

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 STARTUP

Benicia, CA

May 6, 2019

Project #111560

1.0 Introduction

On May 1, 2019 Valero Energy requested that CTEH® initiate air monitoring prior to startup of the Benicia Refinery in Benicia, CA to collect background air quality data in the surrounding community. CTEH will continue to conduct air monitoring to evaluate potential emissions, if any, during the startup of the refinery. Air monitoring activities consist of roaming hand-held real-time and analytical sampling in the surrounding community.

This report summarizes air monitoring data collected from May 5, 2019 06:30 PDT to May 6, 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 refinery startup (if any). All instrumentation was calibrated at least once per day or per manufacturer's recommendations. Target analytes were measured as benzene, carbon monoxide (CO), hydrogen sulfide (H₂S), nitrogen dioxide (NO₂), particulate matter at 2.5-microns (PM_{2.5}), sulfur dioxide (SO₂), toluene, volatile organic compounds (VOCs), and xylene using handheld instruments such as RAE Systems MultiRAEs and UltraRAEs, Arizona Instrument Jerome 631-Xs, TSI SidePak™ AM510/AM520 Aerosol Monitors, and Gastec GV-100 pumps with chemical-specific colorimetric detection tubes.

3.0 Air Monitoring Results

Figures 1 – 11 in **Attachment A** depict 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: Preliminary Community Real-Time Air Monitoring Summary
May 5, 2019 06:30 PDT to May 6, 2019 06:30 PDT

Analyte	Instrument	# Readings	# Detections	Range
Benzene	UltraRAE	115	0	< 0.025 ppm
Carbon Monoxide	MultiRAE	114	12	2 - 15 ppm
H ₂ S	Jerome 613-X	39	0	< 0.003 ppm
	MultiRAE	114	0	< 0.1 ppm
NO ₂	MultiRAE	114	0	< 0.1 ppm
PM _{2.5}	AM510/AM520	112	112	0.002 - 0.070 mg/m ³
SO ₂	MultiRAE	114	0	< 0.1 ppm
Toluene	Gastec #122L	40	0	< 0.5 ppm
VOCs	MultiRAE	114	0	< 0.1 ppm
Xylene	Gastec #123	40	0	< 1 ppm

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

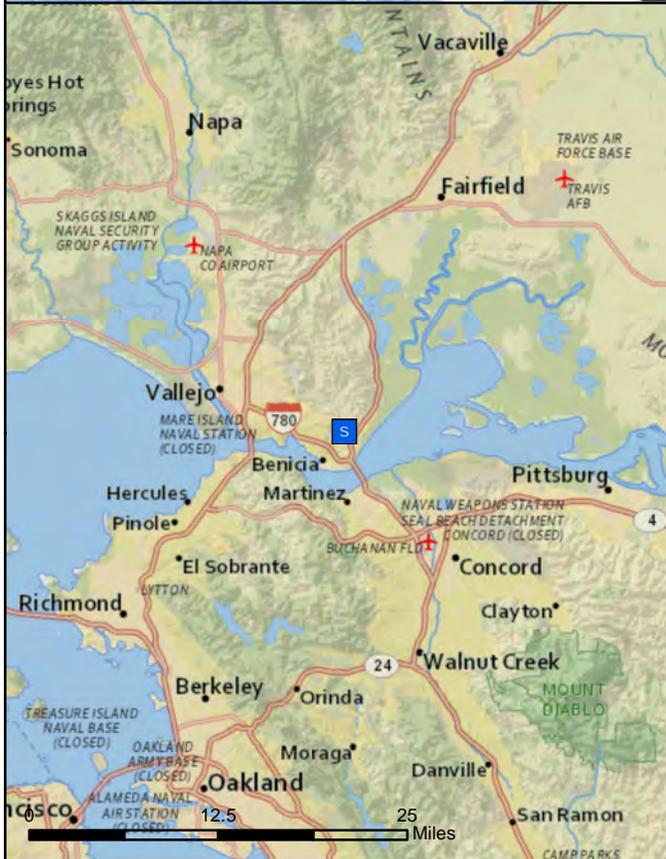
4.0 Weather Conditions

Figure 8 in **Attachment B** 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

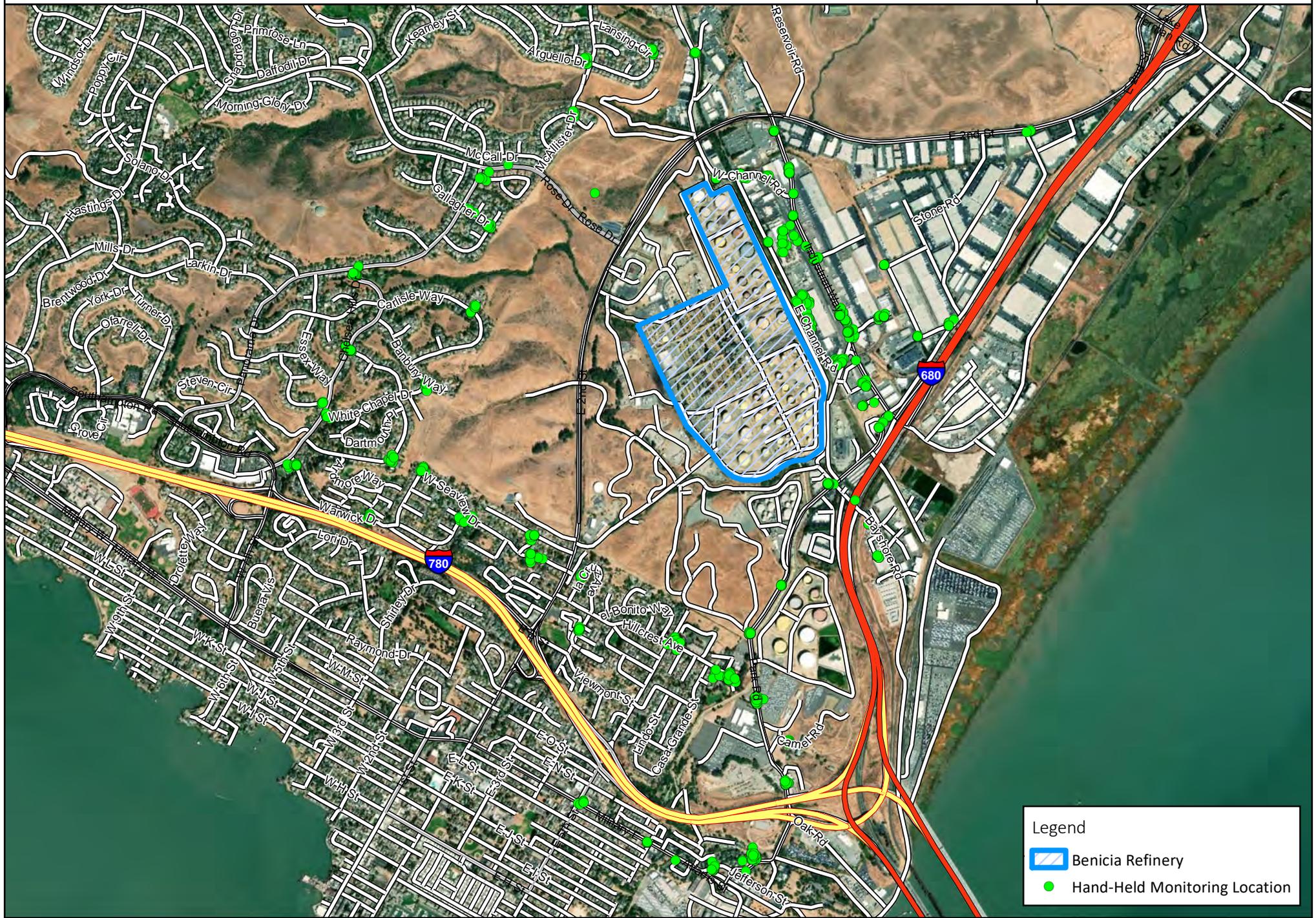
- Valero Benicia Refinery Location
- Benicia Refinery



