

# **Appendix E – Site Analysis for the Marathon Refinery Community Air Monitoring Station**

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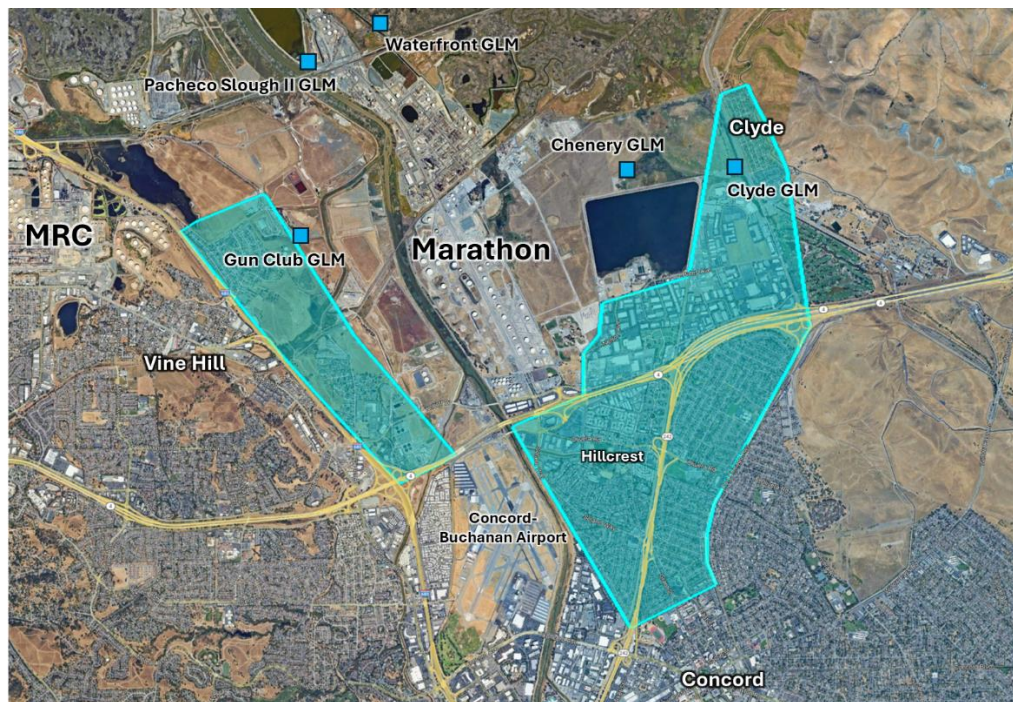
## Executive Summary

This Appendix describes the factors and analyses used to identify a geographic area for siting a community air quality monitoring station near the Marathon Refinery as part of the Major Stationary Source Community Air Monitoring Program (Schedule X).<sup>1</sup> The goal in siting monitors under Schedule X is to select a location that will reflect typical conditions in impacted areas of the community based on a broad range of factors and the weight of available evidence associated with those factors. Importantly, no single fixed monitoring location will capture all the emissions from a given facility. Air District staff considered several factors for this evaluation, including emissions sources, available meteorological and air quality data, area geography and topographical features, results from health risk assessments and air quality modeling, environmental justice indicators, and stakeholder input.

On balance, these factors indicate that multiple locations may be acceptable candidates. A new monitoring station sited southeast, east, or southwest of the Marathon Refinery, as shown in Figure E-1, would be in or near residential areas downwind of the facility for at least some of the time. The recommended search area consists of two sections, one southwest of the refinery and one southeast and east of the refinery, separated by the Concord-Buchanan Airport. The census tract that includes Concord's Hillcrest neighborhood (southeast of the refinery and east of the airport) has the highest CalEnviroScreen composite score among nearby census tracts. The Hillcrest neighborhood is suggested as a starting place for identifying potential locations for a new monitoring station.

A new air monitoring station under Schedule X will also be established near the MRC Refinery (discussed in Appendix D). The selection of locations for both stations should consider the proximity of one station to another to avoid potential redundancy.

**Figure E-1 - Recommended Search Area for the Marathon Refinery Major Stationary Source Community Air Monitoring Station**

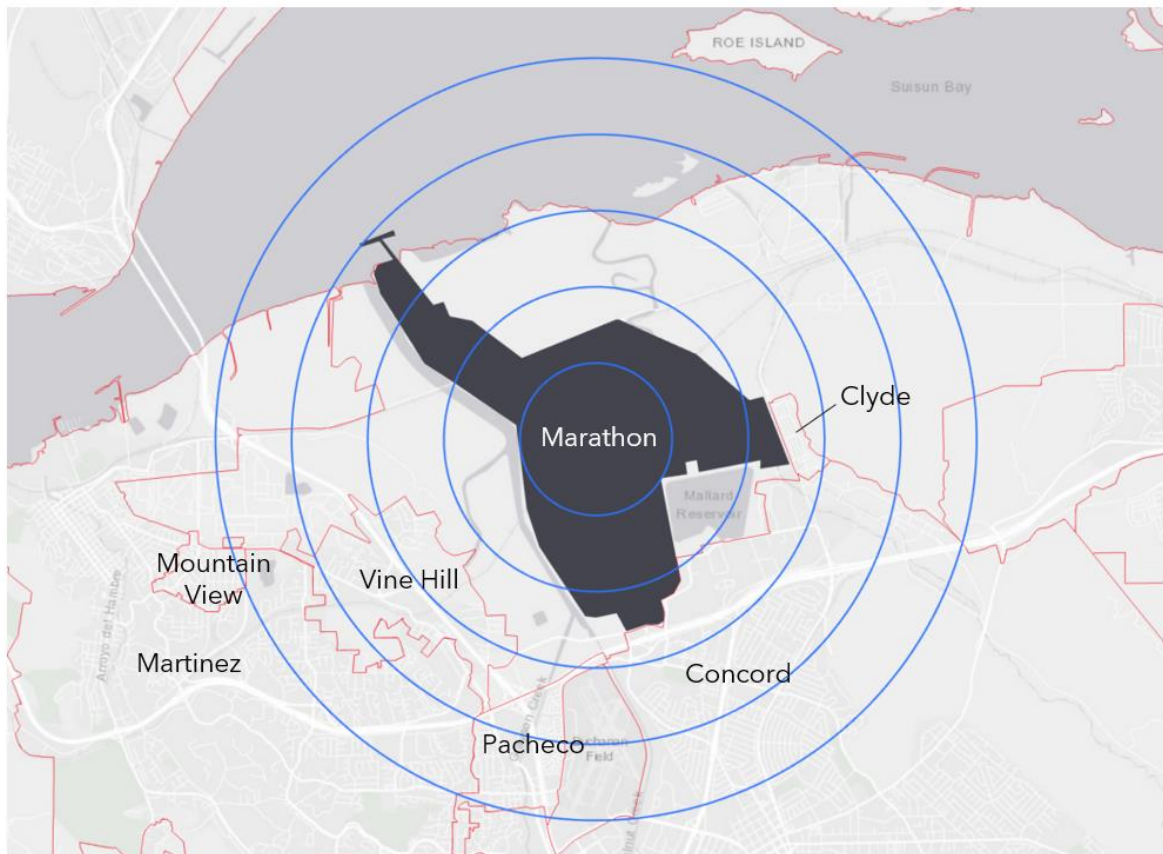


<sup>1</sup> Overview of the Major Stationary Source Community Air Monitoring Program: [https://www.baaqmd.gov/~media/files/technical-services/community-air-monitoring/01\\_refinery-camp-v7-mainapp-a-pdf.pdf](https://www.baaqmd.gov/~media/files/technical-services/community-air-monitoring/01_refinery-camp-v7-mainapp-a-pdf.pdf)

## Study Area

A neighborhood-scale monitoring station located within a few kilometers of the Marathon Refinery is most appropriate given the objectives of the Major Stationary Source Community Air Monitoring Program. In Figure E-2, the Marathon Refinery is shown in gray with concentric buffers around the facility in 1-km increments. Portions of the buffers intersect the communities of Concord, Clyde, Martinez, Pacheco, and Vine Hill, as well as uninhabited areas of Contra Costa County and the Carquinez Strait.

