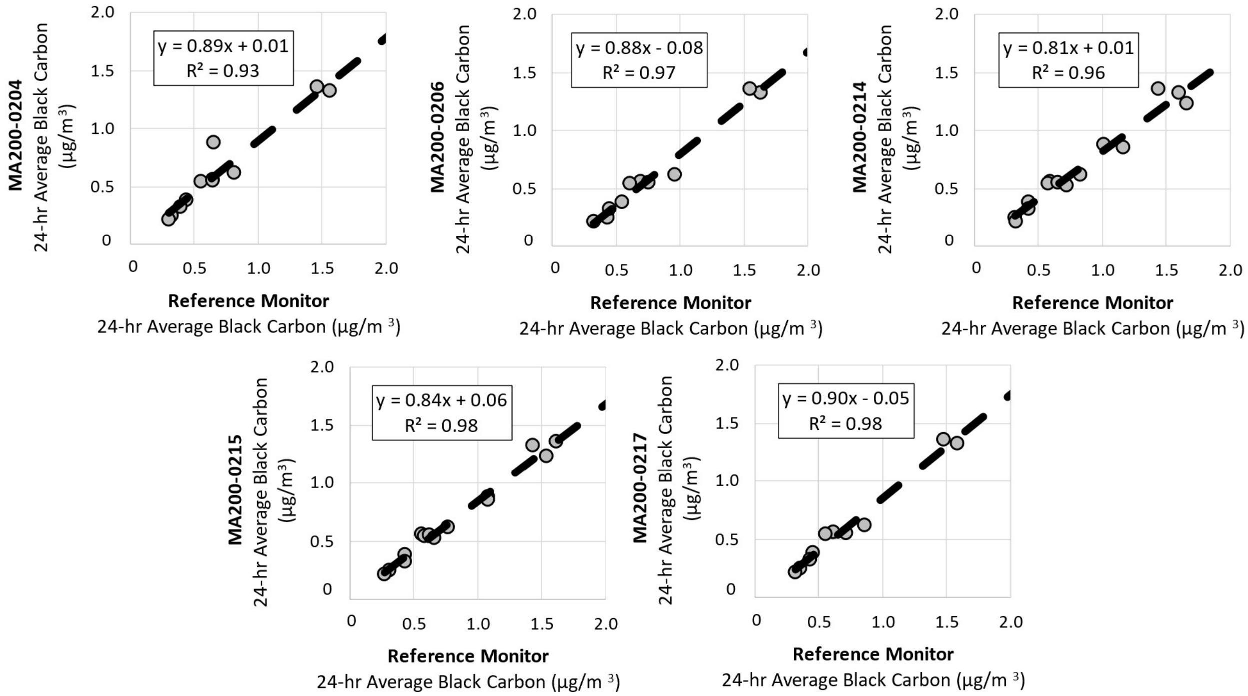

Figure 4-7. Daily averages measured by black carbon monitors compared to reference monitor.

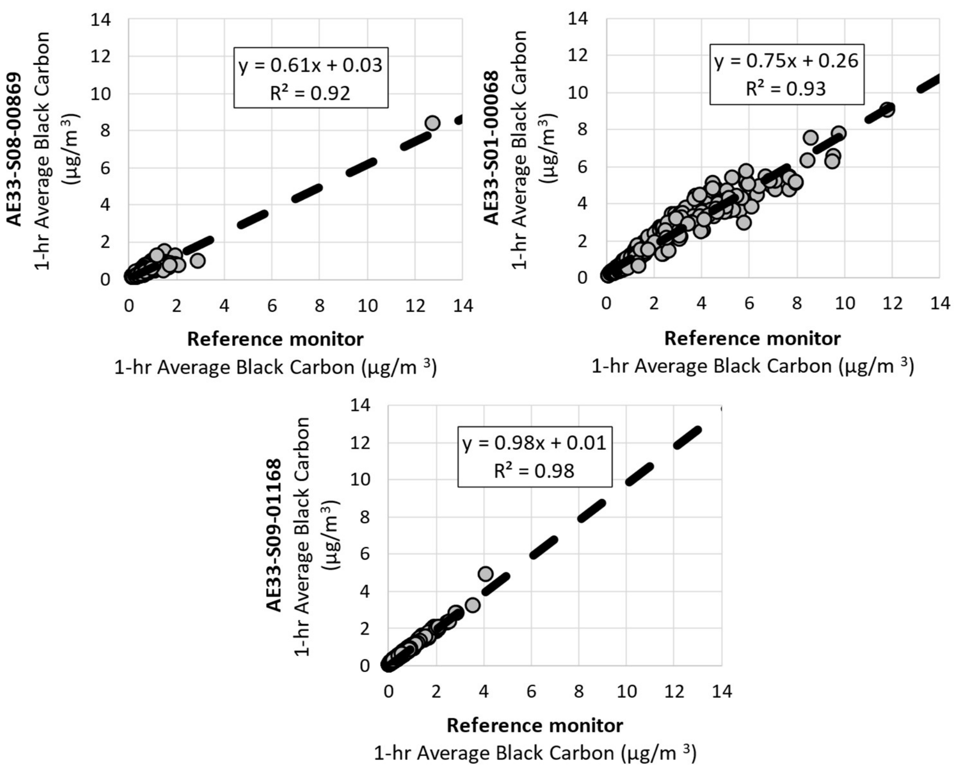

Figure 4-8. Hourly averages measured by Sacramento Fire Department Station 56 black carbon monitors compared to reference monitor.

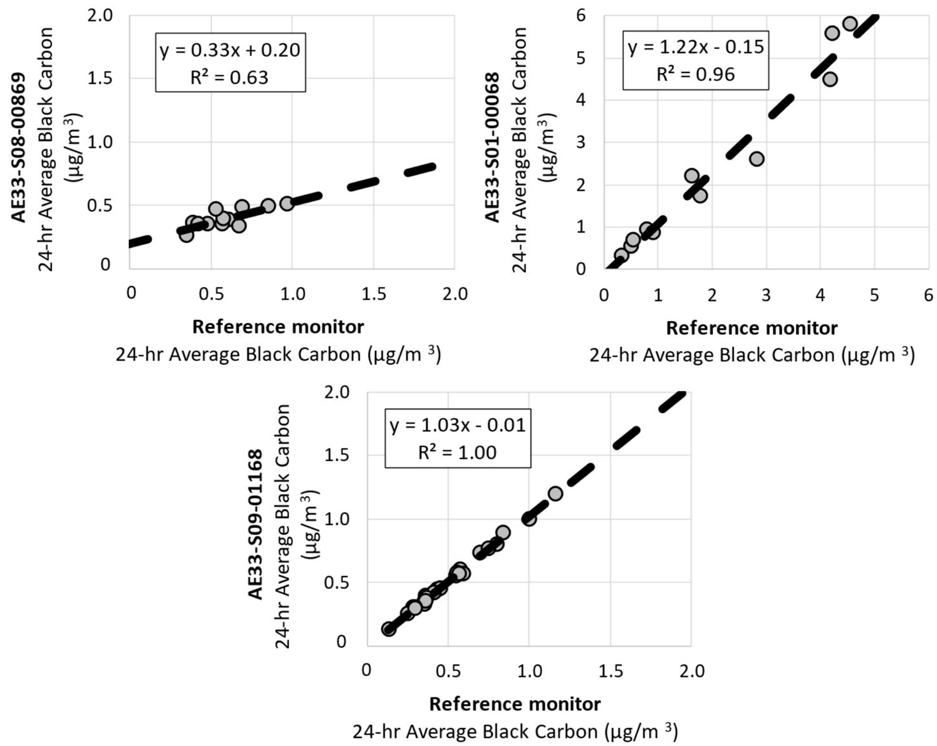

Figure 4-9. Daily averages measured by Sacramento Fire Department Station 56 black carbon monitors compared to reference monitor.

Table 4-7. Black carbon monitors mean absolute error compared to reference monitor.

Site	Monitor ID	Mean absolute error (µg/m³)	
		1-hr Average	24-hr Average
Sacramento Fire Department Station 56[1]	AE33-S08-00869	0.21	0.20
	AE33-S01-00068	0.44	0.37
	AE33-S09-01168	0.03	0.01
City of Sacramento Pump Station No. 50	MA200-0204	0.25	0.11
Florin Elementary School	MA200-0217	0.32	0.12
Veterans of Foreign Wars Post 1267	MA200-0214	0.31	0.15
Cosumnes River College	MA200-0215	0.15	0.13
Impact Church	MA200-0206	0.35	0.18

[1] The first monitor deployed at this site was switched out for a loaner monitor before being replaced by a replacement monitor, resulting in a total of three different monitors deployed at this site (**section 4.3.1.2**).

Table 4-8. Average difference between microAeth MA200 black carbon monitors.

Monitor ID 1	Monitor ID 1 Site	Monitor ID 2	Monitor ID 2 Site	Mean absolute difference ($\mu g/m^3$)	
				1-hr Avg	24-hr Avg
MA200-0204	City of Sacramento Pump Station No. 50	MA200-0206	Impact Church	0.12	0.08
MA200-0204	City of Sacramento Pump Station No. 50	MA200-0214	Veterans of Foreign Wars Post 1267	0.06	0.06
MA200-0204	City of Sacramento Pump Station No. 50	MA200-0215	Cosumnes River College	0.21	0.11
MA200-0204	City of Sacramento Pump Station No. 50	MA200-0217	Florin Elementary School	0.09	0.03
MA200-0206	Impact Church	MA200-0214	Veterans of Foreign Wars Post 1267	0.11	0.08
MA200-0206	Impact Church	MA200-0215	Cosumnes River College	0.29	0.13
MA200-0206	Impact Church	MA200-0217	Florin Elementary School	0.10	0.05
MA200-0214	Veterans of Foreign Wars Post 1267	MA200-0215	Cosumnes River College	0.23	0.08
MA200-0214	Veterans of Foreign Wars Post 1267	MA200-0217	Florin Elementary School	0.09	0.03
MA200-0215	Cosumnes River College	MA200-0217	Florin Elementary School	0.20	0.10

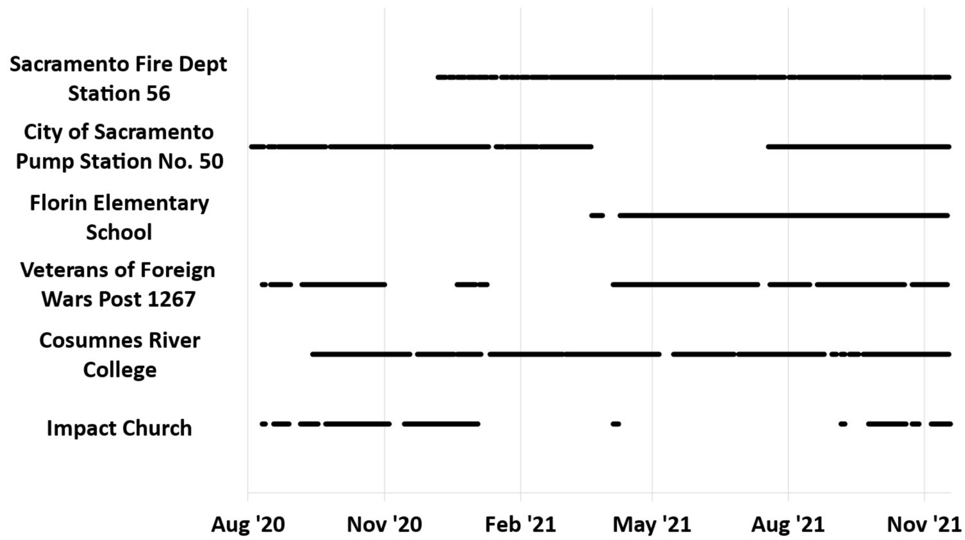

Figure 4-10. Timeline of valid black carbon data by site.

Time periods with valid black carbon data are shown by a solid black line.

4.3.1.5. Data validation and analysis

The black carbon 1-hour average data with minimum 75% completeness were exported from the District's Envista Air Resources Manager database and validated by District staff. The data were exported to the 0.01 µg/m^3 for the Sacramento Fire Department Station 56 site and to the 0.0001 µg/m^3 for the other five sites. The complete and aggregated data were posted to the District Community Air Monitoring webpage[1] March 2022. The posted data were used in the data results shown in **section 5.2.1** with the following modifications: values below the monitor detection limit were replaced by zero (below 0.01 µg/m^3 for the monitors at the Sacramento Fire Department Station 56 site and below 0.03 µg/m^3 for the monitors at the other five sites), 75% completeness was required for valid 24-hour averages, and data from the first monitor deployed at the Sacramento Fire Department Station 56 site were excluded because it did not meet the CAMP data quality objectives (**section 4.3.1.3**). Based upon the greater agreement to the reference monitor for the 24-hour average (see **section 4.3.1.3**), the data results in **section 5.2.1** use the 24-hour average. An exception is the time-of-day trends analysis that used the 1-hour averages. Data from black carbon monitors at District monitoring sites were exported from Envista Air Resources Manager for comparisons in **section 4.3.1.3** and **section 5.2.1.3**. The 1-hour was exported and averaged to 24-hours with a 75% completeness requirement.

The following analyses described in Element 13 of the CAMP are provided in **section 5.2.1**. The related air monitoring objective is noted in parentheses (**section 1.2**).

[1]http://www.airquality.org/CAM

- Site comparisons of black carbon levels
  (*Objective A*)
- Plotting of different averaging intervals for black carbon levels
  (*Objective B and C*)
- Comparison of black carbon levels to reference monitors within the District monitoring network
  (*Objective D*)

4.3.2. Fine and coarse particulate matter ($PM_{2.5}$ and PM_{10})

4.3.2.1. Monitoring summary

Phase 2 monitoring measured $PM_{2.5}$ and PM_{10} levels over a 24-hour sampling period (see **Figure 3-2** for site locations). The $PM_{2.5}$ and PM_{10} measurements included speciation, or measurement, of the metals in the particulate matter. The speciated $PM_{2.5}$ measurements occurred from August 19th, 2020 through November 24th, 2021 and the speciated PM_{10} measurements occurred over a shorter interval from July 15th, 2021 through December 12th, 2021 (**Table 4-4**). For the overlapping interval of July 15th, 2021 through November 24th, 2021, $PM_{2.5}$ and PM_{10} were measured on the same dates. Sampling occurred one in every six days (**Table 3-3**).

AirMetrics MiniVol samplers were used for the speciated $PM_{2.5}$ and PM_{10} monitoring. The MiniVol sampling system was operated in accordance with the MiniVol operation manual, and the SOP developed by Sonoma Technology, Inc. for the District . The sampler draws air through a particle size separator that operates by impaction. The filtered material was collected on a 47mm polytetrafluoroethylene (Teflon) filter. Prior to each sample run, the sampling system was checked for leaks and the sampler vacuum pump was calibrated to a flow rate of 5.0 liters per minute. The flow rate of 5.0 liters per minute is the nominal flow rate for the sampler. The filters were weighed for $PM_{2.5}$ or PM_{10} by CHESTER LabNet (Tigard, OR) in accordance with the *Federal Reference Method for the Determination of Fine Particulate Matter as $PM_{2.5}$ in the Atmosphere* (40 CFR Part 50 Appendix L) and the *Federal Reference Method for the Determination of Fine Particulate Matter as PM_{10} in the Atmosphere* (40 CFR Part 50 Appendix J). Based on the tared weight of the sample and the volume of air drawn through the pump, the concentration of $PM_{2.5}$ or PM_{10} was determined by the laboratory. The uncertainty value reported by the laboratory for each $PM_{2.5}$ or PM_{10} measurement is 10 µg per filter, which ranged from 1.4 to 7.5 $\mu g/m^3$ for $PM_{2.5}$ samples and 1.4 to 3.0 $\mu g/m^3$ for PM_{10} samples at standard conditions.

4.3.2.2. Data gaps

Samples not collected or considered invalid are shown as the hollow circles in **Figure 4-11** and **Figure 4-12**. Some data gaps occurred from a sample run being missed or inadequate run times. Common reasons for missed sample runs or inadequate run times were battery failure, filter shortage, or incorrect programming. Samples were invalidated if the run time was inadequate. There were twenty speciated $PM_{2.5}$ samples and four speciated PM_{10} samples that did not meet the run time requirement. Samples were also invalidated if the $PM_{2.5}$ concentration was greater than the PM_{10} concentration. Data gaps were left in the dataset and were not addressed by extrapolation or substitution. There was about 91% data completeness for speciated $PM_{2.5}$ measurements and about 88% data completeness for speciated PM_{10} measurements (as in, 91% of the potential one-in-six day samples for the six sites had a valid speciated $PM_{2.5}$ measurement and 88% of the potential one-in-six day samples for the six sites had a valid speciated PM_{10} measurement over the entire monitoring period).

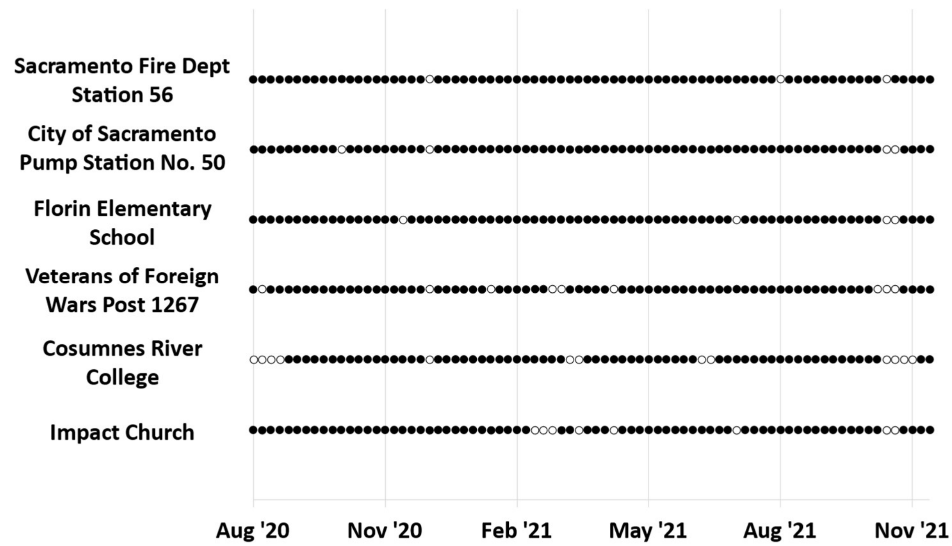

Figure 4-11. Timeline of valid speciated $PM_{2.5}$ data by site.

Each point represents a one in six days sample date. Solid black points represent a sample date with a valid measurement. Hollow points represent an invalid or missed sample.

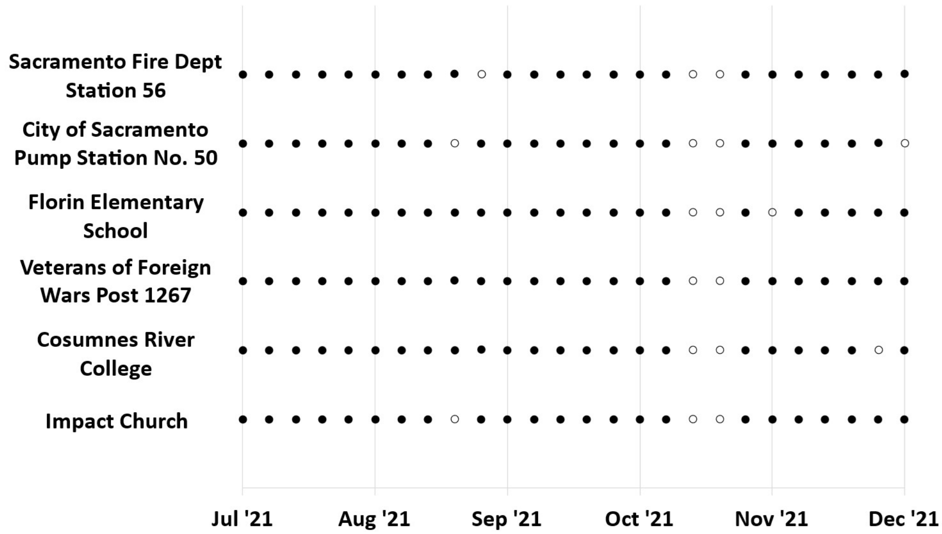

Figure 4-12. Timeline of valid speciated PM_{10} data by site.

Each point represents a one in six days sample date. Solid black points represent a sample date with a valid measurement. Hollow points represent an invalid or missed sample.

4.3.2.3. Data validation and analysis

The $PM_{2.5}$ values from Phase 2 monitoring and District monitoring sites are reported in local conditions while the PM_{10} values from Phase 2 monitoring and District monitoring sites were corrected for standard temperature and pressure conditions. This follows how values are reported in the U.S. EPA Air Quality System (AQS) for comparison to federal health standards for $PM_{2.5}$ and PM_{10}. An exception is the comparison of simultaneous measurements of $PM_{2.5}$ and PM_{10} in **Figure 5-18**, where both $PM_{2.5}$ and PM_{10} are shown in local conditions to provide a more direct comparison. Phase 2 monitoring $PM_{2.5}$ and PM_{10} results in **section 5.2.2** were from the laboratory reported values. The complete set of Phase 2 monitoring laboratory reports were posted on the District Community Air Monitoring webpage[1] on March 2022. The $PM_{2.5}$ and PM_{10} results from District monitoring sites were downloaded from the U.S. EPA AQS for comparisons in **section 5.2.2.4**. Phase 2 monitoring $PM_{2.5}$ and PM_{10} measurements were invalidated if a sample run was outside of a 23.5 to 24.5 hours run time. Additionally, if the $PM_{2.5}$ level exceeded that of a simultaneous PM_{10} sample at the same location, it was deemed suspect or invalid, as $PM_{2.5}$ is a fraction of PM_{10}. The $PM_{2.5}$ and PM_{10} samples from October 25th, 2021 were excluded from the data results in **section 5.2.2** due to suspected sample misidentification on this date; the $PM_{2.5}$ concentrations were greater than that for PM_{10} for two sites. Additionally, the speciated $PM_{2.5}$ July 15th, 2021, sample from Impact Church was excluded due to suspected contamination, as the $PM_{2.5}$ concentration value was much greater than that for the simultaneous PM_{10} sample. Measurements greater than the uncertainty reported by the laboratory were considered detected, which was true for all measurements

[1]http://www.airquality.org/CAM

except for one PM_{10} measurement (August 2nd, 2021 sample from Florin Elementary School). This measurement was treated as a zero value in **section 5.2.2**.

The following analyses described in Element 13 of the CAMP are provided in **section 5.2.2**. The related air monitoring objective is noted in parentheses (**section 1.2**).

- Site comparisons of $PM_{2.5}$ and PM_{10} levels
  (*Objective A*)
- Plotting of monthly $PM_{2.5}$ levels
  (*Objective C*)
- Comparison of $PM_{2.5}$ and PM_{10} levels to the U.S. EPA NAAQS and California Ambient Air Quality Standard (CAAQS)
  (*Objective D)*

4.3.3. Particulate matter metals and volatile organic compounds (VOCs)

4.3.3.1. Monitoring summary

Metals were measured from the $PM_{2.5}$ and PM_{10} samples described in **section 4.3.2**. The monitoring period, frequency, and methods for the metals is the same as that described in **section 4.3.2.1**, with the exception of the laboratory analytical method. The concentration of metals in $PM_{2.5}$ and PM_{10} samples were measured using x-ray fluorescence (XRF). Analysis was performed by the laboratory Chester LabNet (Tigard, OR) in accordance with the U.S. EPA Compendium Method IO-3.3 . The metals measured are listed in **Table 4-9**.

The levels of VOC gases were measured on the same sampling schedule as the metals from August 19th, 2020 through November 24th, 2021 (**Table 3-3**). The VOC concentrations were measured over 24 hours using 6-liter Silonite canisters following the District SOP . The VOC samples were analyzed by the laboratory Atmospheric Analysis and Consulting, Inc. (Ventura, CA). The VOCs were analyzed in accordance with the U.S. EPA Compendium Method TO-15 using gas chromatography-mass spectrometry (GC-MS) and U.S. EPA Compendium Method TO-14A using gas chromatography/flame ionization detection with mass selective detector confirmation (GC/FID/MS) . The VOCs measured are listed in **Table B-1** of Appendix B. There were fifteen VOCs measured by both the TO-15 and TO-14A method (these compounds are shaded under the TO-14A method in **Table B-1**). The concentration values from the TO-15 method were used for these fifteen VOCs in **section 5.2.3**. The TO-15 method was generally more sensitive (had a lower detection limit) compared to the TO-14A method.

Table 4-9. Metals measured by x-ray fluorescence (XRF) analysis.

Metals			
Aluminum	Copper[1]	Mercury[1]	Sodium
Antimony	Europium	Molybdenu	Strontium
Arsenic[1,2]	Gallium	Nickel[1,1]	Sulfur
Barium	Gold	Niobium	Tantalum
Bromine	Hafnium	Phosphorus	Terbium
Cadmium[1,1]	Indium	Potassium	Tin
Calcium	Iridium	Rubidium	Titanium
Cerium	Iron	Samarium	Tungsten
Cesium	Lanthanum	Scandium	Vanadium[1]
Chlorine	Lead[1]	Selenium[1]	Yttrium
Chromium[3]	Magnesium	Silicon	Zinc
Cobalt[1]	Manganese[1]	Silver	Zirconium

4.3.3.2. Metals correction factor

Three sets of trip blank samples were collected throughout the monitoring period from the six Phase 2 monitoring sites for speciated $PM_{2.5}$. Three sets of trip blanks samples were collected from three of the six sites for speciated PM_{10} (the Sacramento Fire Department Station 56, City of Sacramento Pump Station No. 50, and Veterans of Foreign Wars Post 1267 sites) in the last week of the monitoring period. Five metals were present in all speciated $PM_{2.5}$ and PM_{10} trip blank samples: aluminum, copper, iron, sulfur, and zinc. The analytical method for particulate matter metal speciation can contain internal contaminations of copper and zinc .

A correction factor was applied to aluminum, iron, sulfur, copper, and zinc measurement values. The correction factor was an average of the metal concentration values in the trip blank samples. For the speciated $PM_{2.5}$ correction factor, four trip blank samples were excluded from the correction factor calculation due to an unusually high amount of particulate matter in the sample that was suspected contamination (July 9th, 2021 samples for the Sacramento Fire Department Station 56, Veterans of Foreign Wars Post 1267, City of Sacramento Pump Station No. 50, and Impact Church sites). The correction factors are listed in **Table 4-10**. The correction factor was subtracted from measured concentration values to provide a corrected metal concentration. The corrected metal concentration values were used for any results presented in **section 5.2.3**.

[1] Associated with a Reference Exposure Level (REL) listed by the California Office of Environmental Health Hazard Assessment (OEHHA)
[2] Associated with an inhalation cancer unit risk listed by OEHHA.
[3] Certain valence states have a Reference Exposure Level (REL) and inhalation cancer unit risk listed by OEHHA. The x-ray fluorescence (XRF) analytical method does not differentiate metals by valence state.

Table 4-10. Correction factors applied to aluminum, copper, iron, sulfur, and zinc.

Metal	Correction Factor (µg/filter)	
	$PM_{2.5}$	PM_{10}
Aluminum (Al)	0.1631	0.0387
Copper (Cu)	0.0220	0.0066
Iron (Fe)	0.0320	0.0168
Sulfur (S)	0.0795	0.0199
Zinc (Zn)	0.0320	0.0082

4.3.3.3. Data gaps

Data gaps described in **section 4.3.2.2** for the speciated $PM_{2.5}$ and PM_{10} measurements also applied to metals. The VOC samples not collected or considered invalid are shown as the hollow points in **Figure 4-13**. Samples were invalid if the end vacuum pressure of a sample run was outside of the acceptable range. End vacuum pressure was a recurring issue and resulted in 60 invalidated samples. The VOC sampling was suspended between October 18th, 2020, and November 17th, 2020, while a flow controller issue was addressed. Additional data gaps occurred from VOC sample collection issues, including timer malfunction, battery failure, and user error. Data gaps were left in the dataset and were not addressed by extrapolation or substitution. There was about 70% data completeness for the VOC samples (as in, 70% of the potential one-in-six day samples for the six sites over the monitoring period had a valid VOC measurement).

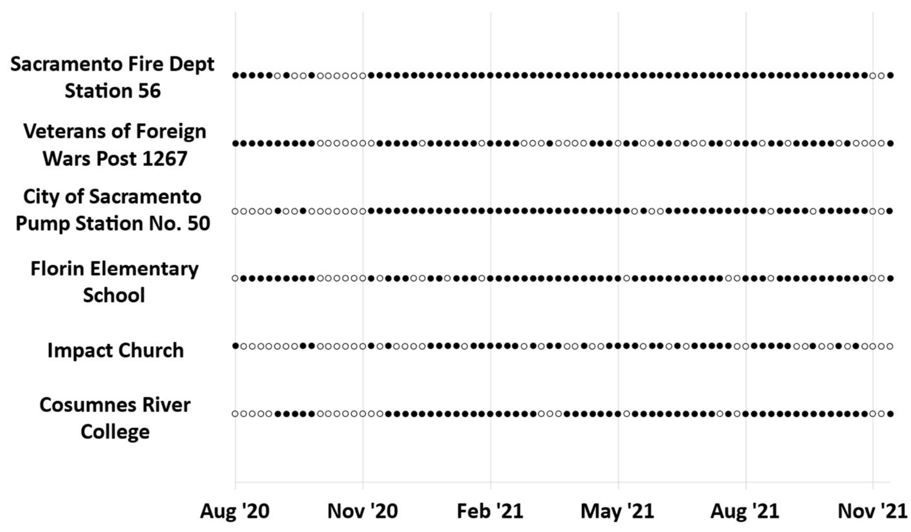

Figure 4-13. Timeline of valid VOC data by site.

Each point represents a one in six days sample date. Solid black points represent a sample date with a valid sample. Hollow points represent an invalid or missed sample.

4.3.3.4. Data analysis

Phase 2 monitoring metal and VOC levels presented in **section 5.2.3** were from the laboratory reported values. The complete set of Phase 2 monitoring laboratory reports were posted on the District Community Air Monitoring webpage[1] on March 2022. The metals and VOCs data from the District monitoring site Sacramento-Del Paso Manor were downloaded from the U.S. EPA Air Quality System (AQS) for comparisons in **section 5.2.3.5**. The statewide averages shown in **section 5.2.3.5** were obtained from CARB's iADAM Toxics Summaries[2]. The concentration values of metals are reported in local conditions (see **section 4.3.2.3**). The same data invalidation and exclusions for the $PM_{2.5}$ and PM_{10} samples described in **section 4.3.2.3** apply to the metals. Metal concentration values that were at least three times greater than the uncertainty reported by the laboratory were considered detected, which is approximately equal to a 99.7% confidence interval for detection . Metal concentration values were also considered below detection if the particulate matter measurement for the sample was below detection, which only occurred for one PM_{10} sample. Metals below detection were assigned zero values in average calculations. The minimum detection level for each metal was below the associated California Office of Environmental Health Hazard Assessment (OEHHA) noncancer health effects Reference Exposure Level (REL), indicating metals could be detected at levels that would be considered harmful for noncancer health impacts (see **section 4.3.3.4.1** for discussion of noncancer health effects; **Table 4-11**). However, the minimum detection levels for some metals were above the level associated with an estimated 1 per million cancer risk, indicating that it is possible for levels that potentially present a public health concern to be below detection for these metals (see **section 4.3.3.4.2** for calculation of cancer risk; **Table 4-11**).

The VOC samples were invalidated if a sample run had an end vacuum pressure outside of -0.1 to -16 inHg. Measurements from the TO-15 laboratory analytical method that were above the detection limit but below the quantitation limit are considered an estimated value with a 99% confidence that the analyte was present in the sample . The sample quantitation limit was sometimes above the OEHHA inhalation REL values and was generally above levels associated with an estimated 1 per million cancer risk, indicating levels below the quantitation limit could be impactful for both cancer and noncancer health effects (**Table 4-12**). Using the estimated values between the detection limit and quantitation limit increases the capture of potential health impacts. For this reason, estimated values between the detection limit and quantitation limit were included in the results presented in **section 5.2.3** even though they are considered an estimation. Measurements of VOCs below detection were assigned zero values in average calculations.