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



Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



Legend

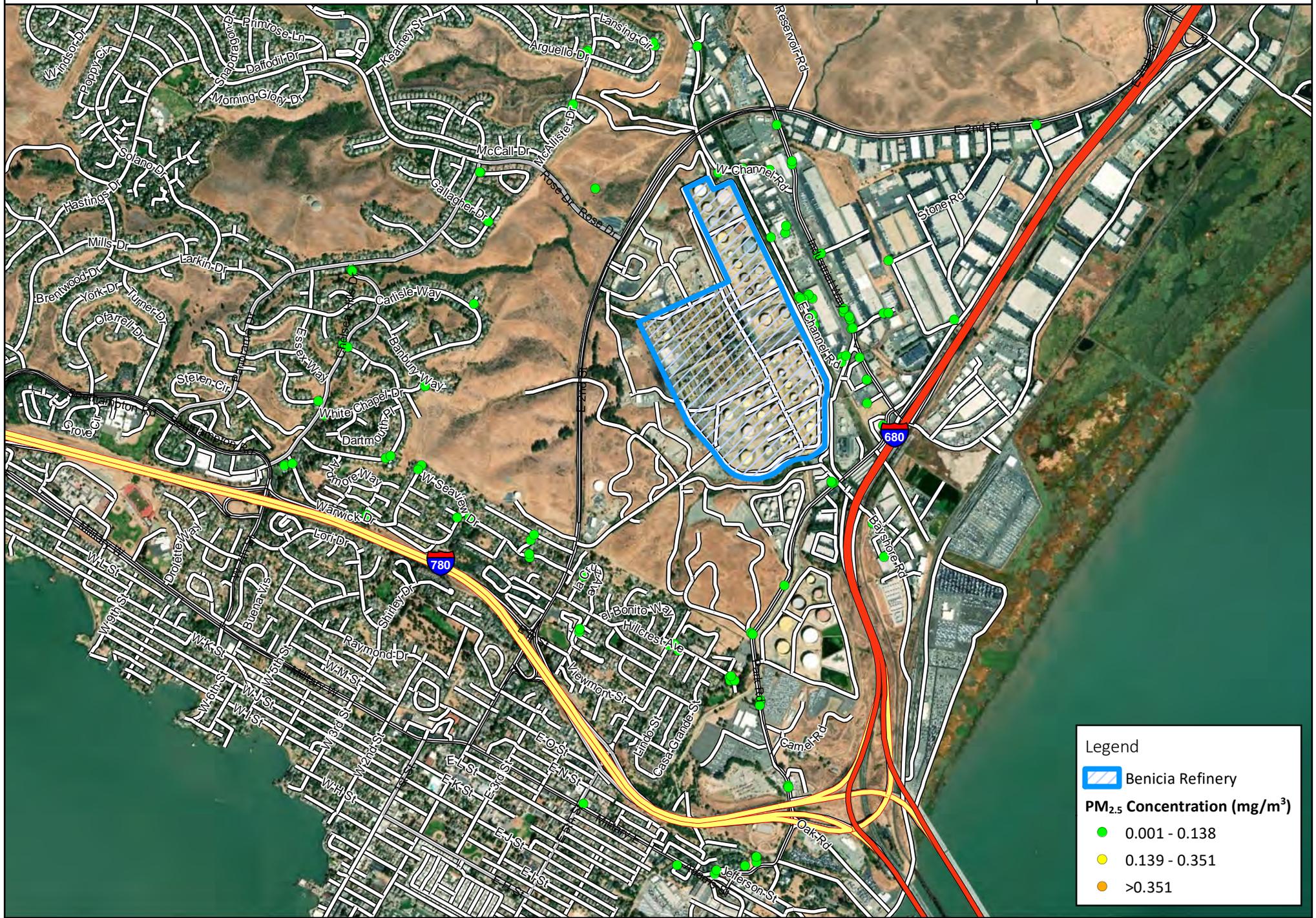
- Benicia Refinery
- Hand-Held Monitoring Location



Figure 3: Hand-Held Real-Time Monitoring Locations (PM_{2.5})
Benicia Refinery Startup

