

The logo for CTEH, featuring the letters 'CTEH' in a bold, white, sans-serif font with a registered trademark symbol (®) to the upper right. The text is set against a dark blue rectangular background.

CTEH®

THE SCIENCE OF READYSM

VALERO ENERGY

BENICIA REFINERY PARTICULATE

RELEASE

Benicia, CA

March 17, 2019

Project #111342

1.0 Introduction

On March 13, 2019 Valero Energy requested that CTEH® conduct air monitoring in the surrounding community after a release of particulate matter from the Benicia Refinery in Benicia California. CTEH® arrived on-site on March 13, 2019 and began air monitoring operations. Activities were comprised of real-time air monitoring and analytical air sampling.

This report summarizes air monitoring data collected from March 16, 2019 06:30 PDT to March 17, 2019 06:30 PDT.

2.0 Air Monitoring and Sampling Methods

CTEH® developed and implemented an air sampling and analysis work plan (SAP) to document and quantify the release of fugitive emissions from the flue gas scrubber. All instrumentation was calibrated at least once per day or per manufacturer's recommendations. Target analytes were measured as, carbon monoxide (CO), nitrogen dioxide (NO₂), 2.5-micron particulate matter (PM_{2.5}), 10-micron particulate matter (PM₁₀), and sulfur dioxide (SO₂) using handheld instruments such as RAE Systems MultiRAEs, TSI SidePak™ AM510/AM520 Aerosol Monitors, TSI DustTrak™ Aerosol Monitors, and Gastec GV-100 pumps with chemical-specific colorimetric detection tubes.

Hand-held air monitoring consisted of roaming air monitoring in the surrounding community. All hand-held air monitoring was conducted in the breathing zone.

Analytical air samples were deployed in the breathing zone at six locations through the community. Each station consisted of SKC active sampling pump equipped with mixed cellulose ester (MCE) filter media suitable for collection of metals.

All samples will be sent to an accredited laboratory for analysis in accordance with NIOSH Method 7303. **Figure 11 in Attachment A** depicts these analytical air sampling locations.

3.0 Air Monitoring Results

Figures 1 – 10 in Attachment A depicts the site location and hand-held monitoring locations for this reporting period.

Table 1 summarizes the results for community hand-held air monitoring readings.

Table 1: Community Hand-Held Real-Time Air Monitoring Results

Analyte	Instrument	# Readings	# Detections	Range
Carbon Monoxide	MultiRAE	85	0	< 1 ppm
NO ₂	MultiRAE	85	3	0.1 - 0.2 ppm
PM ₁₀	AM510/AM520/DustTrak	46	46	0.004 - 0.060 mg/m ³
PM _{2.5}	AM510/AM520/DustTrak	39	39	0.004 - 0.060 mg/m ³
SO ₂	MultiRAE	7	0	< 0.1 ppm

¹Maximum detections preceded by the "<" symbol are considered non-detections below the limit of detection (LoD) value to the right.

Additionally, at the request of public health officials, particulate matter (PM_{2.5} and PM₁₀) data have been grouped by downwind direction and averaged over a 24-hour period for comparison to AQI category equivalents. Wind-rose maps are provided for the corresponding time periods (**Appendix B**). It is notable that the USEPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations, averages may be biased and are not directly comparable to the NAAQS. Comparisons to AQI category equivalents are provided for illustration purposes only.

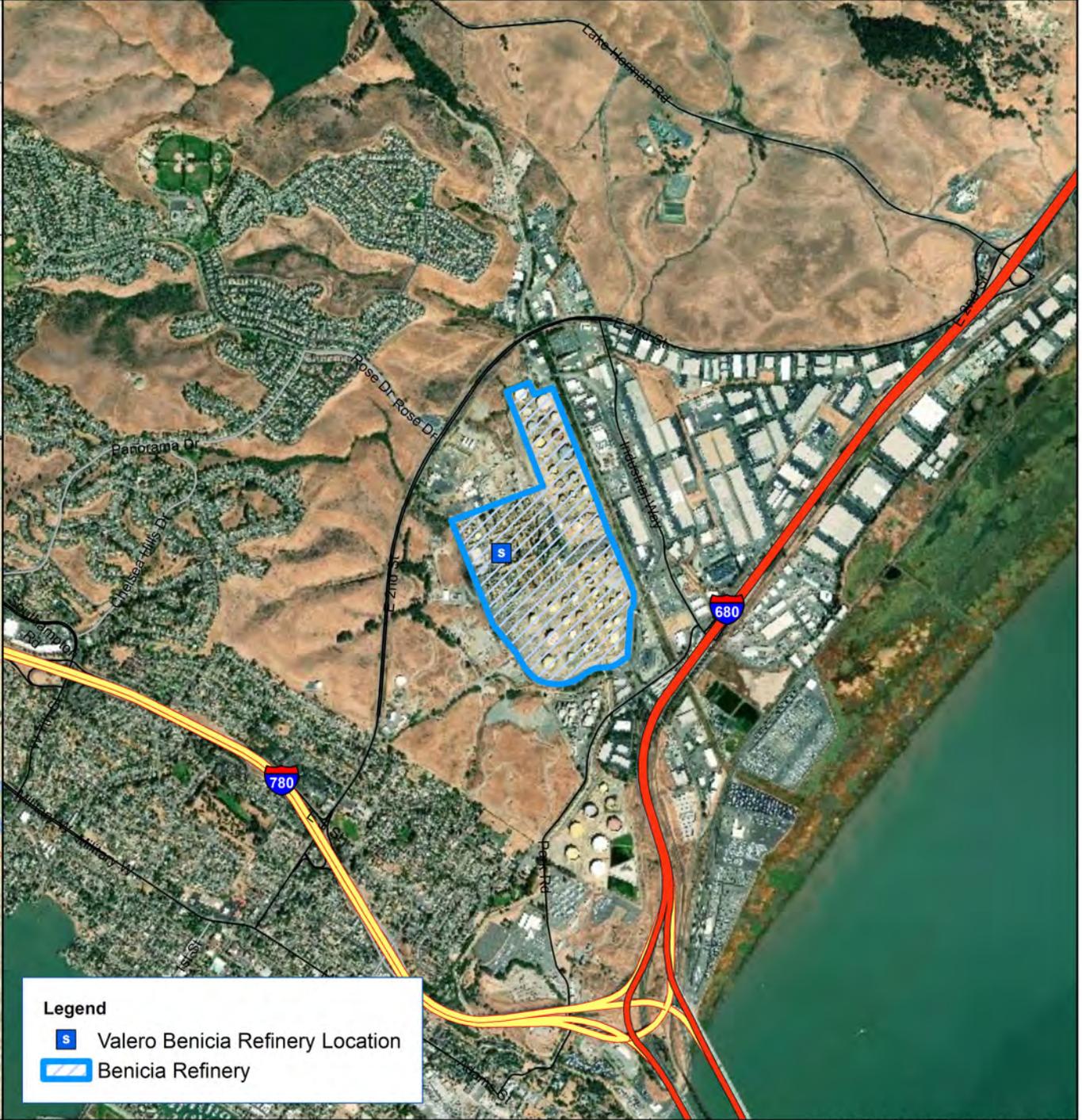
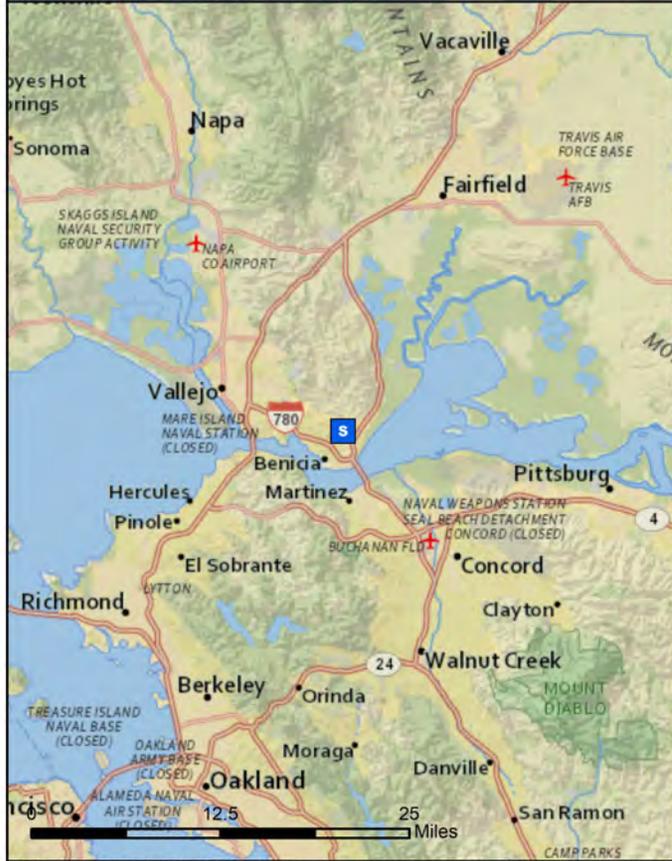
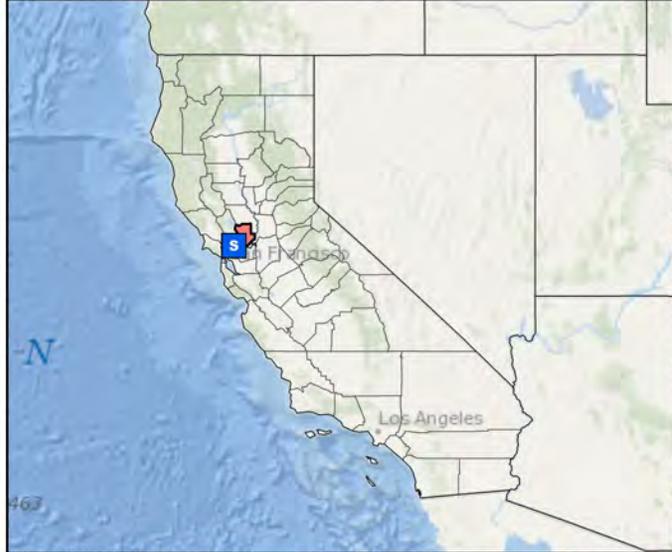
4.0 Weather Conditions