**Figure E-2 - Location of the Marathon Refinery**

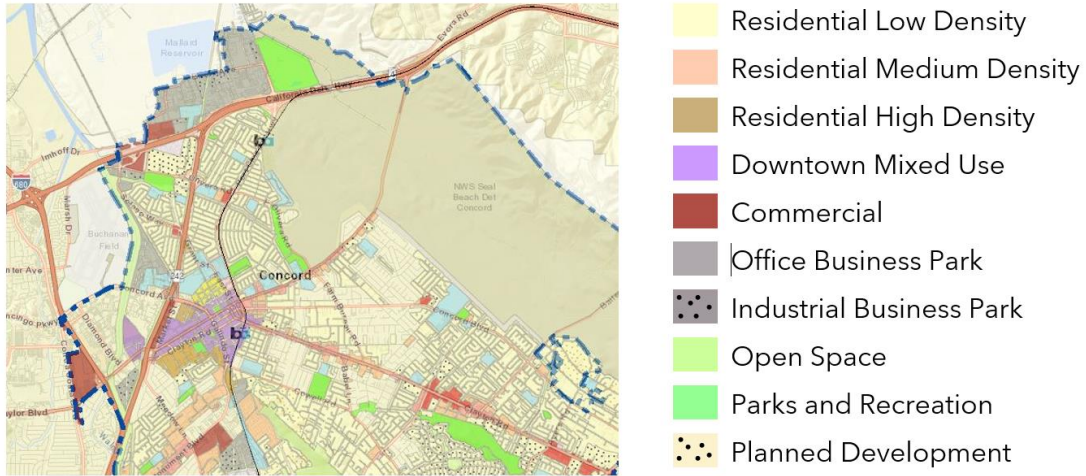


## Population Centers

The Marathon Refinery is located about three and a half miles east of central Martinez and about five and a half miles north of central Concord. The City of Concord has an estimated population of 129,183 (US Census Bureau, 2020) and is bounded on the north by the Marathon Refinery and the unincorporated community of Clyde; on the west by the unincorporated community of Pacheco and the City of Pleasant Hill; on the south by the City of Walnut Creek; and on the east by sparsely populated terrain. A zoning map for the City of Concord is shown in Figure E-3. The unincorporated community of Clyde has an estimated population of 792 (US Census Bureau, 2020) and is located about two miles east of the Marathon Refinery, while the unincorporated community of Pacheco has an estimated population of 4,361 (US Census Bureau, 2020) and is located between Martinez and Concord.

The City of Martinez has an estimated population of 38,290 and the nearby unincorporated communities of Mountain View and Vine Hill have estimated populations of 1,970 and 3,886, respectively (US Census Bureau, 2020). Martinez, Vine Hill, and Mountain view are located southwest of the Marathon Refinery and are closer to the Martinez Refining Company (MRC) facility. These communities are discussed in more detail in Appendix D: Site Analysis for the Martinez Refining Company Community Air Monitoring Station.

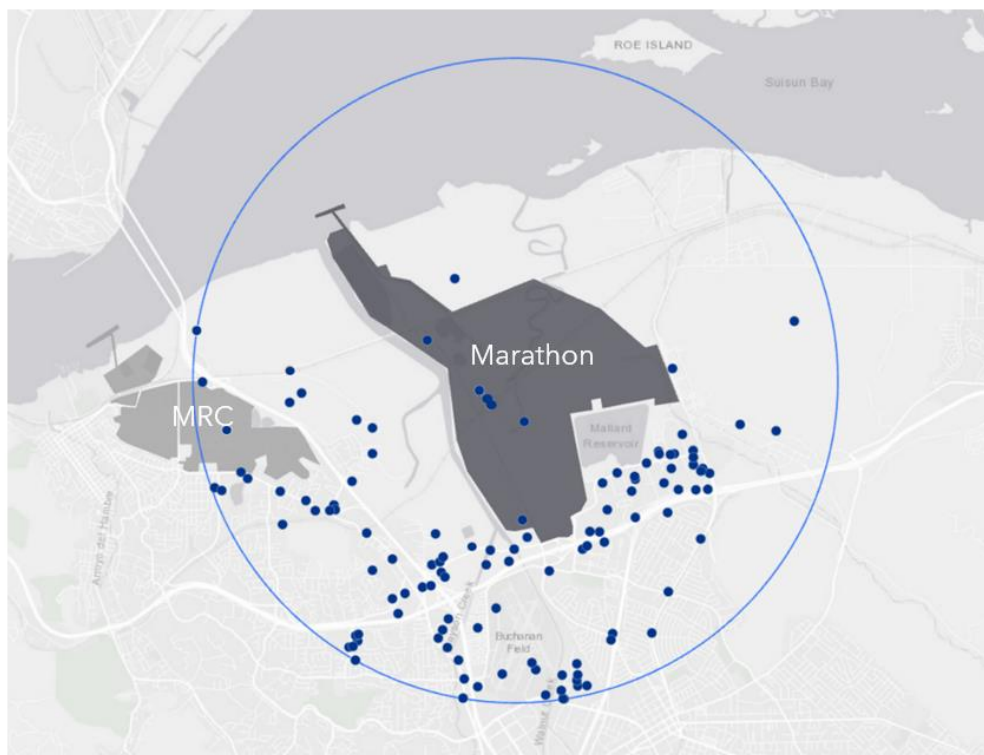
**Figure E-3 - City of Concord Zoning Map (excerpt)**



**Local Emissions Sources**

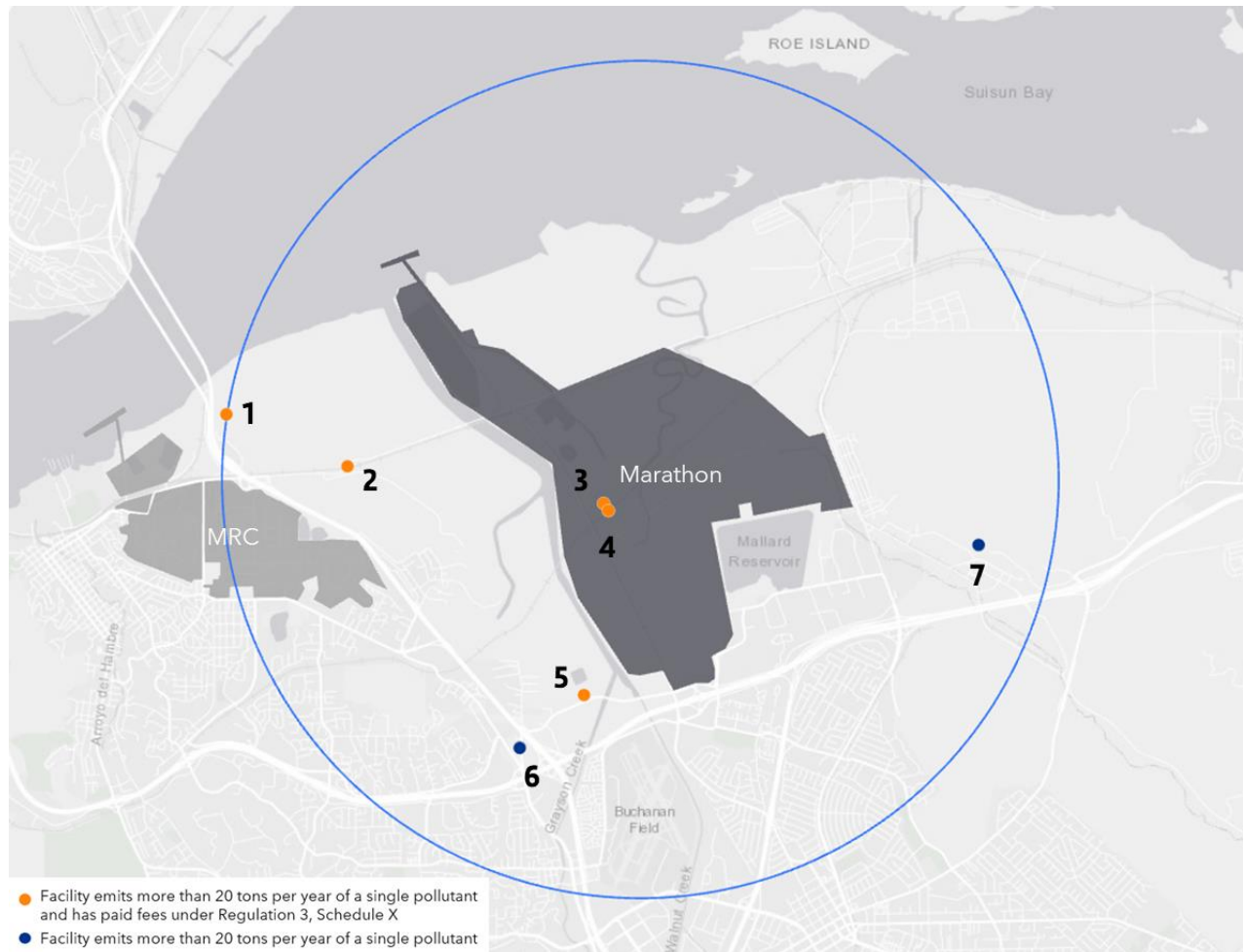
According to the Air District’s database of regulated facilities, there are 121 permitted sources within a 5 km radius of the Marathon Refinery (see Figure E-4).

**Figure E-4 - Permitted Facilities Near the Marathon Refinery**



To highlight some of the larger stationary sources of air pollution in the area in addition to the Marathon Refinery, stationary sources with more than 20 tons per year of emissions of a single pollutant are shown in Figure E-5, and their emissions are summarized in Table E-1. Among those facilities, Air Products & Chemicals Inc, Central Contra Costa Sanitary District, Eco Services Operations Corp, Martinez Cogen Limited Partnership at Tesoro, Shell Martinez Refinery, and TransMontaigne Operating LP have paid major stationary source community air monitoring fees under Regulation 3, Schedule X. Other notable emissions sources in the area include Interstate 680, State Route 4, State Route 242, and the Concord-Buchanan Airport.