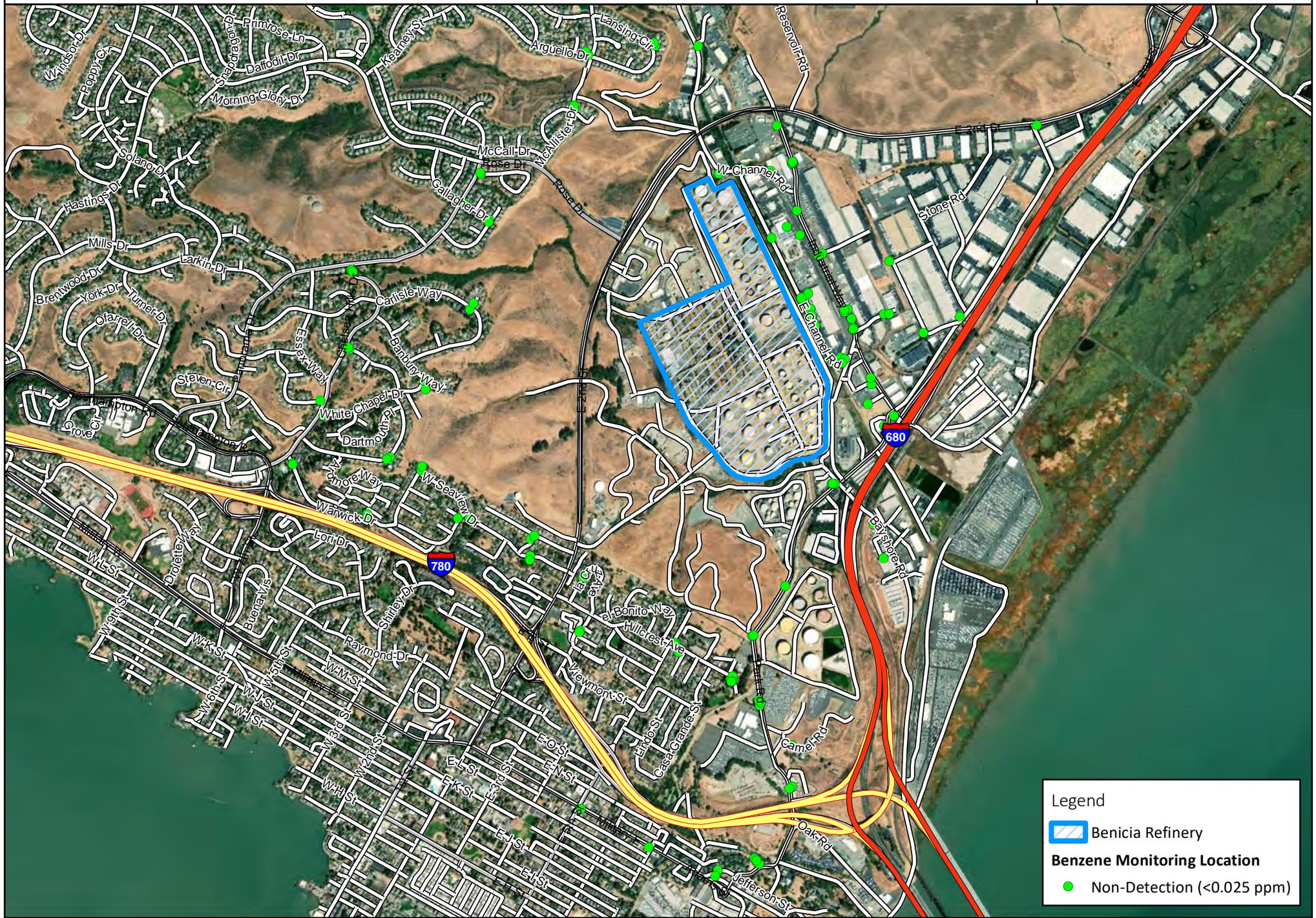


Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



Legend

- Benicia Refinery
- PM_{2.5} Concentration (mg/m³)**
- 0.001 - 0.138
- 0.139 - 0.351
- >0.351



Legend

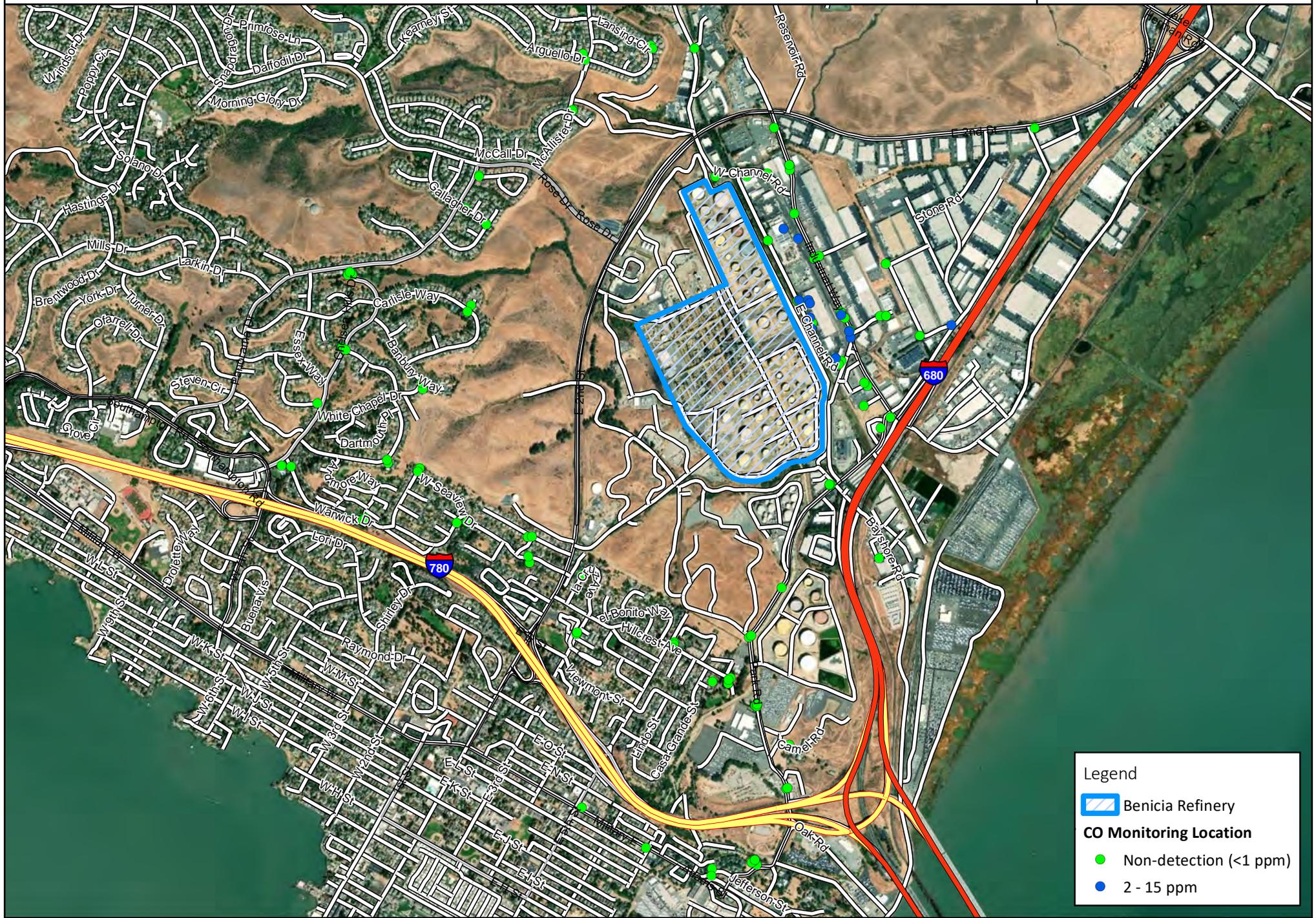
- Benicia Refinery
- Benzene Monitoring Location
- Non-Detection (<0.025 ppm)