[1] http://www.airquality.org/CAM
[2] Available at: https://www.arb.ca.gov/adam/toxics/toxics.html

The following analyses described in Element 13 of the CAMP are provided in **section 5.2.3**. The related air monitoring objectives are noted in parentheses (**section 1.2**).

- Site comparisons of the traffic-related pollutants acetaldehyde, acrolein, and benzene (*Objective A*)
- Plotting of seasonal averages for some air toxics (*Objective B and C*)
- Comparison of air toxics levels to health standards (*Objective D*)
- Comparison of air toxics levels to District sites and statewide averages (*Objective D*)

4.3.3.4.1. Noncancer health effects

Levels of metals and VOCs are compared to health standard values using the Hazard Index Approach in **section 5.2.3.3** . The level of each metal or VOC was divided by its corresponding inhalation REL to calculate the hazard quotient. The inhalation REL is specific to the type of exposure, which may be acute or chronic. The acute inhalation RELs are generally based upon infrequent 1-hour exposures. The acute REL was compared to the levels measured in 24-hour samples as the closest comparison. The 24-hour sample is generally expected to be an underestimate of potential acute exposures, as an average over 24 hours will be lower than what was experienced over a peak 1-hour interval. The chronic REL is based upon continuous exposure over a "significant fraction of a lifetime" similar to residential exposure. Averages over the course of a year of monitoring (from November 23rd, 2020 through November 24th, 2021) were used as an estimate of average long-term exposure levels to compare to the chronic REL. The inhalation REL values are listed in the Consolidated Table of OEHHA/CARB Approved Risk Assessment Health Values[1]. As part of the Hazard Index Approach, the hazard quotients are summed for each affected target organ to find the hazard index. A hazard index greater than 1 indicates there is a potential for adverse health effects for that particular target organ. The probability of adverse health effects increases with a greater hazard index.

[1] Last updated October 6th, 2023. Available at: https://ww2.arb.ca.gov/sites/default/files/classic/toxics/healthval/contable10062023.pdf.
The concentration of metals measured by XRF analysis were compared to the approximately equivalent pollutant in the table: the concentration of arsenic was compared to arsenic and compounds (inorganic), the concentration of cadmium was compared to cadmium and compounds, the concentration of cobalt was compared to cobalt, the concentration of copper was compared to copper and compounds, the concentration of lead was compared to lead and compounds (inorganic), the concentration of manganese was compared to manganese and compounds, the concentration of mercury was compared to mercury and compounds (inorganic), the concentration of nickel was compared to nickel and compounds, the concentration of selenium was compared to selenium and compounds, and the concentration of vanadium was compared to vanadium (fume or dust).

4.3.3.4.2. Cancer risk

Cancer risk values shown in **section 5.2.3.3** were calculated as follows:

$$[\text{average concentration}] \times [\text{inhalation cancer unit risk}] \times 1{,}000{,}0000 =$$
$$\text{estimated cancer risk per million}$$

The calculation is intended to estimate population-wide cancer risk rather than estimate an individual's cancer risk. The inhalation cancer unit risk are listed in the Consolidated Table of OEHHA/CARB Approved Risk Assessment Health Values[1]. The inhalation cancer unit risk is based on exposure for individuals over 16 years of age with a continuous exposure of 70 years. It should be noted that cancer risk is generally considered greater for those under 16, and this was not factored into the cancer risks presented in **section 5.2.3.3**. The exposure length of 70 years is appropriate for considering population-wide impacts .

Table 4-11. Minimum detection levels of particulate matter and metals compared to health standards.

Minimum detection levels for metals are from speciated $PM_{2.5}$ samples. Applicable health standards from the following are listed: the U.S. EPA National Ambient Air Quality Standards (NAAQS), the California Ambient Air Quality Standards (CAAQS), the California Office of Environmental Health Hazard Assessment (OEHHA) inhalation Reference Exposure Level (REL), or the estimated 1 per million cancer risk concentration (using equation in **section 4.3.3.4.2**). Health standards below the upper end of the minimum detection level range are bolded.

Pollutant measured	Monitoring equipment	Minimum detection[1] (µg/m³)	Minimum detection level[2] (µg/m³)	Health standard (µg/m³)
Phase 1 monitoring				
$PM_{2.5}$	Clarity Node-S	1	1	12.0 (annual NAAQS) 35 (24-hour NAAQS)
Phase 2 monitoring				
$PM_{2.5}$	Airmetrics MiniVol	1.8	1.4 - 7.5	12.0 (annual NAAQS) 35 (24-hour NAAQS)
PM_{10}		6.7	1.4 - 3.1	150 (24-hour NAAQS) 20 (annual CAAQS) 50 (24-hour CAAQS)
Arsenic		0.0017	0.0015 - 0.0030	0.2 (acute REL) 0.015 (chronic REL) **0.0003 (1 per million cancer risk)**
Cadmium		0.0091	0.0090	0.02 (chronic REL) **0.002 (1 per million cancer risk)**
Cobalt		0.0025	0.0024 - 0.0039	**0.0001 (1 per million cancer risk)**
Copper		0.0033[3]	0.0015 - 0.0057	100 (acute REL)
Lead		0.0035	0.0033 - 0.0075	1.5 (30-day CAAQS) 0.15 (3-month NAAQS) 0.08 (1 per million cancer risk)
Manganese		0.0039	0.0039 - 0.0190	0.09 (chronic REL)
Mercury		0.0030	0.0030 - 0.0039	0.6 (acute REL) 0.03 (chronic REL)
Nickel		0.0017	0.0015 - 0.0024	0.2 (acute REL) 0.014 (chronic REL) 0.004 (1 per million cancer risk)
Selenium		0.0009	0.0009 - 0.0015	20 (chronic REL)
Vanadium		0.0020	0.0018 - 0.0042	30 (acute REL)

[1] Detected levels are at least three times the uncertainty reported by the laboratory.

[2] Minimum detection level is three times the uncertainty reported by the laboratory. The minimum detection level is given as a range as it is specific to each sample.

[3] The correction factor described in **section 4.3.3.2** was not applied to this minimum detected level.

Table 4-12. Minimum detection levels of VOCs measured compared to health standards.

The minimum detection, sample detection limit, and sample quantitation limits shown are from the TO-15 laboratory analytical method. The health standards listed are either of the following that are applicable: the inhalation Reference Exposure Level (REL) from the California Office of Environmental Health Hazard Assessment (OEHHA) or the concentration associated with an estimated 1 per million cancer risk (using equation in **section 4.3.3.4.2**). Health standards below the upper end of the minimum detection level range are bolded.

Pollutant measured	Monitoring equipment	Minimum detection (µg/m³)	Sample detection limit[1] (µg/m³)	Sample quantitation limit[2] (µg/m³)	Health standard (µg/m³)
1,1,2,2-Tetrachloroethane	6-liter Silonite canister	Not detected	0.5 - 2.3	8.8 - 37.1	**0.02 (1 per mil. cancer risk)**
1,1,2-Trichloroethane		Not detected	0.5 - 1.9	3.5 - 14.8	**0.06 (1 per mil. cancer risk)**
1,1-Dichloroethane		0.81	0.4 - 1.5	1.3 - 5.5	**0.6 (1 per mil. cancer risk)**
1,1-Dichloroethylene		1.16	0.3 - 1.4	1.3 - 5.4	70 (chronic REL)
1,2,4-Trimethylbenzene		0.52	0.5 - 2.0	6.3- 26.6	2400 (acute REL) 4 (chronic REL)
1,2-Dibromo-3-Chloropropane		Not detected	1.2 - 5.1	6.2 - 26.1	**0.0005 (1 per mil. cancer risk)**
1,3,5-Trimethylbenzene		0.83	0.6 - 2.6	3.1 - 13.3	2400 (acute REL) 4 (chronic REL)
1,3-Butadiene		0.33	0.2 - 0.8	0.7 - 3.0	660 (acute REL) 2 (chronic REL) **0.006 (1 per mil. cancer risk)**
1,4-Dichlorobenzene		1.14	0.7 - 3.1	3.8 - 16.3	800 (chronic REL) **0.09 (1 per mil. cancer risk)**
1,4-Dioxane		0.67	0.3 - 1.5	1.2 - 4.9	3000 (acute REL) 3000 (chronic REL) **0.1 (1 per mil. cancer risk)**
2-Propanol		0.44	0.2 - 0.7	0.8 - 3.3	3200 (acute REL) 7000 (chronic REL)
3-Chloropropene		0.48	0.3 - 1.4	2.0 - 8.5	**0.2 (1 per mil. cancer risk)**
Acetaldehyde		4.01	2.7 - 11.2	11.5 - 48.7	470 (acute REL) 140 (chronic REL) **0.4 (1 per mil. cancer risk)**
Acrolein		0.30	0.3 - 1.1	1.5 - 6.2	2.5 (acute REL) **0.35 (chronic REL)**
Acrylonitrile		0.47	0.3 - 1.4	1.4 - 5.9	5 (chronic REL) **0.003 (1 per mil. cancer risk)**
Benzene		0.29	0.2 - 1.0	2.0 - 8.6	27 (acute REL) 3 (chronic REL) **0.03 (1 per mil. cancer risk)**
Benzyl chloride		Not detected	1.0 - 4.2	13.3 - 56.0	240 (acute REL) **0.02 (1 per mil. cancer risk)**

[1] Sample detection limit based on minimum detection limit study by laboratory in December 2020. Sample detection limit is a range due to different dilution factors applied to samples.
[2] Detections below the sample quantitation limit are considered an estimation. Sample quantitation limit is a range due to different dilution factors applied to samples.

Table 4-12. Minimum detection levels of VOCs measured compared to health standards.

Pollutant measured	Monitoring equipment	Minimum detection (µg/m³)	Sample detection limit[1] (µg/m³)	Sample quantitation limit[2] (µg/m³)	Health standard (µg/m³)
Bromomethane		0.57	0.4 - 1.8	5.0 - 21.0	3900 (acute REL) 5 (chronic REL)
Carbon disulfide		0.37	0.3 - 1.4	2.0 - 8.4	6200 (acute REL) 800 (chronic REL)
Carbon tetrachloride		1.26	0.9 - 3.6	4.0 - 17.0	1900 (acute REL) 40 (chronic REL) **0.02 (1 per mil. cancer risk)**
Chlorobenzene		0.52	0.3 - 1.5	1.5 - 6.2	1000 (chronic REL)
Chloroethane		0.47	0.3 - 1.2	1.7 - 7.1	30000 (chronic REL)
Chloroform		0.52	0.4 - 1.6	1.6 - 6.6	150 (acute REL) 300 (chronic REL) **0.2 (1 per mil. cancer risk)**
Dichloromethane		0.45	0.4 - 1.5	4.4 - 18.8	14000 (acute REL) 400 (chronic REL) **1 (1 per mil. cancer risk)**
Ethylbenzene		0.52	0.4 - 1.8	2.8 - 11.7	2000 (chronic REL) **0.4 (1 per mil. cancer risk)**
Ethylene dibromide		0.91	0.5 - 2.2	4.9 - 20.8	**0.8 (chronic REL)** **0.01 (1 per mil. cancer risk)**
Ethylene dichloride		0.40	0.3 - 1.2	5.2 - 21.9	400 (chronic REL) **0.05 (1 per mil. cancer risk)**
m/p-xylene		1.00	1.0 - 4.1	5.6 - 23.5	22000 (acute REL)
o-xylene		0.45	0.4 - 1.9	2.8 - 11.7	700 (chronic REL)
Methanol		1.62	0.5 - 2.0	1.7 - 7.1	28000 (acute REL) 4000 (chronic REL)
Methyl chloroform	6.0-liter Silonite canister	1.60	0.6 - 2.7	3.5 - 14.8	68000 (acute REL) 1000 (chronic REL)
Methyl ethyl ketone		0.32	0.2 - 0.6	0.9 - 4.0	13000 (acute REL)
Methyl tert-butyl ether		0.81	0.4 - 1.6	2.3 - 9.8	8000 (chronic REL) 4 (1 per mil. cancer risk)
Naphthalene		1.97	0.1 - 0.3	13.4 - 56.7	9 (chronic REL) **0.03 (1 per mil. cancer risk)**
n-Hexane		0.63	0.5 - 2.1	2.3 - 9.5	7000 (chronic REL)
Propylene		0.25	0.2 - 0.9	1.1 - 4.7	3000 (chronic REL)
Styrene		0.45	0.4 - 1.8	10.9 - 46.1	21000 (acute REL) 900 (chronic REL)
Tetrachloroethylene		1.63	0.7 - 3.0	4.3 - 18.3	20000 (acute REL) 35 (chronic REL) **0.2 (1 per mil. cancer risk)**
Toluene		0.49	0.3 - 1.4	2.4 - 10.2	5000 (acute REL) 420 (chronic REL)
Trichloroethylene		0.62	0.5 - 2.2	1.7 - 7.3	600 (chronic REL) **0.5 (1 per mil. cancer risk)**

[1] Sample detection limit based on minimum detection limit study by laboratory in December 2020. Sample detection limit is a range due to different dilution factors applied to samples.
[2] Detected levels lower than the sample quantitation limit are considered an estimation. Sample quantitation limit is a range due to different dilution factors applied to samples.

Table 4-12. Minimum detection levels of VOCs measured compared to health standards.

Pollutant measured	Monitoring equipment	Minimum detection (µg/m³)	Sample detection limit[1] (µg/m³)	Sample quantitation limit[2] (µg/m³)	Health standard (µg/m³)
Vinyl acetate	6.0-liter Silonite canister	0.41	0.3 - 1.3	1.1 - 4.8	200 (chronic REL)
Vinyl chloride		0.59	0.2 - 1.1	0.8 - 3.5	180000 (acute REL) **0.01 (1 per mil. cancer risk)**

4.4. Mapping resources

Maps shown throughout this report were created in ArcMap (Esri, version 10.8.1). The roads and truck route data layers were imported from the Sacramento Area Council of Governments (SACOG) Open Data Portal[3]. Truck routes shown are the federally designated Surface Transportation Assistance Act (STAA) routes. The railways and parks data layers were imported from the Sacramento County Open Data platform[4]. The schools data layer was imported from the City of Sacramento Open Data Portal[5]. Locations of childcare centers were downloaded from the California Department of Social Services website[6]. The childcare center locations were geocoded using World ArcGIS Geocoding Service. The licensed healthcare facilities data layer was imported from the California Health and Human Services Open Data Portal[7].

[1] Sample detection limit based on minimum detection limit study by laboratory in December 2020. Sample detection limit is a range due to different dilution factors applied to samples.
[2] Detected levels lower than the sample quantitation limit are considered an estimation. Sample quantitation limit is a range due to different dilution factors applied to samples.
[3] Roads layer last updated September 2019. Truck routes layer last updated February 2020. Available at: https://data.sacog.org/
[4] Railways layer last updated February 2020. Parks layer last updated April 2023. Available at: https://data-sacramentocounty.opendata.arcgis.com/
[5] Schools layer last updated April 4th, 2023. Available at: https://data.cityofsacramento.org/
[6] Childcare centers data last updated August 6th, 2023. Available at: https://www.ccld.dss.ca.gov/carefacilitysearch/DownloadData
[7] Licensed healthcare facilities layer last updated August 1st, 2023. Available at: https://data.chhs.ca.gov/

5. Community Air Monitoring Data Results

Data results from Phase 1 and Phase 2 monitoring are presented in this chapter. Data results for Phase 2 are organized by the type or group of pollutant measured: black carbon, particulate matter ($PM_{2.5}$ and PM_{10}), and air toxics (metals and VOCs). Pollutants are introduced in **section 2.4**. The primary purpose of Phase 1 and Phase 2 monitoring was to obtain air quality information on different areas of the community and as a result, provide screening information to inform the placement of the portable laboratory for the third phase of monitoring.

5.1. Phase 1 monitoring

5.1.1. Introduction

Phase 1 monitoring consists of a network of monitors that continuously measure $PM_{2.5}$ levels (**section 4.2**). Monitoring locations are shown in **Figure 3-1**. The primary purpose of Phase 1 monitoring was as a screening tool for the placement of Phase 2 monitors. Additionally, the monitor network provides real-time air pollution information to the community. Ten of the monitoring sites are schools and considered sensitive receptor sites (locations where there are individuals – children – that are more susceptible to air pollution).

The U.S. EPA Air Quality Index (AQI) is used in this chapter to provide context to $PM_{2.5}$ levels. It was announced by the U.S. EPA on February 7th, 2024, that the AQI categories for $PM_{2.5}$ would be revised based on the latest health science. The revised AQI categories became effective May 2024. The revised AQI categories for $PM_{2.5}$ are used in this report and are shown in **Table 5-1**. Comparisons of $PM_{2.5}$ levels to the AQI is not necessarily representative of the AQI that is typically reported to the public, as this considers multiple pollutants besides $PM_{2.5}$. The U.S. EPA AQI uses the term *sensitive groups*, which it defines as "people with heart or lung disease, older adults, children, and people of lower socioeconomic status" who are considered more susceptible to air pollution .

Table 5-1. U.S. EPA Air Quality Index (AQI) for $PM_{2.5}$.

U.S. EPA Air Quality Index Category	24-hour $PM_{2.5}$ ($\mu g/m^3$)	
	Pre-2024	2024 Revision
Good	0 - 12.0	0 - 9.0
Moderate	12.1 - 35.4	9.1 - 35.4
Unhealthy for Sensitive Groups	35.5 - 55.4	35.5 - 55.4
Unhealthy	55.5 - 150.4	55.5 - 125.4
Very Unhealthy	150.5 - 250.4	125.4 - 225.4
Hazardous	250.5 - 500	225.5 and above

Phase 1 monitoring network $PM_{2.5}$ levels are not compared to levels measured at District regulatory monitoring sites in this report due to the substantial differences in monitoring equipment and methodology. Additionally, the calibration applied to Phase 1 monitoring was based upon the assumption that $PM_{2.5}$ pollution at the District's Sacramento-Del Paso Manor monitoring site is representative of that in South Sacramento-Florin (**section 4.2.3**). Similarity in $PM_{2.5}$ levels between the two areas may be influenced by the assumptions present in the calibration.

5.1.2. Site comparisons

Phase 1 monitoring $PM_{2.5}$ levels were compared between the 21 monitoring sites. Identifying differences between areas is difficult for air pollutants that vary over time (see next **section 5.1.3**). To control the effects of seasonal variation and pollution events (such as wildfires), only dates where all 21 sites had a valid daily (24-hour) average were included for the site comparisons shown in **Figure 5-1**, **Table 5-2**, and **Table C-1** of Appendix C. This is a total of 252 dates between October 2020 and October 2021, which is mainly limited by the data available from the North Laguna-Valley Hi Library site (**Figure 4-4**). The levels described by this dataset are not necessarily representative of typical year-round conditions. A more comprehensive look at pollution levels that includes all data available for each site is shown in **section 5.1.4**.

One method of comparing sites that is used for regulatory monitoring networks is the squared Pearson's correlation coefficient (R^2). A squared Pearson's correlation coefficient greater than 0.75 between two sites is generally interpreted as that the two sites may be redundant with each other in measuring pollution patterns . The 21 monitoring sites were found to have similar $PM_{2.5}$ trends to each other, as all site comparisons had a squared Pearson's correlation coefficient greater than or equal to 0.96 (**Table C-1** of Appendix C). Similarity in $PM_{2.5}$ trends is expected, as a regional pollutant $PM_{2.5}$ trends are generally similar across the Sacramento region. Within the District regulatory monitoring network that covers a much larger area, over half of the paired site comparisons had a squared Pearson's correlation coefficient greater than 0.75 for $PM_{2.5}$ levels .

Although sites were found to have similar $PM_{2.5}$ trends based on a measure applied to regional monitoring networks, the goals of Phase 1 monitoring differ from that of a regional monitoring network. A goal identified by the CAMP for Phase 1 monitoring was to identify local pollution hotspots. In contrast, a regional monitoring network is designed to represent pollution levels over a large scale. To identify variation within the South Sacramento-Florin Phase 1 monitoring network, a heat map of average $PM_{2.5}$ levels is shown in **Figure 5-1**. The Bowling Green Park site had the greatest average $PM_{2.5}$ level. This site is approximately 170' southwest of Highway 99 and is the closest to Highway 99 out of the 21 monitoring sites. All sites besides the Bowling Green Park site were at least 400' from Highway 99. The Camellia Elementary School site was one of two sites with the lowest average $PM_{2.5}$ levels. This site may have had a lower average $PM_{2.5}$ level because of where the monitor was located. The site was unique in that the monitor was located on a building and set back at least 100' from any parking lots or roads.

The Phase 1 monitoring network $PM_{2.5}$ levels are further compared between sites in **Table 5-2**. The mean values shown in **Table 5-2** are the same as the averages shown in **Figure 5-1**. The median is included in **Table 5-2** as another measure of the average and is the middle value of all values ordered from smallest to largest. Measures of peak values using the maximum and 98th percentile are included in **Table 5-2**. The 98th percentile is the value that is equal to or greater than 98% of the values when all values are ordered from smallest to largest. While the maximum describes the greatest pollution level, the 98th percentile is a useful comparison as it can be used to describe peak pollution levels that have occurred multiple times. The maximum $PM_{2.5}$ levels shown in **Table 5-2** all occurred on August 28th, 2021, when there was a potential wildfire smoke impact locally from the Caldor fire. The Bowling Green Park site had the greatest mean, median, 98th percentile, and maximum $PM_{2.5}$ values. The 98th percentile value at this site occurred outside of wildfire season on December 9th, 2020. Outside of potential wildfire smoke impacts, greater $PM_{2.5}$ levels are generally observed in winter months (see **section 5.1.3**). The Camellia Elementary School site had the lowest mean, median, and 98th percentile values in the monitoring network.

The ranking of daily $PM_{2.5}$ levels was also compared between Phase 1 monitoring sites. The daily average $PM_{2.5}$ level at each site was ranked out of the 21 sites for each date, and for each site the percentage of dates in each ranking is shown in **Table C-2** of Appendix C. The Bowling Green Park site that had the greatest mean, median, 98th percentile, and maximum in **Table 5-2** was also ranked first (had the greatest daily $PM_{2.5}$ level) out of the 21 sites on 73% of dates, indicating it had consistently elevated $PM_{2.5}$ levels compared to other sites (**Table C-2**). The Camellia Elementary School sites that had the lowest mean, median, and 98th percentile values in **Table 5-2** was ranked 20th (second to last) and 21st (last) a majority of the time, indicating the site had consistently lower levels compared to the other sites (**Table C-2**).

It could not be evaluated how much differences between sites could be attributed to variation between monitors. The monitors were not located together to measure and assess the difference between monitors. There could be some variation between sites that is due to the differences between monitors.

5.1.3. Trends in pollution levels

Trends observed for $PM_{2.5}$ levels were generally consistent across all Phase 1 monitoring network sites for the different time averaging intervals described in this section (seasonal averages, monthly averages, day-of-week averages, and time-of-day averages). For this reason, all sites are included in the averages used to display the trends in this section. Consistency in trends across all sites indicate that the contributing factors to the trends observed are not localized or specific to certain areas of the South Sacramento-Florin community.

The Phase 1 monitoring network $PM_{2.5}$ levels throughout the year are shown as seasonal averages in **Figure 5-2** and as monthly averages in **Figure 5-3**. Generally, the greatest seasonal average $PM_{2.5}$ levels were winter (**Figure 5-2**). The greatest winter average $PM_{2.5}$ level was in the year 2022 while the lowest winter average $PM_{2.5}$ level was in 2023. This may be in part due to rainfall reducing $PM_{2.5}$ levels more in some years than others. The month of January had the lowest average $PM_{2.5}$ level in 2023 and had the greatest amount of rainfall compared to the month of January in 2020, 2021, and 2022 (**Figure 5-3** and **Table D-1** of Appendix D). Conversely, the month of January had the greatest average $PM_{2.5}$ level in 2022 and had the least amount of rainfall compared to the month of January in 2020, 2021, and 2023. In the year 2020 the greatest seasonal $PM_{2.5}$ average was fall instead of winter and the year 2021 had a more elevated fall average compared to 2022 and 2023 (**Figure 5-2**). These elevated fall averages are likely due to regional wildfire smoke impacts. The months of August, September, and October had the greatest monthly average $PM_{2.5}$ levels in the year 2020, which was when there was a regional wildfire smoke impact from the August Complex, SCU Lightning Complex and LNU Lightning Complex fires (**Figure 5-3**). The average for the months of August and September were greater in 2021 compared to 2022 and 2023; in 2021, there was a regional wildfire smoke impact from the Dixie and Caldor fires during these months. The spring seasonal average $PM_{2.5}$ levels were generally the lowest and had the least variation across the four years of monitoring (**Figure 5-2**).

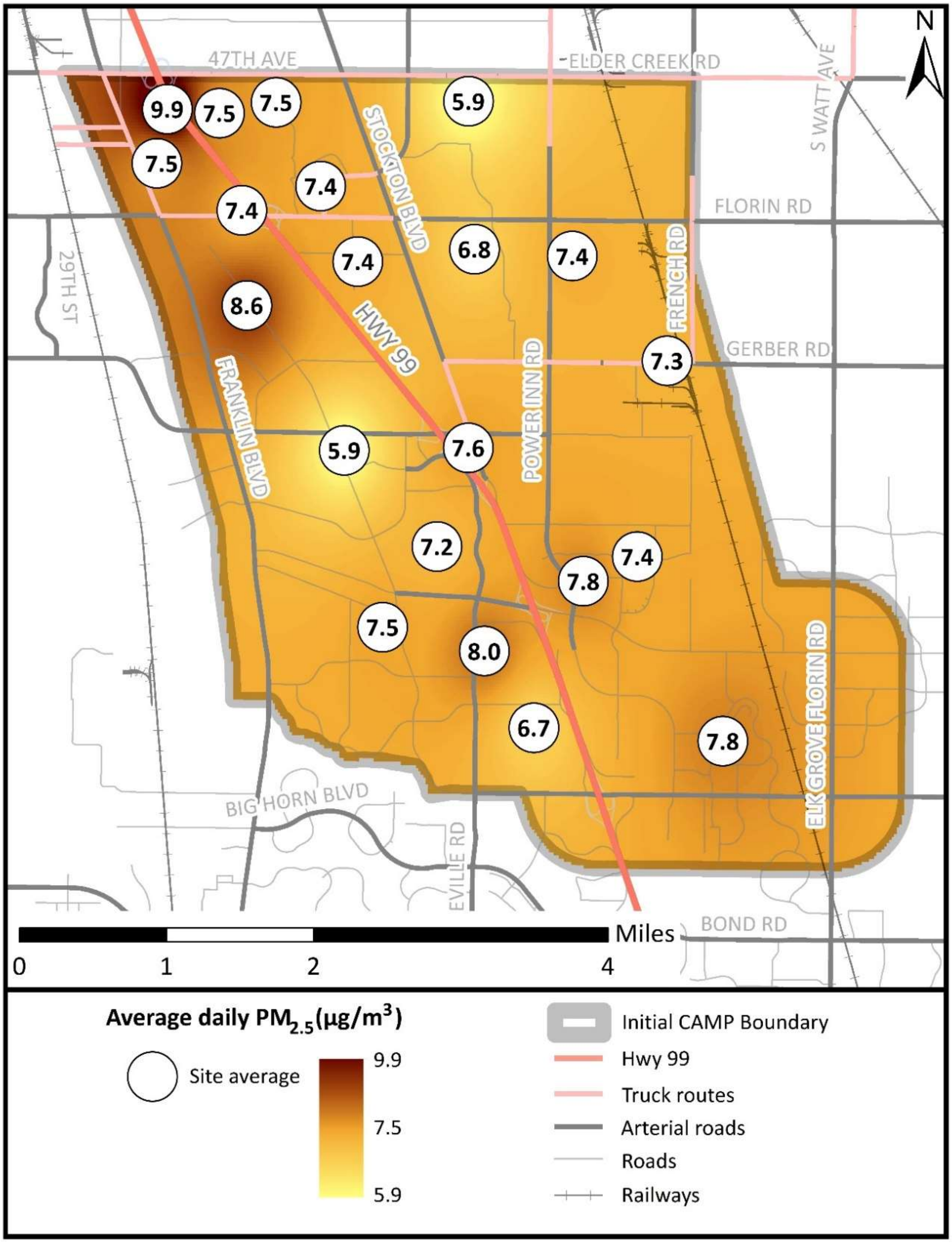

Figure 5-1. Site comparison of Phase 1 monitoring network average $PM_{2.5}$ levels.

Data used for the average were limited to when all 21 sites had a valid 24-hour average $PM_{2.5}$ value. Color gradient is the inverse distance squared weighting of the site averages. Refer to **Figure 3-1** for the name of each site.

Table 5-2. Site comparison of Phase 1 monitoring network $PM_{2.5}$ levels.

Data limited to when all 21 sites had a valid 24-hour average $PM_{2.5}$ value.

Site	24-hour average $PM_{2.5}$ ($\mu g/m^3$)			
	Median	Mean	98th Percentile	Maximum
Bowling Green Elem. School	3.6	7.5	28	78
Bowling Green Pk	5.1	9.9	36	106
Nicholas Pk	3.3	7.5	29	84
Nicholas Elem. School	3.4	7.5	29	81
Camellia Elem. School	2.7	5.9	23	78
District Council 16	3.8	7.4	27	79
Sac. Co. Sheriff Svc Ctr	3.4	7.4	29	87
Parkway Swim Club	4.3	8.6	33	93
Southgate Library	4.0	7.4	27	75
David Reese Elem. School	3.2	6.8	27	78
Florin Elem. School	3.5	7.4	28	88
Elk Grove Adult & Comm. Ed.	3.5	7.3	26	90
Mack Rd Valley Hi Comm. Ctr	2.7	5.9	24	68
Mack Rd Partnership	3.6	7.6	29	82
Herman Leimbach Elem. School	3.6	7.2	27	80
Valley High School	3.4	7.5	29	82
Valley Hi-North Laguna Library	4.1	8.0	29	91
Edwin A. Smith Comm. Pk	3.9	7.8	29	86
Isabella Jackson Elem. School	3.7	7.4	27	86
Irene B West Elem. School	3.2	6.7	26	76
Raymond Case Elem. School	3.7	7.8	28	90

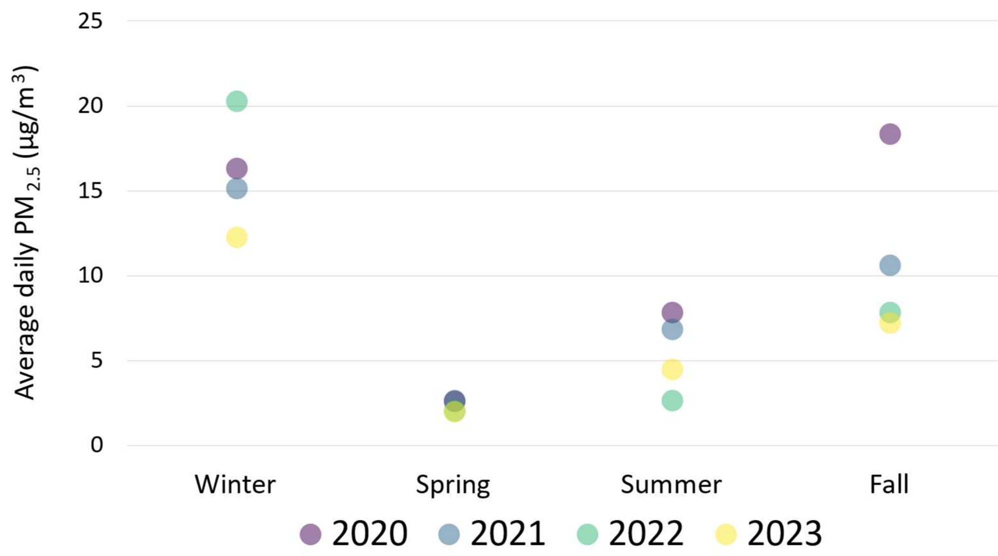

Figure 5-2. Seasonal averages of Phase 1 monitoring network $PM_{2.5}$ levels.