**Figure E-5 - Stationary Sources Near the Marathon Refinery Emitting More Than 20 Tons per Year of a Single Pollutant**



- |   |   |
|---|---|
| 1 - Eco Services Operations Corp <sup>(1)</sup>                   | 5 - Central Contra Costa Sanitary District <sup>(1)</sup> |
| 2 - TransMontaigne Operating LP <sup>(1)</sup>                    | 6 - California Highway Patrol                             |
| 3 - Martinez Cogen Limited Partnership at Tesoro <sup>(1,2)</sup> | 7 - Pacific Gas & Electric Co                             |
| 4 - Air Products & Chemicals, Inc <sup>(1)</sup>                  |   |

Notes: (1) The Eco Services Operations Corp, TransMontaigne Operating LP, Martinez Cogen Limited Partnership at Tesoro, Air Products & Chemicals Inc, and Central Contra Costa Sanitary District have paid fees for Major Stationary Source Community Air Monitoring under Regulation 3, Schedule X. (2) Marathon has proposed to modify the refinery into a repurposed facility that would produce renewable diesel fuel, naphtha, propane and treated fuel gas.

**Table E-1 - Annual Emissions from Stationary Sources Near the Marathon Refinery Emitting More Than 20 Tons per Year of a Single Pollutant<sup>(1)</sup>**

Facility (CEIDARS ID)	Annual Emissions (tons/year)					
	CO	NO <sub>x</sub>	PM <sub>10</sub>	PM <sub>2.5</sub>	ROG	SO <sub>x</sub>
Marathon (14628)	52.5	11.1	10.9	10.9	134.5	0.6
MRC (24726)	1,597.1	1,015	705.2	621.7	1,375.9	1,133.4
California Highway Patrol (13758)	23.5	10	0	0	0.1	0
Central Contra Costa Sanitary District (907)	121.4	66.1	6.7	6.5	17.6	0.9
Eco Services Operations Corp (22789)	23.6	38.8	17.9	13.4	0.7	342.6
Martinez Cogen Limited Partnership at Tesoro (1820)	17.5	67.7	10.7	10.7	3.7	1.3
Pacific Gas & Electric Co (541)	12.1	16.6	0.1	0.1	205.1	0
TransMontaigne Operating LP (24089)	0.3	1.2	0	0	43.2	0

Notes: (1) Criteria pollutant emissions are for the 2021 reporting year, obtained from the California Emissions Inventory Data Analysis and Reporting System (CEIDARS). (2) Air Products & Chemicals, Inc did not report emissions during the 2021 reporting year. However, the facility's emissions previously exceeded thresholds and the company paid fees under Schedule X between 2017 and 2019.

## Wind Climatology and Topography

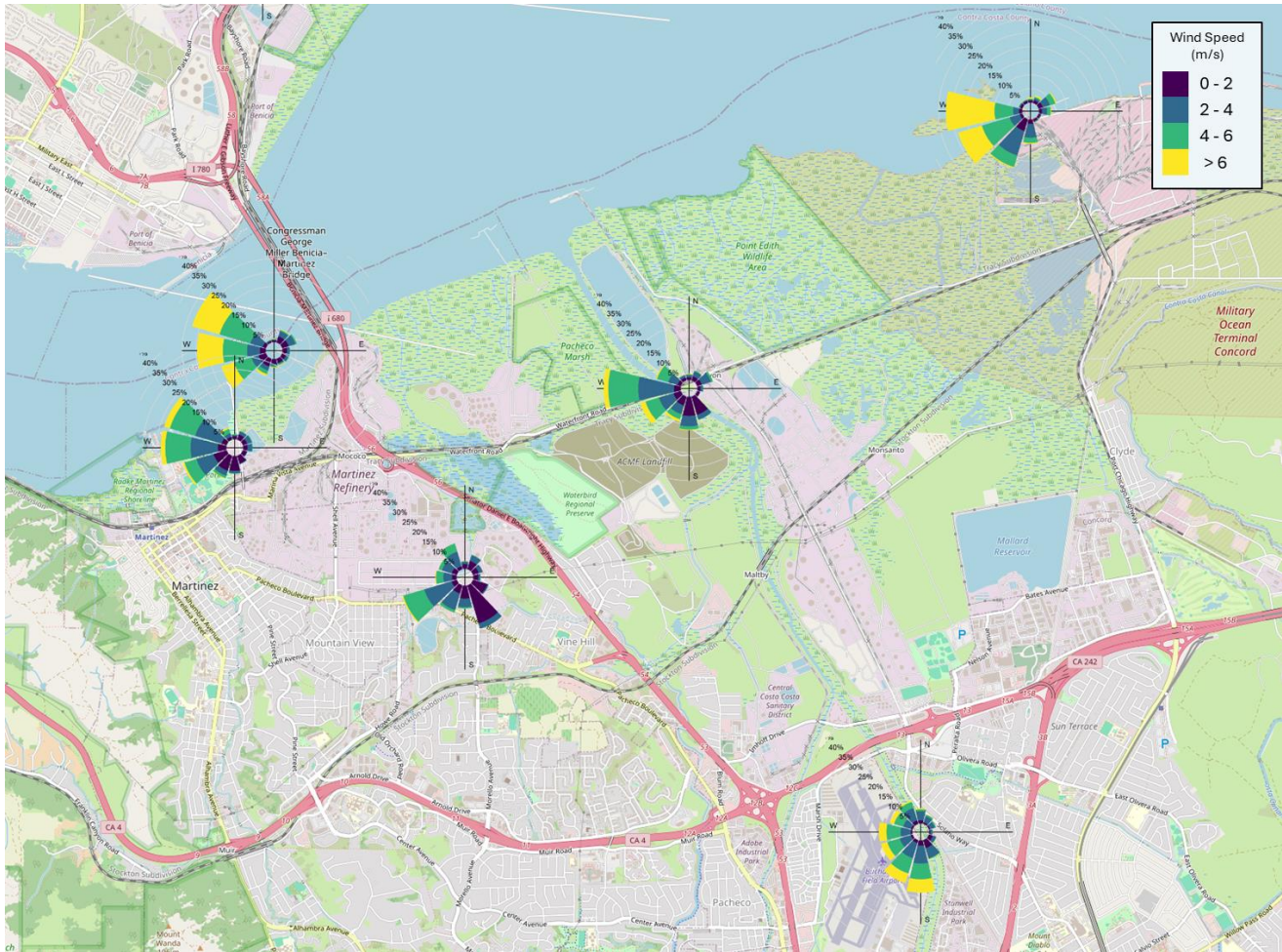
The movement of air and topography (such as hills or valleys) significantly affect where emitted air pollutants end up and get concentrated. Therefore, when identifying potential locations for an air monitoring station to capture the effects of these emissions on ambient concentrations, it is necessary to consider historical wind patterns and topographical features in the area. In this case, the Air District performed a multi-year (2018 - 2022) assessment of wind data from nearby refinery Ground Level Monitors (GLMs) and NOAA-affiliated meteorological stations.<sup>2</sup>

Typical year-round wind patterns are summarized by the wind roses in Figure E-6. A wind rose shows the general wind direction and speed for a particular sampling period. The circular structure of the wind rose shows the direction the winds blew from, and the length of each "spoke" around the circle shows how often the wind blew from that direction. The different colors of each spoke provide details on the wind speed.

As shown by the wind roses, prevailing winds vary somewhat by location, due in part to this region's complex topography. The predominant onshore (blowing from ocean to land) to offshore (blowing from land to ocean) wind patterns in the Bay Area are locally modulated and channeled by the path of the Carquinez Strait and surrounding terrain. Along and near the Carquinez Strait, winds are typically stronger and predominantly from the west to west-northwest through Martinez and from the west to west-southwest farther east, roughly following the path of the waterway. Farther south (and inland) from the Carquinez Strait, winds are comparatively lighter and from variable directions, with southerly winds also occurring relatively frequently.

<sup>2</sup> Data from NOAA-affiliated meteorological stations were obtained through MesoWest: <https://mesowest.utah.edu/>

Figure E-6 - Wind Roses for Nearby Meteorological Stations (2018-2022)



Winds also vary by season and by time of day (Figure E-7 through Figure E-12). Overall, winds are stronger in the daytime and during the spring and summer and prevail from an onshore direction (west to east), channeled through the Carquinez Strait, and would tend to transport refinery-related emissions eastward away from the larger population centers in central Martinez and central Concord, but potentially impact smaller communities such as Clyde and far northern neighborhoods of Concord. Periods of northwesterly winds are also noted at the Concord-Buchanan Airport, located just south of the Marathon Refinery, which may transport refinery-related emissions into the northern part of Concord.

During the cool season, observed winds are typically lighter (under 2 m/s) for a greater portion of the time compared to during the warm season. Light and more variable winds occur more frequently during nighttime hours compared to daytime hours. Calm or light winds from variable directions can limit dispersion and allow pollutants to build up in the local area. Periods of offshore winds (winds from the east and northeast) also occur more frequently during the cool season, which may transport pollutants associated with Marathon westward or southwestward toward Vine Hill, Mountain View, and Martinez. Periods of offshore winds also can transport pollutants into the region from the Central Valley.