Figure 5: Hand-Held Real-Time Monitoring Locations (CO)
Benicia Refinery Startup



Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



Legend

- Benicia Refinery
- CO Monitoring Location**
- Non-detection (<1 ppm)
- 2 - 15 ppm



Legend

- Benicia Refinery
- (H₂S) Monitoring Location**
 - Non-detection (<0.003 ppm)
 - Non-detection (<0.1 ppm)

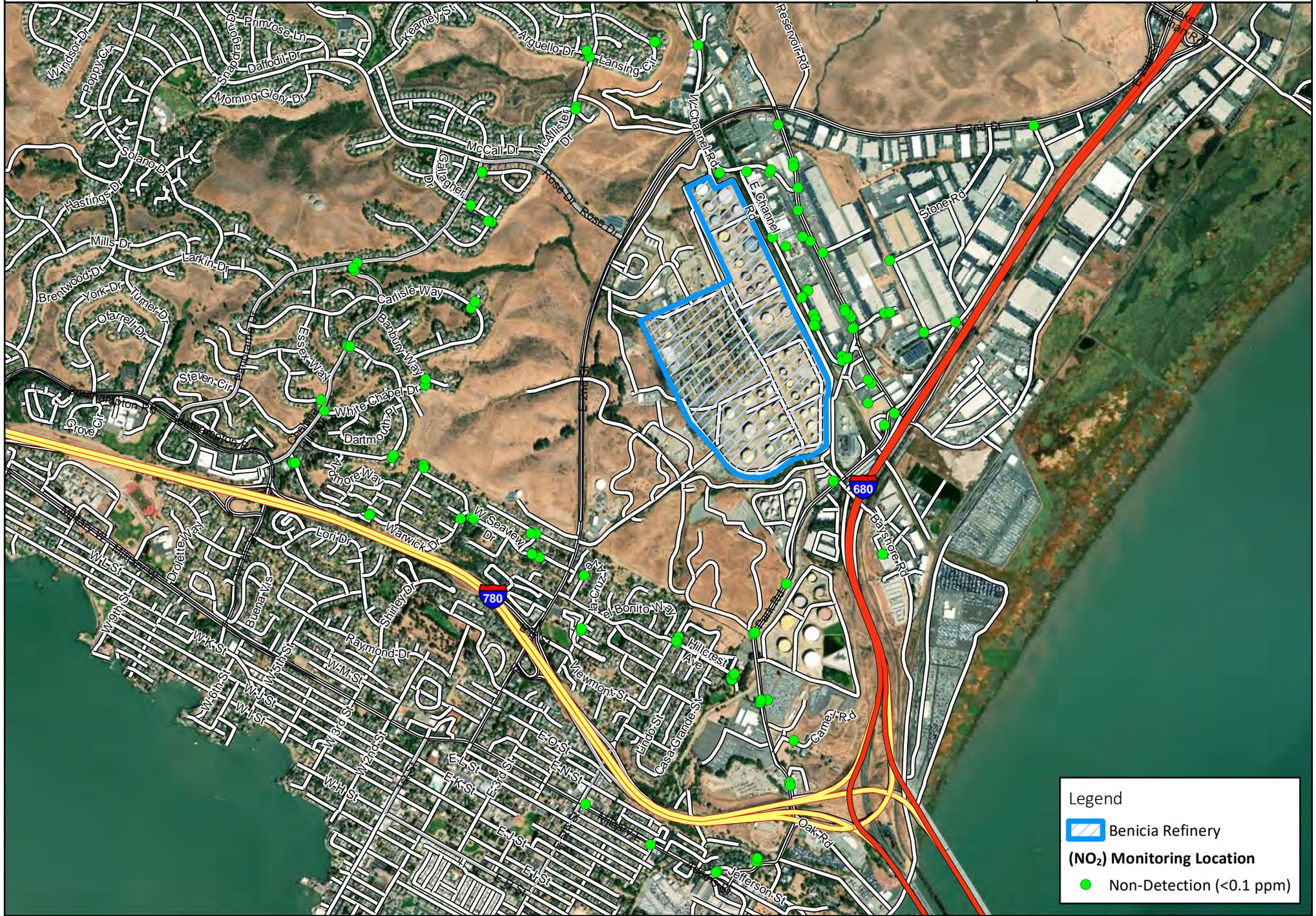


Figure 7: Hand-Held Real-Time Monitoring Locations (NO₂)
Benicia Refinery Startup