Average of all valid 24-hour average $PM_{2.5}$ concentrations reported by Phase 1 monitoring sites in each season and year. Each season was designated as follows: winter included the months of December, January, and February; spring included the months of March, April, and May; summer included the months of June, July, and August; and fall included the months of September, October, and November. Seasonal average sample size ranged from 1,245 to 1,924.

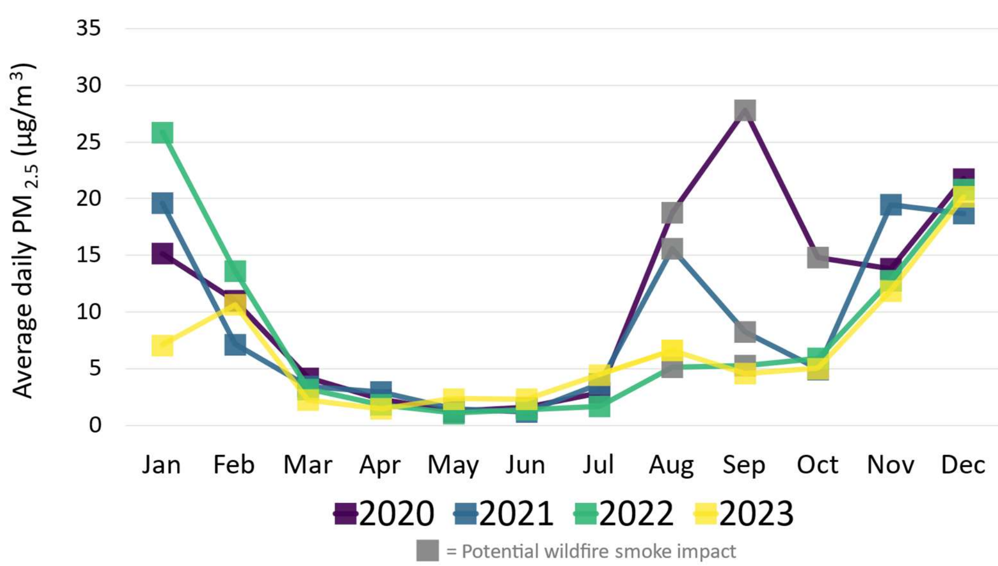

Figure 5-3. Monthly averages of Phase 1 monitoring network $PM_{2.5}$ levels.

Average of all valid 24-hour average $PM_{2.5}$ concentrations reported by the Phase 1 monitoring sites in each month and year. Averages marked in gray had at least 10 days in the month with a potential wildfire smoke impact (**section 4.2.5**). Monthly average sample size ranged from 336 to 651.

A trend in Phase 1 monitoring $PM_{2.5}$ levels based on the day of the week was not obvious. Generally, average $PM_{2.5}$ levels were similar between weekdays and weekends. In averaging across all sites with potentially wildfire-impacted dates excluded (**section 4.2.5**), the average $PM_{2.5}$ level for weekdays was slightly lower at 7.4 µg/m^3 compared to the average for weekends at 8.3 µg/m^3 (data not shown). When averaging over the colder months of November through February, the difference between the weekend and weekday $PM_{2.5}$ levels was larger (17.2 µg/m^3 average for weekends compared to 15.2 µg/m^3 average for weekdays), potentially indicating that larger weekend levels are influenced by preferential residential wood burning on the weekend.

Phase 1 monitoring $PM_{2.5}$ levels throughout the day are shown in **Figure 5-4**. Average $PM_{2.5}$ levels were generally greater overnight. The typical mixing height pattern throughout the day allows for pollutants to disperse and become less concentrated during the day, and conversely, become more concentrated and accumulate overnight. It is expected that mixing height influenced the daily pattern observed for $PM_{2.5}$ levels. The average $PM_{2.5}$ levels peak in the morning and then start increasing in the late afternoon, which may be influenced by traffic levels during those times. The average $PM_{2.5}$ levels peaked at 10 pm for November through February and peaked at 7am for March through October. The late evening peak over the late fall and winter months could be influenced by a contribution from residential wood smoke. Another likely influence is that overnight temperature inversions are more severe over the winter months, which worsens pollution accumulating overnight.

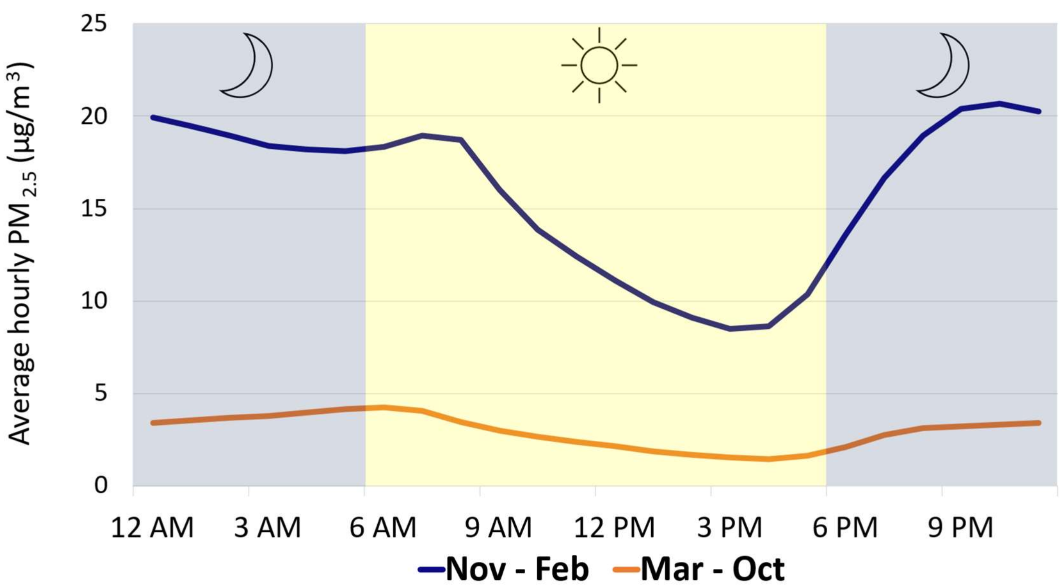

Figure 5-4. Time-of-day averages of Phase 1 monitoring network $PM_{2.5}$ levels.

Average of all valid 1-hour average $PM_{2.5}$ values reported by the Phase 1 monitoring sites in each hour of the day during each seasonal range. Potentially wildfire smoke impacted dates were excluded (**section 4.2.5**). Average hourly sample size ranged from 8,410 to 14,492.

5.1.4. Comparison to health standards

Phase 1 monitoring $PM_{2.5}$ levels are compared to health standards in this section to provide context to the levels measured. The regulatory health standards shown in this section are based on monitoring methods specified in regulation. It is important to note that Phase 1 monitoring does not meet the requirements of regulatory monitoring. As a result, comparisons of Phase 1 monitoring results to regulatory health standards are approximate and do not establish whether pollution levels meet or exceed regulatory standards.

The Phase 1 monitoring network daily average $PM_{2.5}$ levels were compared to the U.S. EPA AQI categories in **Figure 5-5**. Note that the AQI categories shown follow the current scale that was revised in 2024 (**Table 5-1).** The monitoring network maximum and minimum daily $PM_{2.5}$ levels are shown to provide the range of values reported each day across the monitoring network. The monitoring network maximum daily $PM_{2.5}$ levels reached “Very Unhealthy” levels during potentially wildfire smoke impacted intervals in 2020. The monitoring network maximum daily $PM_{2.5}$ levels reached “Unhealthy” levels during potentially wildfire smoke impacted intervals and during the winter.

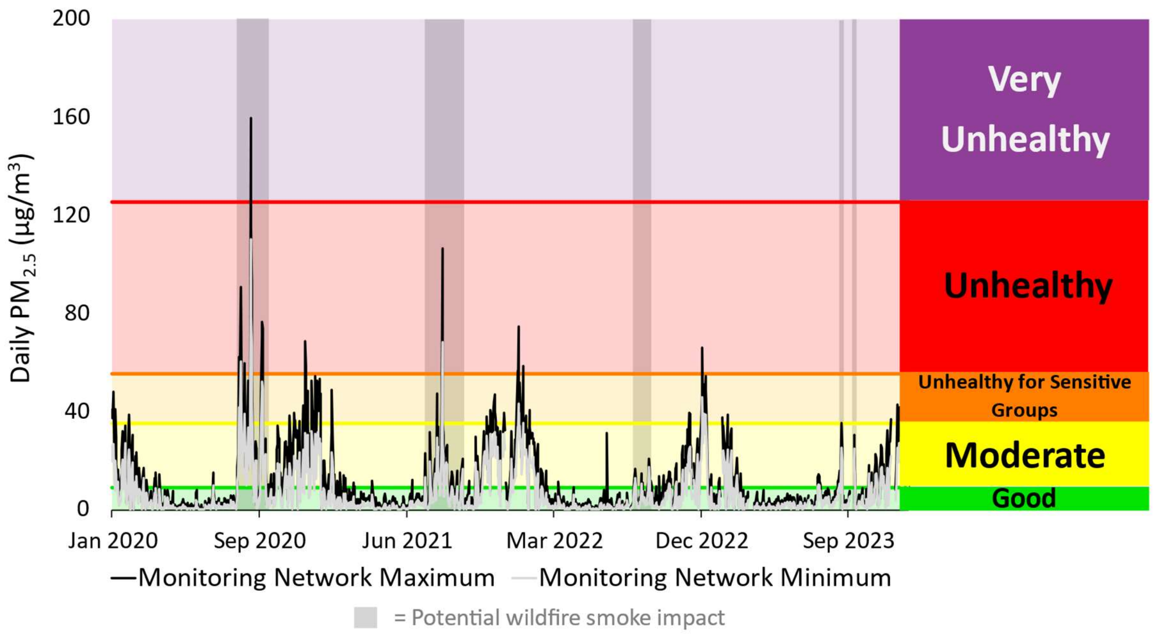

Figure 5-5. Comparison of Phase 1 monitoring network $PM_{2.5}$ levels to the U.S. EPA Air Quality Index (AQI).

The maximum and minimum valid daily $PM_{2.5}$ values reported by the Phase 1 monitoring network sites are shown. Shaded areas of the graph are intervals when there was a potential wildfire smoke impact. The AQI categories shown follow the current scale that was revised in 2024 (**Table 5-1**).

The Phase 1 monitoring network $PM_{2.5}$ levels were compared to federal health standards in **Table 5-3** and **Table 5-4** for the years 2020-2023. The comparison is intended to provide some context to the values measured. However, as Phase 1 monitoring was not equivalent to regulatory monitoring, the levels measured cannot be evaluated for whether they meet health standards. The annual average $PM_{2.5}$ levels are compared to the U.S. EPA annual $PM_{2.5}$ NAAQS in **Table 5-3**. The peak $PM_{2.5}$ levels are compared to the 24-hour $PM_{2.5}$ NAAQS of 35 $\mu g/m^3$ in **Table 5-4.** The 98th percentile value is shown in addition to the maximum value. The 98th percentile is used by the U.S. EPA as a target value for the 24-hour $PM_{2.5}$ NAAQS because it is more stable than the maximum but still protective of the occurrence of peak levels . Additionally, the number of days with $PM_{2.5}$ levels above the 24-hour $PM_{2.5}$ NAAQS are shown for each site. Whether sites had $PM_{2.5}$ levels above the annual or 24-hour $PM_{2.5}$ NAAQS depended upon the year. Generally, levels above the annual and 24-hour $PM_{2.5}$ NAAQS occurred most often for the year 2020, which was potentially due to severe and persistent regional wildfire smoke in 2020. In contrast, none of the sites had an annual average above the annual $PM_{2.5}$ NAAQS in the year 2023, and this year also had the least number of days with levels above the 24-hour $PM_{2.5}$ NAAQS for each site.

Table 5-3. Annual average Phase 1 monitoring network $PM_{2.5}$ levels.

Annual average values are in italics if less than 75% of daily values were valid in each calendar quarter. If no value is shown, there were no valid 24-hour average values reported that year at that site. For context, the annual $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) was revised in 2024 to 9.0 µg/m³ from 12.0 µg/m³. The number of valid daily values in each year for each site ranged from 84 to 366.

Site	Annual Average[1] 24-hour Average $PM_{2.5}$ (µg/m³)			
	2020	2021	2022	2023
Bowling Green Elem. School	11.2	8.8	8.0	6.4
Bowling Green Pk	*16.0*	*9.3*	10.5	8.4
Nicholas Pk	11.3	8.9	*6.5*	-
Nicholas Elem. School	11.8	8.9	8.3	*4.4*
Camellia Elem. School	9.5	7.2	*6.0*	-
District Council 16	10.9	8.8	7.7	6.2
Sac. Co. Sheriff Svc Ctr	11.7	*8.7*	7.6	6.2
Parkway Swim Club	12.5	*8.3*	9.6	*7.9*
Southgate Library	11.1	8.8	8.1	6.3
David Reese Elem. School	*9.9*	8.1	7.6	5.9
Florin Elem. School	11.5	8.8	8.0	6.3
Elk Grove Adult & Comm. Ed.	11.3	8.7	7.8	6.5
Mack Rd Valley Hi Comm. Ctr	9.6	7.5	7.4	-
Mack Rd Partnership	11.6	9.1	8.8	6.7
Herman Leimbach Elem.	11.4	8.8	8.0	6.3
Valley High School	11.7	9.2	8.6	6.5
Valley Hi-North Laguna	*15.7*	*7.3*	-	-
Edwin A. Smith Comm. Pk	*11.3*	9.5	*8.5*	-
Isabella Jackson Elem. School	11.4	8.9	7.9	6.4
Irene B West Elem. School	10.9	8.3	7.4	5.9
Raymond Case Elem. School	*15.9*	*7.3*	*9.9*	6.8

[1] The mean was calculated from an average of each calendar quarter as described in 40 CFR Part 50 Appendix N Section 4.4.

Table 5-4. Peak daily Phase 1 monitoring network $PM_{2.5}$ levels.

Values are in italics if less than 75% of daily values were valid in each calendar quarter. If no value is shown, there were no valid 24-hour average values that year at that site. The maximum and 98th percentile $PM_{2.5}$ values are bolded if above the 24-hour $PM_{2.5}$ NAAQS of 35 µg/m³. The number of valid daily values in each year for each site ranged from 84 to 366.

Site	24-hour Average $PM_{2.5}$ (µg/m³)								Number of days above 24-hour $PM_{2.5}$ NAAQS			
	Maximum				98th Percentile[1]							
	‘20	‘21	‘22	‘23	‘20	‘21	‘22	‘23	‘2	‘21	‘22	‘23
Bowling Green Elem. School	**125**	**78**	**50**	32	**56**	**36**	**38**	28	20	11	11	0
Bowling Green Pk	***69***	***106***	**75**	**44**	***42***	***49***	**49**	**38**	*14*	*19*	27	11
Nicholas Pk	**141**	**84**	***53***	-	**55**	**37**	***37***	-	21	13	*6*	-
Nicholas Elem. School	**145**	**81**	**52**	*30*	**58**	**38**	**41**	*24*	21	12	13	*0*
Camellia Elem. School	**132**	**78**	***43***	-	**51**	31	*29*	-	14	1	*3*	-
District Council 16	**125**	**79**	**51**	35	**50**	**36**	**37**	28	19	11	9	0
Sac. Co. Sheriff Svc Ctr	**146**	***87***	**49**	**36**	**57**	***37***	**38**	29	21	*11*	10	1
Parkway Swim Club	**160**	***93***	**61**	***40***	**71**	***40***	**45**	*34*	20	*13*	20	*6*
Southgate Library	**125**	**75**	**54**	33	**52**	**37**	**39**	29	19	12	11	0
David Reese Elem. School	***135***	**78**	**49**	31	***55***	35	**37**	29	*18*	5	9	0
Florin Elem. School	**149**	**88**	**49**	33	**61**	**36**	**38**	29	20	12	11	0
Elk Grove Adult & Comm. Ed.	**147**	**90**	**48**	32	**59**	35	35	27	20	7	9	0
Mack Rd Valley Hi Comm. Ctr	**110**	**68**	**50**	-	**48**	33	**36**	-	18	3	10	-
Mack Rd Partnership	**139**	**82**	**55**	35	**56**	**38**	**40**	31	21	17	14	1
Herman Leimbach Elem.	**134**	**80**	**57**	35	**58**	**37**	**39**	28	21	11	10	0
Valley High School	**140**	**82**	**61**	35	**56**	**40**	**43**	31	20	20	14	1
Valley Hi-North Laguna	***51***	***91***	-	-	***43***	***41***	-	-	*3*	*12*	-	-
Edwin A. Smith Comm. Pk	***136***	**86**	***56***	-	***64***	**39**	***40***	-	*22*	17	*7*	-
Isabella Jackson Elem. School	**139**	**86**	**50**	34	**61**	**36**	**37**	28	22	13	10	0
Irene B West Elem. School	**126**	**76**	**52**	35	**58**	35	**36**	27	20	8	10	1
Raymond Case Elem. School	***49***	***90***	***58***	**40**	***44***	***39***	***46***	29	*3*	*11*	*7*	2

5.2. Phase 2 monitoring

Phase 2 monitoring included black carbon, speciated $PM_{2.5}$, speciated PM_{10}, and VOCs. The $PM_{2.5}$ and PM_{10} samples were speciated, or analyzed, for metals. Phase 2 monitoring took place from August 2020 through December 2021 (**Table 4-4**). The primary purpose of Phase 2 monitoring was as a screening tool for the placement of Phase 3 monitoring.

[1] The 98th percentile was calculated based on Table 1 of 40 CFR Part 50 Appendix N Section 4.5.

Phase 2 monitoring consisted of six different stand-alone monitor sites, shown in **Figure 3-2**. Only one site was part of the Phase 1 monitoring network — sensitive receptor site Florin Elementary School (**Figure 3-1**). Phase 2 monitoring also included the sensitive receptor site Cosumnes River College (monitor was located near a daycare center). Sites varied in the types of land use surrounding each site, but all sites were within 1000’ of residential areas. Phase 2 monitoring sites are described below.

Sacramento Fire Department Station 56

The site is in the northwest corner of the initial South Sacramento-Florin CAMP boundary. Highway 99 is about 1500’ east of the site. The site is located along an arterial road and truck route (47^{th} Avenue). There are distribution centers to the west of the site as well as some coating operations. There are two gasoline dispensing facilities (gas stations) about 400’ from the site (one is northwest of the site and the other is east of the site). There is a railroad about a half mile west of the site. The site is closest to some sources of concern identified by the Steering Committee that were outside the initial South Sacramento-Florin CAMP boundaries, including a natural gas-fired power plant, the Sacramento Executive Airport, and an industrial/business zone where the Campbell Soup plant used to be located.

City of Sacramento Pump Station No. 50

The site is in the northeast area of the initial South Sacramento-Florin CAMP boundary. The site is surrounded by a residential area. There is an industrial zone about 2000’ east of the site and a railroad about a mile east of the site.

Florin Elementary School

The site is in the northeast area of the initial South Sacramento-Florin CAMP boundary. As an elementary school the site is considered a sensitive receptor site. The site is in a residential area. There is an arterial road about 800’ west of the site (Power Inn Rd) and 1500’ north of the site (Florin Rd). There is an industrial zone about 2000’ east of the site and a railroad about a half mile east of the site.

Veterans of Foreign Wars Post 1267

The site is located north centrally within the initial South Sacramento-Florin CAMP boundaries. There is an auto dismantling facility south of the site. Highway 99 is about 2000’ west of the site. A large intersection and truck route is about 500’ southeast of the site (Gerber Road and Stockton Boulevard). At this same intersection, there is a gasoline dispensing facility.

Cosumnes River College

The site is in the southwest area of the initial South Sacramento-Florin CAMP boundary. The Steering Committee identified the area as having odors from the Sacramento Regional Wastewater Treatment Plant, which is located about 2 miles west of the site. The site is considered a sensitive receptor site as the monitor was placed near the Child

Development Center (a daycare center). The area surrounding the college is largely residential. Highway 99 is about a half mile east of the site. An arterial road is about 600' east of the site (Bruceville Road).

Impact Church
The site is in the southeast area of the initial South Sacramento-Florin CAMP boundary. Highway 99 is about 1000' west of the site. An arterial road is about 500' east of the site (Power Inn Rd). Some of the surrounding area is commercial, including a gasoline dispensing facility about 700' south of the site.

5.2.1. Black carbon

5.2.1.1. Site comparisons

Phase 2 monitoring black carbon levels were compared between the six monitoring sites. As a component of $PM_{2.5}$, black carbon levels similarly varied over time, making it difficult to identify site differences (see **section 5.2.1.2**). To control the effects of seasonal variation, data were limited to when all six sites had a valid value for the site comparisons shown in **Figure 5-6**, **Table 5-5**, and **Table 5-6**. Time periods where all six sites were reporting only occurred in fall 2021 and comprised a total of 45 different days between September 16th, 2021 and November 28th, 2021 (**Figure 4-10**). The black carbon levels described from this dataset are not necessarily representative of year-round conditions.

As introduced in **section 5.1.2**, one method of comparing sites is the squared Pearson's correlation coefficient (R^2). In contrast to the Phase 1 monitoring $PM_{2.5}$ levels, there was some variation between sites using this comparison for black carbon levels. Site comparisons with an R^2 less than 0.75 are bolded in **Table 5-5**. The Sacramento Fire Department Station 56 site had an R^2 less than 0.75 when compared to all other sites, potentially indicating that the site had unique trends in black carbon pollution levels compared to the other Phase 2 monitoring sites. However, this site also used a different black carbon monitor than the other five Phase 2 monitoring sites (**section 4.3.1**). It is unknown how much of the difference between the Sacramento Fire Department Station 56 site and the other sites is due to a difference in monitor. The other five sites had an R^2 greater than 0.75 when compared to each other, indicating these sites had similar trends in black carbon levels.

The Phase 2 monitoring black carbon site averages are shown in **Figure 5-6**. The site with the greatest average black carbon levels was the Sacramento Fire Department Station 56 site with an average of 0.94 µg/m^3. This site used a different black carbon monitor than the other sites, but it is not expected that the monitor would overestimate black carbon levels (**section 4.3.1.3**). The Sacramento Fire Department Station 56 site is located along a truck route and is also near distribution centers, industrial zones, and Highway 99. The second greatest black carbon site average was 0.89 µg/m^3 at the Florin Elementary School site. Although this site is located further from Highway 99, there is evidence that there is a greater traffic volume along Power Inn Rd than in most areas of the initial South Sacramento-Florin CAMP boundary outside of the Highway 99 corridor, and Florin Elementary School is located near this road (**Figure E-2** of Appendix E). The Veterans of Foreign Wars Post 1267 site had the third greatest black carbon average of 0.85 µg/m^3 and is located near a large intersection and truck route (Stockton Blvd and Gerber Rd). The other three site black carbon averages were similar and ranged from 0.77 to 0.78 µg/m^3.

Table 5-5. Squared Pearson's correlation coefficients (R^2) between the Phase 2 monitoring sites for black carbon.

Comparison applied to daily black carbon levels and was limited to when all sites had a reported value. Sample size of each site comparison equal to 45. Values less than or equal to 0.75 in bold type.

Site	Squared Pearson's correlation coefficient (R^2)					
	Sacramento Fire Department Station 56	City of Sacramento Pump Station No. 50	Florin Elementary School	Veterans of Foreign Wars Post 1267	Cosumnes River College	Impact Church
Sacramento Fire Department Station 56	1.00	**0.69**	**0.68**	**0.73**	**0.71**	**0.64**
City of Sacramento Pump Station No. 50	**0.69**	1.00	0.87	0.89	0.87	0.87
Florin Elementary School	**0.68**	0.87	1.00	0.97	0.98	0.98
Veterans of Foreign Wars Post 1267	**0.73**	0.89	0.97	1.00	0.98	0.98
Cosumnes River College	**0.71**	0.87	0.98	0.98	1.00	0.97
Impact Church	**0.64**	0.87	0.98	0.98	0.97	1.00

Phase 2 monitoring black carbon levels are compared between sites in **Table 5-6**. The mean values shown in **Table 5-6** are the same as those in **Figure 5-6**. The three sites with the greatest black carbon mean values (Sacramento Fire Department Station 56, Florin Elementary School, and Veterans of Foreign Wars Post 1267) also had the greatest median values. As the median is not as affected by outlier values, it indicates these sites had consistently greater black carbon levels compared to the other three sites. The Florin Elementary School site had the greatest maximum black carbon levels. The maximum values shown in **Table 5-6** occurred on Thanksgiving and the day after Thanksgiving (November 25th and 26th, 2021) for all sites except the Sacramento Fire Department 56 site (its maximum occurred on October 16th, 2021), potentially measuring preferential residential wood burning on holidays. Black carbon levels during winter holidays are shown in the next section in **Figure 5-10**.

Phase 2 monitoring black carbon levels are compared over time across the six sites in **Figure 5-7**. Generally, sites had similar peaks and valleys over time, indicating that some sources or processes contributing to black carbon levels are common to all Phase 2 monitoring sites. The

Sacramento Fire Department Station 56 site generally had the greatest black carbon levels compared to the other five sites over the time periods where it had valid data (**Figure 5-7**).

Some site differences for Phase 2 monitoring black carbon levels may be within the measurement differences expected between monitors. The monitor deployed at the Sacramento Fire Department Station 56 site was not collocated with the monitors deployed at the other five sites, and it is unknown how much of the difference between this site and the other five sites is due to differences between monitors. The other five black carbon monitors were located together prior to deployment and were evaluated for differences (**section 4.3.1.3**). The mean absolute difference in paired monitor measurements ranged from 0.03 to 0.13 µg/m^3 for daily averages Ta**ble 4-8**). The difference in site averages for the City of Sacramento Pump Station No. 50, Cosumnes River College, and Impact Church sites are within the mean absolute difference measured between these monitors, and as such the differences in the site average between these sites may only be due to differences between monitors. In contrast, the difference between the Florin Elementary School site average and those of the other sites with the same type of monitor is greater than the mean absolute difference between monitors. The greater site average for the Florin Elementary School site is likely not solely attributed to differences in monitors.

5.2.1.2. Trends in pollution levels

As was observed for the Phase 1 monitoring $PM_{2.5}$ levels, the Phase 2 monitoring black carbon trends were generally consistent across all sites for the different time averaging intervals described in this section (seasonal averages, monthly averages, day-of-week averages, and time-of-day averages). For this reason, all Phase 2 monitoring sites are included in the averages. Consistency in trends across sites indicate that the contributing factors to the black carbon trends observed are common across the South Sacramento-Florin community.

Phase 2 monitoring black carbon levels were found to vary throughout the year, with levels greatest in winter, followed by fall, summer, and then spring (**Figure 5-8**). The winter black carbon average was about four times that of the spring average. The summer and fall black carbon levels were likely affected by severe regional wildfire smoke that occurred during monitoring. The greatest monthly average black carbon level was the month of August in 2020, when there was wildfire smoke present regionally from the August Complex, SCU Lightning Complex and LNU Lightning Complex wildfires (**Figure 5-9**).

Greater black carbon levels were observed over winter holidays during Phase 2 monitoring. The maximum daily black levels measured at each site over winter holidays are shown in **Figure 5-10**, and ranged from 2.09 to 3.85 µg/m^3 (compared to the winter average of 1.37 µg/m^3 shown in **Figure 5-8**). Preferential residential wood burning over winter holidays may be responsible for the greater levels observed. Based on a survey completed during the winter of 2016-2017, about 25% of residents in South Sacramento that use an indoor fireplace mainly use it on holidays . All

Phase 2 monitoring sites are within 1000’ of residential areas and potentially influenced by residential emissions.

Phase 2 monitoring black carbon trends throughout the week differed depending on the time of year. For the months of November through February, average black carbon levels were greater on the weekend than on weekdays (**Figure 5-11**). Potentially, this indicates a source of black carbon pollution that occurs more on weekends. Considering this trend was not observed for the warmer months of the year, it may be from preferential residential wood burning on weekends. For the months of March through October, the average black carbon levels increased throughout the week with the lowest levels on Sunday (**Figure 5-11**). This is potentially indicative of pollution that is emitted during weekdays and accumulated during successive days.

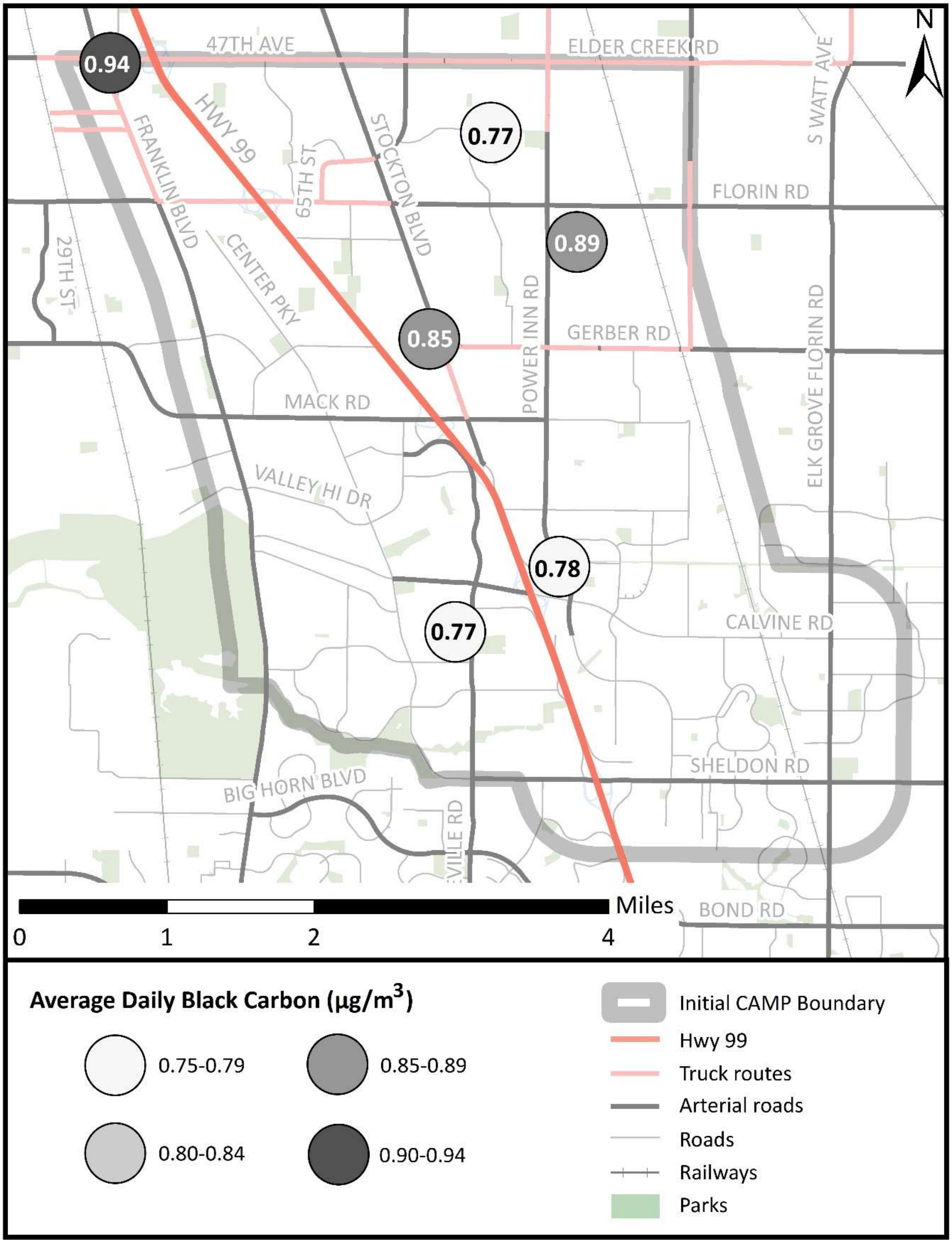

Figure 5-6. Site comparison of Phase 2 monitoring average black carbon levels.