Figure E-7 - Wind Roses for Winter (Dec-Jan-Feb 2018-2022)



Figure E-8 - Wind Roses for Spring (Mar-Apr-May 2018-2022)

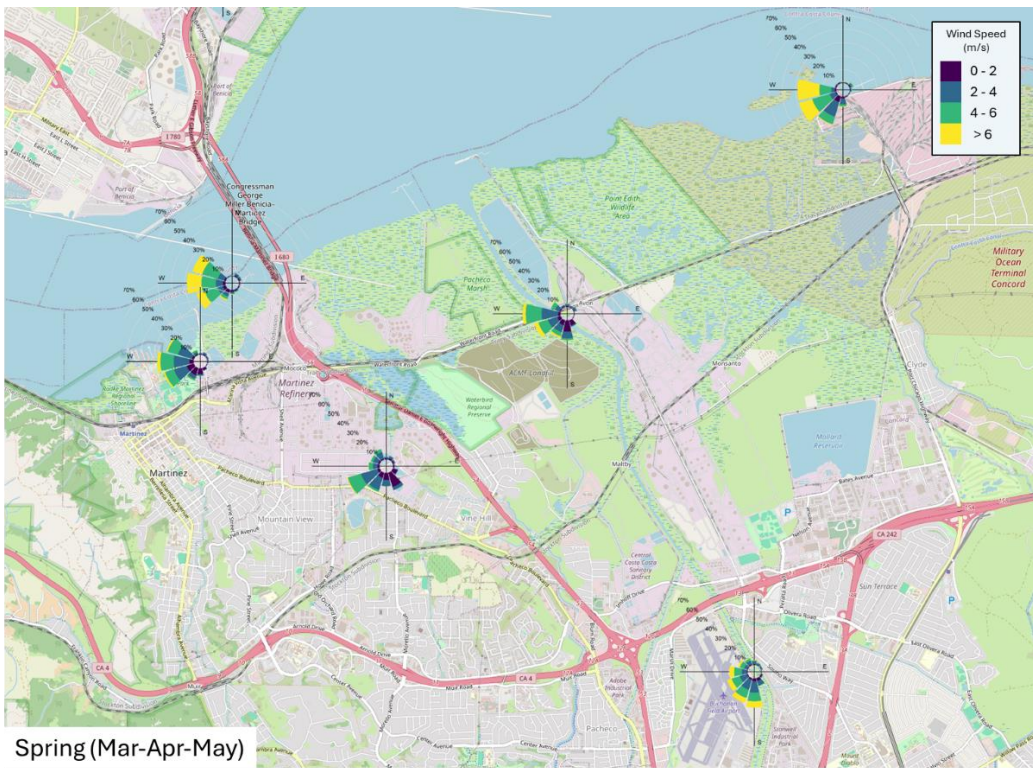




Figure E-9 - Wind Roses for Summer (Jun-Jul-Aug 2018-2022)

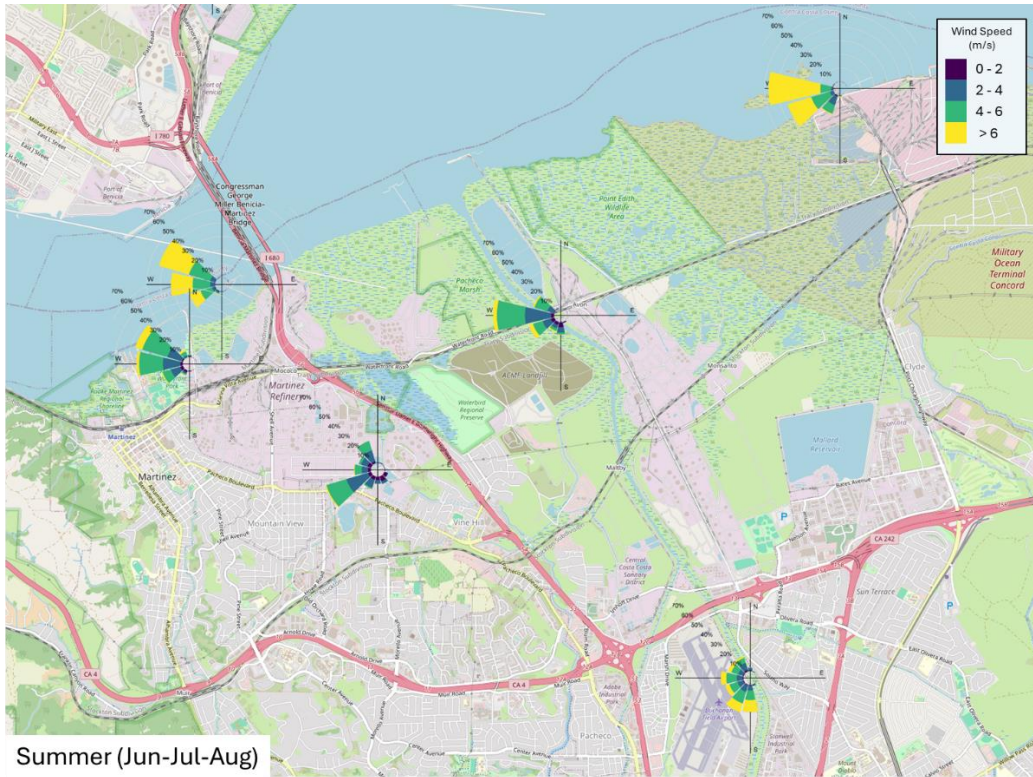


Figure E-10 - Wind Roses for Autumn (Sep-Oct-Nov 2018-2022)

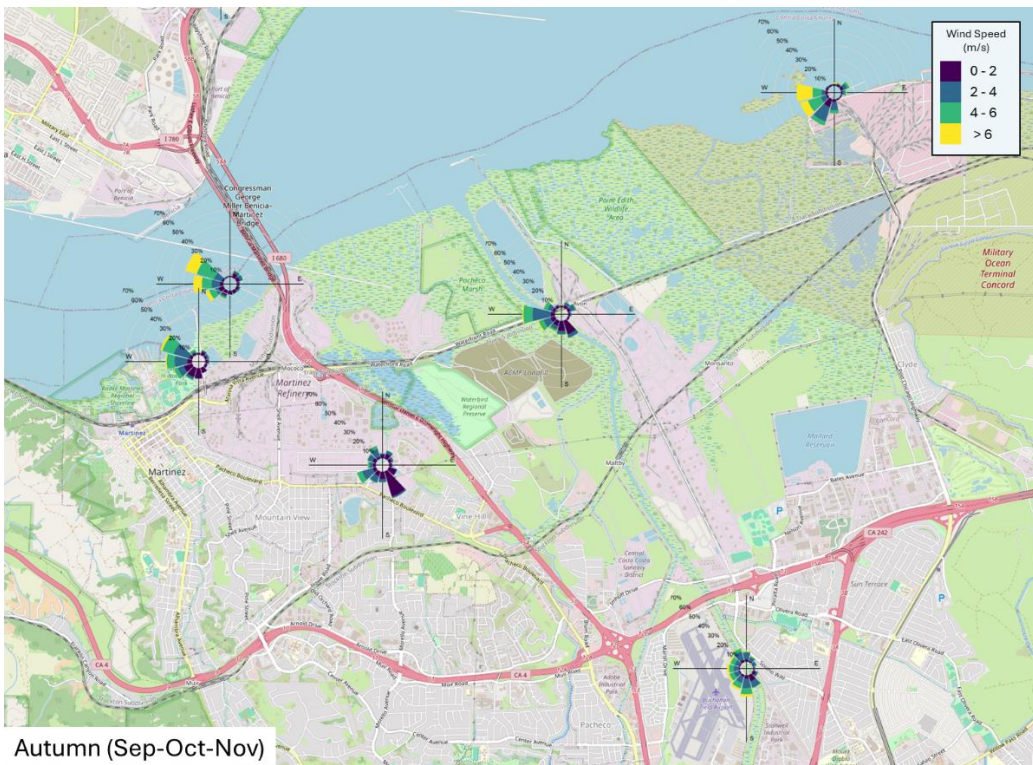


Figure E-11 - Wind Roses for Nighttime (2018-2022)