0 1,000 2,000 Feet



Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



Legend

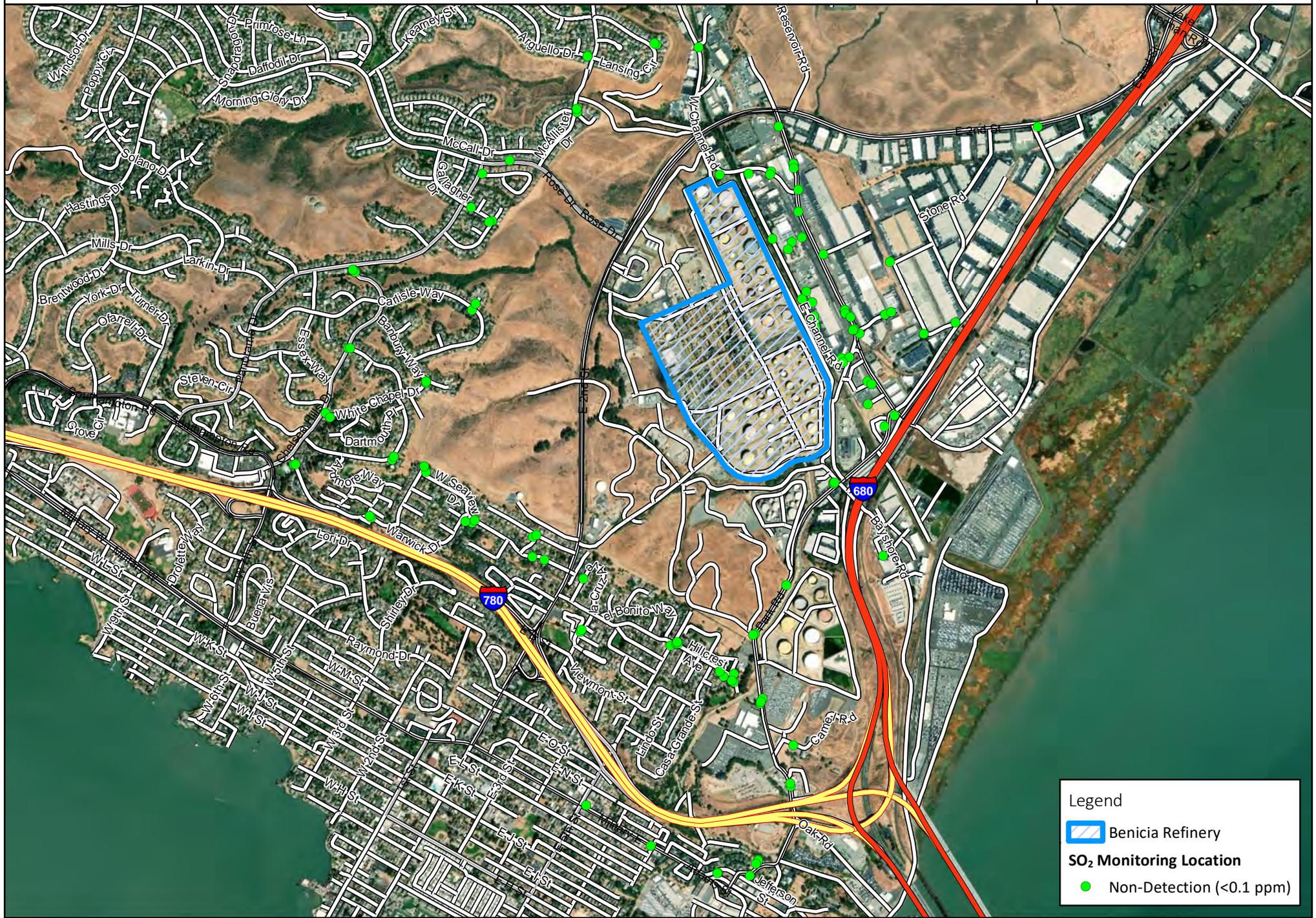
-  Benicia Refinery
-  (NO₂) Monitoring Location
-  Non-Detection (<0.1 ppm)



Figure 8: Hand-Held Real-Time Monitoring Locations (SO₂)
Benicia Refinery Startup



Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



Legend

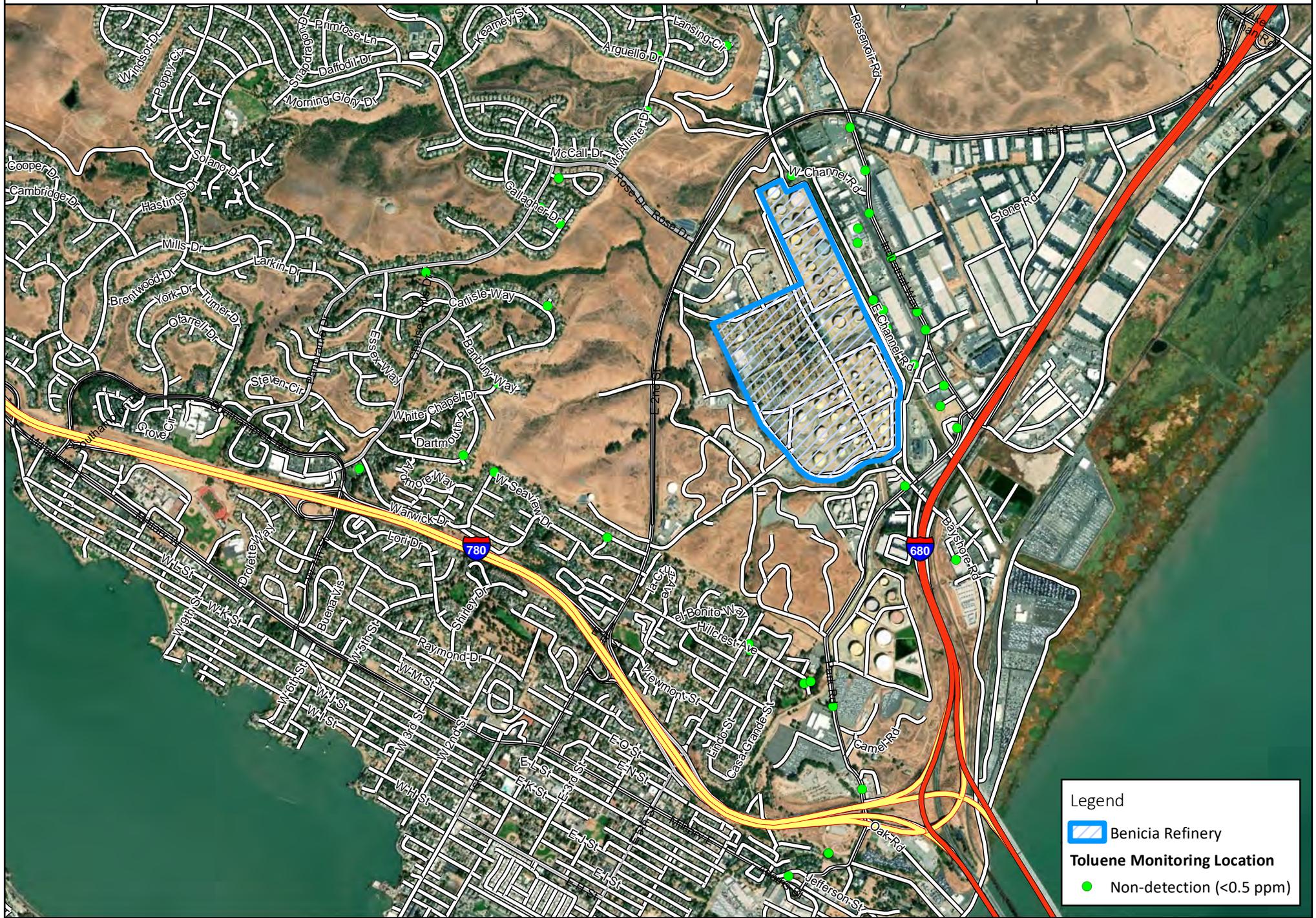
- Benicia Refinery
- SO₂ Monitoring Location**
- Non-Detection (<0.1 ppm)