Figure 12 in attachment C contains meteorological data and a wind rose depicting wind speed and direction for this reporting period. Data was acquired from California Irrigation Management System (CIMIS) meteorological station #170 located in Concord to the southeast of the Benicia Refinery.



Attachment A

CTEH Air Sampling and Monitoring Locations



Legend

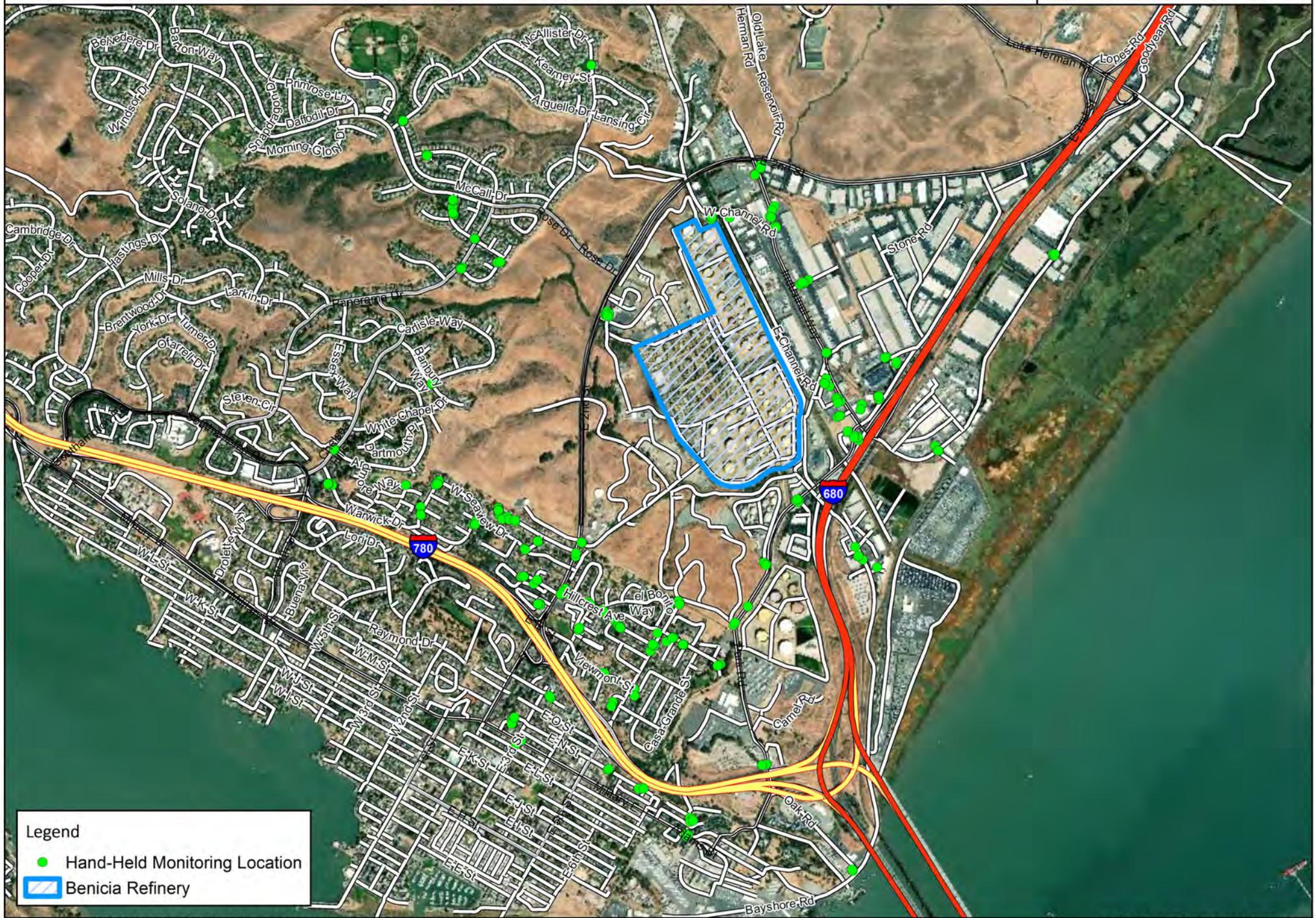
- Valero Benicia Refinery Location
- Benicia Refinery