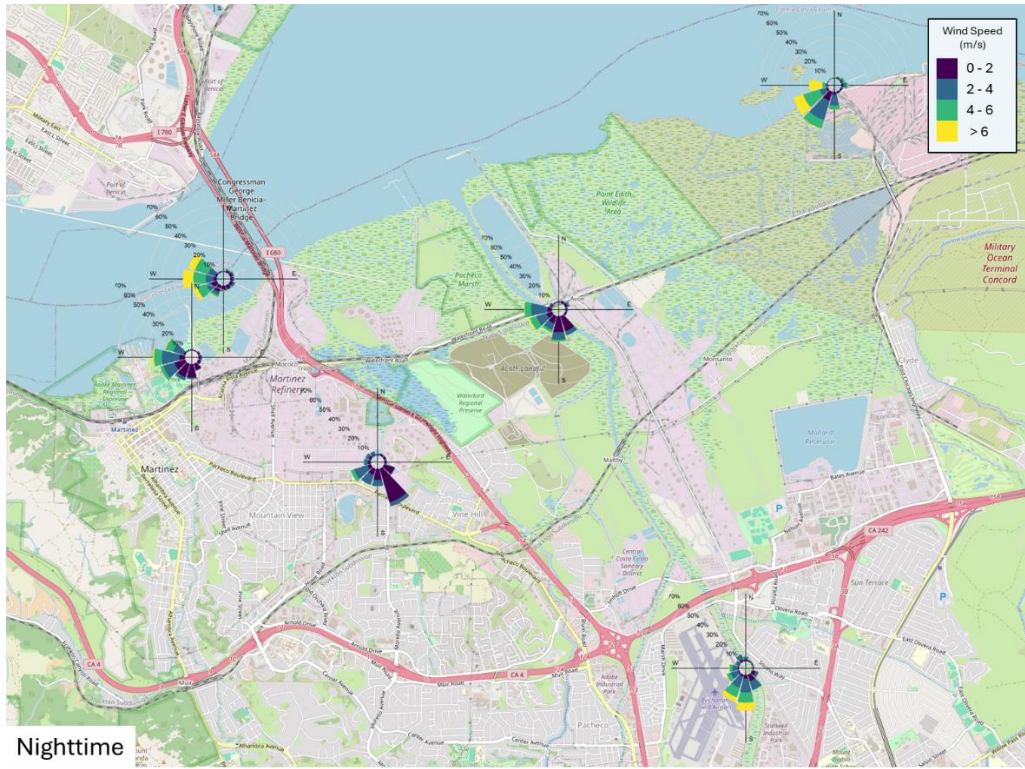
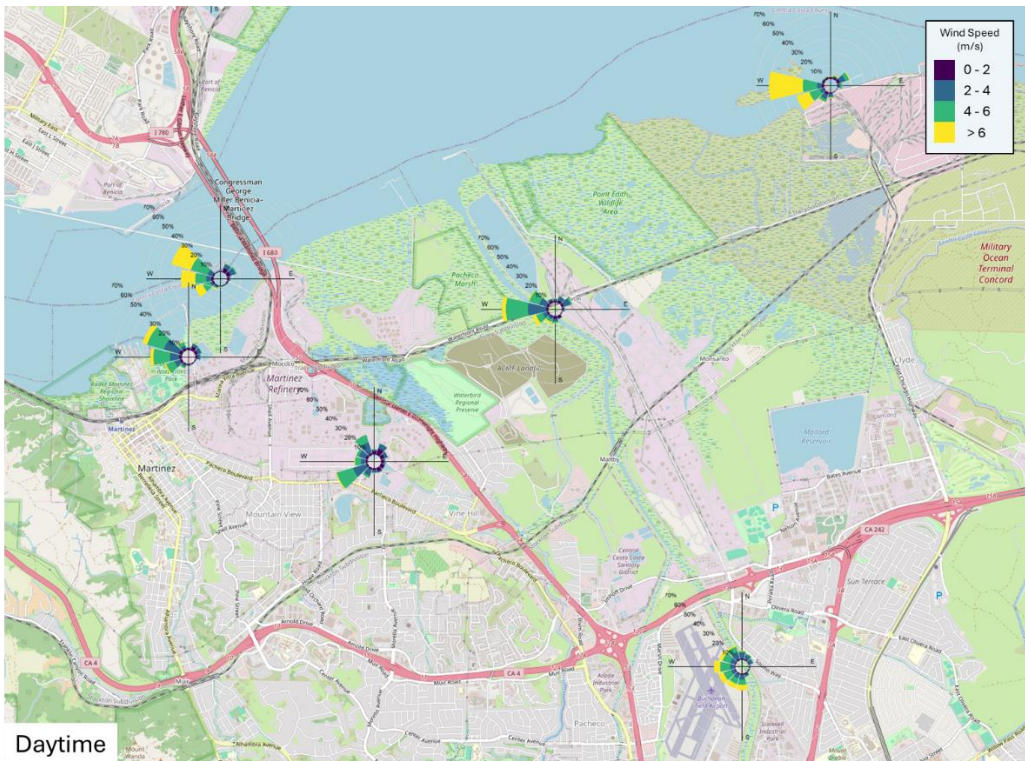


Figure E-12 - Wind Roses for Daytime (2018-2022)



While some wind patterns are driven by global or regional phenomena, topography can drive additional circulation at the local level, which may impact the dispersion and transport of pollution; the nature and degree of this impact depends on the specific arrangement of physical features in the area.

The shaded relief maps in Figure E-13 and Figure E-14 show complex terrain surrounding the Marathon Refinery. Located at the northern edge of the Diablo Valley, the area is bounded to the west and southwest by the Franklin Ridge and Briones Hills, which have local peak elevations of around 1,020 and 1,410 feet, respectively. To the east and southeast lie the Diablo Range and Mt. Diablo, which has a peak elevation of 3,849 feet. Hills also lie north of the area across the Carquinez Strait, creating a high-pressure gradient causing high wind flows through the Carquinez Strait.

When the wind blows from the west or south, winds channeled through the Carquinez Strait would tend to transport pollutants east. However, when winds are lighter and more variable, periods of stagnation may develop in the communities around the refineries.

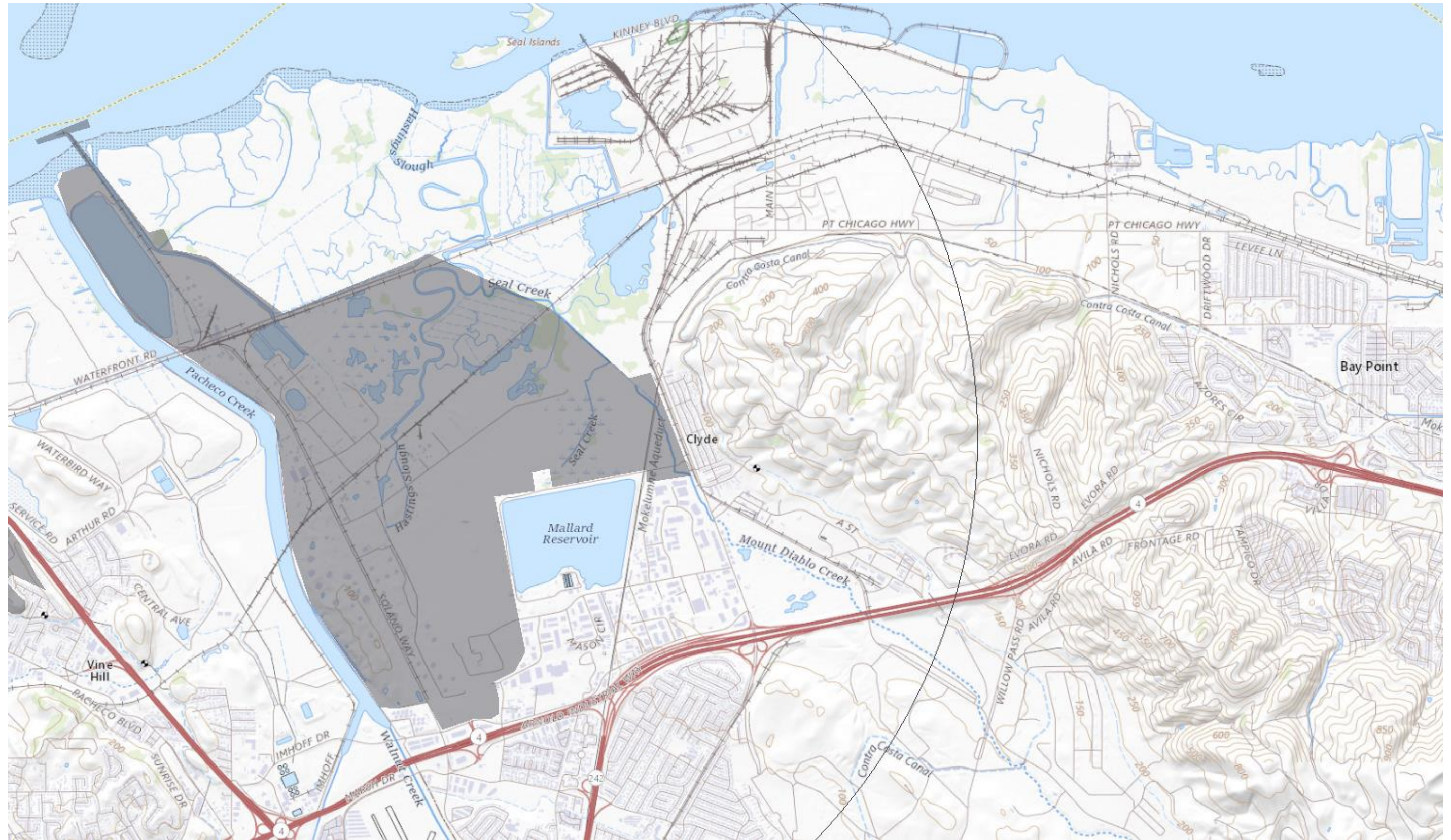
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**Figure E-13 - Topography Around the Marathon Refinery**