Figure 9: Hand-Held Real-Time Monitoring Locations (Toluene)
Benicia Refinery Startup



Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



Legend

-  Benicia Refinery
- Toluene Monitoring Location**
-  Non-detection (<0.5 ppm)

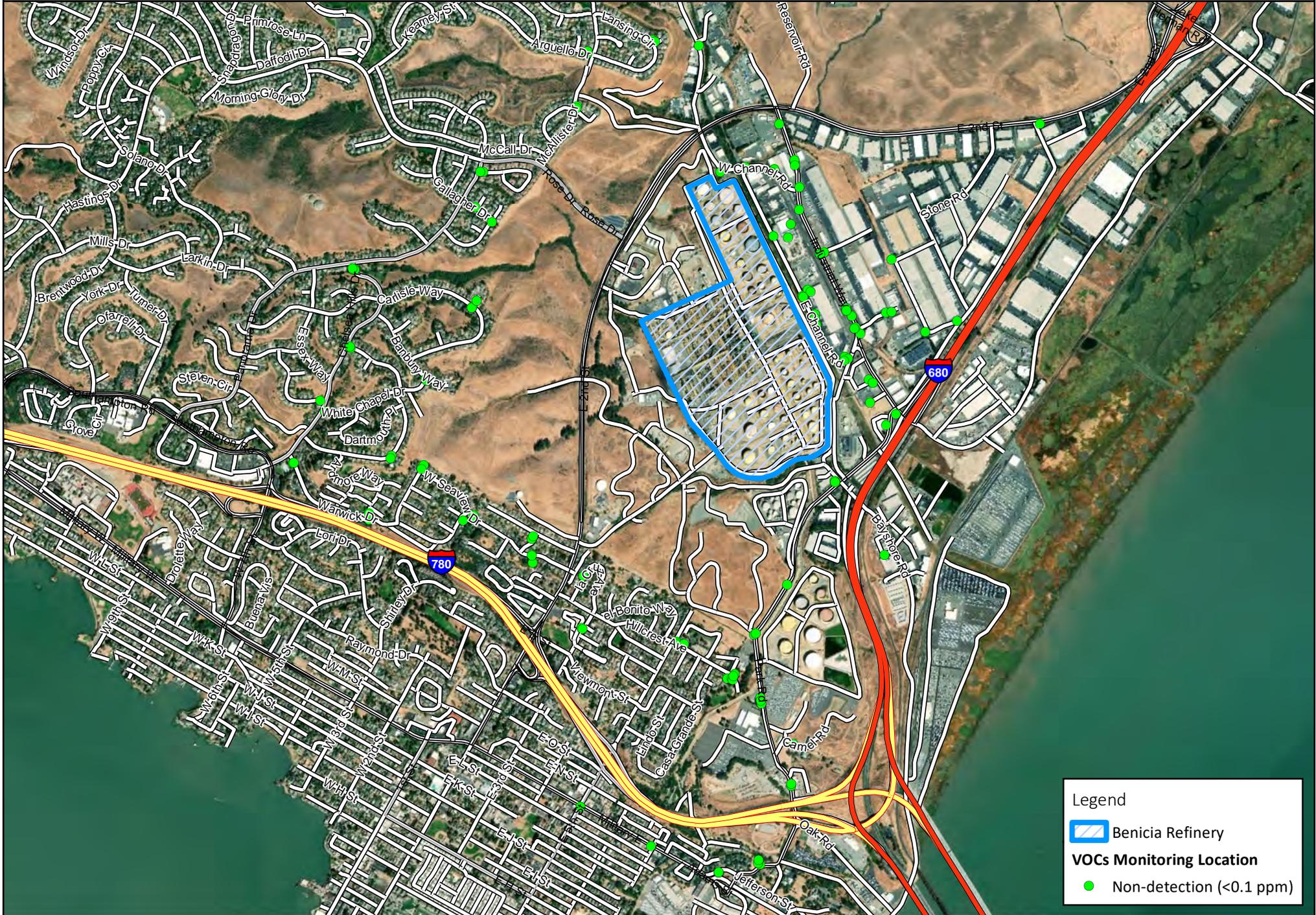


Figure 10: Hand-Held Real-Time Monitoring Locations (VOCs)
Benicia Refinery Startup