Figure 2: Hand-Held Real-Time Monitoring Locations
Benicia Refinery Particulate Release



Project: 111342
Client: Valero Energy
City: Benicia, AR
County: Solano



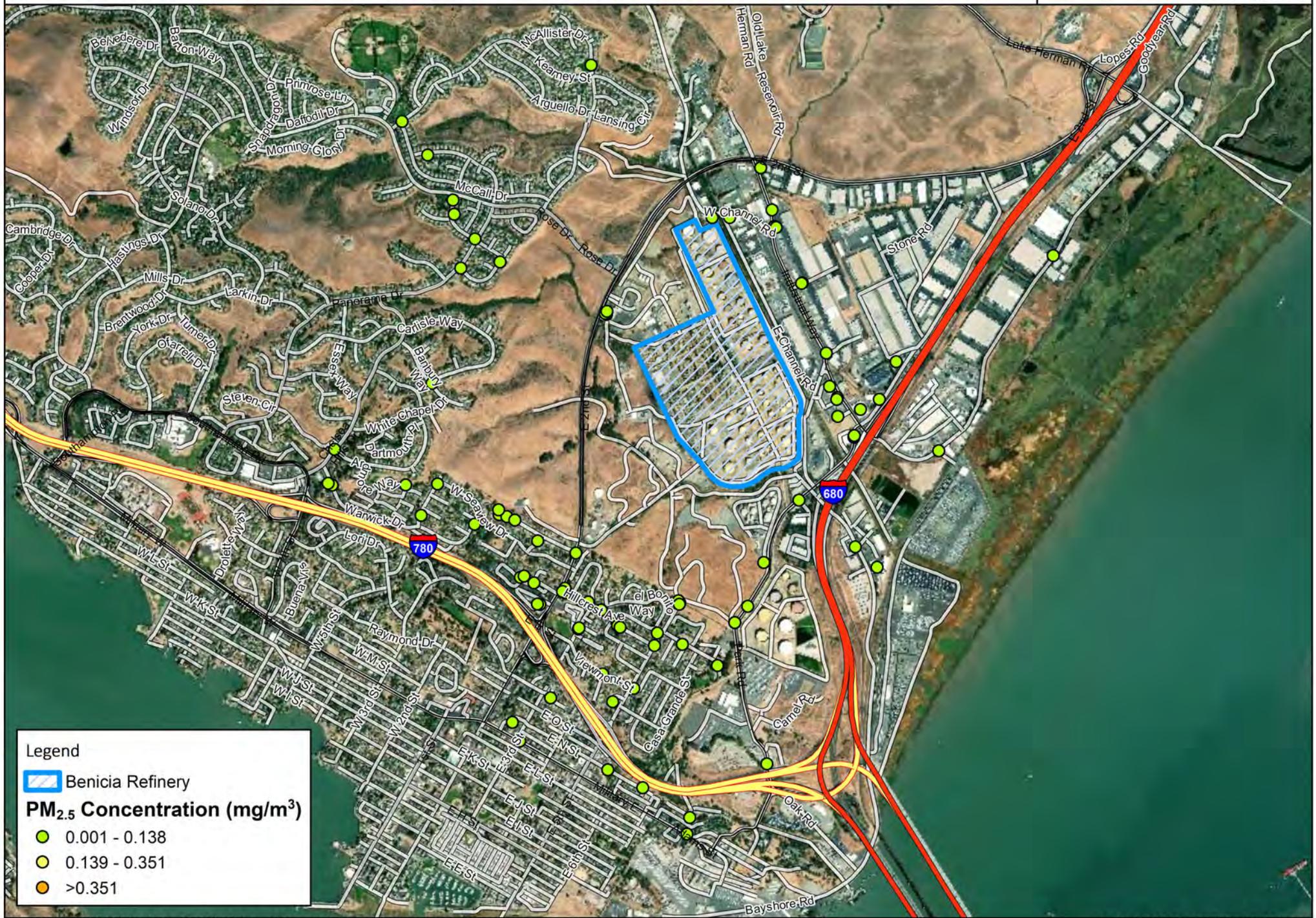
Legend

- Hand-Held Monitoring Location
- Benicia Refinery



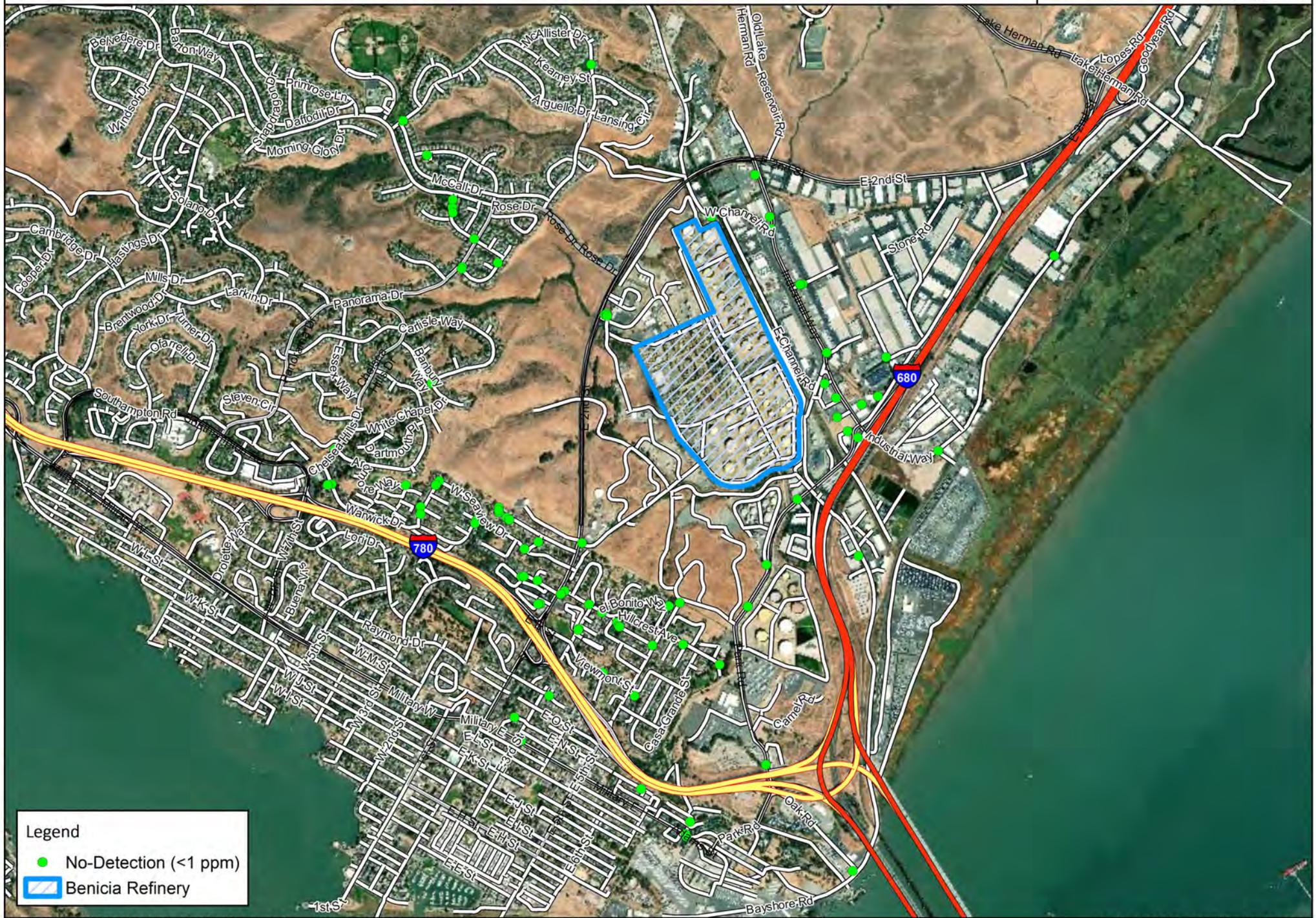
Legend

- Benicia Refinery
- PM₁₀ Concentration (mg/m³)**
- 0.001 - 0.138