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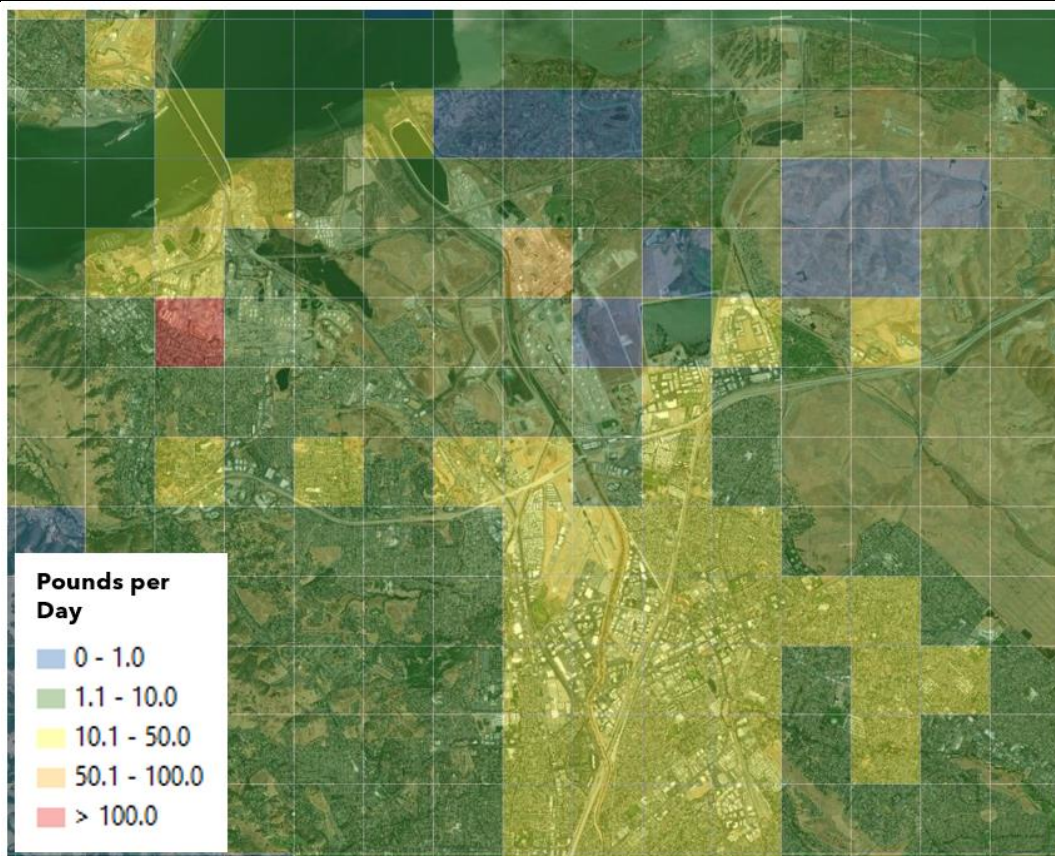
Figure E-14 - Topography Around the Marathon Refinery (detail)



## Health Risk Data, Sensitive Populations, and Environmental Justice Considerations

In an analysis for the Air District's Community Air Risk Evaluation (CARE)<sup>3</sup> project, estimated emissions of certain toxic air contaminants (TACs) from permitted stationary sources, on-road mobile sources, and distributed area sources in 2015 were allocated to a grid of cells with a spatial resolution of 1-km for use in cancer-risk modeling. This modeling effort found that five compounds (diesel PM, acetaldehyde, benzene, 1,3-butadiene, and formaldehyde) were responsible for more than 90% of the cancer risk attributed to emissions. The estimated combined TAC emissions of these compounds for the area near the Marathon Refinery is shown in Figure E-15. The greatest estimated emissions of TACs in the area are associated with the Marathon and MRC refineries. However, elevated levels of TAC emissions are also indicated near Interstate 680, the Buchanan Field Airport, State Route 242, and roughly along State Route 4 due to transportation sources.

**Figure E-15 - Estimated Total Emissions of Diesel PM, Acetaldehyde, Benzene, 1,3-butadiene, and Formaldehyde Near the Marathon Refinery (2015)**



In a separate analysis, the Air District estimated health impacts from air contaminants by reviewing a Health Risk Screening Assessment (HRSA) from 2015 for the Rodeo-Crockett area using toxic emissions inventories provided by Bay Area refineries and meteorological data generated through AERMOD, to illustrate the locations of expected maximum impacts for a range of conditions and magnitude of those impacts. Figure E-16 shows the estimated cancer risk (in one million) for the area due to emissions from the Marathon Refinery (which was the Tesoro Refinery at the time the HRSA was conducted). The contours generally exhibit a pattern extending eastward from the refinery toward far

<sup>3</sup> Website for the Air District's CARE Program: <https://www.baaqmd.gov/community-health/community-health-protection-program/community-air-risk-evaluation-care-program>

northern Concord and Clyde, consistent with the prevailing wind direction. The areas with the greatest estimated elevated cancer risk include the Marathon Refinery and the area to the north of the refinery. The Air District is conducting new air toxics evaluations for Marathon under Rule 11-18, but that work is not expected to impact the general results of this analysis for the community air monitoring station.

**Figure E-16 - Estimated Cancer Risk from a 2015 Health Risk Assessment of Emissions from the Marathon Refinery**



When considering the health impacts from air pollution, it is also instructive to consider biological traits, health status, or other community characteristics that can result in increased vulnerability to pollution. A number of these population characteristics have been incorporated into the CalEnviroScreen (CES)<sup>4</sup> model (version 4.0), which identifies California communities by census tract that are disproportionately burdened by, and vulnerable to, multiple sources of pollution. CalEnviroScreen uses 21 statewide indicators to characterize pollution burden and population characteristics. Individual indicator scores are provided along with composite scores based on a specified formula. The population characteristics used by CalEnviroScreen are: emergency department visits associated with asthma, cardiovascular disease (emergency department visits for heart attacks), low birth-weight infants, educational attainment, housing-burdened low-income households, linguistic isolation, poverty, and unemployment. The percentiles for the 12 census tracts that intersect the 5 km buffer around the Marathon Refinery as labeled below in Figure E-17 are summarized in Table E-2.

Overall, tract 9 (south of the Marathon Refinery and including portions of Concord and Pacheco between I-680, Highway 4, and Highway 282) had the highest composite CES score, falling above the 80<sup>th</sup> percentile. Tracts 1, 2, 10, and 12 (areas north, east, and southeast of the Marathon Refinery, respectively) had the highest asthma rates falling above the 90<sup>th</sup> percentile. In addition, tracts 1, 2, and 12 (areas north, east, and southeast of the Marathon Refinery) had the highest cardiovascular disease rates between the 80<sup>th</sup> and 90<sup>th</sup> percentiles. The highest rates of low-birth weight are found in tracts 9 and 12 (south and southeast of the Marathon Refinery), which fall between the 80<sup>th</sup> and 90<sup>th</sup> percentiles.

<sup>4</sup> Website for CalEnviroScreen 4.0: <https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40>

Figure E-17 - Percentiles for CES Composite Score and Selected CES Indicators in Census Tracts Near the Marathon Refinery

a. Composite CES Score



b. Asthma



c. Cardiovascular Disease



d. Education



e. Housing Burden



f. Linguistic Isolation



g. Low Birth-weight



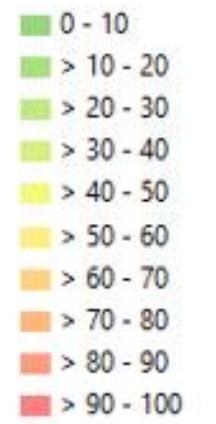
h. Poverty



i. Unemployment



Percentile



**Table E-2 - Percentiles for CES Composite Score and Selected CES Indicators in Census Tracts Near the Marathon Refinery**

	Indicator								
	Composite CES Score	Asthma	Cardiovascular Disease	Education	Housing Burden	Linguistic Isolation	Low Birth-weight	Poverty	Unemployment
Tract 1	70-80	90-100	80-90	30-40	60-70	30-40	10-20	40-50	50-60
Tract 2	60-70	90-100	80-90	50-60	20-30	10-20	30-40	40-50	30-40
Tract 3	40-50	60-70	50-60	10-20	20-30	20-30	20-30	30-40	0-10
Tract 4	70-80	60-70	40-50	50-60	50-60	30-40	60-70	30-40	20-30
Tract 5	10-20	60-70	40-50	0-10	0-10	0-10	30-40	0-10	0-10
Tract 6	40-50	60-70	40-50	20-30	50-60	10-20	10-20	10-20	0-10
Tract 7	20-30	60-70	40-50	10-20	20-30	20-30	40-50	0-10	40-50
Tract 8	30-40	30-40	20-30	20-30	40-50	50-60	50-60	30-40	40-50
Tract 9	80-90	80-90	60-70	50-60	30-40	40-50	80-90	40-50	40-50
Tract 10	60-70	90-100	70-80	50-60	40-50	60-70	40-50	20-30	10-20
Tract 11	40-50	60-70	40-50	40-50	20-30	50-60	0-10	30-40	70-80
Tract 12	70-80	90-100	80-90	40-50	0-10	40-50	80-90	20-30	50-60



## Air Monitoring Stations & Monitoring Data

The locations of existing air quality monitors and historical data from those monitors are important considerations when establishing new monitoring sites. Table E-3 summarizes the recent history of air monitoring in the area, and Figure E-18 shows the location of the relevant monitoring stations.