Site average sample size equals 45. See **Figure 3-2** for site location names.

Table 5-6. Site comparison of Phase 2 monitoring black carbon levels.

Data limited to when all six sites had a valid black carbon value (total of 45 dates during fall 2021).

Site	24-hour Average Black Carbon (µg/m³)		
	Median	Mean	Maximum
Sacramento Fire Department Station 56	0.62	0.94	2.79
City of Sacramento Pump Station No. 50	0.52	0.77	3.15
Florin Elementary School	0.56	0.89	3.85
Veterans of Foreign Wars Post 1267	0.55	0.85	3.53
Cosumnes River College	0.47	0.77	3.07
Impact Church	0.53	0.78	3.49

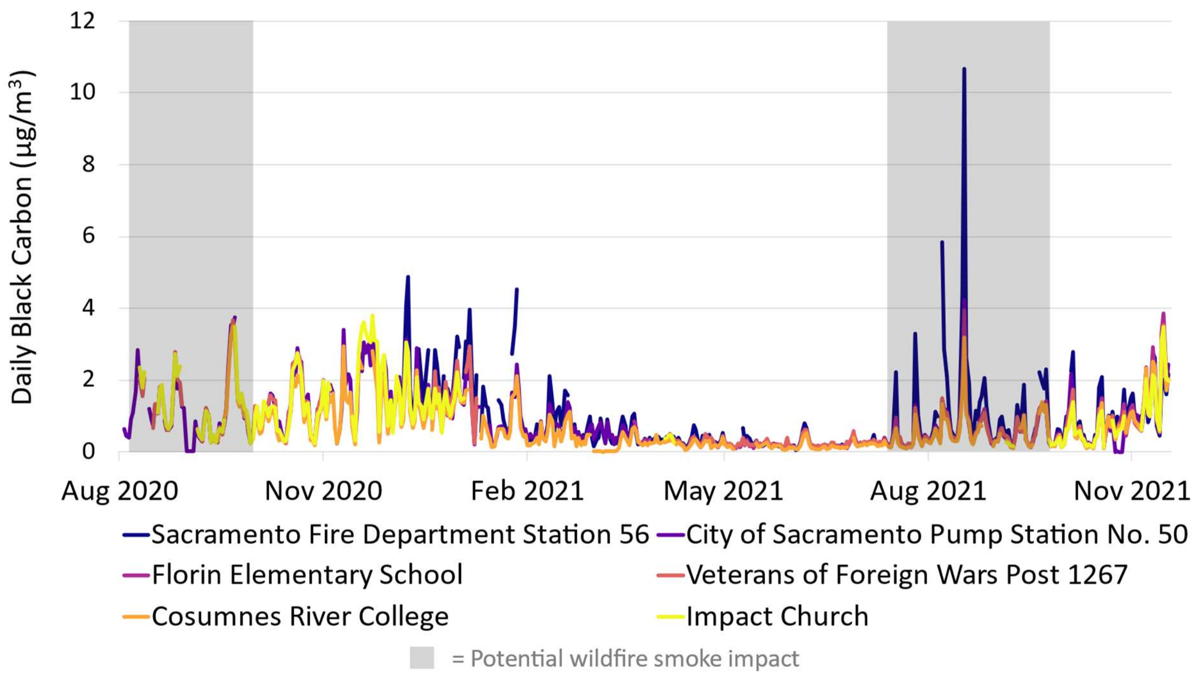

Figure 5-7. Phase 2 monitoring daily black carbon levels.

Shaded areas of the graph are intervals when there was a potential wildfire smoke impact.

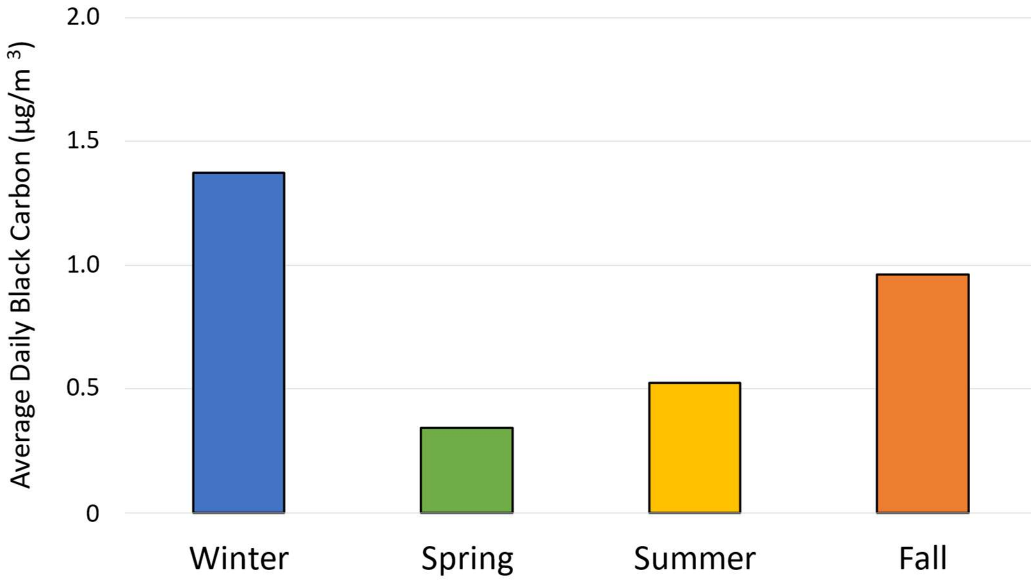

Figure 5-8. Seasonal averages of Phase 2 monitoring black carbon levels.

Average of all valid 24-hour average black carbon values reported by Phase 2 monitoring sites in each season. Each season was designated as follows: winter included the months of December, January, and February; spring included the months of March, April, and May; summer included the months of June, July, and August; and fall included the months of September, October, and November. Average sample size ranged from 540 to 1,086.

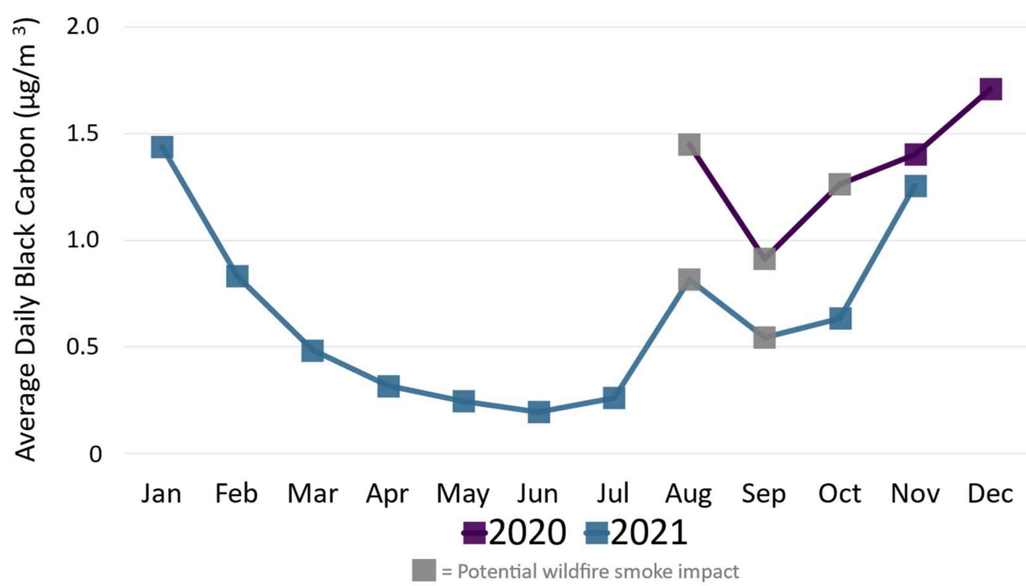

Figure 5-9. Monthly averages of Phase 2 monitoring black carbon levels.

Average of all valid 24-hour average black carbon concentrations reported by Phase 2 monitoring sites in each month and year. Averages marked in gray had at least 10 days in the month with a potential wildfire smoke impact. Average sample size ranged from 120 to 186.

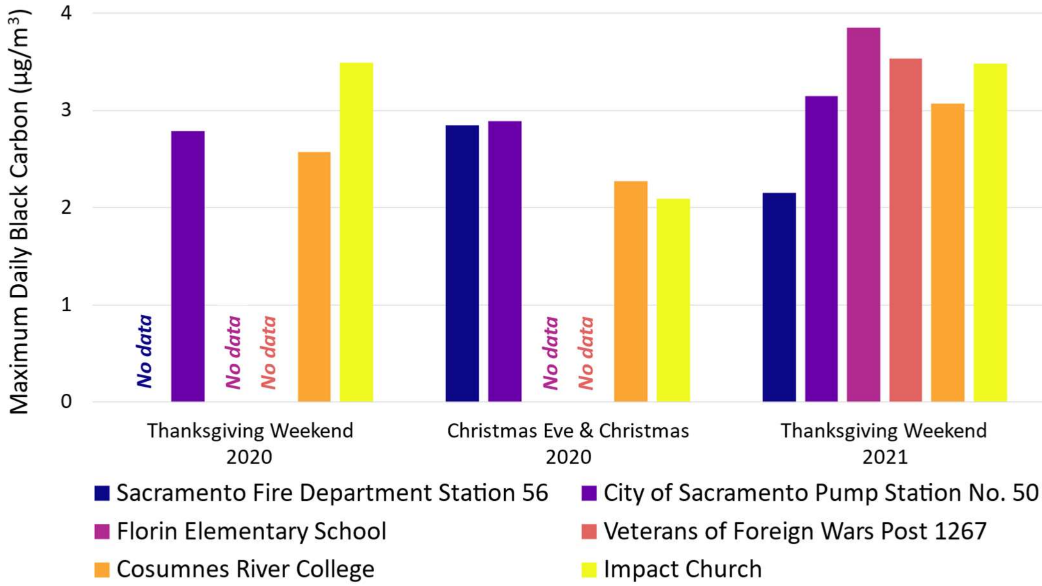

Figure 5-10. Maximum Phase 2 monitoring black carbon levels over winter holidays.

The holiday weekends were identified as follows: Thanksgiving weekend 2020 was November 26th through November 29th, 2020; Christmas Eve and Christmas 2020 was December 24th and December 25th, 2020; and Thanksgiving weekend 2021 was November 25th through November 28th, 2021.

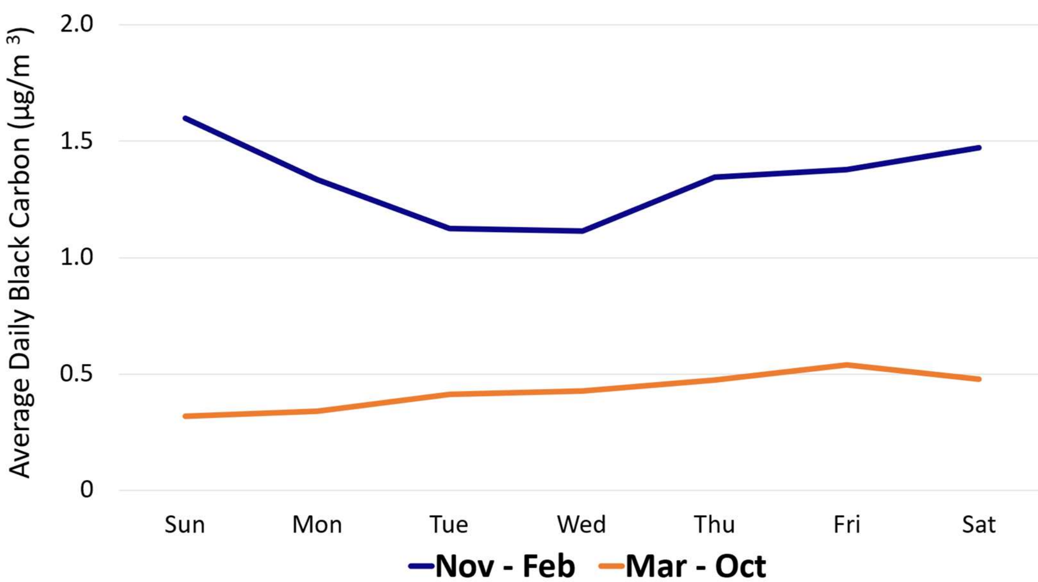

Figure 5-11. Day-of-week averages of Phase 2 monitoring black carbon levels.

Average of all valid 24-hour average black carbon concentrations reported by Phase 2 monitoring sites in each day of the week during the month range. Average sample size ranged from 72 to 112. Potentially wildfire smoke impacted dates were excluded (**section 4.2.5**).

Phase 2 monitoring black carbon time-of-day trends were similar to that seen with Phase 1 monitoring $PM_{2.5}$ levels, with average black carbon levels greater overnight than during the day (**Figure 5-4** and **Figure 5-12**). As was described for $PM_{2.5}$ levels in **section 5.1.3**, the diurnal pattern for black carbon levels is likely influenced by mixing height. The morning peak and the increasing levels starting in late afternoon may be influenced by traffic emissions. For the months of November through February, the greatest average black carbon level occurred over the 9pm hour, while in the months of March through October, the greatest average black carbon level is at the 7am hour. The late evening peak over the late fall and winter months is likely due in part from seasonal meteorology differences, as temperature inversions are more severe over the winter months and cause pollution levels to become more concentrated. However, the late evening peak was more pronounced for weekends compared to weekdays in the months of November through February; potentially this is indicating a residential wood burning contribution due to preferential use of residential wood burning on the weekend (**Figure 5-13**).

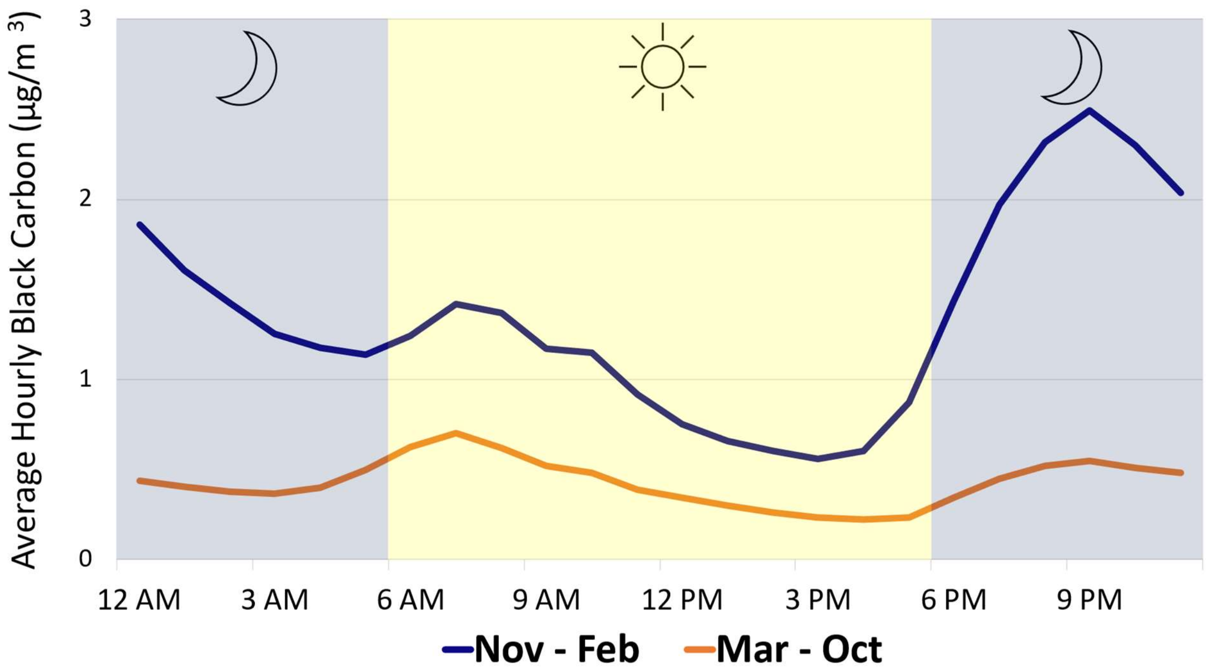

Figure 5-12. Time-of-day averages of Phase 2 monitoring black carbon levels.

Average of all valid 1-hour average black carbon values reported by Phase 2 monitoring sites for each hour of the day during the month range. Average sample size ranged from 538 to 777. Potentially wildfire smoke impacted dates were excluded (**section 4.2.5**).

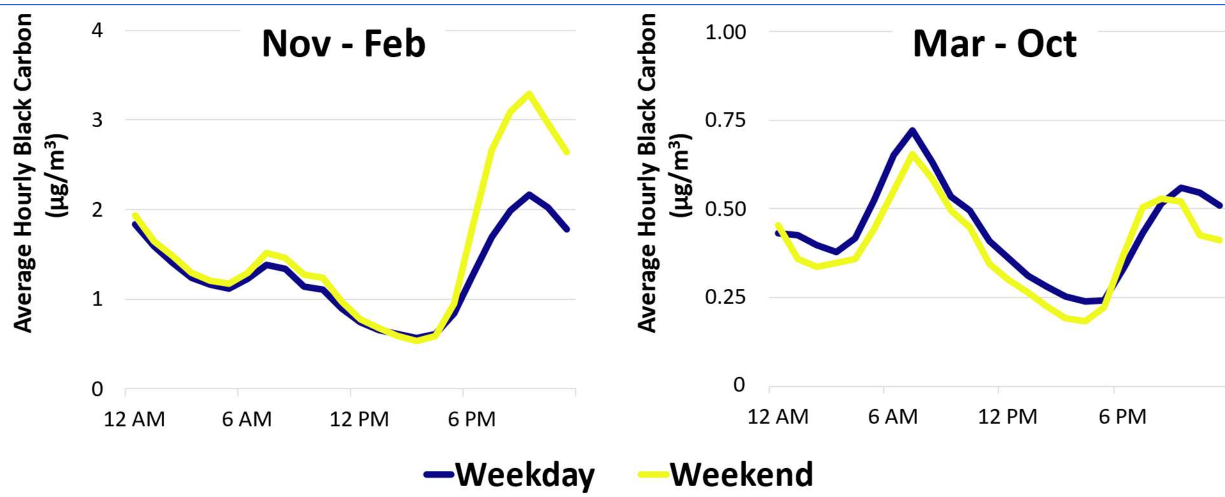

Figure 5-13. Phase 2 monitoring black carbon weekend and weekday time-of-day trends.

Average of all valid 1-hour average black carbon values reported by Phase 2 monitoring sites on that hour of the day for the day-of-week range. Day-of-week range is designated as follows: weekdays include Monday through Friday and weekend includes Saturday and Sunday. Average sample size ranged from 160 to 559. Potentially wildfire smoke impacted dates were excluded (**section 4.2.5**). Note the difference in vertical axis scale between the two graphs.

5.2.1.3. Comparison to District monitoring network sites

Phase 2 monitoring black carbon levels were compared to levels at District monitoring sites. Phase 2 monitoring black carbon levels were compared to the same reference monitor used for pre-deployment collocation, such that the Sacramento Fire Department Station 56 site was compared to the District monitoring network site Sacramento-Bercut Dr., and the other five South Sacramento-Florin sites were compared to the District monitoring network site Sacramento-Del Paso Manor (**section 4.3.1.3**). These comparisons are shown in **Table 5-7** and **Table 5-8** and were limited to when all monitoring sites included in the comparison had a valid daily black carbon value. The black carbon levels for the Sacramento Fire Department Station 56 site comparison were further limited to only those measured by the replacement monitor, as this monitor had the greatest agreement with the reference monitor (**Figure 4-9** and **Table 4-7**).

The Sacramento-Bercut Dr. monitoring site was established in 2015 with the intention of measuring near-road emissions. It is located about 65 feet east of Interstate-5 and 1 mile north of downtown Sacramento in the Railyards area. The monitoring station is about 6 miles north-northwest from the initial South Sacramento-Florin CAMP boundary. The Sacramento-Del Paso Manor site was established in 1979 and the black carbon monitor was installed in 1998 as part of the California Regional Particulate Air Quality Study and has remained in place as a Special Purpose Monitor. The Sacramento-Del Paso Manor site is in a residential neighborhood and is intended to capture population exposure downwind of downtown. The site is about 7 miles northeast of the initial South Sacramento-Florin CAMP boundary in the Arden-Arcade area

Black carbon levels at South Sacramento-Florin sites were compared to the District monitoring network sites using the squared Pearson's correlation coefficient (**Table 5-7**). Comparisons between the South Sacramento-Florin sites and the Sacramento-Del Paso Manor site had a squared Pearson's correlation coefficient greater than 0.75, indicating these South Sacramento-Florin sites had similar black carbon trends to the Sacramento-Del Paso Manor site. In contrast, the comparison between the Sacramento Fire Department Station 56 site and the Sacramento-Bercut Dr. site had a correlation coefficient of $R^2 = 0.64$, indicating these two areas have dissimilar black carbon trends.

Table 5-7. Squared Pearson's correlation coefficients (R^2) between the South Sacramento-Florin Phase 2 monitoring sites and the District monitoring network sites for black carbon.

Comparison applied to 24-hour average black carbon levels at the South Sacramento-Florin Phase 2 monitoring sites and the District monitoring network sites. A correlation coefficient less than 0.75 is bolded.

South Sacramento-Florin Site	Reference Monitor Site	Squared Pearson's correlation coefficient (R^2)
Veterans of Foreign Wars Post 1267	Sacramento-Del Paso Manor	0.80
City of Sacramento Pump Station No. 50	Sacramento-Del Paso Manor	0.90
Florin Elementary School	Sacramento-Del Paso Manor	0.90
Impact Church	Sacramento-Del Paso Manor	0.92
Cosumnes River College	Sacramento-Del Paso Manor	0.85
Sacramento Fire Department Station 56	Sacramento-Bercut Dr.	**0.64**

The mean, median, and maximum black carbon values for the South-Sacramento Florin sites were compared to the District monitoring sites in **Table 5-8**. The Florin Elementary School site had a greater mean black carbon value compared to the Sacramento-Del Paso Manor site, but the difference was within the mean absolute error measured during collocation (0.12 µg/m^3) and could be attributable to differences between monitors (**Table 4-7**). The five South Sacramento-Florin sites compared to the Sacramento-Del Paso Manor site had lower median values compared to Sacramento-Del Paso Manor, indicating the black carbon levels at these sites are often lower than that of the Arden-Arcade area. The maximum black carbon levels at the Florin Elementary School, Veterans of Foreign Wars Post 1267, and Impact Church sites were greater than that at the Sacramento-Del Paso Manor site, potentially indicating that greater peak levels are experienced in the South Sacramento-Florin community compared to the Arden-Arcade area. The Sacramento Fire Department Station 56 site had a greater mean black carbon value than the Sacramento-Bercut Dr. site. The difference in averages was greater than the mean absolute error measured during pre-deployment collocation (0.01 µg/m^3), indicating the difference is likely not solely attributable to differences between monitors (**Table 4-7**). In contrast, the median black carbon value at the Sacramento Fire Department Station 56 site was less than that of the Sacramento-Bercut Dr. site, indicating that black carbon levels are often more elevated at the Sacramento-Bercut Dr. site even though the overall average is lower. The maximum black carbon value at the Sacramento Fire Department Station 56 site was about three times greater than that at the Sacramento-Bercut Dr. site, indicating the Sacramento Fire Department Station 56 site experiences greater peak levels. It is notable that the mean and maximum black carbon levels were greater at the Sacramento Fire Department Station 56 site despite the Sacramento-Bercut Dr. site being located much closer to a highway — the Sacramento-Bercut Dr. site is less than 100' from Interstate-5 compared to the Sacramento Fire Department Station 56 site located about 1500' from Highway 99. However, there is a potential that the Sacramento Fire Department Station 56 site was in a hotspot of hyperlocal emissions, as the monitor was located close to the ingress and egress for the fire station. If this is the case, the levels measured at the Sacramento Fire Department Station 56 site are not representative of the surrounding area.

Table 5-8. Comparison of black carbon mean, median, and maximum values at the South Sacramento-Florin Phase 2 monitoring sites to District monitoring network sites.

The Sacramento-Del Paso Manor site comparison is a total of 46 dates. The Sacramento-Bercut Dr. comparison is a total of 216 dates. Values greater than the reference site value are shown in bold type.

Site	24-hr Average Black Carbon ($\mu g/m^3$)		
	Mean	Median	Maximum
Sacramento-Del Paso Manor site comparison			
City of Sacramento Pump Station No. 50	0.80	0.54	3.15
Florin Elementary School	**0.93**	0.59	**3.85**
Veterans of Foreign Wars Post 1267	0.89	0.60	**3.53**
Cosumnes River College	0.80	0.56	3.07
Impact Church	0.81	0.58	**3.49**
Sacramento-Del Paso Manor	**0.89**	**0.72**	**3.24**
Sacramento-Bercut Dr. site comparison			
Sacramento Fire Department Station 56	**0.73**	0.38	**10.67**
Sacramento-Bercut Dr.	**0.63**	**0.44**	**3.50**

5.2.2. Fine and coarse particulate matter ($PM_{2.5}$ and PM_{10})

5.2.2.1. Site comparisons

Phase 2 monitoring $PM_{2.5}$ and PM_{10} levels were compared between the six monitoring sites. It was demonstrated in **section 5.1.3** that $PM_{2.5}$ levels vary seasonally, and it was also found that PM_{10} levels vary over time (**Figure 5-17**). To control the effects of variation over time, the comparisons between sites that are shown in **Table 5-9**, **Table 5-10**, **Figure 5-14**, **Figure 5-15**, **Table 5-11**, and **Table 5-12** only included dates when there was a valid sample for all six sites. This is a total of 54 dates for $PM_{2.5}$ and a total of 19 dates for PM_{10}. The dataset is weighted towards fall and winter (**Figure 4-11** and **Figure 4-12**). As a result, the data presented are intended primarily for site comparisons and are not considered representative of year-round conditions.

As previously described in **sections 5.1.2** and **5.2.1.1**, one method of comparing pollution levels between sites is the squared Pearson's correlation coefficient (R^2). Site comparisons of Phase 2 monitoring $PM_{2.5}$ levels consistently had a squared Pearson's correlation coefficient greater than 0.75, indicating all sites had similar $PM_{2.5}$ trends to each other **(Table 5-9**). This is consistent with Phase 1 monitoring sites (**Table C-1** of Appendix C). The PM_{10} trends showed more variation between sites compared to $PM_{2.5}$ as lower R^2 values were observed between sites (**Table 5-9** and **Table 5-10**). It is expected that PM_{10} levels would vary more than $PM_{2.5}$ between sites as the PM_{10} fraction includes coarser particles that do not travel as far as $PM_{2.5}$, making them more reflective of local rather than regional sources. For site comparisons of Phase 2 monitoring PM_{10} levels, the Veterans of Foreign Wars Post 1267 and Florin Elementary School sites had a squared Pearson's correlation coefficient equal to 0.75, potentially indicating these two sites have different trends in PM_{10} levels compared to each other. The rest of the site comparisons had a squared Pearson's correlation coefficient greater than 0.75, indicating these sites had similar PM_{10} trends to each other (**Table 5-10**).

Phase 2 monitoring $PM_{2.5}$ site averages are shown in **Figure 5-14**. The Veterans of Foreign Wars Post 1267 site had the greatest average $PM_{2.5}$ levels of 19.1 $\mu g/m^3$. This site also had the greatest median and 98th percentile $PM_{2.5}$ values of the six sites (**Table 5-11**). The difference between the Veterans of Foreign Wars Post 1267 site average and the three lowest $PM_{2.5}$ site averages — for the Cosumnes River College, Sacramento Fire Department Station 56, and City of Sacramento Pump Station No. 50 sites — is greater than the average measurement uncertainty reported by the laboratory, which ranged from 1.7 to 1.8 $\mu g/m^3$. This indicates that differences between these site averages are not entirely due to measurement uncertainty. The Veterans of Foreign Wars site has nearby sources similar to those seen for other Phase 2 monitoring sites, but potentially had greater $PM_{2.5}$ levels due to the combination of nearby sources. The Veterans of Foreign Wars Post 1267 site was in proximity to arterial roads, truck routes, scrap yard, fuel station, Highway 99, and residential woodsmoke. The Florin Elementary School site had the second greatest average $PM_{2.5}$ levels of 17.5 $\mu g/m^3$. There is evidence that there is elevated traffic volume along Power Inn Rd near the Florin Elementary School site (**Figure E-1** and **Figure E-2** of Appendix E).

Phase 2 monitoring PM_{10} site averages are shown in **Figure 5-15**. The site with the greatest PM_{10} average was the Sacramento Fire Department Station 56 site (28 µg/m^3) and the site with the second greatest PM_{10} average was the Veterans of Foreign Wars Post 1267 site (27 µg/m^3). These two sites also had the greatest median and maximum PM_{10} values of the six sites (**Table 5-12**). The difference between the site averages for the Sacramento Fire Department Station 56 or Veterans of Foreign Posts 1267 sites and the other four site averages (ranging from 22 to 24 µg/m^3) is greater than the average measurement uncertainty, which was approximately 2 µg/m^3. This indicates that the differences in these site averages are not entirely attributable to measurement uncertainty. There are open lots and gravel areas in industrial zones west of the Sacramento Fire Department Station 56 site. The Veterans of Foreign Wars Post 1267 site had the greatest $PM_{2.5}$ levels, which would have contributed to the PM_{10} levels (**Figure 5-14**).

Table 5-9. Squared Pearson's correlation coefficients (R^2) between the Phase 2 monitoring sites for $PM_{2.5}$.

Sample size of each site comparison equals to 54.

Site	Squared Pearson's correlation coefficient (R^2)					
	Sacramento Fire Department Station 56	City of Sacramento Pump Station No. 50	Florin Elementary School	Veterans of Foreign Wars Post 1267	Cosumnes River College	Impact Church
Sacramento Fire Department Station 56	1.00	0.94	0.95	0.97	0.97	0.96
City of Sacramento Pump Station No. 50	0.94	1.00	0.92	0.92	0.96	0.95
Florin Elementary School	0.95	0.92	1.00	0.98	0.97	0.97
Veterans of Foreign Wars Post 1267	0.97	0.92	0.98	1.00	0.98	0.98
Cosumnes River College	0.97	0.96	0.97	0.98	1.00	0.99
Impact Church	0.96	0.95	0.97	0.98	0.99	1.00

Table 5-10. Squared Pearson's correlation coefficients (R^2) between the Phase 2 monitoring sites for PM_{10}.

Sample size of each site comparison equal to 19. Levels less than or equal to 0.75 in bold type.