- 0.139 - 0.351
- >0.352



Legend

- Benicia Refinery
- PM_{2.5} Concentration (mg/m³)**
- 0.001 - 0.138
- >0.351



Legend

- No-Detection (<1 ppm)
- Benicia Refinery



Legend

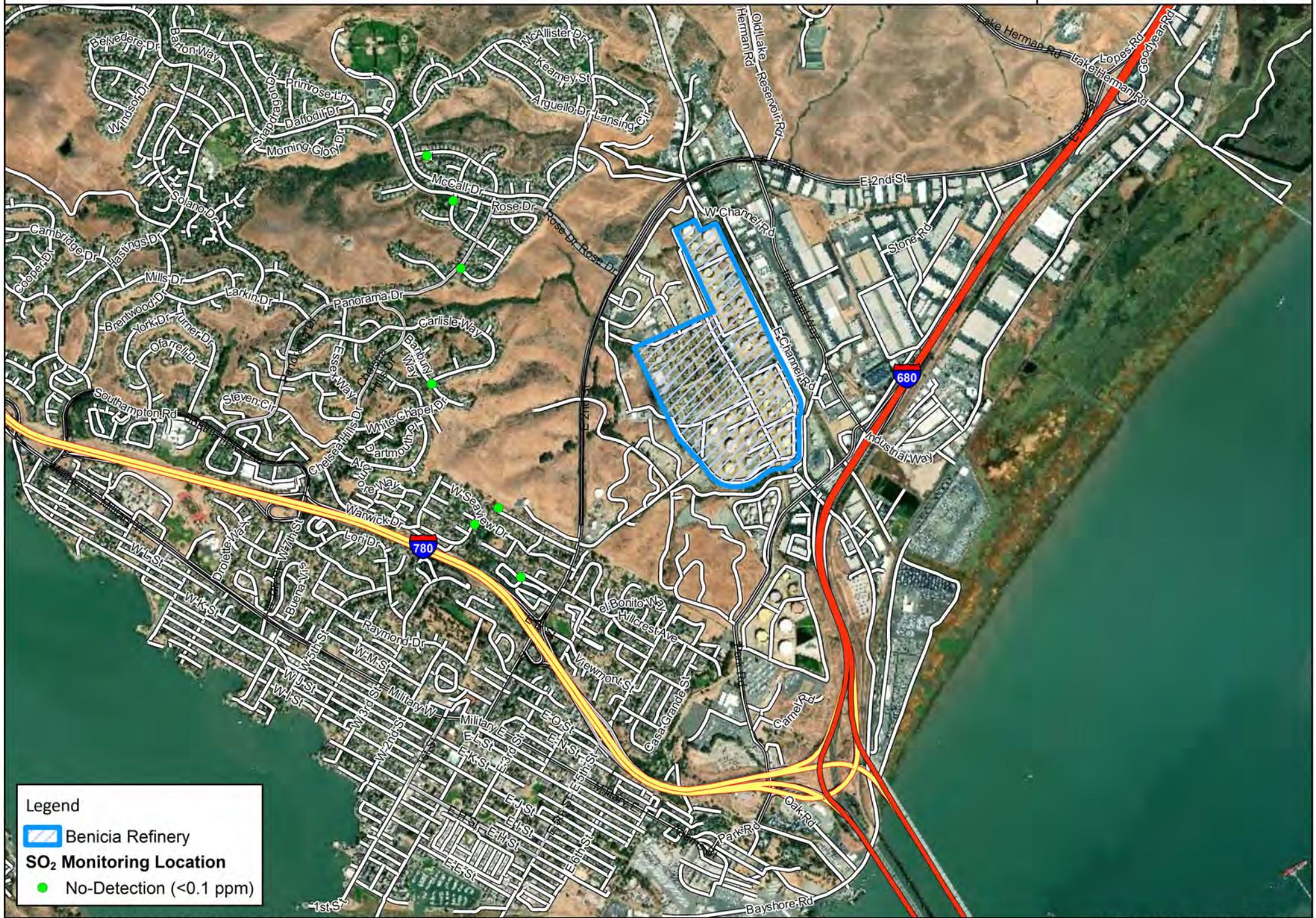
- Benicia Refinery
- (NO₂) Monitoring Location
- No-Detection (<0.1 ppm)



Figure 7: Hand-Held Real-Time Monitoring Locations (SO₂)
Benicia Refinery Particulate Release