0 1,000 2,000 Feet



Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



Legend

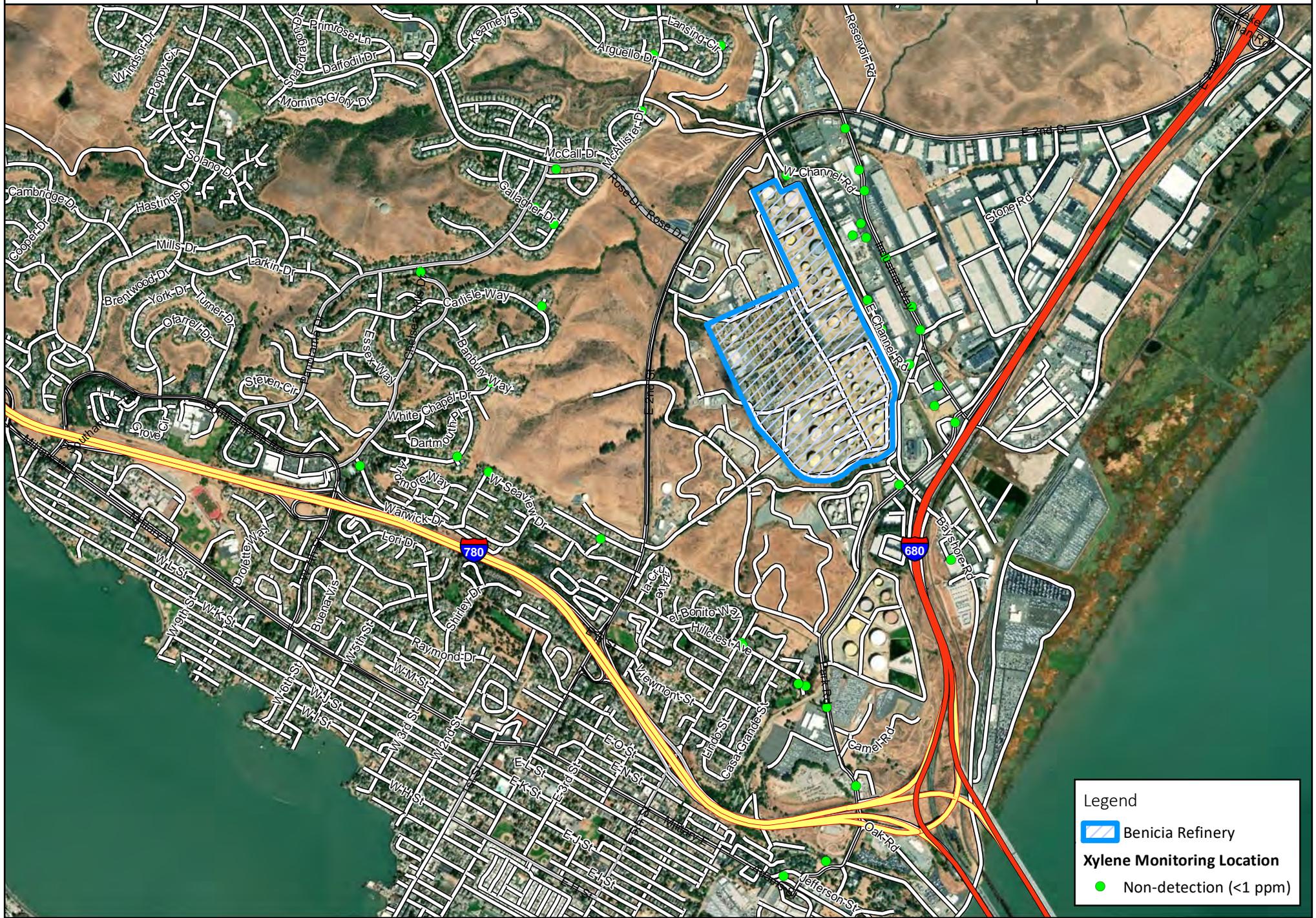
-  Benicia Refinery
- VOCs Monitoring Location**
-  Non-detection (<0.1 ppm)



Figure 11: Hand-Held Real-Time Monitoring Locations (Xylene)
Benicia Refinery Startup