The Marathon and MRC refineries both monitor H<sub>2</sub>S and SO<sub>2</sub> as part of their Ground-Level Monitoring (GLM) networks. This type of monitoring is required at all five Bay Area refineries by Air District Regulation 9, Rule 1 and Regulation 9, Rule 2.<sup>5,6</sup> The Air District oversees the monitoring conducted by the refineries, including conducting site evaluations and performance audits of the monitors. Measurements in excess of rule limits are reviewed and investigated by Air District staff. Currently, Marathon operates four stations that monitor H<sub>2</sub>S and three that monitor SO<sub>2</sub>, while MRC operates four stations that monitor H<sub>2</sub>S and one that monitors SO<sub>2</sub>. Meteorological monitoring is performed at one additional station at the Marathon refinery and two additional stations at the MRC refinery.

In addition to the refinery GLM network, the Air District currently operates two monitoring stations in the area: one in Martinez, which monitors SO<sub>2</sub> and air toxics, and one in Concord, which monitors CO, NO, NO<sub>2</sub>, O<sub>3</sub>, SO<sub>2</sub>, PM<sub>10</sub>, PM<sub>2.5</sub>, and air toxics.<sup>7</sup> Air toxics monitoring has been performed at additional stations in Concord and Martinez in the past but those stations are no longer in operation.

**Table E-3 - Current and Historical Air Quality Monitoring Near the Marathon and MRC Refineries**

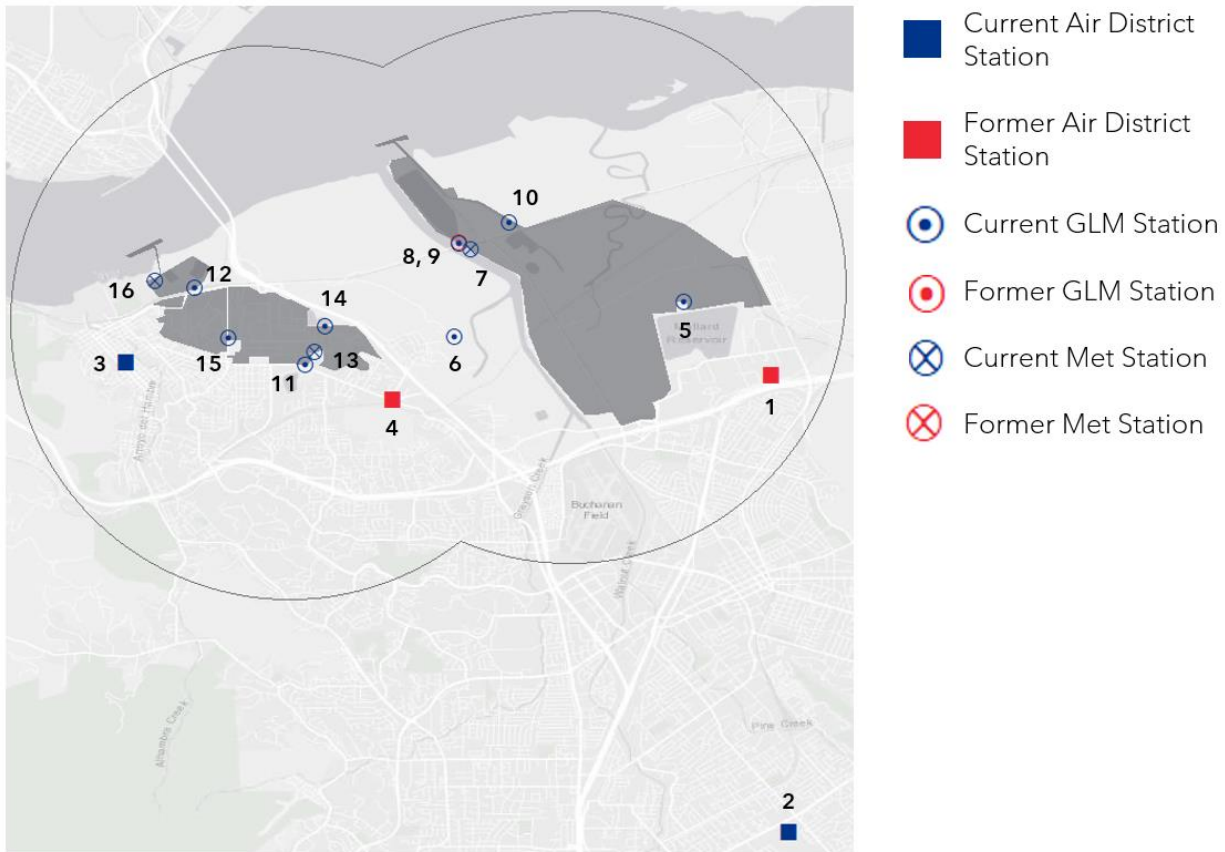
Station (map label)	Operator	Operation	Parameters Measured
BAAQMD-Concord-Arnold Ind Way (1)	BAAQMD	Historical	Air Toxics
BAAQMD-Concord-Treat Blvd (2)	BAAQMD	Current	CO, NO, NO <sub>2</sub> , O <sub>3</sub> , SO <sub>2</sub> , PM <sub>10</sub> , PM <sub>2.5</sub>
			Air Toxics
BAAQMD-Martinez-Jones St (3)	BAAQMD	Current	SO <sub>2</sub>
			Air Toxics
BAAQMD-Martinez-Pacheco Blvd (4)	BAAQMD	Historical	Air Toxics
Marathon-Chenery (5)	Marathon	Current	H <sub>2</sub> S, SO <sub>2</sub>
Marathon-Gun Club (6)	Marathon	Current	H <sub>2</sub> S
			SO <sub>2</sub>
Marathon-Meteorology (7)	Marathon	Current	Meteorology
Marathon-Pacheco Slough (8)	Marathon	Historical	H <sub>2</sub> S
Marathon-Pacheco Slough II (9)	Marathon	Current	H <sub>2</sub> S
Marathon-Waterfront (10)	Marathon	Current	H <sub>2</sub> S, SO <sub>2</sub>
MRC-Ace Hardware (11)	MRC	Current	H <sub>2</sub> S, SO <sub>2</sub>
MRC-East Levee Gate (12)	MRC	Current	H <sub>2</sub> S
MRC-East Met (13)	MRC	Current	Meteorology
MRC-Mountain View (14)	MRC	Current	H <sub>2</sub> S
MRC-Shell Avenue (15)	MRC	Current	H <sub>2</sub> S
MRC-West Met (16)	MRC	Current	Meteorology

<sup>5</sup> Air District Regulation 9, Rule 1: Sulfur Dioxide: <https://www.baaqmd.gov/rules-and-compliance/rules/reg-9-rule-1-sulfur-dioxide>

<sup>6</sup> Air District Regulation 9, Rule 2: Hydrogen Sulfide: <https://www.baaqmd.gov/rules-and-compliance/rules/reg-9-rule-2-hydrogen-sulfide>

<sup>7</sup> Although the Concord monitoring station is outside of the 5-km buffer around the Marathon and MRC refineries, data from that station are included in the analyses below for reference.

**Figure E-18 - Location of Current and Historical Monitoring Stations Near the Marathon and MRC Refineries**



Notes:

- 1) See Table E-3 for the names corresponding to the numbered labels
- 2) In 2017, the Marathon-Pacheco Slough monitor was moved a short distance and renamed to Pacheco Slough II.

A review of historical hourly SO<sub>2</sub> and H<sub>2</sub>S measurements around the Marathon and MRC refineries over the period 2019 to 2021 shows that while concentrations have been low generally, variability is noted among the stations and occasional higher concentrations do occur. Figure E-19 shows distributions of hourly SO<sub>2</sub> concentrations by monitoring site, where each smaller dot represents an hourly SO<sub>2</sub> concentration, and the larger black dot represents the three-year average concentration. SO<sub>2</sub> is a criteria air pollutant regulated under the Clean Air Act and the National Ambient Air Quality Standard (NAAQS) for SO<sub>2</sub> is also shown for reference; however, refinery GLMs are not subject to the NAAQS since they operate within a facility fenceline. The data distributions are color-coded to match the site locations on the adjacent map. There were more occurrences of relatively higher SO<sub>2</sub> concentrations (above 25 ppb) at the Marathon - Waterfront and MRC - Ace Hardware GLMs compared to other nearby locations and other SO<sub>2</sub> monitors in the Bay Area. SO<sub>2</sub> concentrations at Air District monitoring sites, which are located outside the refinery fenceline, were comparatively lower and were well below the NAAQS. Data from the Oakland West monitoring site (near the Port of Oakland) and the San Jose-Jackson (urban area without refinery or port related SO<sub>2</sub> sources) are also shown for context.