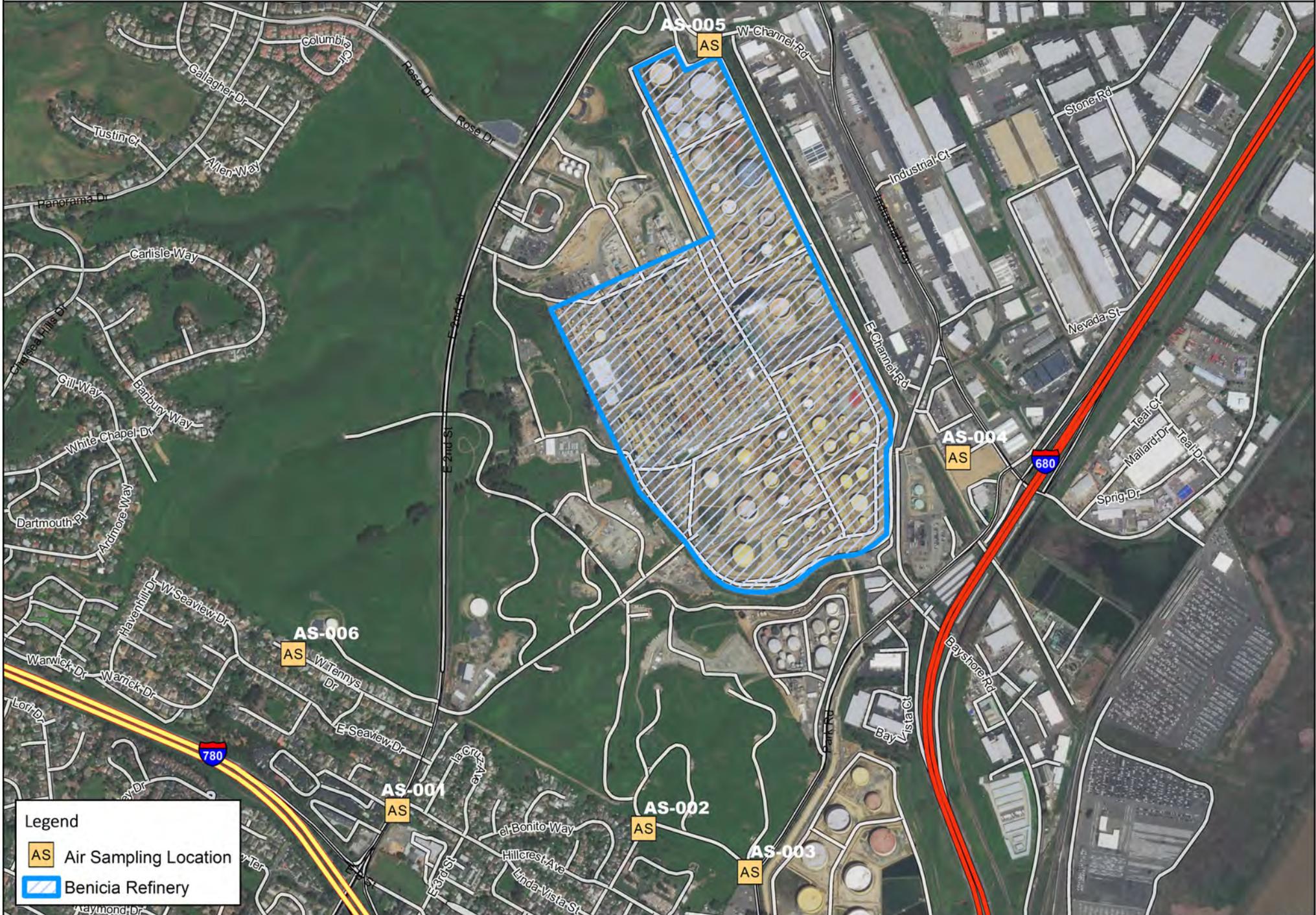


Project: 111342
Client: Valero Energy
City: Benicia, AR
County: Solano



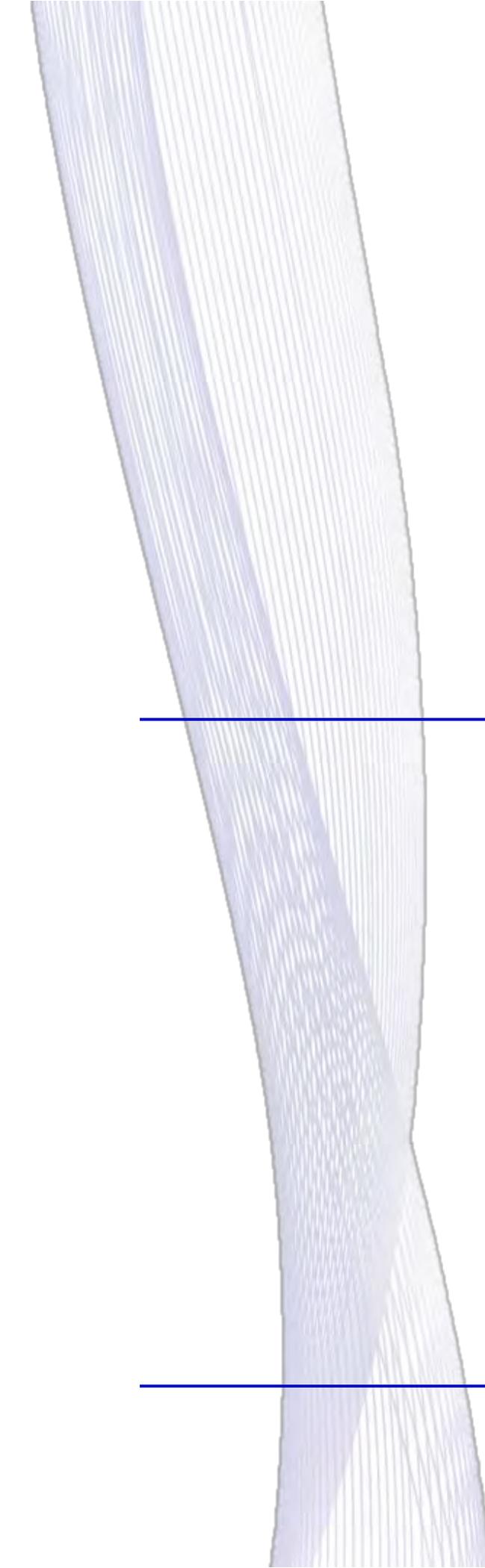
Legend

-  Benicia Refinery
- SO₂ Monitoring Location**
-  No-Detection (<0.1 ppm)