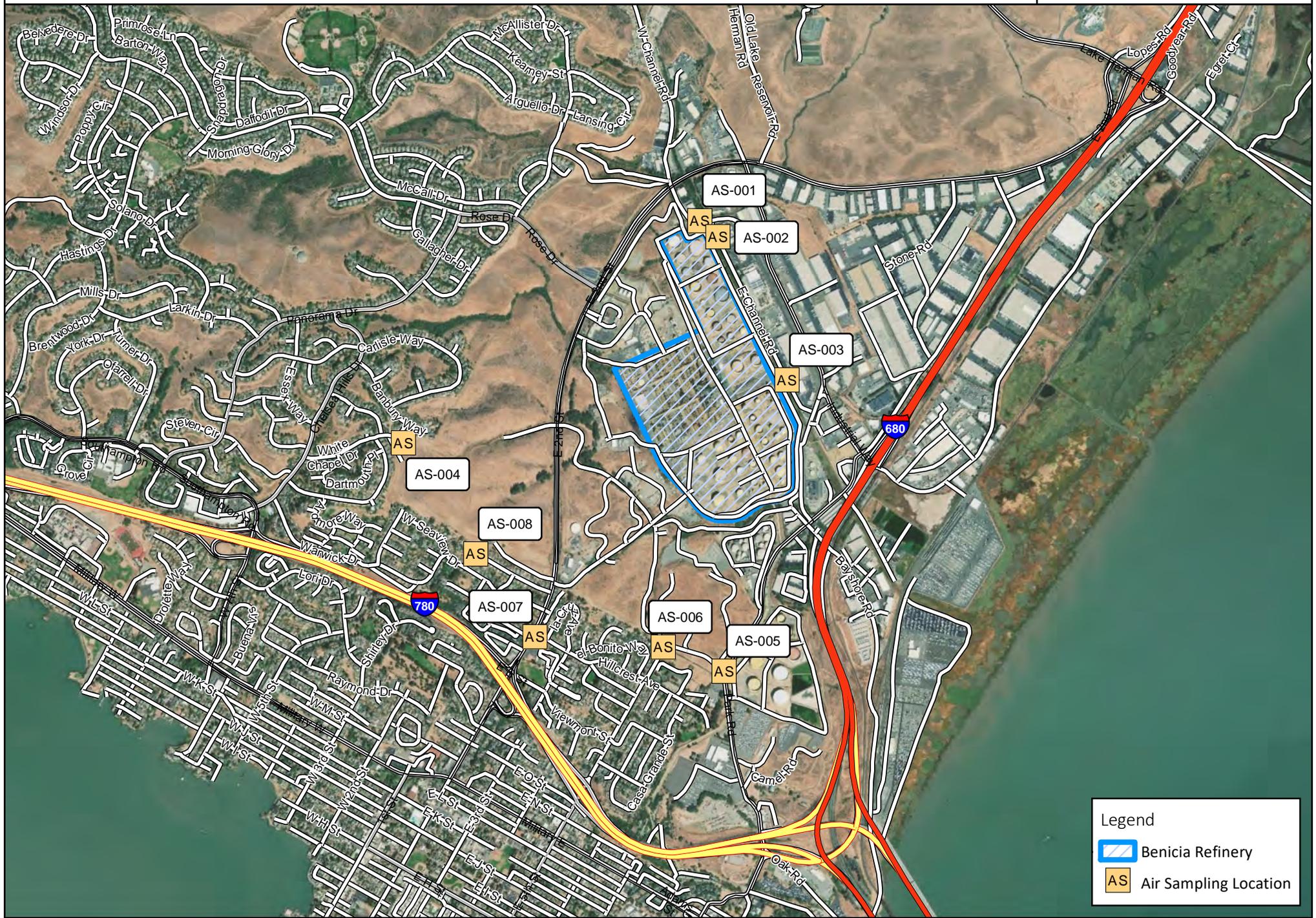


Project: 111560
Client: Valero Energy
City: Benicia, CA
County: Solano



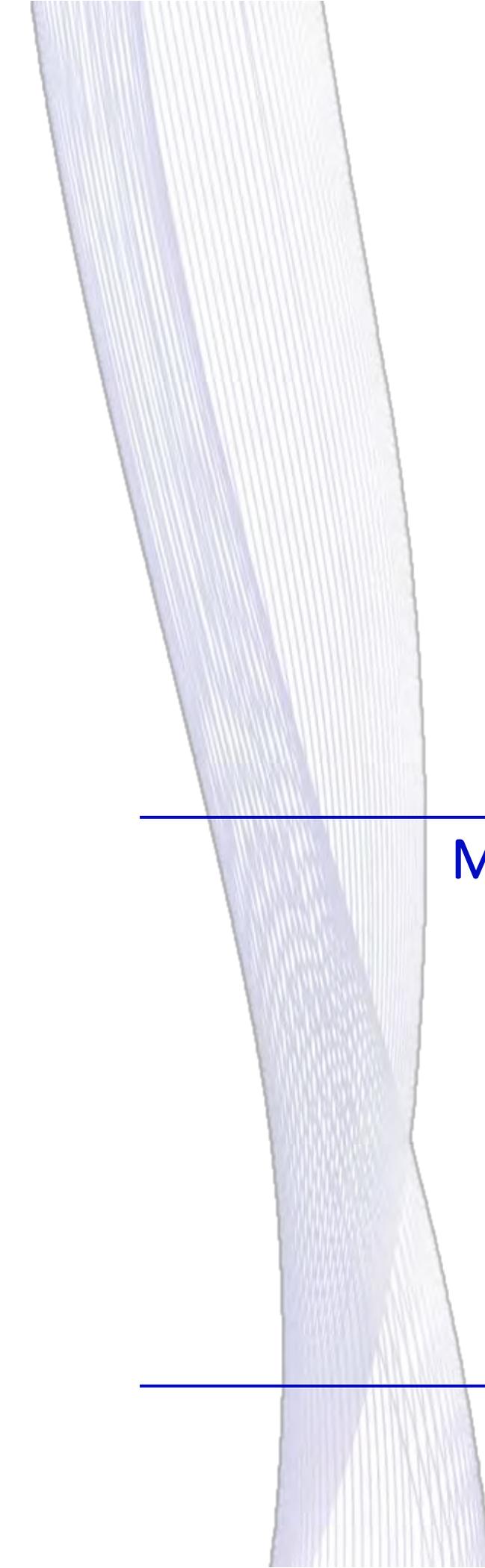
Legend

- Benicia Refinery
- Xylene Monitoring Location**
- Non-detection (<1 ppm)



Legend

- Benicia Refinery
- Air Sampling Location



Attachment B

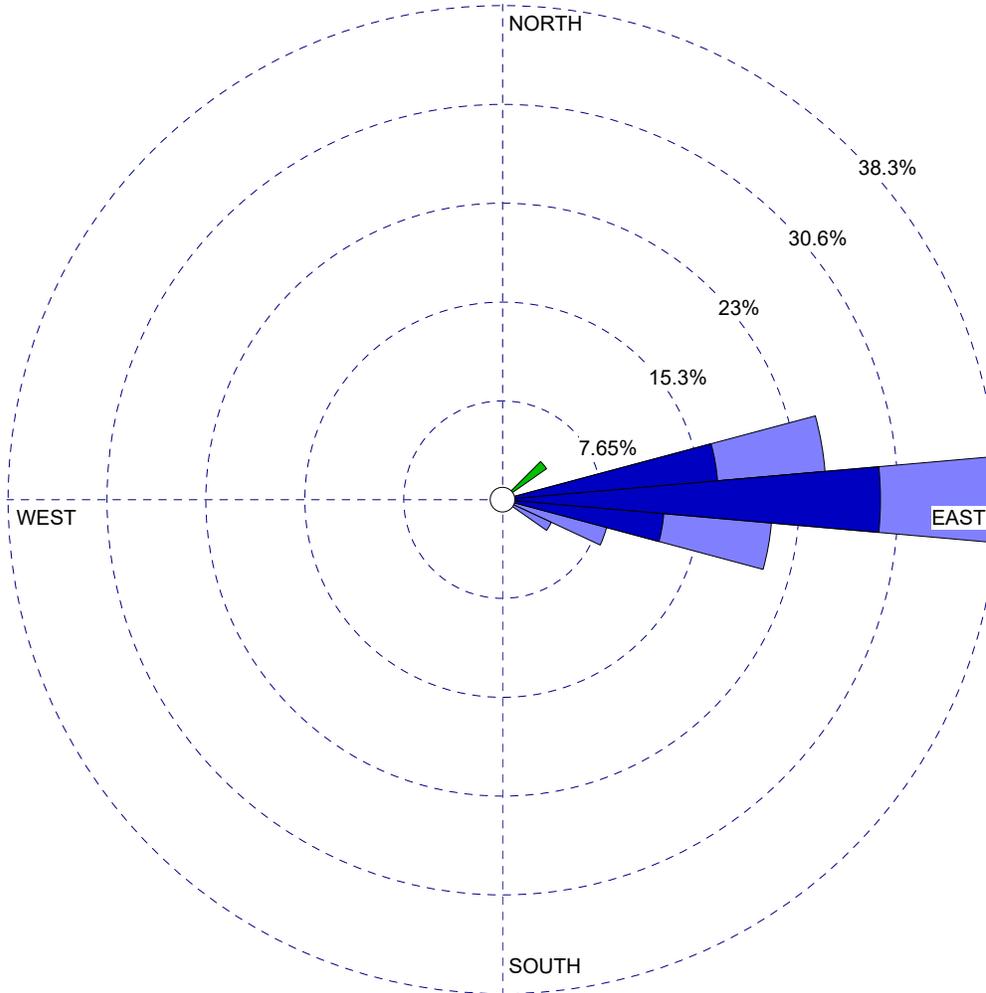
Meteorological Conditions

WIND ROSE PLOT:

CIMIS Meteorological Station 170 (Concord, CA)

DISPLAY:

**Wind Speed
Flow Vector (blowing to)**



WIND SPEED
(mph)

- >= 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: 5/5/2019 - 07:00
End Date: 5/6/2019 - 06:00**

COMPANY NAME:

CTEH

MODELER:

CALM WINDS:

0.00%

TOTAL COUNT:

24 hrs.

AVG. WIND SPEED:

6.17 mph

DATE:

5/6/2019

PROJECT NO.:

111560