Site	Squared Pearson's correlation coefficient (R^2)					
	Sacramento Fire Department Station 56	City of Sacramento Pump Station No. 50	Florin Elementary School	Veterans of Foreign Wars Post 1267	Cosumnes River College	Impact Church
Sacramento Fire Department Station 56	1.00	0.92	0.82	0.87	0.84	0.91
City of Sacramento Pump Station No. 50	0.92	1.00	0.82	0.80	0.79	0.90
Florin Elementary School	0.82	0.82	1.00	**0.75**	0.82	0.81
Veterans of Foreign Wars Post 1267	0.87	0.80	**0.75**	1.00	0.89	0.84
Cosumnes River College	0.84	0.79	0.82	0.89	1.00	0.90
Impact Church	0.91	0.90	0.81	0.84	0.90	1.00

Phase 2 monitoring $PM_{2.5}$ and PM_{10} levels are shown over time for each site in **Figure 5-16** and **Figure 5-17**. For both $PM_{2.5}$ and PM_{10}, sites generally have the same peaks and valleys in time series, indicating sites shared similar $PM_{2.5}$ and PM_{10} trends over time. This potentially indicates that the sources or processes responsible for these trends over time are common across all sites. The U.S. EPA 24-hour $PM_{2.5}$ NAAQS is shown in **Figure 5-16** and the 24-hour PM_{10} CAAQS is shown in **Figure 5-17** for reference. The 24-hour PM_{10} CAAQS is shown instead of the 24-hour PM_{10} NAAQS as it is a lower value and more protective of public health. Most $PM_{2.5}$ levels above the 24-hour $PM_{2.5}$ NAAQS were on dates with a potential wildfire smoke impact (**section 4.2.5**). All PM_{10} samples were below the U.S. EPA 24-hour PM_{10} NAAQS of 150 µg/m^3, while there were three samples above the 24-hour PM_{10} CAAQS of 50 µg/m^3. Two of these three samples occurred on potentially smoke wildfire impacted dates (**section 4.2.5**).

Phase 2 monitoring simultaneous measurements of $PM_{2.5}$ and PM_{10} were compared for each site in **Figure 5-18**. The $PM_{2.5}$ level at each Phase 2 monitoring site is shown as a percentage of the PM_{10} level measured at the same time. Only dates where all six sites had a valid, detectable $PM_{2.5}$ and PM_{10} measurement are included in **Figure 5-18**. Most of these dates were potentially wildfire smoke impacted (**section 4.2.5**). The $PM_{2.5}$ fraction was generally about half of the PM_{10} fraction, but varied widely from 26% to 97% of the PM_{10} fraction. The Sacramento Fire Department Station 56 site generally had the lowest contribution to PM_{10} from the $PM_{2.5}$ fraction of the six sites, indicating the greater PM_{10} levels at this site were from the coarser $PM_{2.5-10}$ fraction. This is also evidenced by the Sacramento Fire Department Station 56 site having the second lowest average $PM_{2.5}$ levels despite having the greatest average PM_{10} levels of the six sites (**Figure 5-14** and **Figure 5-15**).

It was not evaluated how much of the difference in $PM_{2.5}$ and PM_{10} levels between Phase 2 monitoring sites could be attributed to variation between monitors. The monitors were not located together to measure and assess the differences between monitors. There could be some variation between sites that is due to the differences between monitors.

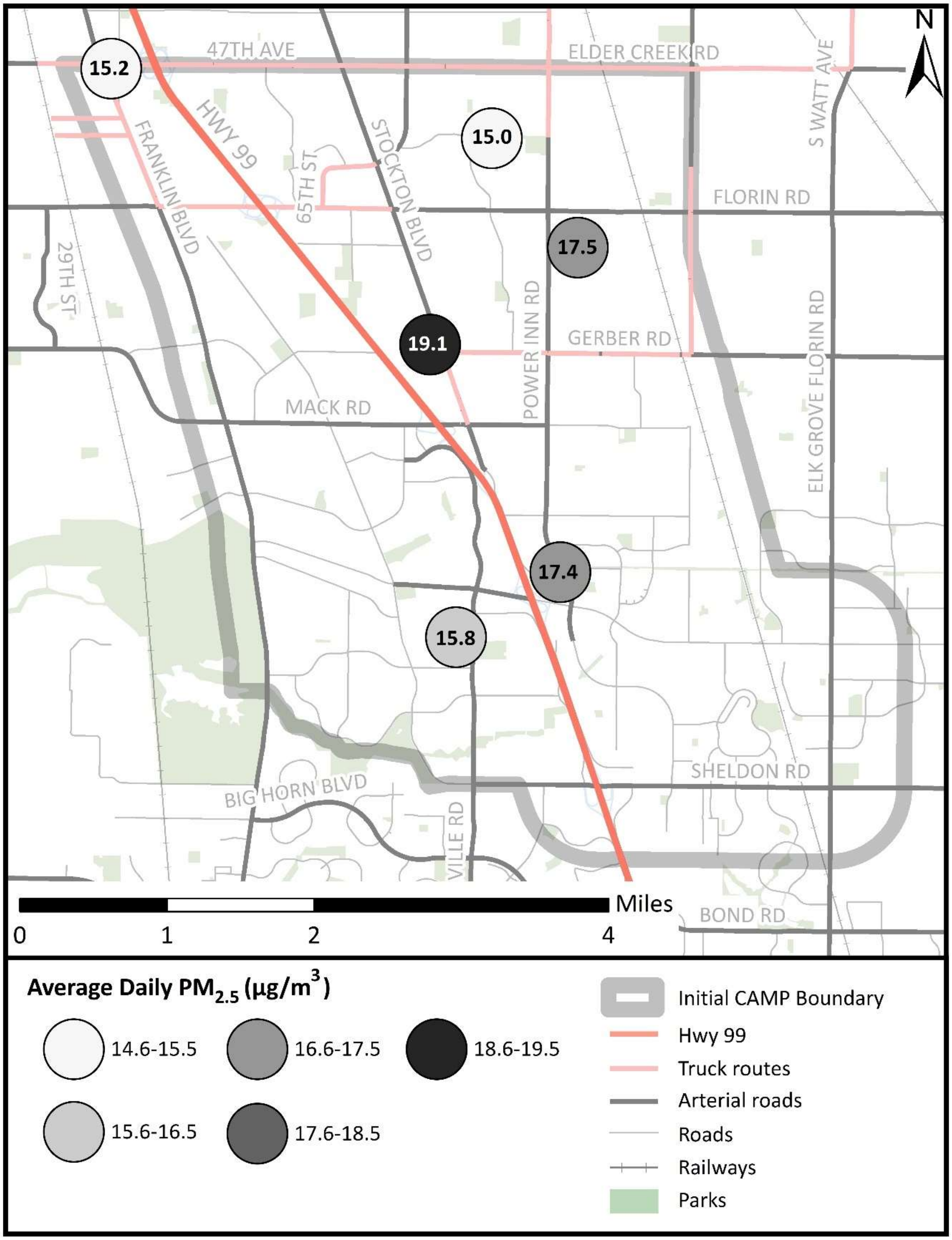

Figure 5-14. Site comparison of Phase 2 monitoring average $PM_{2.5}$ levels.

Sample size equals to 54. See **Figure 3-2** for site location names.

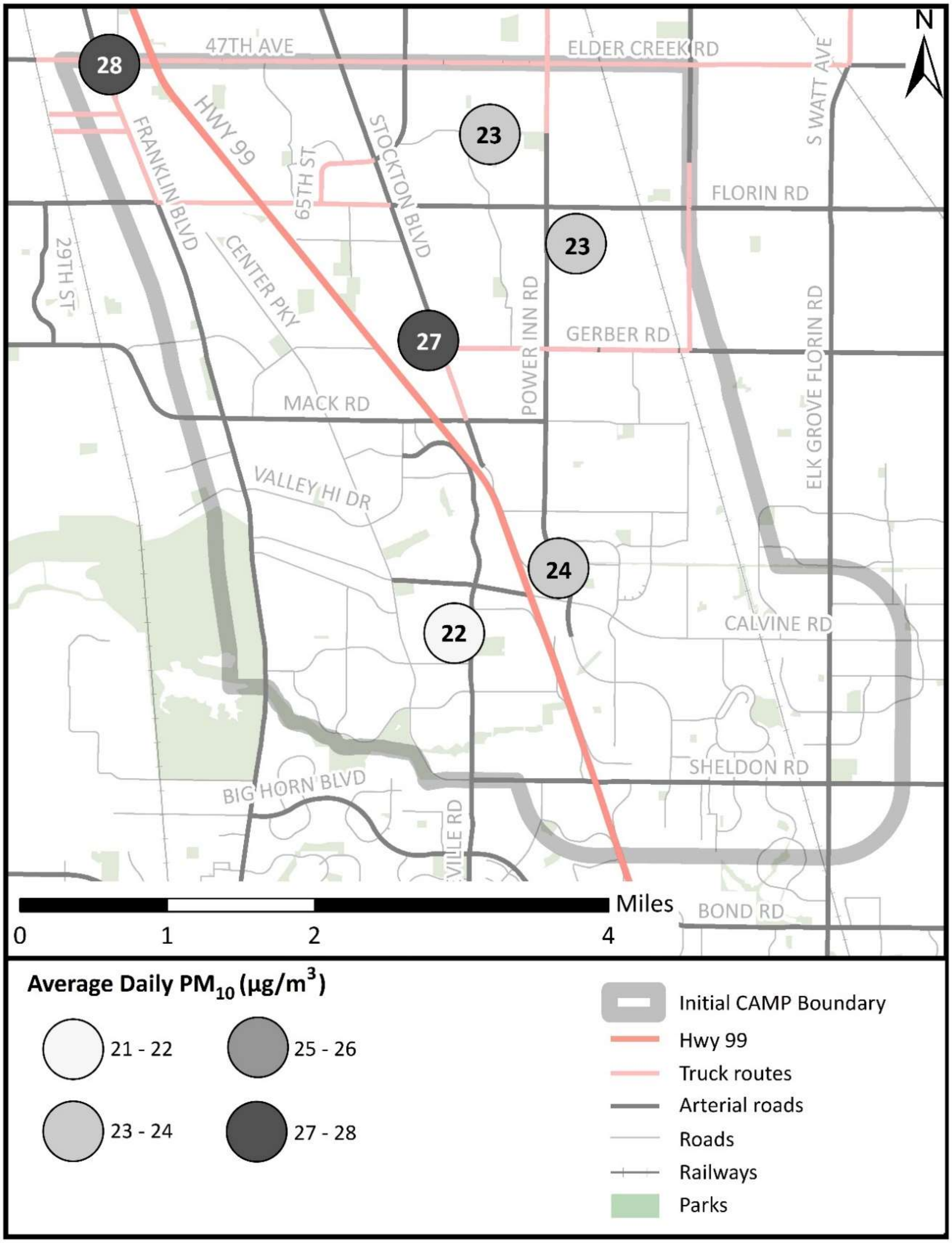

Figure 5-15. Site comparison of Phase 2 monitoring average PM_{10} levels.

One PM_{10} sample was below detection and was included in the average calculation as a zero value. Sample size equals to 19. See **Figure 3-2** for site location names.

Table 5-11. Site comparison of Phase 2 monitoring $PM_{2.5}$ levels.

The 98th percentile is the second greatest value. Site comparison sample size equal to 54 dates from September 2020 through November 2021.

Site	24-hour $PM_{2.5}$ ($\mu g/m^3$)			
	Median	Mean	98th Percentile	Maximum
Sacramento Fire Department Station 56	11.0	15.2	59.7	120.1
City of Sacramento Pump Station No. 50	9.7	15.0	57.8	134.0
Florin Elementary School	13.3	17.5	67.4	141.7
Veterans of Foreign Wars Post 1267	14.3	19.1	69.9	141.4
Cosumnes River College	11.1	15.8	63.5	136.4
Impact Church	12.2	17.4	62.6	147.6

Table 5-12. Site comparison of Phase 2 monitoring PM_{10} levels.

Site comparison sample size equal to 19 dates from July through November 2021. The 98th percentile is not shown separately as it is equivalent to the maximum value due to the small sample size.

Site	24-hour PM_{10} ($\mu g/m^3$)		
	Median	Mean	Maximum
Sacramento Fire Department Station 56	25	28	56
City of Sacramento Pump Station No. 50	19	23	49
Florin Elementary School	21	23	44
Veterans of Foreign Wars Post 1267	26	27	50
Cosumnes River College	21	22	41
Impact Church	20	24	49

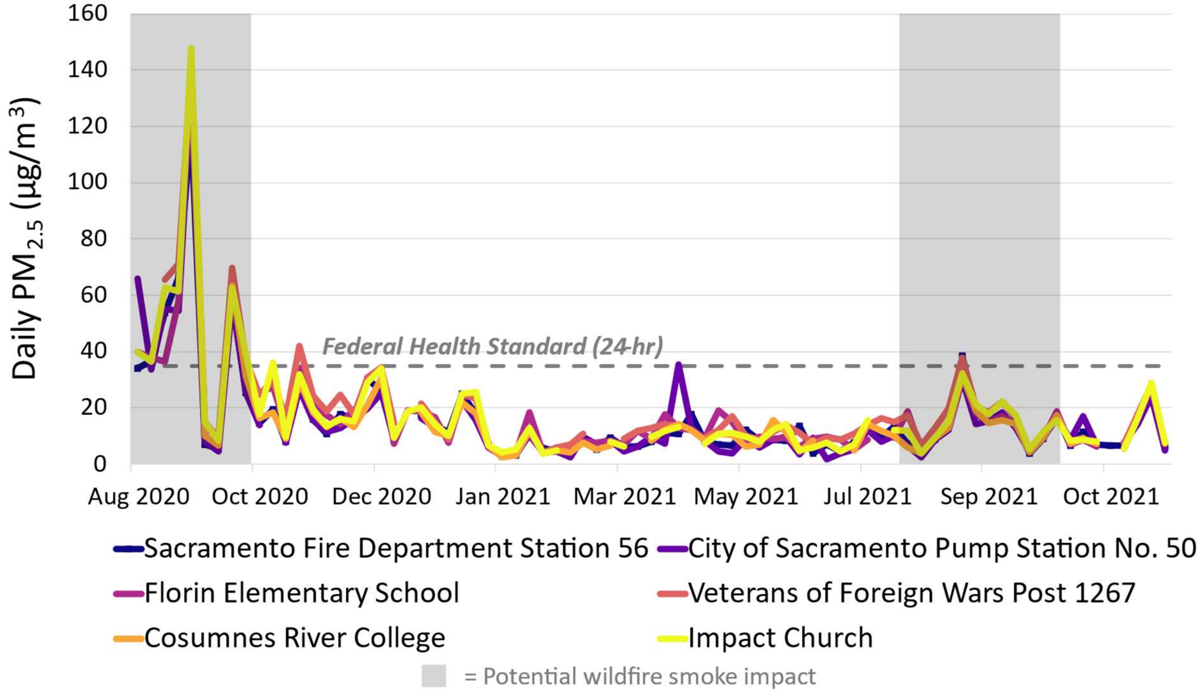

Figure 5-16. Phase 2 monitoring daily $PM_{2.5}$ levels.

Shaded areas of the graph are intervals when there was a potential wildfire smoke impact.

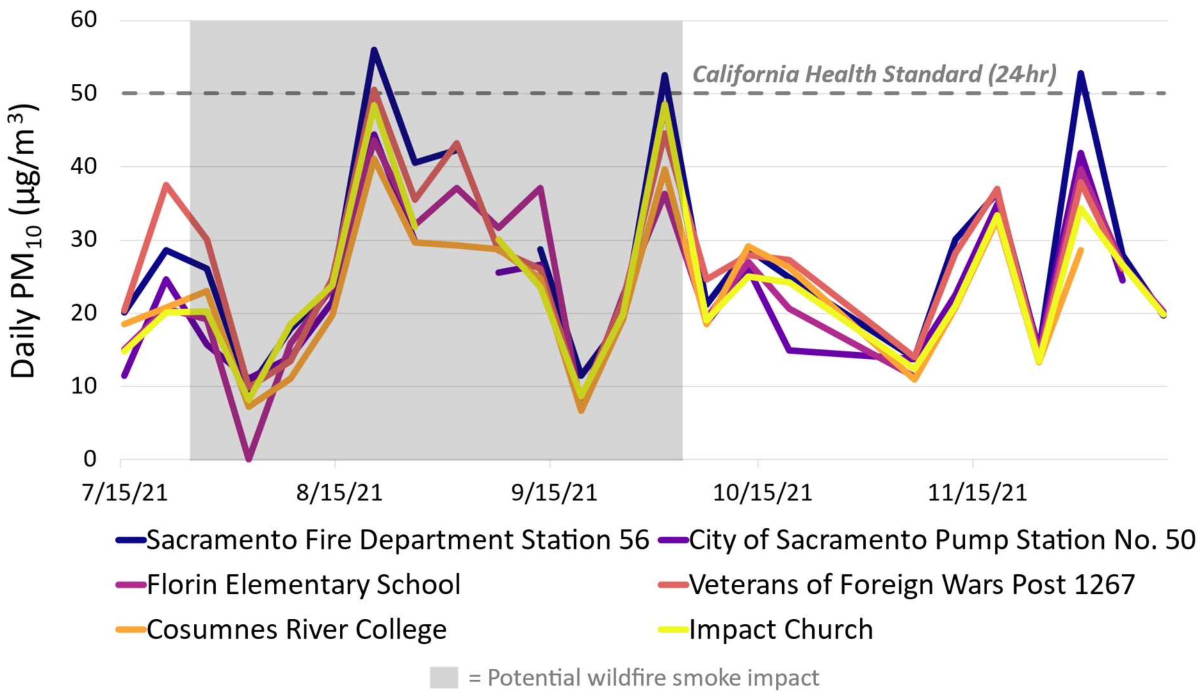

Figure 5-17. Phase 2 monitoring daily PM_{10} levels.

Shaded areas of the graph are intervals when there was a potential wildfire smoke impact.

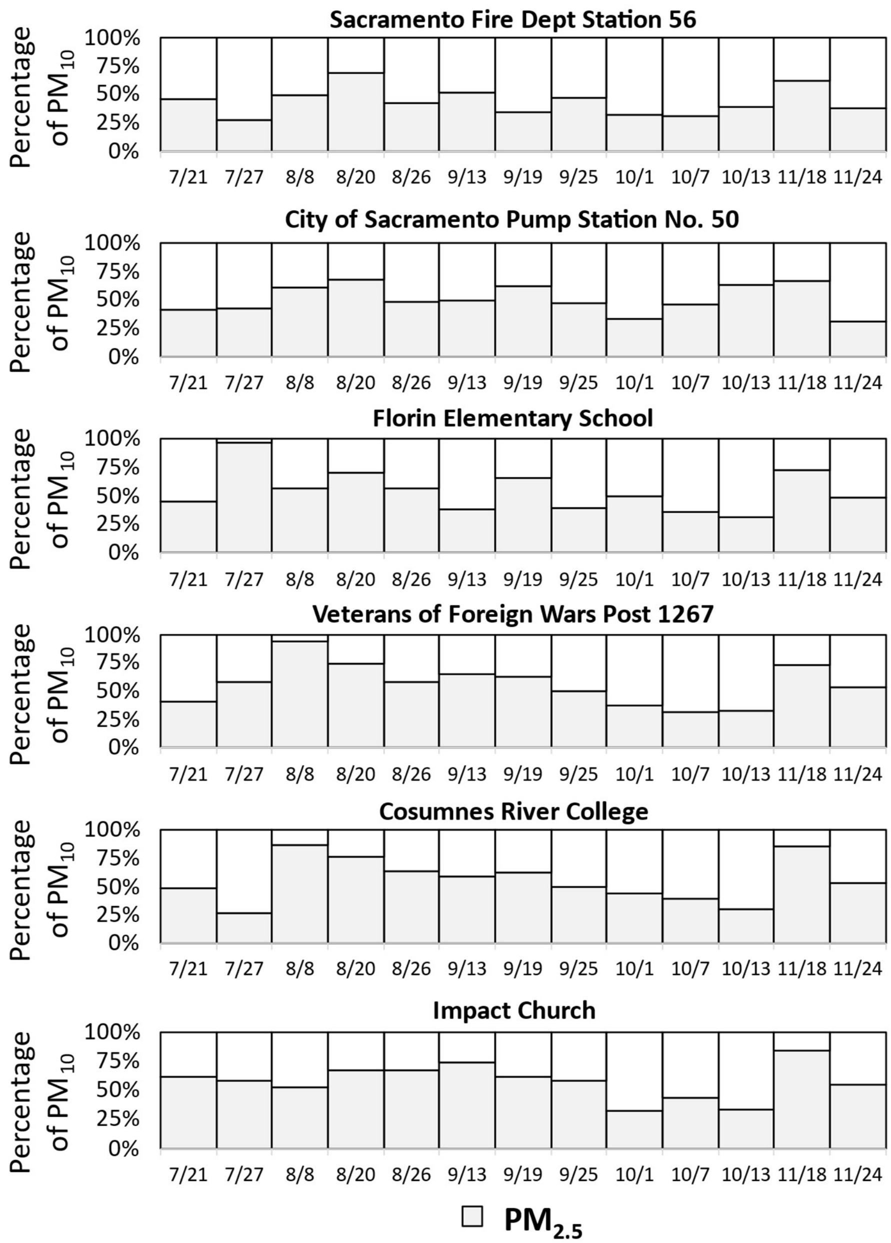

Figure 5-18. Comparison of simultaneous Phase 2 monitoring $PM_{2.5}$ and PM_{10} levels at each site.

The $PM_{2.5}$ level is shown as a percentage of the PM_{10} level measured at the same site on the same date (PM_{10} level is set at 100%).

5.2.2.2. Trends in pollution levels

Phase 2 monitoring $PM_{2.5}$ monthly averages by year are shown in **Figure 5-19**. As the monthly averages trend was found to be similar between the six sites, all six sites are included in the averages shown in **Figure 5-19**. The $PM_{2.5}$ annual NAAQS is included in **Figure 5-19** for comparison, which is based on an annual average value. The greatest monthly average $PM_{2.5}$ level in 2020 was September and in 2021 was August. During both of these months wildfire smoke was present regionally (**section 4.2.5**). For the calendar year 2021, the winter and late fall months of January and November had the greatest monthly $PM_{2.5}$ averages after August (there was no monitoring in December 2021). Monthly averages for PM_{10} are not shown due to the small sample size and shorter monitoring period.

Day-of-week trends for Phase 2 monitoring $PM_{2.5}$ and PM_{10} levels could not be fully evaluated because the one-in-six day sampling provided a limited sample size for each day of the week. In averaging across all sites with potentially wildfire impacted dates excluded (**section** 4.2.5), the $PM_{2.5}$ average for weekdays at 11.8 μg/m^3 was slightly lower than the average for weekends at 13.7 μg/m^3 (data not shown). Phase 1 monitoring also found $PM_{2.5}$ levels to be slightly lower on weekdays compared to weekends (**section 5.1.3**). The PM_{10} average was greater for weekdays at 25 μg/m^3 compared to the weekend average of 16 μg/m^3 (potential wildfire impacted dates excluded; data not shown).

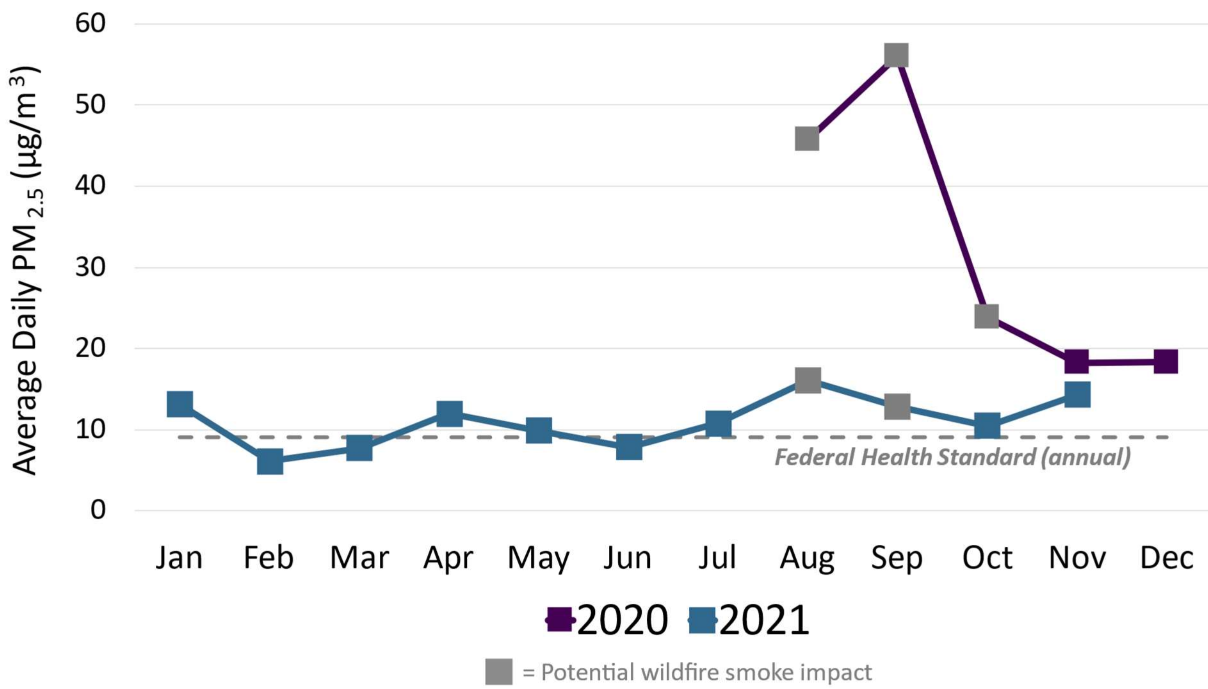

Figure 5-19. Phase 2 monitoring monthly average $PM_{2.5}$ levels.

Average of all valid $PM_{2.5}$ values reported by Phase 2 monitoring sites in each month and year. Averages marked in gray had at least 10 days in the month with a potential wildfire smoke impact. The monthly average sample size ranged from 14 to 30.

5.2.2.3. Comparison to health standards

Phase 2 monitoring $PM_{2.5}$ and PM_{10} levels are compared to state and federal health standards in this section to provide a public health context to the levels measured, as was done in **section 5.1.4**. As with Phase 1 monitoring, Phase 2 monitoring does not meet the requirements of regulatory monitoring. As a result, comparisons of Phase 2 monitoring results to health standards are approximate and do not establish whether pollution levels meet or exceed health standards.

Phase 2 monitoring $PM_{2.5}$ levels were compared to the U.S. EPA AQI categories in **Figure 5-20.** Note that the AQI categories shown follow the current scale that was revised in 2024 (**Table 5-1**). To illustrate $PM_{2.5}$ levels measured across all Phase 2 monitoring sites, the range of $PM_{2.5}$ levels at the six sites are shown for each sampling date as a hatched area in **Figure 5-20**. Phase 2 monitoring $PM_{2.5}$ levels reached the "Very Unhealthy" and "Unhealthy" levels on potentially wildfire smoke impacted dates (**section 4.2.5**). Generally, $PM_{2.5}$ levels were within the "Moderate" and "Good" categories outside of wildfire smoke impacted time periods, apart from two fall samples: the October 18th, 2020 sample for the Impact Church site (36 µg/m^3), the October 30th, 2020 sample for the Veterans of Foreign Wars Post 1267 site (42 µg/m^3).

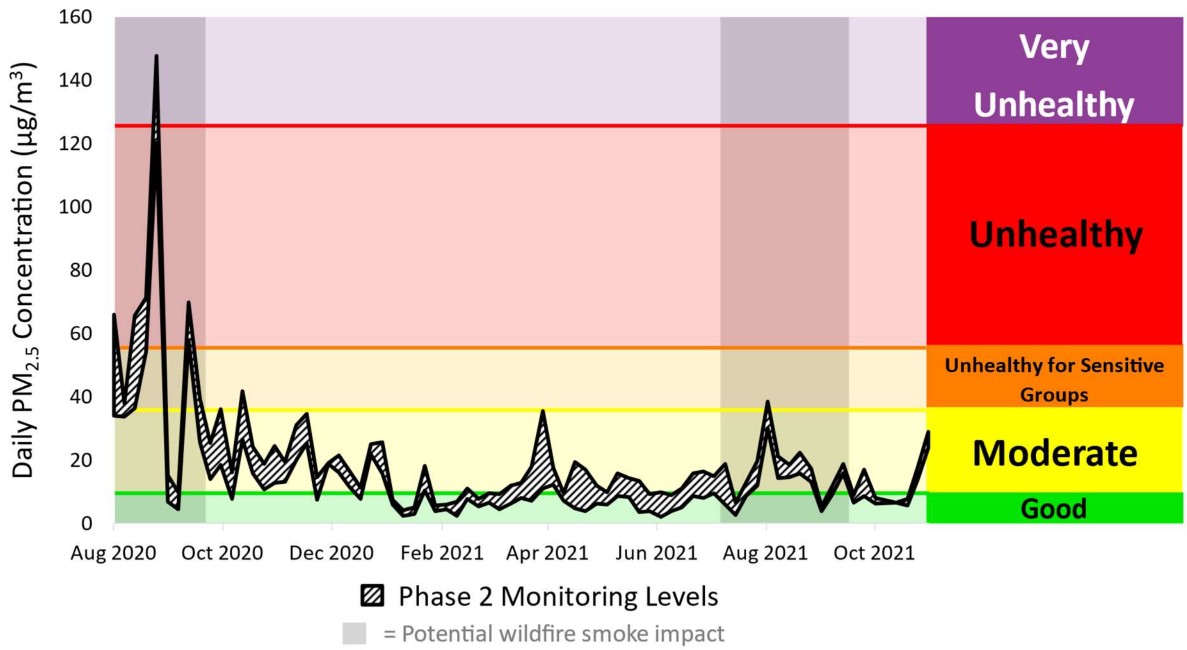

Figure 5-20. Comparison of Phase 2 monitoring $PM_{2.5}$ levels to the U.S. EPA Air Quality Index (AQI).

The hatched area is the range of $PM_{2.5}$ levels across the six Phase 2 monitoring sites on each date. Shaded areas of the graph are intervals when there was a potential wildfire smoke impact. The AQI categories shown follow the current scale that was revised in 2024 (**Table 5-1**).

Phase 2 monitoring $PM_{2.5}$ levels were compared to federal health standards in **Table 5-13.** The comparison is intended to provide some context to the values measured. However, as Phase 2 monitoring was not equivalent to regulatory monitoring, the levels measured cannot be evaluated for whether they meet health standards. The annual and 24-hour $PM_{2.5}$ U.S. EPA NAAQS were described in **section 5.1.4**. All six Phase 2 monitoring sites had an annual mean value for the calendar year 2021 above the annual $PM_{2.5}$ NAAQS of 9.0 µg/m^3. The average laboratory reported uncertainty for each site ranged from 1.5 to 1.6 µg/m^3. With the measurement uncertainty considered, some mean values may not have been above the annual $PM_{2.5}$ NAAQS. The 98th percentile values were compared to the 24-hour $PM_{2.5}$ NAAQS as the 98th percentile is used as a target value for this standard (**section 5.1.4**). In comparing the 98th percentile values to the 24-hour $PM_{2.5}$ NAAQS of 35 µg/m^3, only the Veterans of Foreign Wars Post 1267 site had a 98th percentile value above the standard. The 98th percentile for the Veterans of Foreign Wars Post 1267 site was 37.6 µg/m^3, which was associated with a laboratory reported uncertainty of 2.3 µg/m^3. The 98th percentile value may have been below the standard when the measurement uncertainty is considered.

Phase 2 monitoring PM_{10} levels were compared to state and federal health standards in **Table 5-14.** The comparison is intended to provide some context to the values measured, but as Phase 2 monitoring was not equivalent to regulatory monitoring, the levels measured cannot be evaluated for whether they meet health standards. Phase 2 monitoring of PM_{10} occurred over 5 months, so the average PM_{10} levels are an approximate comparison to the annual CAAQS. The average PM_{10} levels for all six sites were above the annual PM_{10} CAAQS of 20 µg/m^3. The average laboratory reported uncertainty for each site was about 2 µg/m^3. Even with the average measurement uncertainty considered, the annual mean for each site was above the annual standard. The maximum values were compared to the 24-hour CAAQS, as this standard is a value not to be exceeded. One of the six sites (Sacramento Fire Department Station 56) had a maximum PM_{10} value that was above the 24-hour CAAQS of 50 µg/m^3. These maximum values had an associated laboratory reported uncertainty of about 3 µg/m^3. Considering the measurement uncertainty, the maximum level at the Sacramento Fire Department Station 56 site would still be above the 24-hour PM_{10} standard. All measurements were below the 24-hour NAAQS of 150 µg/m^3.

Table 5-13. Phase 2 monitoring $PM_{2.5}$ levels compared to health standards.