Legend

- Air Sampling Location
- Benicia Refinery



Attachment B

Directional Averages

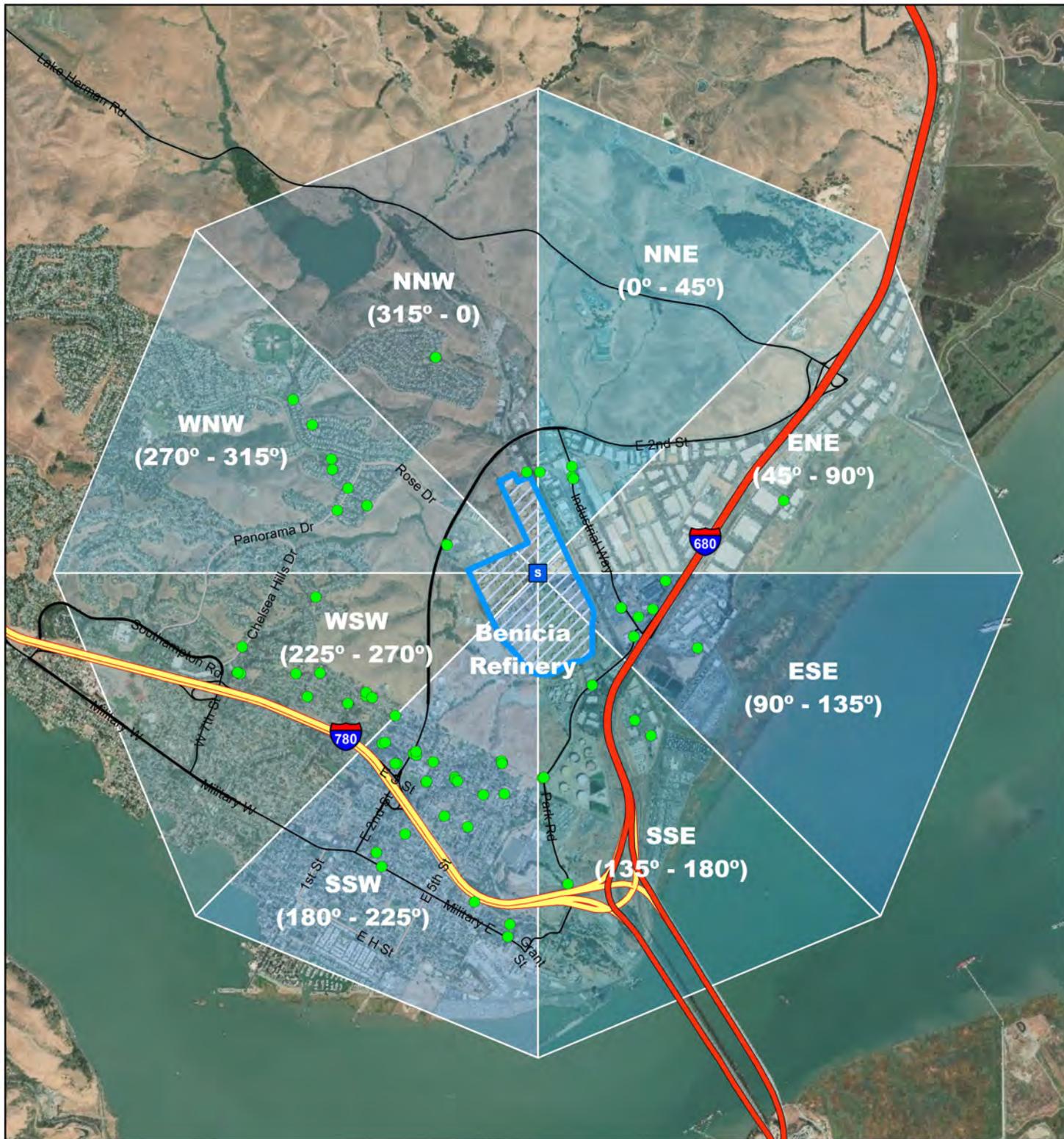


PM_{2.5} Directional Averages Benicia Refinery Particulate Release

PM_{2.5} Avg. for 24 Hour Period
March 16 00:00 - March 17 00:00¹

Direction	# Readings	# Detections	Avg (mg/m ³)	Range (mg/m ³)	AQI Category Equivalent
NNE	4	4	0.0058	0.005 - 0.007	Good
ENE	1	1	0.004	0.004	Good
ESE	7	7	0.0069	0.006 - 0.008	Good
SSE	6	6	0.0073	0.005 - 0.012	Good
SSW	26	26	0.0109	0.004 - 0.032	Good
WSW	12	12	0.0159	0.007 - 0.06	Moderate
WNW	9	9	0.0117	0.005 - 0.016	Good
NNW	2	2	0.013	0.009 - 0.017	Good

¹The EPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations, averages may be biased and are not directly comparable to the NAAQS.

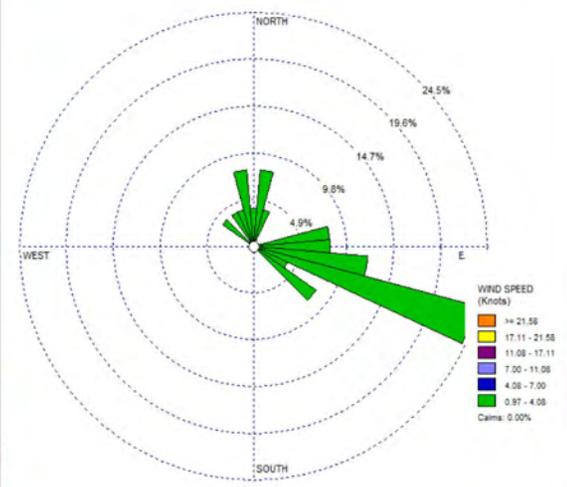


Benicia Refinery

PM_{2.5} Real-Time Monitoring Location

Monitoring Direction

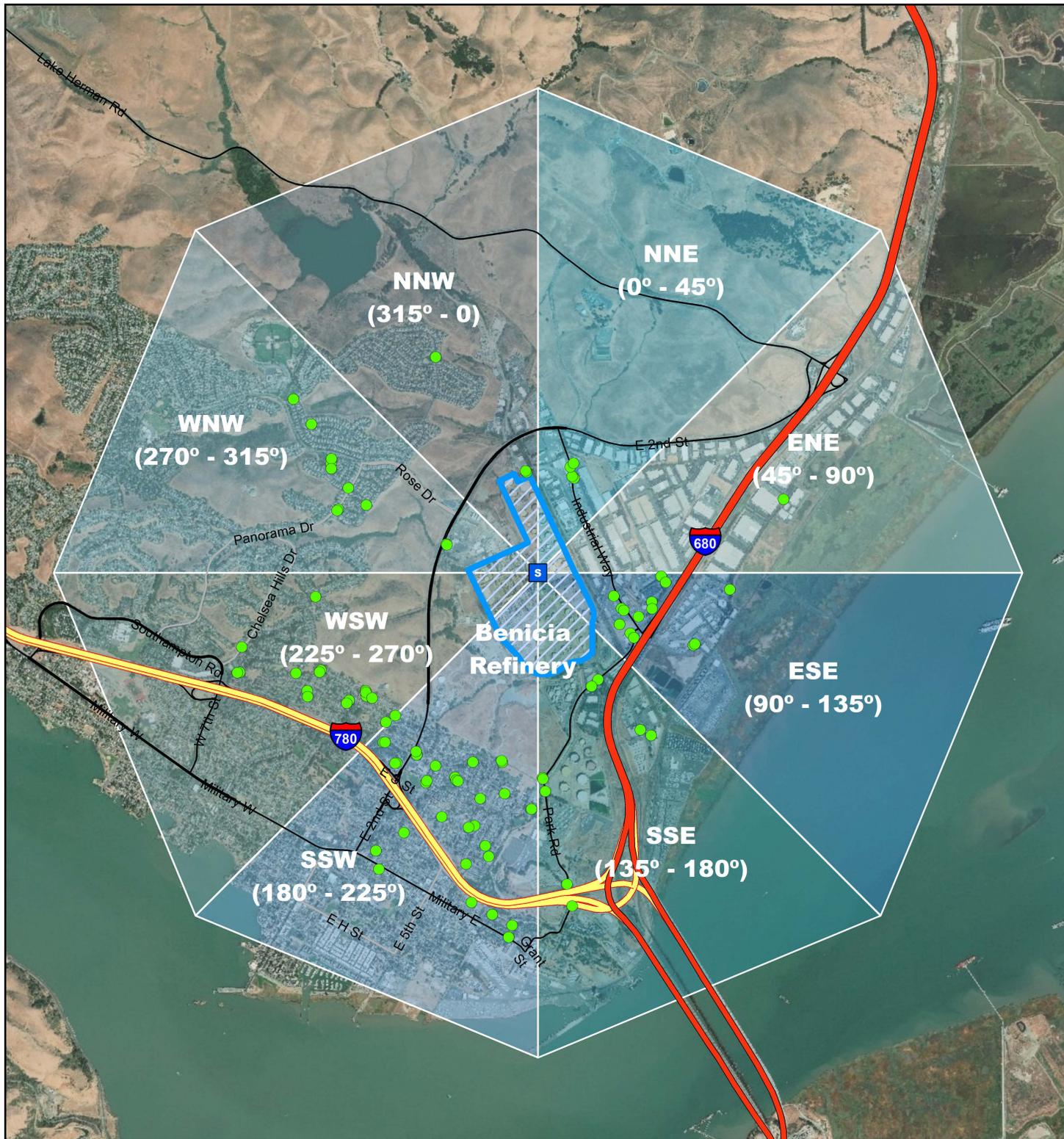
- ENE
- ESE
- NNE
- NNW
- SSE
- SSW
- WNW
- WSW