Values are shown in italics as they do not meet the data completeness requirement associated with the health standard (at least 75% of daily values valid in each calendar quarter). The annual $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS) was revised in 2024 to 9.0 µg/m³ from 12.0 µg/m³ and is shown for context. The number of values used in the annual mean and 98th percentile calculations for each site ranged from 47 to 53.

Site	24-hour $PM_{2.5}$ (µg/m³)	
	2021 Mean[1]	2021 98th Percentile[2]
Sacramento Fire Department Station 56	*10.4*	*24.9*
City of Sacramento Pump Station No. 50	*10.1*	*30.1*
Florin Elementary School	*11.3*	*27.5*
Veterans of Foreign Wars Post 1267	*12.9*	*37.6*
Cosumnes River College	*10.7*	*31.4*
Impact Church	*11.6*	*32.4*
2012 Federal Health Standard	**12.0**	**35.0**
2024 Federal Health Standard	**9.0**	**35.0**

[1] The mean was calculated from an average of each calendar quarter as described in 40 CFR Part 50 Appendix N Section 4.4.

[2] The 98th percentile was calculated based on Table 1 of 40 CFR Part 50 Appendix N Section 4.5. The 98th percentile was either the maximum value or second greatest value depending on the sample size.

Table 5-14. Phase 2 monitoring PM_{10} levels compared to health standards.

Averages were limited to five months of monitoring. The California Ambient Air Quality Standard (CAAQS) and the National Ambient Air Quality Standard (NAAQS) are shown for context only. The number of values used in the mean and maximum calculations for each site ranged from 22 to 24.

Site	24-hour PM_{10} (µg/m³)	
	Mean	Maximum
Sacramento Fire Department Station 56	28	56
City of Sacramento Pump Station No. 50	23	49
Florin Elementary School	24	44
Veterans of Foreign Wars Post 1267	27	50
Cosumnes River College	23	41
Impact Church	24	49
Federal Health Standard	**N/A**	**150**
California Health Standard	**20**	**50**

5.2.2.4. Comparison to District monitoring network sites

Phase 2 monitoring $PM_{2.5}$ and PM_{10} levels are shown in this section alongside reported levels at District monitoring sites that used a similar 24-hour gravimetric monitoring method to provide context. However, the Phase 2 monitoring $PM_{2.5}$ and PM_{10} results should not be directly compared to District sites due to differences in monitoring and the lack of a pre-deployment collocation to assess these differences. The comparisons shown in **Table 5-15** and **Table 5-16** were limited to dates when all monitoring sites had a valid value.

Phase 2 monitoring $PM_{2.5}$ levels and those measured at the District monitoring site Sacramento-Del Paso Manor are shown in **Table 5-15**. Only this District site is included as it is the only other 24-hour gravimetric measurement of $PM_{2.5}$ in the District monitoring network that was in use concurrently for much of the same period as Phase 2 monitoring. The Sacramento-Del Paso Manor site was introduced in **section 5.2.1.3**. The Sacramento-Del Paso Manor site has historically been the peak $PM_{2.5}$ site in the District monitoring network . The sampler used at this site is a Rupprecht & Patashnick Co., Inc. (R & P) Partisol-Plus Model 2025 Sequential Sampler. The Sacramento-Del Paso Manor levels are shown for context but should not be directly compared to Phase 2 monitoring results.

Phase 2 monitoring PM_{10} levels and those measured at three District monitoring sites (Sacramento-Del Paso Manor, North Highland-Blackfoot Way, Sacramento-Branch Center #2) are shown in **Table 5-16**. These three sites also measure PM_{10} with a 24-hour gravimetric measurement. The Sacramento-Del Paso Manor site was introduced in **section 5.2.1.3**. The

North Highlands-Blackfoot Way site, which is closed as of July 2022, was located in a residential area approximately 14 miles north of the initial South Sacramento-Florin CAMP boundary. The Sacramento-Branch Center #2 site is considered a high concentration area for PM_{10}. The site is in a business and industrial area. The site is located about 4 miles northeast of the initial South Sacramento-Florin CAMP boundary. The values shown in **Table 5-16** for all three District monitoring sites were from a General Metal Works Sierra/Anderson Model 1200 Size Selective Inlet PM_{10} Sampler. The levels at District sites are shown for context but should not be directly compared to Phase 2 monitoring results.

Table 5-15. Mean, median and maximum $PM_{2.5}$ values at South Sacramento-Florin Phase 2 monitoring sites and a District monitoring network site.

The District site Sacramento-Del Paso Manor is shown for context. Due to differences in monitoring, Phase 2 monitoring $PM_{2.5}$ levels should not be directly compared to the Sacramento-Del Paso Manor site. Data are limited to dates when all sites had a valid value. Sample size equal to a total of 44 days.

Site	24-hour $PM_{2.5}$ ($\mu g/m^3$)		
	Mean	Median	Maximum
Sacramento Fire Department Station 56	16.1	11.0	120.1
City of Sacramento Pump Station No. 50	16.0	9.7	134.0
Florin Elementary School	18.6	13.3	141.7
Veterans of Foreign Wars Post 1267	20.6	14.7	141.4
Cosumnes River College	17.0	11.2	136.4
Impact Church	18.5	12.2	147.6
Sacramento-Del Paso Manor	**14.2**	**9.0**	**122.4**

Table 5-16. Mean, median, and maximum PM_{10} values at South Sacramento-Florin Phase 2 monitoring sites and District monitoring network sites.

The District sites are shown for context. Due to differences in monitoring, Phase 2 monitoring $PM_{2.5}$ levels should not be directly compared to District sites. Data are limited to dates when all sites had a valid value. Sample size equal to a total of 19 days.

Site	24-hour PM_{10} ($\mu g/m^3$)		
	Mean	Median	Maximum
Sacramento Fire Department Station 56	29	26	56
City of Sacramento Pump Station No. 50	24	20	49
Florin Elementary School	24	22	44
Veterans of Foreign Wars Post 1267	28	27	50
Cosumnes River College	23	22	41
Impact Church	24	22	49
Sacramento-Del Paso Manor	**25**	**26**	**50**
North Highlands-Blackfoot Way	**27**	**24**	**54**
Sacramento-Branch Center #2	**34**	**32**	**57**

5.2.3. Particulate matter metals and volatile organic compounds (VOCs)

5.2.3.1. Introduction

This section provides results for air toxics measured from speciated $PM_{2.5}$ and PM_{10} samples and VOC monitoring. The $PM_{2.5}$ and PM_{10} samples described in **section 5.2.2** were speciated for metals by XRF. The XRF method provides an estimate of the total amount of a metal in a sample and does not specify its form, which limits the ability to make health impacts comparisons. There are some health standards that are not specific to a certain form of a metal, which are used for health comparisons in **section 5.2.3.3** (described in the footnotes of **section 4.3.3.4**). The metal concentration values described in the following sections (apart from lead averages shown in **Table 5-21**) are measured from the $PM_{2.5}$ fraction. There was over a year of speciated $PM_{2.5}$ monitoring while the speciated PM_{10} monitoring covered five months, and as such the speciated $PM_{2.5}$ monitoring results provide a better estimate of year-round conditions. The VOC monitoring occurred on the same dates as the speciated $PM_{2.5}$ and PM_{10} sampling at the Phase 2 monitoring sites (see **Figure 3-2** for locations).

A total of 173 analytes were measured from the speciated $PM_{2.5}$ and PM_{10} and VOC monitoring. Of these, a total of 59 analytes are identified by CARB as a TAC. Analytes identified as a TAC are not expected to cause harmful noncancer health effects when they are at or below the REL, which is specific to each analyte and type of exposure. To identify any potential risk of noncancer health effects, comparisons to the RELs were made using OEHHA's Hazard Index Approach in **section 5.2.3.3**. The Hazard Index Approach method is described in **section 4.3.3.4.1**.

A total of 27 air toxics measured by Phase 2 monitoring have a cancer inhalation unit risk value identified by OEHHA. These air toxics are referred to as carcinogens (cancer-causing agents) in this report. Other toxics measured – such as acrolein – are probably carcinogenic but do not have a cancer inhalation unit risk developed at this time, and the associated cancer risk is not estimated in this report . Estimated cancer risk is presented in this chapter on a per million basis, which is an estimate of the number of cancer cases expected in a million people. The cancer risk estimation is considered in excess of other cancer risk factors that may be present in the population, such as genetic risk factors. One-year averages (from November 23rd, 2020 to November 24th, 2021) were used to approximate a continuous exposure level and calculate cancer risk as described in **section 4.3.3.4.2**. In risk assessments of contaminated sites, a cancer risk of more than 1 per million is considered a public health concern . The minimum detection limit of many carcinogens was above the equivalent of an estimated 1 per million cancer risk (**Table 4-11** and **Table 4-12**). As such, potentially substantial amounts of the carcinogens measured by Phase 2 monitoring were not detectable.

5.2.3.2. Site comparisons

The levels of select metals and VOCs were compared between Phase 2 monitoring sites. For site comparisons described in **Figure 5-21** and **Table 5-17**, data were isolated to dates when all six sites had a valid sample (total of 54 dates for metals and a total of 13 dates for VOCs). The metals levels used in comparisons are from the $PM_{2.5}$ fraction, as the speciated $PM_{2.5}$ monitoring covered a longer time period. Select metals compared between sites in **Table 5-17** were either a TAC and/or were of interest due to potential sources. The metals lead and sulfur were of interest to the Steering Committee as potential emissions from a nearby airport, although sulfur does not cause adverse health impacts. Lead is a carcinogen and is regulated by the U.S. EPA as a criteria air pollutant. Arsenic is a carcinogen and has the potential for noncancer health impacts. Chromium can be carcinogenic and has the potential for noncancer health impacts depending on its valence state. Select VOCs shown in **Figure 5-21** were found to be most impactful for public health (**section 5.2.3.3**).

Phase 2 monitoring site averages of the VOCs acetaldehyde, acrolein, and benzene are shown in **Figure 5-21**. These three VOCs displayed different trends across the six sites. Levels of the VOCs acetaldehyde and acrolein were similar or greater in residential areas (the City of Sacramento Pump Station No. 50 and Florin Elementary School sites) compared to commercial areas (the Sacramento Fire Department Station 56 site). This indicates that sources of these air toxics are not limited to commercial or industrial sources. Potential sources for these VOCs are varied and include residential woodsmoke, wildfire smoke, mobile sources, and stationary sources. Wildfire smoke likely influenced the levels of benzene (**section 5.2.3.4**).

Phase 2 monitoring site averages of select metals are shown in **Table 5-17**. Differences in site averages were within the average measurement uncertainty reported by the laboratory for arsenic (average measurement uncertainty of 0.0007 µg/m^3), chromium (average measurement uncertainty of 0.0008 µg/m^3), and lead (average measurement uncertainty of 0.002 µg/m^3). This indicates that site differences in these metal levels were generally not measurable. The average measurement uncertainty for sulfur was 0.02 µg/m^3, indicating the differences between some site averages may not be solely attributable to measurement uncertainty. It does not appear that airport emissions of sulfur or lead were captured by Phase 2 monitoring. The Sacramento Fire Department Station 56 site is closest to the nearest airport but did not have the greatest sulfur or lead levels. Lead levels were well below the U.S. EPA NAAQS of 0.15 µg/m^3 and average levels were below that associated with an estimated cancer risk of 1 per million (based on calculation described in **section 4.3.3.4.2**; lead levels also evaluated in **section 5.2.3.3**). The average chromium levels are below the chronic inhalation REL for trivalent chromium, which is a common form of chromium (0.06 µg/m^3). It is unknown how much of the chromium is hexavalent chromium, which is carcinogenic.

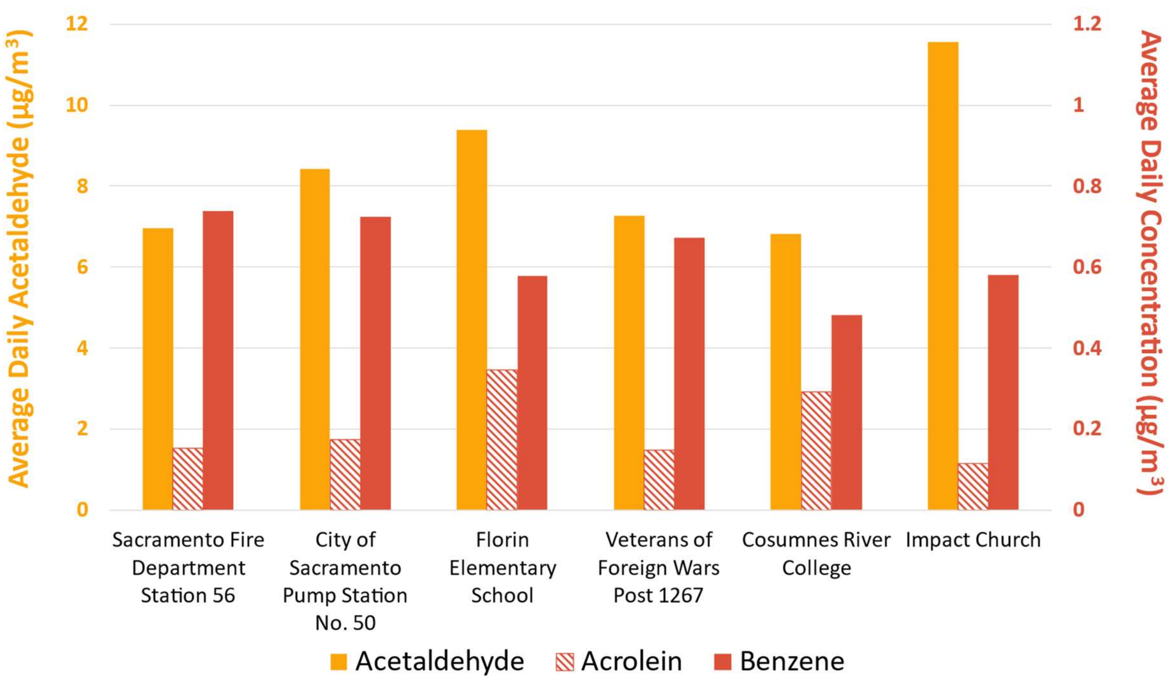

Figure 5-21. Site comparison of Phase 2 monitoring average acetaldehyde, acrolein, and benzene levels.

The acetaldehyde levels are graphed to the left vertical axis. The acrolein and benzene levels are graphed to the right vertical axis. Sample size equals to 13.

Table 5-17. Site comparison of Phase 2 monitoring average metal levels.

Average metal levels are from the $PM_{2.5}$ fraction. Sample size equals to 54.

Site	Average 24-hr Concentration ($\mu g/m^3$)			
	Arsenic	Chromium	Lead	Sulfur
Sacramento Fire Department Station 56	0.0001	0.0001	0.0006	0.23
City of Sacramento Pump Station No. 50	0.0001	0.0004	0.0008	0.23
Florin Elementary School	0.0002	0.0004	0.0009	0.24
Veterans of Foreign Wars Post 1267	0.0002	0.0001	0.0009	0.26
Cosumnes River College	0.0002	0.0003	0.0009	0.25
Impact Church	0.0003	0.0001	0.0005	0.25

5.2.3.3. Comparison to health standards

The Hazard Index Approach was used to identify any potential noncancer health effects from the air toxics measured (described in **section 4.3.3.4.1**). The hazard index was calculated for acute, and chronic exposure levels. A hazard index greater than 1 indicates that there may be noncancer health impacts.

Hazard indices for acute exposure based on Phase 2 monitoring results are shown in **Table 5-18**. Dates included in **Table 5-18** are limited to those where the acute hazard index exceeded 1 for at least one of the six sites. The acute hazard index was above 1 only for the target organs of eyes and respiratory system. The acute hazard index for these target organs was above 1 in eleven different sampling events. An acute hazard index above 1 was largely driven by the hazard quotient for acrolein, which made up 92% or greater of the hazard index for sampling events that had a hazard index greater than 1. Acrolein can cause eye, nose, and throat irritation when the concentration exceeds the acute REL . Acrolein levels reaching potentially toxic levels was potentially affected by wildfires. Eight out of the eleven sampling events with an acute hazard index above 1 were on dates that had a potential wildfire smoke impact (**section 4.2.5**).

Hazard quotients and indices for chronic exposure based on Phase 2 monitoring results are shown in **Table 5-19**. The chronic hazard index was above 1 for the target organ of the respiratory system only. The respiratory system chronic hazard index was above 1 for five of the six sites. Similar to the acute hazard indices, the acrolein hazard quotient was largely responsible for the chronic hazard index exceeding 1 and made up 73% to 89% of the respiratory system chronic hazard index for the five sites with a respiratory system chronic hazard index above 1. Chronic exposure to acrolein may result in lung inflammation and lesions in the nasal cavity . The chronic hazard index was potentially affected by wildfires. If dates when there was a potential wildfire smoke impact locally were excluded from the average calculation, the Sacramento Fire Department Station 56 site was the only site with a chronic hazard index over 1 (data not shown).

Estimated cancer risk from Phase 2 monitoring carcinogen levels is shown in **Figure 5-22**. The “Other carcinogens” shown in **Figure 5-22** includes carcinogens with an estimated cancer risk that was below 1 per million for every site and includes 1,1-dichloroethane, 1,4-dichlorobenzene, 1,4-dioxane, arsenic, cadmium, chloroform, ethylbenzene, ethylene dichloride, lead, methyl tert-butyl ether, nickel, tetrachloroethylene, and trichloroethylene. The carcinogens acetaldehyde and benzene generally had the greatest cancer risk across the six sites. The estimated cancer risk of acetaldehyde ranged from 23 to 33 per million and the estimated cancer risk of benzene ranged from 12 to 16 per million across the six sites. In comparison, the total cancer risk from ambient air for the initial South Sacramento-Florin CAMP boundary is estimated at over 390 per million based on the California Air Toxics Assessment (CATA) modeling for the year 2017 . Although these carcinogens were significant out of the air toxics measured, they are likely minor contributions to the overall cancer risk from ambient air. It is expected that diesel particulate matter is responsible for most of the cancer risk from ambient air and is estimated to contribute 78% of the cancer risk of ambient air for the initial South Sacramento-Florin CAMP boundary. Diesel particulate matter cannot be directly measured and must be estimated from a surrogate. Diesel particulate matter was not estimated from any Phase 2 monitoring results. The carcinogens acetaldehyde, benzene, and dichloromethane were detected more frequently than most other carcinogens (**Table 5-20**). Many of the carcinogens measured were detected only sporadically (**Table 5-20**).

For the initial South Sacramento-Florin CAMP boundary, CATA similarly identified the carcinogens acetaldehyde and benzene as some of the largest VOC contributors to cancer risk in ambient air. CATA also identified formaldehyde and 1,3-butadiene as primary VOC contributors to cancer risk. Formaldehyde was not measured by Phase 2 monitoring. The VOC 1,3-butadiene was only detected at three of the six sites (**Table 5-20**). The compound could have been at levels above a 1 per million cancer risk at other sites but still below detection (**Table 4-12**).

Phase 2 monitoring average lead levels on a 3-month rolling basis are shown in **Table 5-21**. The U.S. EPA NAAQS for lead is based on a 3-month rolling average of lead levels from Total Suspended Particles (TSP), which includes coarser particles up to 100 µm in size. To approximate this measurement, the 3-month rolling average from the PM_{10} fraction was calculated. The Phase 2 monitoring may be an underestimate of regulatory lead monitoring as it only includes particles up to 10 µm in size. All 3-month rolling averages were well below the NAAQS of 0.15 $\mu g/m^3$.

Table 5-18. Phase 2 monitoring acute inhalation hazard index.

Hazard indices for the target organs of respiratory system (abbreviated Resp.) and eyes are shown. Dates marked with an asterisk (*) are potentially wildfire smoke impacted.

Date	Acute Inhalation Hazard Index					
	Sacramento Fire Dept Station 56	City of Sacramento Pump Station No. 50	Florin Elementary School	Veterans of Foreign Wars Post 1267	Cosumnes River College	Impact Church
12/23/20	<0.1 Resp. <0.1 Eyes	<0.1 Resp. <0.1 Eyes	*No VOC sample*	<0.1 Resp. <0.1 Eyes	**1.1 Resp.** **1.1 Eyes**	*No VOC sample*
1/28/21	**1.4 Resp.** **1.4 Eyes**	<0.1 Resp. <0.1 Eyes	<0.1 Resp. <0.1 Eyes	*No metals sample*	<0.1 Resp. <0.1 Eyes	*No VOC sample*
3/17/21	0.8 Resp. 0.8 Eyes	0.2 Resp. 0.2 Eyes	**1.1 Resp.** **1.1 Eyes**	*No VOC, metals sample*	0.3 Resp. 0.3 Eyes	0.4 Resp. 0.4 Eyes
*7/27/21	<0.1 Resp. <0.1 Eyes	<0.1 Resp. <0.1 Eyes	<0.1 Resp. <0.1 Eyes	**1.1 Resp.** **1.1 Eyes**	*No VOC sample*	<0.1 Resp. <0.1 Eyes
*8/20/21	<0.1 Resp. <0.1 Eyes	0.2 Resp. 0.2 Eyes	**1.1 Resp.** **1.1 Eyes**	<0.1 Resp. <0.1 Eyes	0.7 Resp. 0.7 Eyes	<0.1 Resp. <0.1 Eyes
*8/26/21	**1.2 Resp.** **1.2 Eyes**	<0.1 Resp. <0.1 Eyes	<0.1 Resp. <0.1 Eyes	*No VOC sample*	<0.1 Resp. <0.1 Eyes	<0.1 Resp. <0.1 Eyes
*10/1/21	**1.6 Resp.** **1.6 Eyes**	*No VOC sample*	**1.3 Resp.** **1.3 Eyes**	**1.6 Resp.** **1.6 Eyes**	**1.1 Resp.** **1.1 Eyes**	**1.5 Resp.** **1.5 Eyes**

Table 5-19. Phase 2 monitoring chronic inhalation hazard quotients and hazard index.

Average metal levels from the $PM_{2.5}$ fraction were used in the hazard quotient calculation.

Toxic	Chronic Inhalation Hazard Quotient – Respiratory System					
	Sacramento Fire Dept Station 56	City of Sacramento Pump Station No. 50	Florin Elementary School	Veterans of Foreign Wars Post 1267	Cosumnes River College	Impact Church
Acetaldehyde	0.1	0.1	0.1	0.1	0.1	0.1
Acrolein	1.6	0.7	1.0	0.9	1.0	0.8
Acrylonitrile	*ND*	*ND*	<0.01	*ND*	<0.01	*ND*
Arsenic	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	*ND*	<0.01	*ND*	*ND*	*ND*	*ND*
Methyl bromide	0.1	*ND*	0.1	0.2	0.1	0.2
Naphthalene	<0.01	<0.01	*ND*	*ND*	*ND*	<0.01
Nickel	*ND*	*ND*	*ND*	*ND*	<0.01	*ND*
p-dichlorobenzene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Propylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vinyl acetate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
m/p-xylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
o-xylene	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Hazard Index	**1.8**	0.8	**1.2**	**1.2**	**1.2**	**1.1**

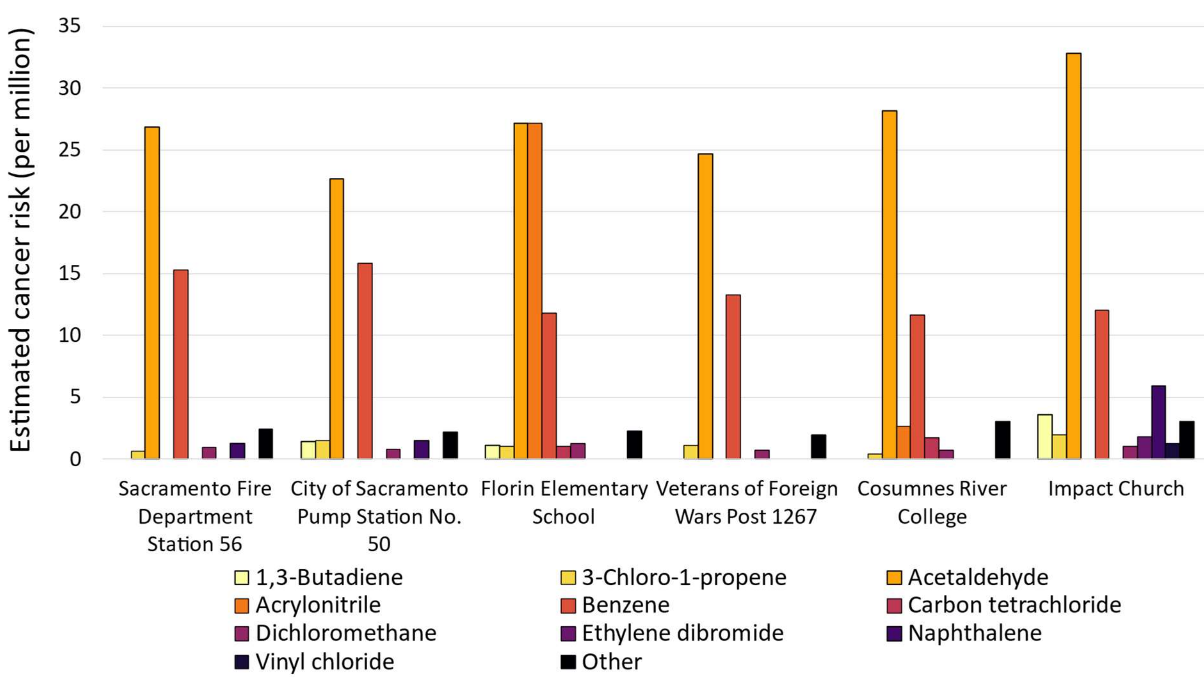

Figure 5-22. Estimated cancer risk from carcinogens measured by Phase 2 monitoring.

Table 5-20. Frequency of Phase 2 monitoring carcinogen detections.

The number of detections of each carcinogen out of all valid samples. The total number of valid samples is shown at the bottom of the table for comparison. Carcinogens listed in italics were below an estimated 1 per million cancer risk for all six sites.

Carcinogen	Number of Detections					
	Sacramento Fire Dept Station 56	City of Sacramento Pump Station No. 50	Florin Elementary School	Veterans of Foreign Wars Post 1267	Cosumnes River College	Impact Church
1,3-Butadiene	0	1	1	0	0	1
3-Chloro-1-propene	7	14	8	4	4	8
Acetaldehyde	53	51	46	34	47	35
Acrylonitrile	0	0	1	0	1	0
Benzene	37	38	26	20	27	19
Carbon tetrachloride	0	0	1	0	1	0
Cobalt	1	0	1	0	0	0
Dichloromethane	53	48	44	31	40	32
Ethylene dibromide	0	0	0	0	0	1
Naphthalene	1	1	0	0	0	3
Vinyl chloride	0	0	0	0	0	1
1,1-Dichloroethane	*1*	*0*	*1*	*0*	*2*	*1*
1,4-Dichlorobenzene	*2*	*1*	*1*	*1*	*1*	*2*
1,4-Dioxane	*0*	*1*	*0*	*0*	*1*	*0*
Arsenic	*2*	*4*	*5*	*4*	*6*	*6*
Cadmium	*0*	*1*	*0*	*0*	*0*	*0*
Chloroform	*1*	*2*	*1*	*1*	*1*	*1*
Ethylbenzene	*8*	*4*	*2*	*3*	*4*	*1*
Ethylene dichloride	*0*	*0*	*1*	*0*	*2*	*1*
Lead	*6*	*5*	*4*	*3*	*5*	*4*
Methyl tert-butyl ether	*0*	*1*	*0*	*1*	*1*	*0*
Nickel	*0*	*0*	*0*	*0*	*1*	*0*
Tetrachloroethylene	*1*	*0*	*2*	*1*	*2*	*1*
Trichloroethylene	*1*	*1*	*1*	*1*	*2*	*1*
Total Valid Samples	**57**	**60**	**39**	**67**	**57**	**48**

Table 5-21. Phase 2 monitoring rolling 3-month average lead levels.

Lead levels are from the PM_{10} fraction. All measurements below detection in a 3-month interval are notated by *ND*. Sample size ranged from 10 to 14.

Site	Average 24-hr Lead (µg/m³)			
	July - Sept. 2021	Aug. - Oct. 2021	Sept. - Nov. 2021	Oct. - Dec. 2021
Sacramento Fire Department	*ND*	0.0005	0.0018	0.0030
City of Sacramento Pump	0.0003	0.0003	0.0008	0.0007
Florin Elementary School	0.0009	0.0006	0.0003	*ND*
Veterans of Foreign Wars Post	0.0008	0.0007	0.0015	0.0019
Cosumnes River College	*ND*	0.0002	0.0006	0.0008
Impact Church	*ND*	*ND*	0.0008	0.0009

5.2.3.4. Trends in pollution levels

Phase 2 monitoring acetaldehyde and benzene levels are compared by season in **Figure 5-23**. All six sites are included in the averages. Seasonal trends could not be fully evaluated for individual sites due to the limited amount of data with all six sites having a valid sample. These two VOCs were included in the figure because of their relative risk and frequent detections (**section 5.2.3.3**). Benzene levels were greatest in the fall and winter. The summer and fall averages for benzene were likely influenced by wildfire smoke. The summer and fall benzene averages were 37% and 36% lower, respectively, if dates when there was a potential wildfire smoke impact locally were excluded (**section 4.2.5**). Acetaldehyde levels were greatest in the summer, with summer and fall averages similar in value. Acetaldehyde can be produced by photochemical reactions, which increase in warm, sunny conditions and likely influenced greater levels in the summer. Although acetaldehyde is emitted from wildfires, the summer and fall acetaldehyde averages were not obviously affected by wildfire smoke impacts. The summer and fall acetaldehyde averages were similar or higher if dates when there was a potential wildfire smoke impact locally were excluded (**section 4.2.5**). Aldehydes (such as acetaldehyde) break down readily in the atmosphere and could be transformed during the transport of a distant wildfire smoke plume . In contrast to benzene trends observed, acetaldehyde levels were lowest in winter. Benzene does not break down as readily in atmospheric reactions compared to aldehydes . As benzene persists in the atmosphere, it can accumulate in winter when there are more severe weather inversion conditions, similar to what is observed for particulate matter pollution (**section 5.1.3**).

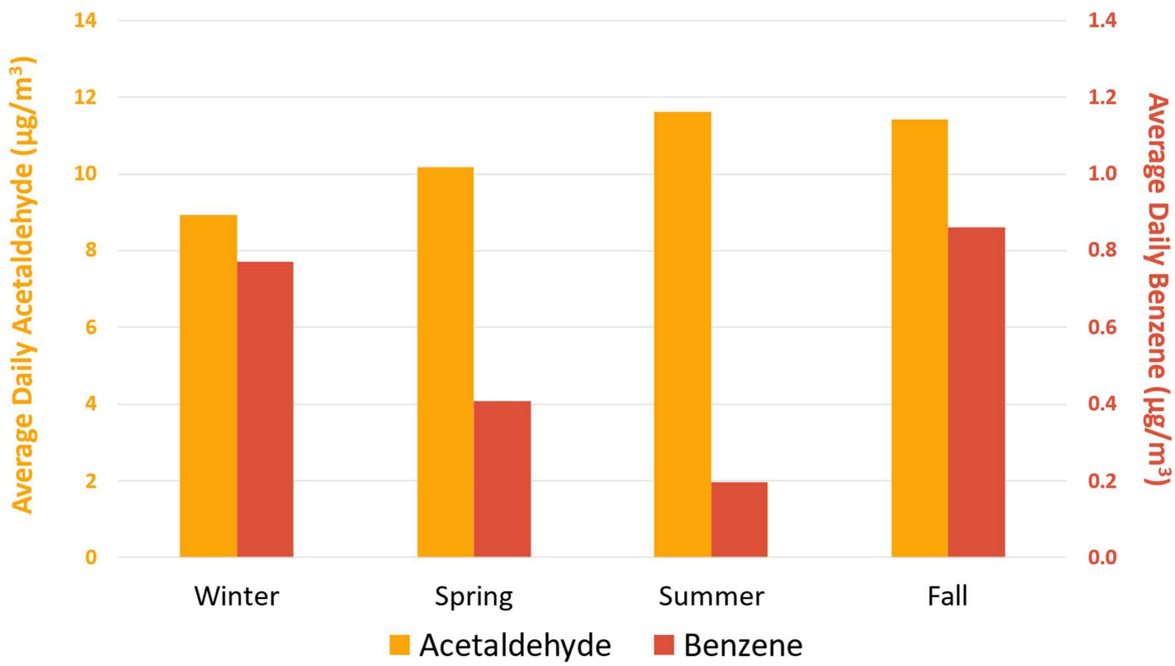

Figure 5-23. Phase 2 monitoring seasonal average acetaldehyde and benzene levels.