PM₁₀ Avg. for 24 Hour Period
March 16 00:00 - March 17 00:00¹

Direction	# Readings	# Detections	Avg (mg/m ³)	Range (mg/m ³)	AQI Category Equivalent
ENE	1	1	0.004	0.004	Good
ESE	14	14	0.0089	0.005 - 0.015	Good
NNE	4	4	0.0085	0.006 - 0.012	Good
NNW	3	3	0.0143	0.008 - 0.022	Good
SSE	9	9	0.0104	0.007 - 0.019	Good
SSW	32	32	0.0114	0.005 - 0.041	Good
WNW	11	11	0.0099	0.005 - 0.014	Good
WSW	17	17	0.014	0.008 - 0.06	Good

¹The EPA has eliminated spatial averaging provisions as part of the annual National Ambient Air Quality Standards (NAAQS) to avoid potential disproportionate impacts on at-risk populations. Additionally, due to the uneven temporal distribution of particulate matter monitoring data at these locations, averages may be biased and are not directly comparable to the NAAQS.

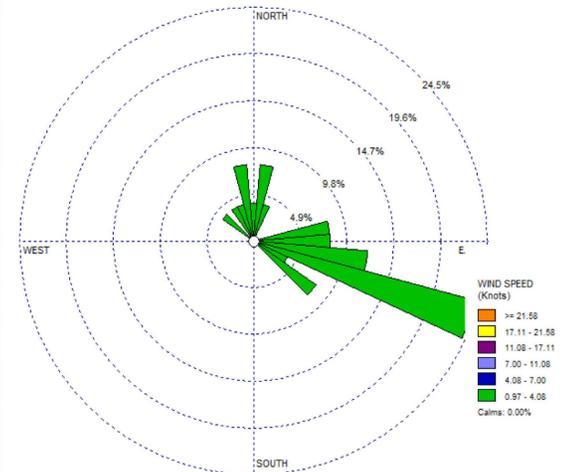