Average of all valid samples in each season. Each season was designated as follows: winter included the months of December, January, and February; spring included the months of March, April, and May; summer included the months of June, July, and August; and fall included the months of September, October, and November. The acetaldehyde levels are graphed to the left vertical axis. The benzene levels are graphed to the right vertical axis.

5.2.3.5. Comparisons of toxics levels to Sacramento County monitoring sites and statewide averages

Phase 2 monitoring air toxic levels were compared to Sacramento County monitoring sites and statewide averages to provide context to the levels shown in the previous sections. However, there are differences between Phase 2 monitoring and the monitoring at other Sacramento County sites and the statewide averages, including differences in monitoring equipment and analytical methods. It is unknown how much differences in monitoring may be attributable for the differences between the South Sacramento-Florin sites and other Sacramento County monitoring sites and the statewide averages.

Phase 2 monitoring air toxic levels are compared to those at Sacramento County monitoring sites and statewide average levels in **Table 5-22**. Air toxics shown in **Table 5-22** are included due to their potential health impacts (see **sections 5.2.3.2** and **5.2.3.3**). The average levels acetaldehyde, acrolein, and benzene shown for Phase 2 monitoring sites are a year-round average from November 23rd, 2020 through November 24th, 2021. The Sacramento-Del Paso Manor monitoring site was introduced in **section 5.2.1.3**. The VOC monitoring at this site occurred during the months of July through September and was discontinued after 2020. The average levels shown in **Table 5-22** for acetaldehyde, acrolein, and benzene are an average of monitoring from July through September 2020. The VOC sample duration at the Sacramento-Del Paso Manor site was 3-hours in length compared to the 24-hour sampling for Phase 2 monitoring and the statewide average. Generally, a shorter duration sample would result in larger value if it captured the greater levels over the course of a day. The levels of arsenic and lead were compared between Phase 2 monitoring sites and the Sacramento-Del Paso Manor and Sacramento-1309 T Street (located in downtown Sacramento) monitoring sites. Data were isolated to when all sites in the comparison had valid data (total of 23 days). The statewide averages shown in **Table 5-22** are from 18 monitoring sites across the state of California . The statewide toxics monitoring was incomplete for the years 2020 and 2021 when Phase 2 monitoring took place. The statewide averages shown in **Table 5-22** are from 2019. The acetaldehyde levels were greater at the South Sacramento-Florin sites compared to the Sacramento-Del Paso Manor site average and the statewide average. Both the Sacramento-Del Paso Manor site and the statewide toxics monitoring uses a different analytical method that has been found to underestimate acetaldehyde levels (Herrington et al., 2007). The acetaldehyde levels from Phase 2 monitoring are likely more elevated in part due to better capture of acetaldehyde levels in the sample. The levels of acrolein and benzene at the South Sacramento-Florin sites were lower or equal to the Sacramento-Del Paso Manor site average or the statewide average. Arsenic and lead levels at South Sacramento-Florin sites were lower than the statewide average and Sacramento-1309 T St site but greater than the Sacramento-Del Paso Manor site.

Table 5-22. Comparison of Phase 2 monitoring air toxic levels to Sacramento County monitoring sites and statewide averages.

	Average Concentration (µg/m³)				
	Acetaldehyde	Acrolein	Benzene	Arsenic	Lead
Sacramento Fire Department Station 56	9.9	0.56	0.53	0.0006	0.0015
City of Sacramento Pump Station No. 50	8.4	0.26	0.55	0.0006	0.0014
Florin Elementary School	10.1	0.35	0.41	0.0006	0.0014
Veterans of Foreign Wars Post 1267	9.1	0.33	0.46	0.0006	0.0015
Cosumnes River College	10.4	0.35	0.40	0.0006	0.0015
Impact Church	12.2	0.29	0.42	0.0006	0.0015
Sacramento-Del Paso Manor	**6.0**	***Not measured***	**0.70**	***Not detected***	**0.0009**
Sacramento-1309 T St	***Not measured***	***Not measured***	***Not measured***	**0.0010**	**0.0021**
Statewide Average	**1.4**	**1.1**	**0.55**	**0.0011**	**0.0045**

5.3. Summary of Phase 1 and Phase 2 monitoring

The pollutant $PM_{2.5}$ was measured by different monitoring methods that provided differing results. Phase 2 monitoring consistently reported greater $PM_{2.5}$ levels compared to Phase 1 monitoring (compare averages between **Figure 5-1** and **Figure 5-14**). As Phase 2 monitors were not collocated with a professional-grade monitor, it is unknown whether the Phase 1 or Phase 2 monitoring results are more accurate.

The northwest and north-central areas of the initial South Sacramento-Florin CAMP boundary were identified as having greater levels of various pollutants from Phase 1 and Phase 2 monitoring, which guided the siting of the Phase 3 monitoring site in the northwest area of the initial South Sacramento-Florin CAMP boundary. Pollutants measured that had the greatest levels measured in the northwest and north-central areas area of the initial South Sacramento-Florin CAMP boundary include $PM_{2.5}$, PM_{10}, black carbon, and benzene (**Figure 5-1**, **Figure 5-6**, **Figure 5-14**, **Figure 5-15**, and **Figure 5-21**). It is suspected that traffic emissions related to Highway 99, truck routes, distribution centers, and arterial roads contribute to some of the elevated pollution levels in this area. Additionally, unpaved areas may have contributed to elevated PM_{10} levels in the northwest area.

Seasonal and diurnal trends of pollutants were evaluated to develop a better understanding of how pollution levels vary over time and potentially identify sources. It was found that $PM_{2.5}$, black carbon, and benzene levels are more elevated in the winter compared to the spring and summer (**Figure 5-2**, **Figure 5-8**, and **Figure 5-23**). Greater levels of $PM_{2.5}$, black carbon, and benzene in winter are likely influenced by more severe temperature inversions, which allow pollutants to accumulate. Benzene has a longer atmospheric lifetime than most other VOCs, which contributes to concentrations accumulating in inversion conditions . Additionally, residential woodsmoke may increase levels of $PM_{2.5}$, black carbon, and benzene in winter. Over colder months, greater than average black carbon levels over holidays and evening black carbon levels more elevated on weekends compared to weekdays were potentially indicative of preferential wood burning on holidays and weekends (**Figure 5-10** and **Figure 5-13**). In contrast to benzene, the VOC acetaldehyde had the greatest levels in the summer and the lowest levels in the winter (**Figure 5-23**). This VOC can be produced by photochemical reactions in the air that increase in warm, sunny conditions. Both Phase 1 and Phase 2 monitoring captured two particularly severe wildfire seasons for regional wildfire smoke in 2020 and 2021. It is suspected that wildfire smoke influenced the levels of many pollutants during late summer and fall, including $PM_{2.5}$, PM_{10}, black carbon, and benzene levels. The greatest $PM_{2.5}$ levels were experienced on dates when there was wildfire smoke present regionally (**Figure 5-5** and **Figure 5-16**).

The Phase 1 and Phase 2 monitoring results were compared to health standards to provide a public health context to the levels measured. Phase 1 and Phase 2 monitoring did not meet regulatory requirements and as a result it is not possible to establish whether levels in South Sacramento-Florin meet or exceed regulatory standards. However, measuring values above regulatory standards from Phase 1 and Phase 2 monitoring established that continued monitoring in South Sacramento-Florin with Phase 3 monitoring was warranted. The average and peak $PM_{2.5}$ values for Phase 1 monitoring sites were sometimes above the corresponding federal health standard, although it depended upon the year (**Table 5-3** and **Table 5-4**). It is likely that wildfire smoke impacts in 2020 and 2021 influenced greater $PM_{2.5}$ levels in those years. For Phase 2 monitoring, which occurred in 2020 and 2021, average $PM_{2.5}$ levels were above the corresponding federal health standard for all sites and the peak $PM_{2.5}$ level was above the corresponding federal health standard for one Phase 2 monitoring site (**Table 5-13**). For Phase 2 monitoring PM_{10} levels, average levels were above the corresponding California health standard for all sites and three measurements were above the short-term California health standard (**section 5.2.2.1** and **Table 5-14**). The California health standards for PM_{10} are more stringent than the federal health standard. None of the Phase 2 monitoring measurements of PM_{10} were above the federal health standard. Acrolein was the primary contributor to potential noncancer health effects out of all the air toxics measured, driving the acute and chronic hazard index to reach levels that have possible noncancer health impacts (**section 5.2.3.3**). Acetaldehyde and benzene generally contributed the most to cancer risk out of all the carcinogens measured directly (**Figure 5-22**). However, these two carcinogens are likely minor contributions to the total cancer risk from ambient air based on CARB modeling .

Sensitive receptor sites did not necessarily have lower pollution levels in the South Sacramento-Florin community. The sensitive receptor site Florin Elementary School had the second greatest average $PM_{2.5}$, black carbon, and acetaldehyde levels out of the six Phase 2 monitoring sites (**Figure 5-6**, **Figure 5-14**, and **Figure 5-21**). The site is in a mainly residential area. Wood burning for heating occurs in residential areas, which would contribute to a variety of pollutants such as $PM_{2.5}$, PM_{10}, black carbon, and volatile organic compounds like acetaldehyde, acrolein, and benzene. Additionally, it was found that the site may be near elevated traffic volumes compared to other areas of the South Sacramento-Florin community (**Figure E-1** and **Figure E-2** of Appendix E).

Pollution levels in South Sacramento-Florin were compared to Sacramento County levels and California statewide averages to provide context to the levels measured. It was found that the average and peak black carbon levels were sometimes greater at South Sacramento-Florin sites than at other District monitoring sites in Sacramento County (**Table 5-8**). The carcinogen acetaldehyde was at levels in South Sacramento-Florin that were greater than the statewide average as well as the District monitoring site in the Arden-Arcade area (**Table 5-22**). Although this is likely in part due to a difference in the laboratory analytical method, potentially some of the difference is from the carcinogen being at especially elevated levels in South Sacramento-Florin. The levels of the air toxics acrolein and benzene at South Sacramento-Florin sites were generally lower than the statewide averages and the District monitoring site in the Arden-Arcade area. Arsenic and lead levels at South Sacramento-Florin sites were lower than the statewide average and the downtown Sacramento monitoring site, but greater than the District monitoring site in the Arden-Arcade area.

6. Evaluation of Progress on Achieving Four Objectives

The process for evaluating the effectiveness of the community air monitoring program is described in Element 12 of the CAMP. Specific milestones from Element 12 are stated in bold type in this chapter and organized in the following sections by the community air monitoring objectives (**section 1.2**). Progress to date is described beneath each milestone.

6.1. Progress towards Objective A: Traffic-related pollution

- **Within the first six months of adoption of the CAMP, the placement of Phase 1 monitors will be evaluated. The evaluation of whether the monitoring locations selected continue to be useful to meet monitoring objectives will be reported back to the Steering Committee.**

  Phase 1 monitoring network was largely in place by the time the CAMP was adopted on July 1st, 2020. Once a monitor was deployed, real-time monitoring information was immediately available to the public through Clarity OpenMap. Results from Phase 1 monitoring were reported to the Steering Committee in February 2021. It was communicated to the Steering Committee that the $PM_{2.5}$ levels were comparable across all Phase 1 monitoring sites. There was no recommendation made at that time to change the location of the Phase 1 monitoring sites.

- **Information will be posted on the District Community Air Protection webpage about the number of monitors placed at schools and hospitals.**

  The addresses of the Phase 1 and Phase 2 monitoring site locations are posted on the District Community Air Protection webpage[1]. Phase 1 monitoring site locations include ten different schools (nine elementary schools and one high school). One of the Phase 2 monitoring site locations is an elementary school. The closest community monitoring site to a hospital is the Phase 1 monitoring site Mack Road Partnership, which is located approximately 1000' away and on the opposite side of Highway 99 from a hospital.

- **Within 30 days after the data has been aggregated, accepted, and deemed complete by the District, laboratory data from Phase 2 will be posted on the District's website.**

  The first six months of Phase 2 monitoring data (August 2020 through February 2021) were posted to the District Community Air Protection webpage in March 2021. The rest of the Phase 2 monitoring data (March 2021 through December 2021) were posted to the District Community Air Protection webpage in March 2022. Data were aggregated and posted as a Microsoft Excel file. Data validation was noted and described in the spreadsheet file. Electronic copies of the original laboratory reports and a guide to reading the laboratory reports were also posted.

[1] https://www.airquality.org/CAM

- **An evaluation of whether the collected air quality data to date are sufficient to be analyzed with traffic information to assess hot spots and health risk will be reported in the annual report. This evaluation will review air quality data to determine whether traffic-related pollutants are being detected at each monitoring location. If those pollutants are not being detected, the District will discuss relocating air monitors. That analysis will also show pollutant detection limits in comparison to state and federal air quality standards.**

  This report provides Phase 1 and Phase 2 monitoring data results for the traffic-related pollutants of $PM_{2.5}$, PM_{10}, black carbon, and certain air toxics (e.g., benzene). These traffic-related pollutants were detected across all sites for Phase 1 and Phase 2 monitoring. The minimum detection limits of measured pollutants were generally below state and federal health standards, meaning that if pollution levels were above these standards, they would be measured (**Table 4-11** and **Table 4-12**). The District did not find it necessary to relocate monitors to measure traffic-related pollutants.

6.2. Progress towards Objective B: Pollution from businesses

- **An evaluation of Phase 1 monitors at sensitive receptor locations will be completed six months after the CAMP is adopted. This evaluation will include review of the air quality data being collected for completeness and whether it is enough for source inventory/attribution analysis. The District will evaluate whether key air pollutants are detected in air samples. These key pollutants will include Black Carbon, light hydrocarbons, lead, and other pollutants indicative of specific sources. The initial evaluation of the data may only include data from Phases 1 and 2. If data are not sufficient, the District will evaluate whether the analysis needs to be changed or monitoring locations need to be moved.**

  Phase 1 monitoring results were evaluated in February 2021 for the previous six months. It was found that the monitors were detecting $PM_{2.5}$ at all sites – including sensitive receptor sites – and that levels of $PM_{2.5}$ were comparable across all monitoring sites. The Phase 2 monitoring results were also evaluated in February 2021 for monitoring from August 2020 through December 2020. Key air pollutants indicative of specific sources (specifically, black carbon as an indication of mobile emissions, light hydrocarbons as an indication of gasoline emissions, and lead as an indication of airport emissions) were detected by all Phase 2 monitoring sites, including sensitive receptor sites. There were no recommendations made during the initial evaluations to change the location of the Phase 1 or Phase 2 monitoring sites.

- **The data will also be reviewed to determine whether it indicates emission impacts from traffic emissions and truck emissions.**

  Phase 1 and Phase 2 monitoring results were reviewed in this report for potential sources, including traffic and truck emissions. Some indications of traffic and truck emissions include greater pollution levels at the Phase 1 monitoring site closest to Highway 99 and greater black carbon levels at a Phase 2 monitoring site near various traffic emission sources (i.e., truck routes, distribution centers, and Highway 99). Specific details are discussed in **Chapter 5** of this report.

6.3. Progress towards Objective C: Asthma and respiratory illness

- **The air quality data will be reviewed annually to determine whether air quality monitoring provides complete seasonal coverage.**

  Data completeness for Phase 1 and Phase 2 monitoring varied by the pollutant measured (**Table A-1** of Appendix A). Based on the duration of monitoring and multiple monitor locations across the initial CAMP boundary, it is considered that there is sufficient seasonal coverage for Phase 1 and Phase 2 monitoring. Seasonal comparisons of pollutants measured by Phase 1 and Phase 2 monitoring are shown in **Chapter 5**.

- **The air quality data will be reviewed six months after the adoption of the CAMP and every six months thereafter for spatial coverage. The spatial coverage will be evaluated for completeness and for coverage of sensitive receptors.**

  The Phase 1 monitoring results were evaluated about six months after the CAMP was adopted in February 2021. It was found that the Phase 1 monitoring sites were comparable in the $PM_{2.5}$ levels measured. Due to the similar levels measured across the initial CAMP boundary, the spatial coverage of Phase 1 monitoring had been considered adequate for measuring levels in the initial CAMP boundary overall as well as for measuring levels at sensitive receptor sites. About half of the Phase 1 monitoring site locations were at schools and considered sensitive receptor sites.

  The Phase 2 monitoring results were evaluated after the first six months of data collection and at the conclusion of the monitoring. Black carbon, $PM_{2.5}$, PM_{10}, most metals, and many VOCs were detected at all six monitoring sites. The monitoring sites were considered adequate for measuring levels in the initial CAMP boundary overall as well as for measuring levels at sensitive receptor sites. The Phase 2 monitoring sites included two sensitive receptor sites: Florin Elementary School and Cosumnes River College (near the Child Development Center daycare center).

6.4. Progress towards Objective D: Air quality education and outreach

- **Evaluate education and outreach activities on a year-to-year basis.**

  Education and outreach activities were limited by the COVID-19 coronavirus pandemic after the CAMP adoption in 2020. Various education and outreach opportunities were evaluated and discussed routinely in Steering Committee meetings. The Steering Committee has had an active outreach subcommittee since early 2021.

- **Engage in at least six (6) community events within 12 months of adoption of the CAMP.**

  The COVID-19 coronavirus pandemic prevented engagement with community events when the CAMP was first adopted. Since pandemic restrictions have lifted, the District has been participating in community events in the initial South Sacramento-Florin CAMP boundary and surrounding areas. The South Sacramento-Florin community air monitoring program was represented by District staff at a total of eight different outreach events in 2022 and 2023 (**Table 6-1**). Steering Committee members have participated in additional community engagements beyond those shown in **Table 6-1**.

Table 6-1. South Sacramento-Florin Community Air Monitoring Plan (CAMP) Community Engagement

Community Event	Sponsoring Org(s)	Location	Date	South Sacramento-Florin CAMP Community Engagement
National Night Out	North Laguna/Valley Hi Neighborhood Association	**Shasta Community Park** (7407 Imagination Pkwy, Sacramento)	8/2/22	Provided information on South Sacramento-Florin community air monitoring
			8/1/23	
	Deerfield/Mesa Grande Neighborhood Association	**Willie Caston Park** (4325 Valley Hi Dr, Sacramento)	8/2/22	
	Deerfield/Mesa Grande Neighborhood Association		8/1/23	
Sac Clean Air Celebration	District & Steering Committee	**Fern Bacon Middle School** (4140 Cuny Ave, Sacramento)	4/29/23	Produced community event to celebrate start of Phase 3 monitoring, featuring: • Portable laboratory tours • Phase 1 and 2 monitoring results • Free portable box fan air filters • Free public transit to event • Diverse mix of organizations represented, including: CARB, City of Sacramento, Sacramento County, SACOG, Museum of Science and Curiosity, United Latinos, Sacramento Lowriders, and Breathe
South Sacramento Festival	Office of Sacramento City Councilmember Mai Vang	**Shasta Community Park** (7407 Imagination Pkwy, Sacramento)	10/21/23	Provided information on South Sacramento-Florin community air monitoring
Safe Routes to Schools Listening Session	Civic Thread, District & Steering Committee	**La Familia Maple Neighborhood Center** (3200 37th Ave, Sacramento)	11/15/23	Provided real-time monitoring from Phase 3 monitoring
Evening with Santa	District & La Familia Counseling Center	**La Familia Maple Neighborhood Center** (3200 37th Ave, Sacramento)	12/12/23	Provided information on South Sacramento-Florin community air monitoring

- **Provide air quality data access through District's website and CARB's AQView website.**

  Air quality data from all three phases of monitoring are available on CARB's AQView[1] website. Real-time air quality information from Phase 1 monitoring has been available on the District Community Air Protection webpage since early 2020. The complete set of aggregated and validated air quality data from Phase 2 monitoring has been available on the District Community Air Protection webpage since March 2022. The first year of Phase 3 laboratory air quality data has been posted to the District Community Air Protection webpage since September 2024.

- **Evaluate effectiveness of public outreach**
- **Conduct polling to monitor effectiveness of public outreach.**

  Polling has not been conducted to measure effectiveness of public outreach. Public outreach was limited for the first three years of the CAMP implementation due to COVID-19 coronavirus pandemic restrictions.

- **Monitor Community Air Protection webpage traffic with a goal of a 10% increase in the first year.**

  The Community Air Protection webpages were created in March 2021. Based upon data from Google Analytics, the traffic to these pages ranges from approximately 400 to 900 visitors per month (**Table 6-2**). The traffic in March 2022 was over 50% greater than it was in March 2021.

  The Steering Committee's outreach committee created its own website[2] for the community air monitoring efforts. The website went live in summer 2022. It had over 2,000 visitors by the end of 2023 based on the hit counter on the webpage.

[1] https://aqview.arb.ca.gov/
[2] https://www.saccleanair.com/

Table 6-2. District Community Air Protection webpage monthly traffic.

Month	Number of visits		
	2021	2022	2023
January	-	550	631
February	-	468	709
March	539	821	697
April	902	639	543
May	601	512	526
June	450	475	649
July	762	560	470
August	743	484	463
September	605	411	571
October	560	462	752
November	578	509	703
December	450	543	694

7. Communicating the Results

The following sections describe past, ongoing, and future communication of the community air monitoring results. An overview of how community air monitoring results are to be communicated and shared is described in Element 14 of the CAMP. Communications are guided by priority audiences identified by the Steering Committee.

7.1. Communication with the Steering Committee

Preliminary data results from Phase 1 and Phase 2 monitoring have been presented previously in public Steering Committee meetings. The purpose of some previous data sharing with the Steering Committee was to provide information for deciding the location of the Phase 3 monitoring portable laboratory. The data results presented in this report expand upon previous presentations made to the Steering Committee. A summary of the data results presented in this report will be shared in Steering Committee meetings.

7.2. Communication with priority audiences

The Steering Committee identified the following five priority audiences for air quality-related communication:

- **Community organizations**
- **Children, students, schools, and youth leaders**
- **Hospitals, individuals that suffer asthma, and health fairs**
- **Senior and elderly community members**
- **Vulnerable groups**

The Steering Committee identified the type of information and best communication tool for each priority audience (Element 14 of the CAMP). Planned communication actions and the targeted priority audiences are shown in **Table 7-1** for sharing monitoring results. Some of these communication actions have already occurred for Phase 1 and Phase 2 monitoring results (**Chapter 6**). Translation into different languages is made available upon request for public presentations or printed materials.

Table 7-1. Community air monitoring results communication actions and targeted audiences.

Communication of Community Air Monitoring Results	Priority Audience				
	Community orgs	Children, students, schools, and youth leaders	Hospitals, individuals that suffer asthma, and health fairs	Senior and elderly community members	Vulnerable groups
Public Workshops/Presentations					
Presentations to the Steering Committee	✓				
Presentations to group(s) representing senior and elderly				✓	
Presentations to group(s) representing vulnerable communities					✓
Community Events					
Presenting or tabling at community events	✓	✓	✓		
Community Air Protection Webpage					
Annual report posted to webpage	✓				
Results summary posted to webpage	✓				
Monitoring data posted to webpage	✓				
Print Media					
Poster displays	✓	✓	✓	✓	✓
Print handouts	✓	✓	✓	✓	✓
Social Media					
Social media posts	✓	✓	✓		✓

8. Conclusions and Next Steps

8.1. Data results summary

8.1.1. Traffic-related pollutants

The average levels of the traffic-related pollutant $PM_{2.5}$ were greatest at the Bowling Green Park site for Phase 1 monitoring (**Figure 5-1**). The Bowling Green Park site is the closest to Highway 99. The average levels of the traffic-related pollutants black carbon and benzene were generally greatest at the Sacramento Fire Department Station 56 site in the northwest corner of the initial South Sacramento-Florin CAMP boundary (**Figure 5-6** and **Figure 5-21**). This site is near sources of traffic emissions, as it is along an arterial road and truck route and is close to gas stations, distribution centers, and Highway 99.

8.1.2. Health risk

Phase 1 and Phase 2 monitoring equipment does not meet regulatory standards, and as a result, it is not possible to evaluate whether pollutant levels measured by Phase 1 and Phase 2 monitoring exceeded state or federal health standards. However, there were pollution levels measured above state and federal health standards during the community air monitoring completed so far, which warranted the continuation of air monitoring through Phase 3 monitoring (**Table 5-3**, **Table 5-4, Table 5-13**, and **Table 5-14**). Both Phase 1 and Phase 2 monitoring included the wildfire seasons in the years 2020 and 2021, which saw particularly severe wildfire smoke impacts locally. It is expected that some of the levels measured above state and federal health standards were influenced by wildfire smoke.

The air toxics measured sometimes reached levels that had possible noncancer health impacts from short-term exposure (**Table 5-18**). The air toxics measured reached levels that had possible noncancer health impacts from long-term exposure for five of the six Phase 2 monitoring sites (**Table 5-19**). The compound acrolein was largely responsible for measured air toxics reaching potentially harmful levels. There is evidence that wildfire smoke contributed to acrolein reaching levels with possible health effects (**section 5.2.3.3**).

Acetaldehyde and benzene generally contributed the most cancer risk out of the carcinogens measured across the six sites (**Figure 5-22**). Based on CARB modeling, diesel particulate matter is the primary contributor to cancer risk of ambient air and acetaldehyde and benzene are a relatively minor part of the overall cancer risk from ambient air . Diesel particulate matter cannot be measured directly and was not estimated from other pollutants measured by Phase 2 monitoring.

8.1.3. Sensitive receptor sites

Phase 1 and Phase 2 monitoring demonstrated that sensitive receptor sites can have similar pollution levels to other areas of the community and do not necessarily have lower levels of pollution. The $PM_{2.5}$ levels measured at sensitive receptor sites ranged from being greater than most other Phase 1 monitoring sites – such as the Raymond Case Elementary School site – to being some of the lowest levels measured by Phase 1 monitoring sites – such as the Camellia Elementary School site (**Table 5-2** and **Table C-2** in Appendix C). The Phase 2 monitoring site Florin Elementary School had greater levels of some pollutants compared to the other Phase 2 monitoring sites. The Florin Elementary School site had the greatest average acrolein levels and the second greatest average $PM_{2.5}$, black carbon, and acetaldehyde levels of the six Phase 2 monitoring sites (**Figure 5-6**, **Figure 5-14**, and **Figure 5-21**). In contrast, the sensitive receptor site Cosumnes River College (monitor was near the daycare on campus) had lower or mid-range levels for most of these same pollutants ($PM_{2.5}$, black carbon, and acetaldehyde) compared to the other Phase 2 monitoring sites.

8.1.4. Pollution trends

The pollutants $PM_{2.5}$, black carbon, and benzene were more elevated in the winter compared to other times of year, outside of potentially wildfire smoke impacted intervals (**Figure 5-2**, **Figure 5-8**, and **Figure 5-23**). Weather inversions that trap pollution and cause it to accumulate are more severe over colder months, which worsen existing pollution levels. There is also some evidence of residential wood burning contributing to pollution levels in colder months. Over colder months of the year, black carbon levels were more elevated on the weekend, reached greater levels in the evening on the weekend, and were greater than average over winter holidays, all of which is potentially indicative of preferential wood burning on weekends and holidays (**Figure 5-10, Figure 5-11**, and **Figure 5-13**). In contrast, the compound acetaldehyde had the greatest levels in the summer and the lowest levels in winter (**Figure 5-23**). The compound is produced through photochemical reactions, which increase in warm, sunny conditions. This compound is also short-lived in the atmosphere, which prevents accumulation in weather inversions . It is suspected that local wildfire smoke impacts influenced the levels of some pollutants measured – such as $PM_{2.5}$, PM_{10}, and benzene – based on greater levels measured during intervals when there were potential local wildfire smoke impacts (**Figure 5-5**, **Figure 5-16**, **Figure 5-17**, and **section 5.2.3.4**).

8.2. Progress towards air monitoring objectives

Significant progress has been made towards each of the four primary air monitoring objectives outlined in the CAMP. Objectives are listed in italics and a summary of progress to date is described beneath each objective. Specific progress towards each milestone in Element 12 of the CAMP is described in **Chapter 6**.

Objective A: Monitoring for traffic-related air pollutants. Determine the spatial distribution of pollution from traffic on Highway 99 and whether these emissions are significant at schools and hospitals.

Traffic-related pollutants measured by Phase 1 and Phase 2 monitoring include $PM_{2.5}$, PM_{10}, black carbon, and certain toxics (e.g., benzene). Phase 1 and Phase 2 monitoring covered multiple locations across the initial South Sacramento-Florin CAMP boundary to capture spatial distribution of pollutants as well as pollution levels at schools. Evaluation of pollution levels measured in relation to Highway 99 and other traffic sources are described in **Chapter 5**.

Determine which source categories the emissions are coming from and whether the emissions from the sources contribute significantly to poor air quality in nearby areas.

Pollutants measured by Phase 1 and Phase 2 monitoring that have some of the most significant health impacts (e.g., $PM_{2.5}$, acetaldehyde, acrolein, benzene) can come from a variety of sources, making it difficult to identify the most significant sources. However, some potential sources were identified based on the observed trends in pollution levels. These sources include traffic emissions, regional wildfires, and residential woodsmoke (**Chapter 5**). Phase 1 and Phase 2 monitoring locations were not designed to measure emissions from any specific stationary source, and as a result the potential contribution of stationary sources to pollution levels could not be fully assessed.

Determine the air quality at sensitive receptor locations and whether air quality changes by season and locations for these sensitive locations.

Both Phase 1 and Phase 2 monitoring included sensitive receptor locations. It was found that seasonal trends in the pollution levels measured were generally consistent across all sites and no trends unique to sensitive locations were identified. It was found that pollution levels were not necessarily lower at sensitive receptor locations. For both Phase 1 and Phase 2 monitoring there were sensitive receptor locations that had pollutant levels similar to business and industrial locations (**Chapter 5**).

To increase air quality awareness in the community by making air quality information readily accessible and easy to understand.

Real-time air quality information from the Phase 1 monitoring network has been made available to the public through Clarity OpenMap. Phase 1 and Phase 2 monitoring results have been shared with the public through various community events and public presentations (**section 6.4**). Additionally, the Steering Committee has created the website SacCleanAir.com to educate and engage with the community on air quality.

8.3. Timeline for ongoing monitoring

Phase 3 monitoring began in April 2023 and consists of a portable laboratory that has continued to operate in the same location (**Figure 8-1**). The Steering Committee is currently in deliberations for the future location of the portable air monitoring laboratory within the expanded South Sacramento-Florin boundaries.

Figure 8-1. Phase 3 monitoring at Fern Bacon Middle School.

It is expected that the Phase 1 monitoring network will remain in place as long as monitors continue to be operational and monitor $PM_{2.5}$ levels.

As stated in Element 4 of the CAMP, monitoring under the CAMP will cease when any of the following conditions has been met:

1) the monitoring has met the objectives in the CAMP,

2) the information collected within the community is sufficient to inform CERP development and implementation,

3) the monitoring demonstrates that the air quality in the community does not exceed air quality standards or OEHHA's REL or

4) program funds are no longer available to continue monitoring.