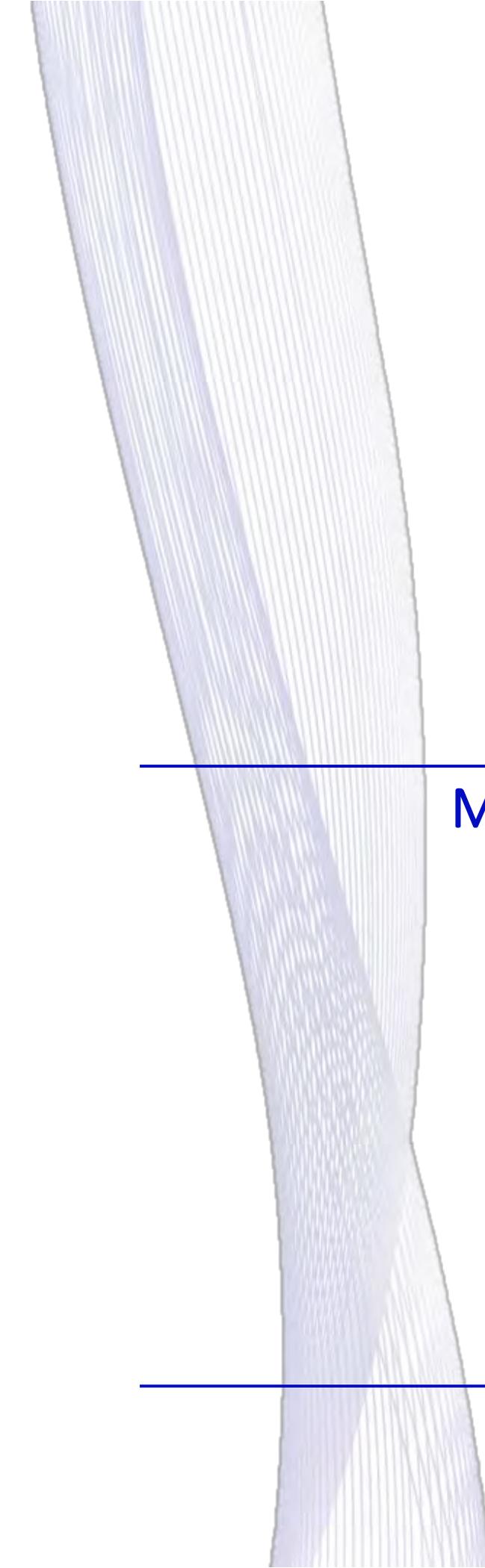
Benicia Refinery

PM₁₀ Real-Time Monitoring Location

Monitoring Direction

	ENE		NNW		WNW
	ESE		SSE		WSW
	NNE		SSW		



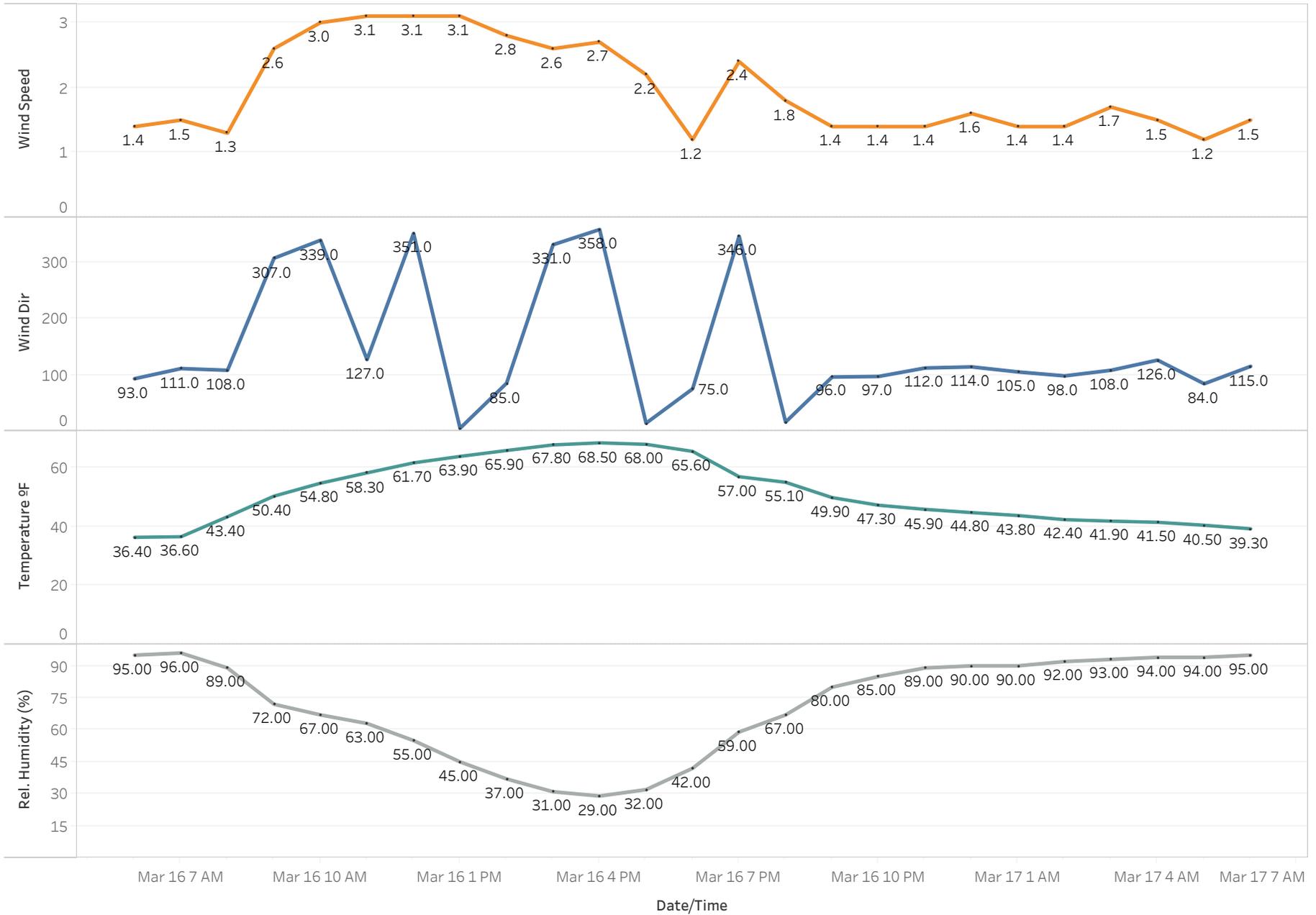


Attachment C

Meteorological Conditions

Figure 9: CIMIS Concord Meteorological Conditions

Mar 16 06:00 - Mar 17 06:00

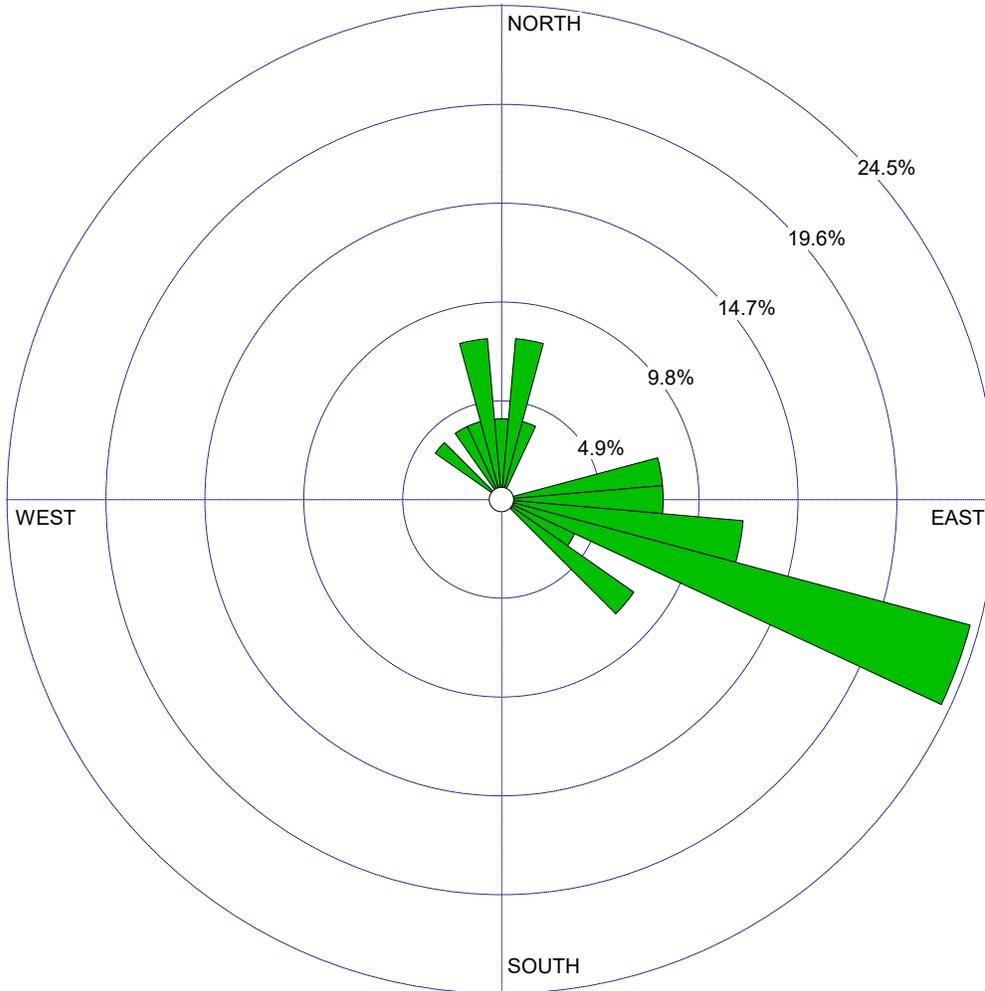


WIND ROSE PLOT:

Station #**CIMIS**

DISPLAY:

Wind Speed
Direction (blowing from)



WIND SPEED
(Knots)

- >= 21.58
- 17.11 - 21.58
- 11.08 - 17.11
- 7.00 - 11.08
- 4.08 - 7.00
- 0.97 - 4.08

Calms: 0.00%

COMMENTS:

DATA PERIOD:

Start Date: 3/16/2019 - 06:00
End Date: 3/17/2019 - 06:00

COMPANY NAME:

MODELER:

CALM WINDS:

0.00%

TOTAL COUNT:

25 hrs.

AVG. WIND SPEED:

1.60 Knots

DATE:

3/17/2019

PROJECT NO.:

111342