8.4. Recommendations for next steps

In addition to the ongoing monitoring outlined in **section 8.3** and the communications actions outlined in **Chapter 7**, the following next steps are recommended for the South Sacramento-Florin CAMP:

- Analyze results from the Phase 3 monitoring with a focus on the four air monitoring objectives of the CAMP.
- Use air monitoring results to inform the CERP for the South Sacramento-Florin community. The air monitoring results can provide information such as:
    - Baseline pollution levels
    - Evidence of pollution sources
    - Identifying areas with worse pollution

References

AethLabs. 2018. *microAeth MA Series MA200, MA300, MA350 Operating Manual.* https://aethlabs.com/sites/all/content/microaeth/maX/MA200%20MA300%20MA350%20Operating%20Manual%20Rev%2003%20Dec%202018.pdf

Airmetrics. 2007. *Minivol Portable Air Sampler Operation Manual.* https://www.airmetrics.com/wp-content/uploads/2021/08/Manual_V5b_PICS.pdf

Atkinson, R. 2000. “Atmospheric chemistry of VOCs and NO_x.” *Atmospheric Environment*, 34 (12-14), 2063-2101. https://doi.org/10.1016/S1352-2310(99)00460-4

Brown, S., J. Lam Snyder, M. McCarthy, N. Pavlovic, S. D’Andrea, J. Hanson, A.P. Sullivan, and H. Hafner. 2020. “Assessment of Ambient Air Toxics and Wood Smoke Pollution among Communities in Sacramento County.” *International Journal of Environmental Research and Public Health,* 17(3), 1080. https://doi.org/10.3390/ijerph17031080

California Air Resources Board. 2017. *Short-Lived Climate Pollutant Reduction Strategy.* https://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf

—. 2023a. *California Air Toxics Assessment for 2017.* https://california-air-toxics-assessment-californiaarb.hub.arcgis.com/

—. 2023b. *Annual Network Plan.* https://ww2.arb.ca.gov/sites/default/files/2023-08/2023%20Annual%20Network%20Plan.pdf

—. 2024. *CARB Identified Toxic Air Contaminants*. Accessed July 5, 2024. https://ww2.arb.ca.gov/resources/documents/carb-identified-toxic-air-contaminants

California Office of Environmental Health Hazard Assessment. 2008. *Air Toxics Hot Spots Risk Assessment Guidelines: Technical Support Document For the Derivation of Noncancer Reference Exposure Levels. Appendix D.1.* https://oehha.ca.gov/media/downloads/crnr/appendixd1final.pdf

—. 2015. *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessment.* https://oehha.ca.gov/air/crnr/notice-adoption-air-toxics-hot-spots-program-guidance-manual-preparation-health-risk-0

—. 2020. *Cancer Risk and Noncancer Hazard Index: Fact Sheet for Contaminated Sites in California.* https://oehha.ca.gov/media/downloads/risk-assessment/fact-sheet-california-human-health-screening-levels-chhsls/riskfactsheet.pdf

Clarity. 2024. *Node-S Technical Specifications V5.* https://click.clarity.io/hubfs/Marketing%20Assets%20-%20PDFs/Product%20and%20Specification%20Sheets/Node-S%202%20Specifications%20Sheet%20(October%202021).pdf

Herrington, J. S., Z.H. Fan, P.J. Lioy, and J. Zhang. 2007. “Low Acetaldehyde Collection Efficiencies for 24-Hour Sampling with 2,4-Dinitrophenylhydrazine (DNPH)-Coated Solid Sorbents.” *Environmental Science & Technology,* 41(2), 580-585. https://doi.org/10.1021/es061247k

International Agency for Research on Cancer. 2021. “Carcinogenicity of acrolein, crotonaldehyde, and arecoline.” *The Lancet Oncology,* 22(1). https://doi.org/10.1016/S1470-2045(20)30727-0

Magee Scientific. 2023. *Aethalometer Model AE33 Specification Sheet V2.4.* https://aerosolmageesci.com/webdocuments/AE33_spec_sheet.pdf

O’Dell, K., R.S. Hornbrook, W. Permar, E.J. Levin, L.A. Garofalo, E.C. Apel, N.J. Blake, A. Jarnot, M.A. Pothier, D.K. Farmer, L. Hu, T. Campos, B. Ford, J.R. Pierce, and E.V. Fischer. 2020. “Hazardous Air Pollutants in Fresh and Aged Western US Wildfire Smoke and Implications for Long-Term Exposure.” *Environmental Science & Technology,* 54(19), 11838-11847. 10.1021/acs.est.0c04497

Polidori, A., V. Papapostolou, A. Collier-Oxandale, H. Hafner, and T. Blakey. 2021. *Community in Action: A Comprehensive Guidebook on Air Quality Sensors.* http://www.aqmd.gov/aq-spec/special-projects/star-grant

Sacramento Metropolitan Air Quality Management District. 2013. *$PM_{2.5}$ implementation/maintenance plan and redesignation request for Sacramento $PM_{2.5}$ nonattainment area.* https://www.airquality.org/ProgramCoordination/Documents/PM2.5%20Imp%20and%20Redesignation%202013.pdf

—. 2018. *Final Assessment of Proposed Monitoring Locations for AB 617 Community Air Protection Action.* https://www.airquality.org/ProgramCoordination/Documents/SMAQMD%20Final%20Recommendations-Report.pdf

—. 2021a. *Standard Operating Procedure for AethLabs MA200 SOP #217.*

—. 2021b. *Standard Operating Procedure for Clarity Node-S SOP #437.*

—. 2021c. *Standard Operating Procedure for Clarity Sensor SOP #427.*

—. 2021d. *Standard Operating Procedure for Magee AE-33 SOP #227.*

—. 2021e. *Standard Operating Procedure for TO-15 Canister Sampling SOP #837.*

—. 2022. *2022 Annual Network Plan.* https://www.airquality.org/ProgramCoordination/Documents/2022%20Annual%20Monitoring%20Network%20Plan.pdf

—. 2023. *5-year Air Monitoring Network Assessment.* https://www.airquality.org/ProgramCoordination/Documents/2020%205%20Year%20Network%20Assessment.pdf

Sonoma Technology, Inc. 2021. *Mini-Vol SOP #417.*

South Coast Air Quality Management District Air Quality Sensor Performance Evaluation Center. 2018. *Field Evaluation of Clarity Node PM Sensor.* http://www.aqmd.gov/docs/default-source/aq-spec/laboratory-evaluations/clarity-node---lab-evaluation.pdf?sfvrsn=25

United States Agency for Toxic Substances and Disease Registry. 2007. *Toxicological profile for acrolein.* https://www.atsdr.cdc.gov/toxprofiles/tp124.pdf

United States Environmental Protection Agency. 1987. *Health Assessment Document for Acetaldehyde.* https://nepis.epa.gov/Exe/ZyPDF.cgi/30001FBF.PDF?Dockey=30001FBF.PDF

—. 1999a. *Compendium of Methods for the Determination of Inorganic Compounds in Ambient Air: Compendium Method IO-3.3.* https://www.epa.gov/sites/default/files/2019-11/documents/mthd-3-3.pdf

—. 1999b. *Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, Second Edition.* https://www.epa.gov/amtic/compendium-methods-determination-toxic-organic-compounds-ambient-air

—. 2007. *Ambient Air Monitoring Network Assessment Guidance: Analytical Techniques for Technical Assessment of Ambient Air Monitoring Networks.* https://www.epa.gov/sites/default/files/2020-01/documents/network-assessment-guidance.pdf

—. 2012. *Report to Congress on Black Carbon.* https://www3.epa.gov/airquality/blackcarbon/2012report/fullreport.pdf

—. 2020. *Policy Assessment for the Review of the National Ambient Air Quality Standards for Particulate Matter.* https://www.epa.gov/system/files/documents/2021-10/final-policy-assessment-for-the-review-of-the-pm-naaqs-01-2020.pdf

—. 2024a. *Final Updates to the Air Quality Index (AQI) for Particulate Matter Fact Sheet and Common Questions.* https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-air-quality-index-fact-sheet.pdf

—. 2024b. *Technical Assistance Document for the Reporting of Daily Air Quality – the Air Quality Index (AQI).* https://document.airnow.gov/technical-assistance-document-for-the-reporting-of-daily-air-quailty.pdf

Appendix A:
Data completeness summary

Table A-1. Community air monitoring data completeness.

Pollutant	Averaging Interval	Monitoring Period	Data completeness
Phase 1 monitoring			
$PM_{2.5}$	24-hour	1/1/20 – 12/31/23	85%
	1-hour	1/1/20 – 12/31/23	85%
Phase 2 monitoring			
Black carbon	24-hour	8/19/20 - 11/29/21	62%
	1-hour	8/19/20 - 11/29/21	64%
Speciated $PM_{2.5}$	N/A (1-in-6 days 24-hour sample)	8/19/20 - 11/24/21	91%
Speciated PM_{10}	N/A (1-in-6 days 24-hour sample)	7/15/21 – 12/12/21	88%
VOCs	N/A (1-in-6 days 24-hour sample)	8/19/20 - 11/24/21	70%

Appendix B:
List of VOCs measured

Table B-1. Volatile organic compounds (VOCs) measured by TO-15 and TO-14A analytical methods.

Values shaded under the TO-14A method were also analyzed by the TO-15 method. For these VOCs measured by both methods, the results shown in **section 5.2.3** used values obtained from the TO-15 method.

TO-15			TO-14A	
1,1,2,2-Tetrachloroethane[1]	Bromoform	m/p-Xylene[1]	1,2,3-Trimethylbenzene[1]	Isopentane
1,1,2-Trichloroethane[1]	Bromomethane[1]	Methanol[1]	1,2,4-Trimethylbenzene[1]	Isoprene
1,1-Dichloroethane[1]	Butylbenzene	Methyl butyl ketone	1,3,5-Trimethylbenzene[1]	Isopropylbenzene
1,1-Dichloroethylene[2]	Carbon disulfide[1]	Methyl chloroform[1]	1-Butene	m/p-Xylene[1]
1,2,3-Trichloropropane	Carbon tetrachloride[1,1]	Methyl ethyl ketone[1]	1-Hexene	m-Diethylbenzene
1,2,4-Trichlorobenzene	Chlorobenzene[1]	Methyl isobutyl ketone	1-Pentene	Methylcyclohexane
1,2,4-Trimethylbenzene[1]	Chlorodifluoromethane	Methyl methacrylate	2,2,4-Trimethylpentane	Methylcyclopentane
1,2-Dibromo-3-Chloropropane[1]	Chloroethane[1]	Methyl tert-butyl ether[1,1]	2,2-Dimethylbutane	m-Ethyltoluene
1,2-Dichlorobenzene	Chloroform[1,1]	Naphthalene[1,1]	2,3,4-Trimethylpentane	n-Butane
1,2-Dichloropropane	Chloromethane	n-Hexane[1]	2,3-Dimethylbutane	n-Decane
1,3,5-Trimethylbenzene[1]	cis-1,2-Dichloroethene	n-Propylbenzene	2,3-Dimethylpentane	n-Dodecane
1,3-Butadiene[1,1]	cis-1,3-Dichloropropene	o-Xylene[1]	2,4-Dimethylpentane	n-Heptane
1,3-Dichlorobenzene	Cyclohexane	p-Ethyltoluene	2-Methylheptane	n-Hexane[1]
1,4-Dichlorobenzene[1,1]	Dibromochloromethane	Propylene[1]	2-Methylhexane	n-Nonane
1,4-Dioxane[1,1]	Dichlorodifluoromethane	sec-Butylbenzene	2-Methylpentane	n-Octane
2,2,4-Trimethylpentane	Dichlorofluoromethane	Styrene[1]	3-Methylheptane	n-Pentane
2-Chlorotoluene	Dichloromethane[1,1]	tert-butyl alcohol	3-Methylhexane	n-Propylbenzene
2-Propanol[1]	Dichlorotetrafluoroethane	Tetrachloroethylene[1,1]	3-Methylpentane	n-Undecane
3-Chloropropene[1]	Dimethyl Ether	Toluene[1]	Acetylene	o-Ethyltoluene
Acetaldehyde[1,1]	Ethyl acetate	trans-1,2-Dichloroethylene	Benzene[1,1]	o-Xylene[1]
Acetone	Ethyl alcohol	trans-1,3-Dichloropropene	cis-2-Butene	p-Diethylbenzene
Acrolein[1]	Ethylbenzene[1,1]	Trichloroethylene[1,1]	cis-2-Pentene	p-Ethyltoluene
Acrylonitrile[1,1]	Ethylene dibromide[1,1]	Trichlorofluoromethane	Cyclohexane	Propane
α-Pinene	Ethylene dichloride [1,1]	Trichlorotrifluoroethane	Cyclopentane	Propylene[1]
Benzene[1,1]	Furan, tetrahydro-	Vinyl acetate[1]	Ethane	Styrene[1]
Benzyl chloride[1,1]	Heptane	Vinyl bromide	Ethylbenzene[1,1]	Toluene[1]
β-Pinene	Hexachlorobutadiene	Vinyl chloride[1,1]	Ethylene	trans-2-Butene
Bromodichloromethane	Isopropylbenzene		Isobutane	trans-2-Pentene

[1] Associated with an inhalation cancer unit risk listed by the California Office of Environmental Health Hazard Assessment (OEHHA).
[2] Associated with a Reference Exposure Level (REL) listed by OEHHA.

Appendix C:
Phase 1 monitoring site comparisons

Table C-1. Squared Pearson's correlation coefficient (R^2) between Phase 1 monitoring network sites for $PM_{2.5}$.
Comparison of 24-hour averages of $PM_{2.5}$ when all sites had a valid average (total of 252 dates between October 2020 and October 2021).

Site key:

1 - Bowling Green Elem. School
2 - Bowling Green Pk
3 - Nicholas Pk
4 - Nicholas Elem. School
5 - Camellia Elem. School
6 - District Council 16
7 - Sac. Co. Sheriff Svc Ctr
8 - Parkway Swim Club
9 - Southgate Library
10 - David Reese Elem. School
11 - Florin Elem. School
12 - Elk Grove Adult & Comm. Ed.
13 - Mack Rd Valley Hi Comm. Ctr
14 - Mack Rd Partnership
15- Herman Leimbach Elem. School
16 - Valley High School
17 - Valley Hi-North Laguna Library
18 - Edwin A. Smith Comm. Pk
19 - Isabella Jackson Elem. School
20 - Irene B West Elem. School
21 - Raymond Case Elem. School

Site	Squared Pearson's correlation coefficient (R^2)																				
	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Site 21
1	**1.00**	0.98	0.99	0.99	0.98	0.98	0.99	0.99	0.98	0.99	0.98	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.98
2	0.98	**1.00**	0.99	0.99	0.96	0.98	0.99	0.99	0.98	0.99	0.98	0.97	0.97	0.98	0.98	0.98	0.98	0.98	0.98	0.97	0.98
3	0.99	0.99	**1.00**	1.00	0.97	0.98	1.00	0.99	0.97	0.99	0.98	0.98	0.98	0.99	0.98	0.99	0.98	0.98	0.98	0.97	0.98
4	0.99	0.99	1.00	**1.00**	0.97	0.98	0.99	0.99	0.98	0.99	0.98	0.97	0.98	0.99	0.98	0.99	0.98	0.99	0.98	0.98	0.98
5	0.98	0.96	0.97	0.97	**1.00**	0.96	0.98	0.97	0.96	0.98	0.99	0.99	0.97	0.96	0.98	0.97	0.98	0.98	0.99	0.98	0.98
6	0.98	0.98	0.98	0.98	0.96	**1.00**	0.98	0.98	0.97	0.98	0.97	0.97	0.97	0.98	0.98	0.98	0.97	0.98	0.97	0.97	0.98
7	0.99	0.99	1.00	0.99	0.98	0.98	**1.00**	0.99	0.98	0.99	0.98	0.98	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.98	0.99
8	0.99	0.99	0.99	0.99	0.97	0.98	0.99	**1.00**	0.98	0.99	0.98	0.97	0.98	0.99	0.98	0.99	0.98	0.99	0.98	0.98	0.98
9	0.98	0.98	0.97	0.98	0.96	0.97	0.98	0.98	**1.00**	0.98	0.97	0.97	0.97	0.98	0.98	0.98	0.98	0.98	0.98	0.97	0.98
10	0.99	0.99	0.99	0.99	0.98	0.98	0.99	0.99	0.98	**1.00**	0.99	0.98	0.99	0.99	0.98	0.99	0.99	0.99	0.99	0.98	0.99
11	0.98	0.98	0.98	0.98	0.99	0.97	0.98	0.98	0.97	0.99	**1.00**	0.99	0.98	0.98	0.99	0.98	0.99	0.99	0.99	0.99	0.99
12	0.98	0.97	0.98	0.97	0.99	0.97	0.98	0.97	0.97	0.98	0.99	**1.00**	0.98	0.98	0.99	0.98	0.99	0.99	0.99	0.99	0.99
13	0.98	0.97	0.98	0.98	0.97	0.97	0.98	0.98	0.97	0.99	0.98	0.98	**1.00**	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.98
14	0.98	0.98	0.99	0.99	0.96	0.98	0.99	0.99	0.98	0.99	0.98	0.98	0.98	**1.00**	0.98	0.99	0.98	0.99	0.98	0.98	0.98
15	0.99	0.98	0.98	0.98	0.98	0.98	0.99	0.98	0.98	0.98	0.99	0.99	0.99	0.98	**1.00**	0.99	0.99	0.99	0.99	1.00	0.99
16	0.99	0.98	0.99	0.99	0.97	0.98	0.99	0.99	0.98	0.99	0.98	0.98	0.99	0.99	0.99	**1.00**	0.99	0.99	0.99	0.99	0.99
17	0.99	0.98	0.98	0.98	0.98	0.97	0.99	0.98	0.98	0.99	0.99	0.99	0.99	0.98	0.99	0.99	**1.00**	0.99	0.99	0.99	1.00
18	0.99	0.98	0.98	0.99	0.98	0.98	0.99	0.99	0.98	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	**1.00**	1.00	0.99	1.00
19	0.98	0.99	0.98	0.98	0.99	0.97	0.99	0.98	0.98	0.99	0.99	0.99	0.99	0.98	0.99	0.99	0.99	1.00	**1.00**	0.99	0.99
20	0.97	0.99	0.97	0.98	0.98	0.97	0.98	0.98	0.97	0.98	0.99	0.99	0.99	0.98	1.00	0.99	0.99	0.99	0.99	**1.00**	0.99
21	0.98	0.98	0.98	0.98	0.98	0.98	0.99	0.98	0.98	0.99	0.99	0.99	0.98	0.98	0.99	0.99	1.00	1.00	0.99	0.99	**1.00**

Table C-2. Ranking of Phase 1 monitoring network sites for $PM_{2.5}$.

Percent of days each site had a given numbered ranking out of the 21 sites for 24-hour average $PM_{2.5}$. Data limited to dates when all 21 sites had a valid 24-hour average (total of 252 dates between October 2020 and October 2021). A rank of 1 is the greatest 24-hour average $PM_{2.5}$ across all sites on a given date.

Site key:
1 - Bowling Green Elem. School
2 - Bowling Green Pk
3 - Nicholas Pk
4 - Nicholas Elem. School
5 - Camellia Elem. School
6 - District Council 16
7 - Sac. Co. Sheriff Svc Ctr
8 - Parkway Swim Club
9 - Southgate Library
10 - David Reese Elem. School
11 - Florin Elem. School
12 - Elk Grove Adult & Comm. Ed.
13 - Mack Rd Valley Hi Comm. Ctr
14 - Mack Rd Partnership
15- Herman Leimbach Elem. School
16 - Valley High School
17 - Valley Hi-North Laguna Library
18 - Edwin A. Smith Comm. Pk
19 - Isabella Jackson Elem. School
20 - Irene B West Elem. School
21 - Raymond Case Elem. School

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6	Site 7	Site 8	Site 9	Site 10	Site 11	Site 12	Site 13	Site 14	Site 15	Site 16	Site 17	Site 18	Site 19	Site 20	Site 21
1	0%	73%	1%	0%	0%	6%	0%	1%	6%	0%	1%	2%	3%	0%	0%	0%	2%	1%	0%	0%	2%
2	2%	16%	3%	1%	0%	7%	2%	27%	4%	0%	2%	2%	1%	4%	0%	0%	18%	6%	1%	0%	5%
3	5%	4%	6%	3%	0%	1%	2%	15%	2%	1%	2%	3%	0%	9%	2%	2%	23%	11%	1%	0%	9%
4	13%	2%	4%	4%	0%	1%	2%	15%	2%	1%	2%	6%	0%	9%	2%	2%	11%	11%	1%	0%	12%
5	7%	1%	4%	4%	0%	2%	4%	10%	3%	1%	3%	4%	1%	5%	2%	6%	8%	19%	5%	0%	11%
6	8%	2%	5%	4%	0%	2%	6%	8%	6%	2%	3%	4%	0%	8%	4%	6%	6%	9%	8%	1%	8%
7	10%	0%	5%	4%	0%	2%	5%	3%	3%	1%	5%	7%	0%	8%	5%	10%	5%	8%	12%	1%	8%
8	6%	0%	3%	5%	0%	4%	3%	5%	4%	3%	6%	7%	1%	5%	7%	8%	4%	7%	8%	2%	13%
9	6%	0%	5%	6%	0%	4%	6%	2%	7%	1%	6%	6%	0%	6%	9%	10%	4%	6%	9%	2%	5%
10	5%	0%	5%	4%	0%	1%	7%	3%	5%	2%	10%	7%	1%	4%	10%	12%	6%	4%	6%	3%	6%
11	7%	0%	5%	4%	1%	3%	4%	4%	9%	5%	8%	8%	0%	2%	8%	6%	2%	6%	9%	5%	7%
12	6%	0%	4%	4%	0%	3%	5%	3%	11%	4%	9%	8%	1%	4%	7%	7%	3%	3%	6%	8%	5%
13	4%	0%	6%	8%	2%	4%	5%	1%	6%	5%	6%	8%	2%	7%	6%	3%	4%	3%	11%	4%	3%
14	4%	0%	6%	11%	0%	5%	8%	1%	8%	6%	10%	7%	2%	7%	8%	7%	2%	1%	4%	6%	2%
15	3%	0%	8%	10%	1%	10%	7%	1%	6%	5%	5%	6%	2%	4%	6%	5%	2%	2%	6%	6%	2%
16	4%	0%	7%	9%	3%	8%	9%	0%	6%	10%	9%	4%	2%	4%	7%	4%	1%	1%	6%	8%	2%
17	4%	0%	6%	9%	3%	10%	11%	0%	8%	7%	6%	6%	3%	3%	7%	2%	1%	1%	5%	9%	0%
18	3%	0%	8%	8%	4%	12%	7%	0%	4%	10%	4%	3%	4%	6%	6%	4%	0%	0%	2%	13%	0%
19	2%	0%	6%	4%	8%	7%	5%	0%	0%	28%	2%	2%	8%	3%	4%	4%	0%	0%	1%	16%	0%
20	2%	0%	3%	1%	38%	6%	2%	0%	1%	7%	0%	1%	23%	2%	1%	2%	0%	0%	0%	10%	0%
21	1%	0%	1%	0%	37%	2%	0%	0%	0%	1%	0%	0%	46%	2%	0%	0%	0%	0%	0%	7%	0%

Appendix D:
Past weather data

Table D-1. Precipitation totals for Sacramento, CA (2020-2023).

Precipitation totals for the weather station near Sacramento State University in Sacramento, CA (SACRAMENTO 5 ESE, CA). The weather station at the Sacramento Executive Airport was not used because there was missing data for January 2023. Precipitation totals from the National Weather Service (available at: http://www.weather.gov).

Year	Total Precipitation (inches)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	**Annual**
2023	7.54	2.56	4.90	0.17	0.29	0.01	0.00	0.03	0.07	0.34	0.73	4.02	**20.66**
2022	0.05	0.00	0.94	0.96	0.06	0.16	0.00	0.00	0.49	0.00	1.16	9.52	**13.34**
2021	3.00	1.05	1.29	0.00	0.00	0.00	0.00	0.00	0.00	6.72	0.74	6.98	**19.78**
2020	1.26	0.00	1.68	2.19	0.32	0.01	0.00	0.01	0.00	0.00	0.87	1.53	**7.87**

Appendix E:
Traffic maps

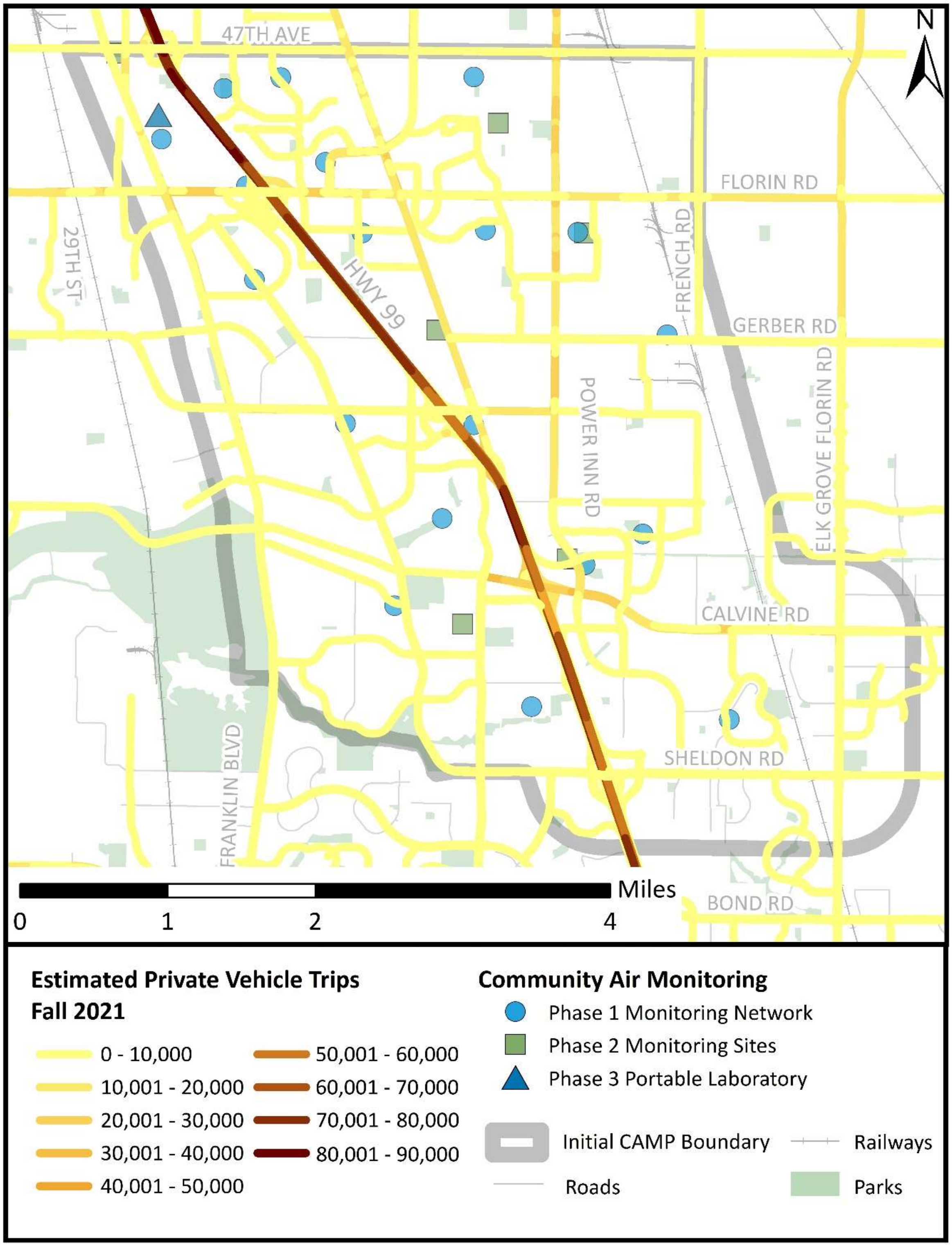

Figure E-1. Private vehicle trips in South Sacramento-Florin.

Traffic volumes obtained from Sacramento Area Council of Governments (SACOG) and provided by Replica, Inc.

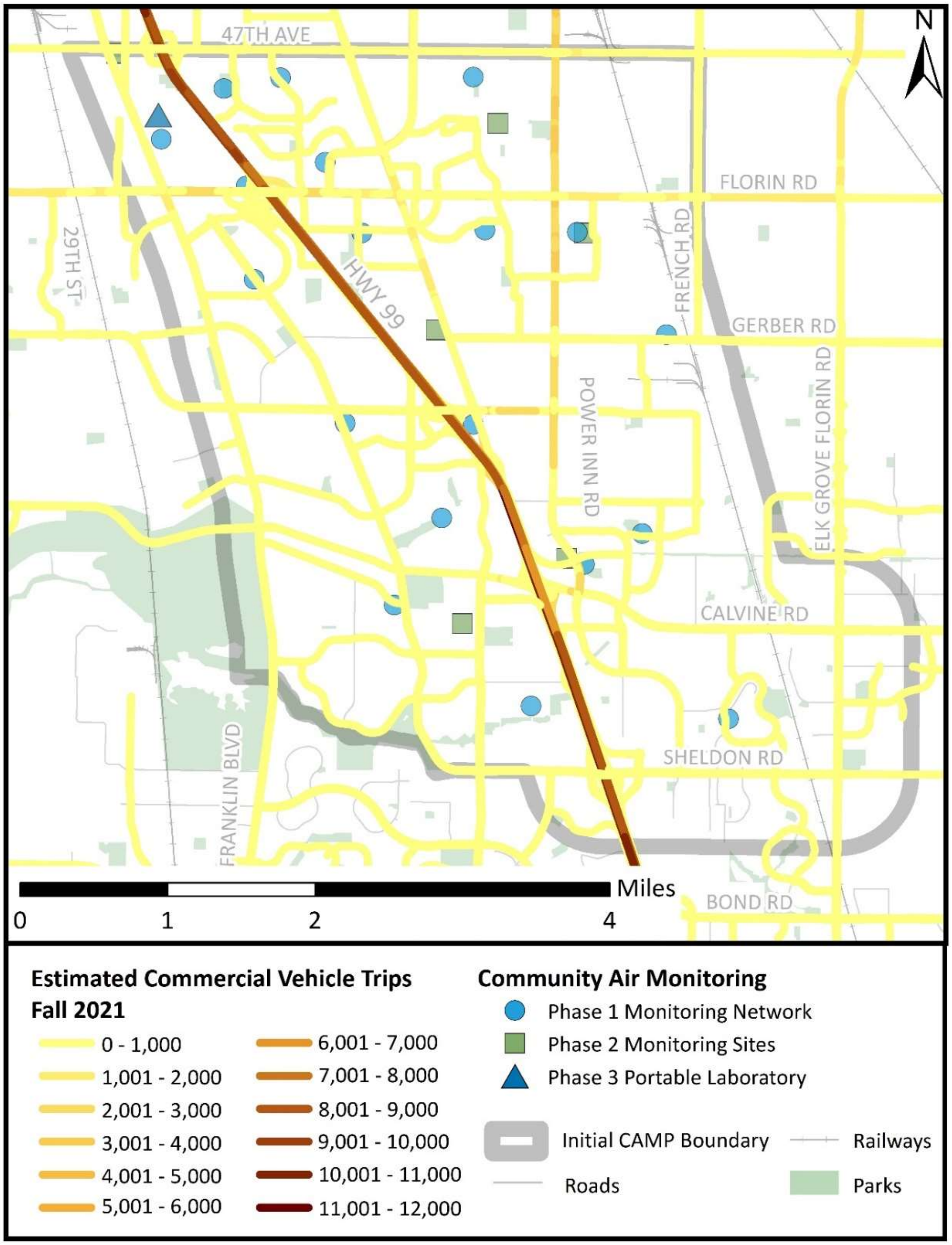

Figure E-2. Commercial vehicle trips in South Sacramento-Florin.

Traffic volumes obtained from Sacramento Area Council of Governments (SACOG) and provided by Replica, Inc.