**Figure E-19 - Historical SO<sub>2</sub> Concentrations and Map of SO<sub>2</sub> Monitor Locations**

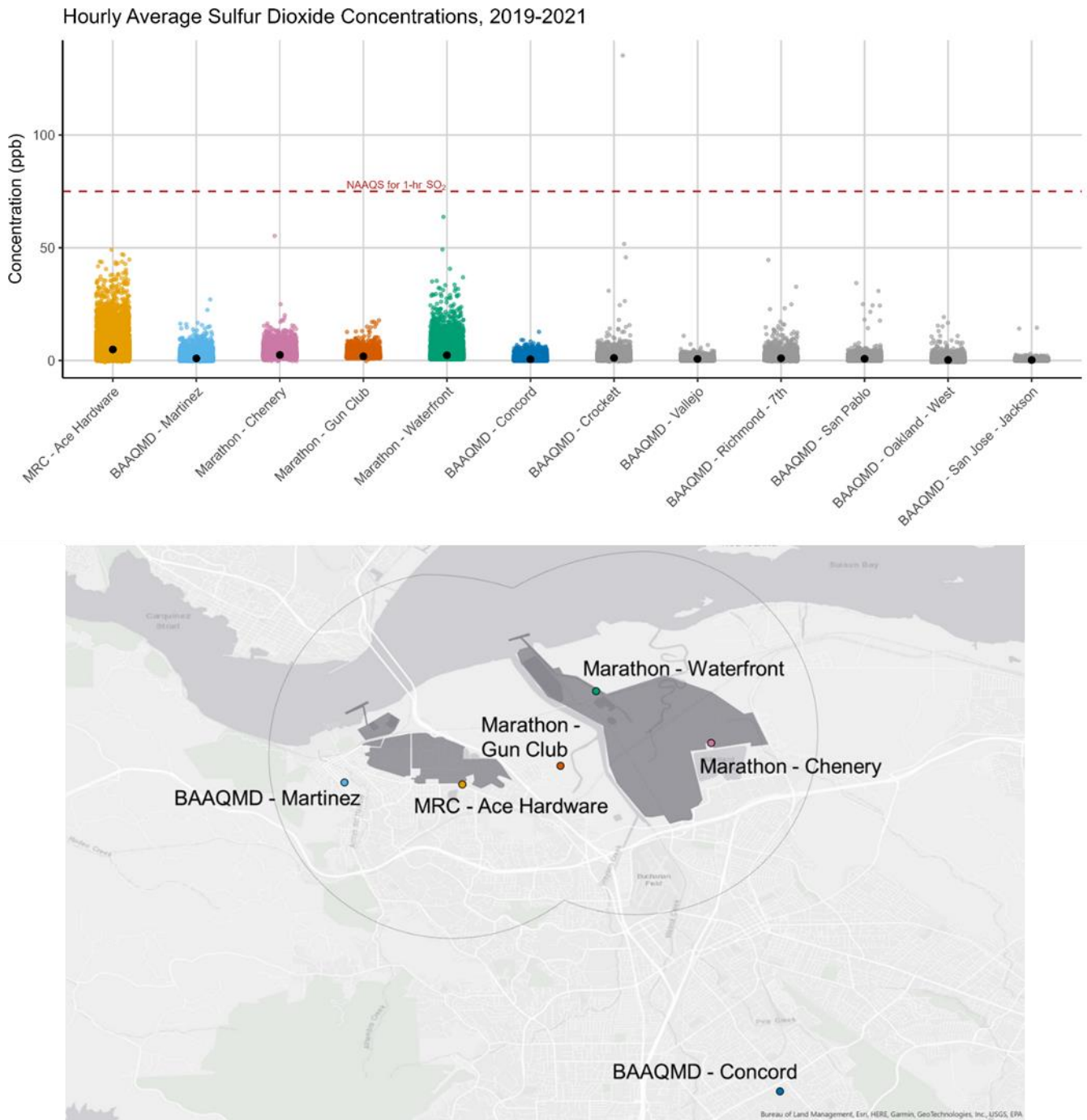
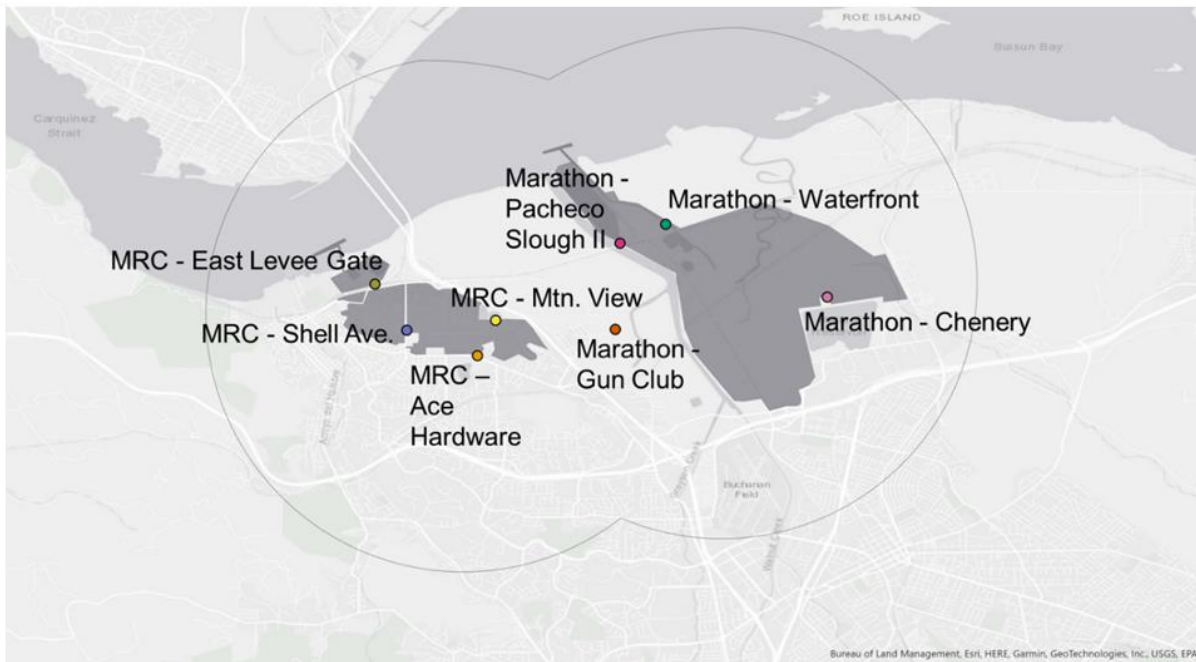
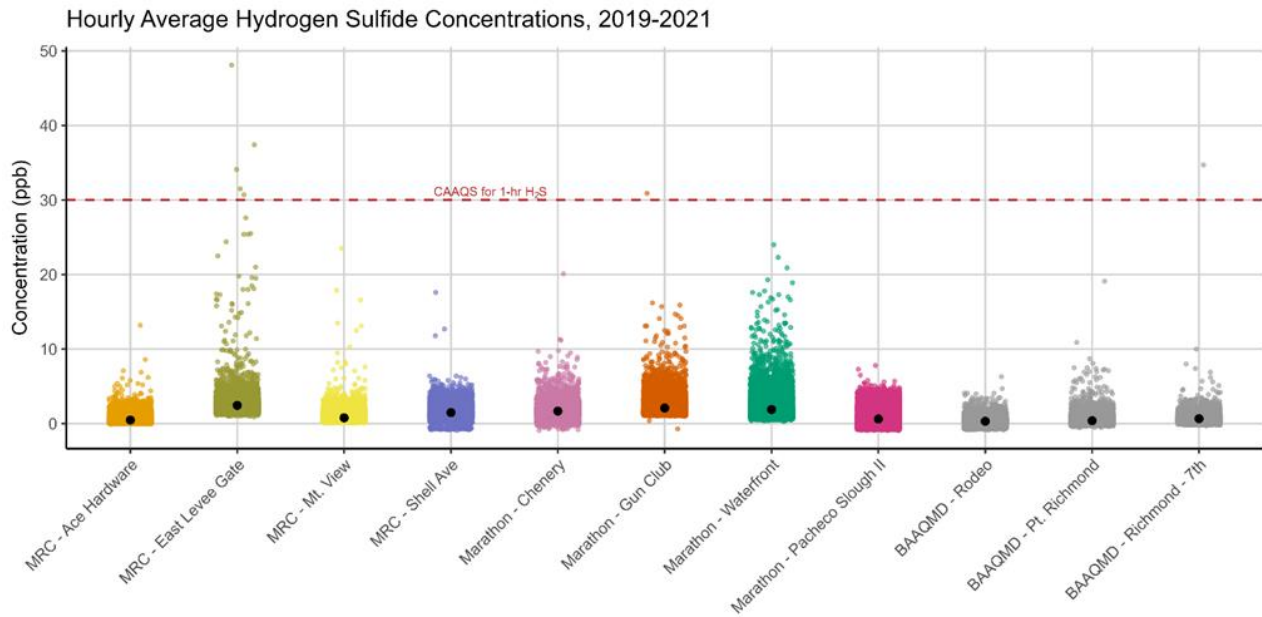


Figure E-20 is similar to the previous figure but shows measured hourly H<sub>2</sub>S concentrations. While H<sub>2</sub>S is not a criteria pollutant regulated under the Clean Air Act, CARB has established a California Ambient Air Quality Standard (CAAQS) for 1-hr hydrogen sulfide of 30 ppb for the purpose of odor control, though some people may detect odors at lower concentrations. From 2019 to 2021, H<sub>2</sub>S data from the refinery ground-level monitors and Air District monitoring sites were mostly below 10 ppb, except for several occurrences of relatively higher concentrations at the MRC - East Levee Gate, MRC - Mountain View, Marathon - Gun Club, and Marathon - Waterfront GLMs.

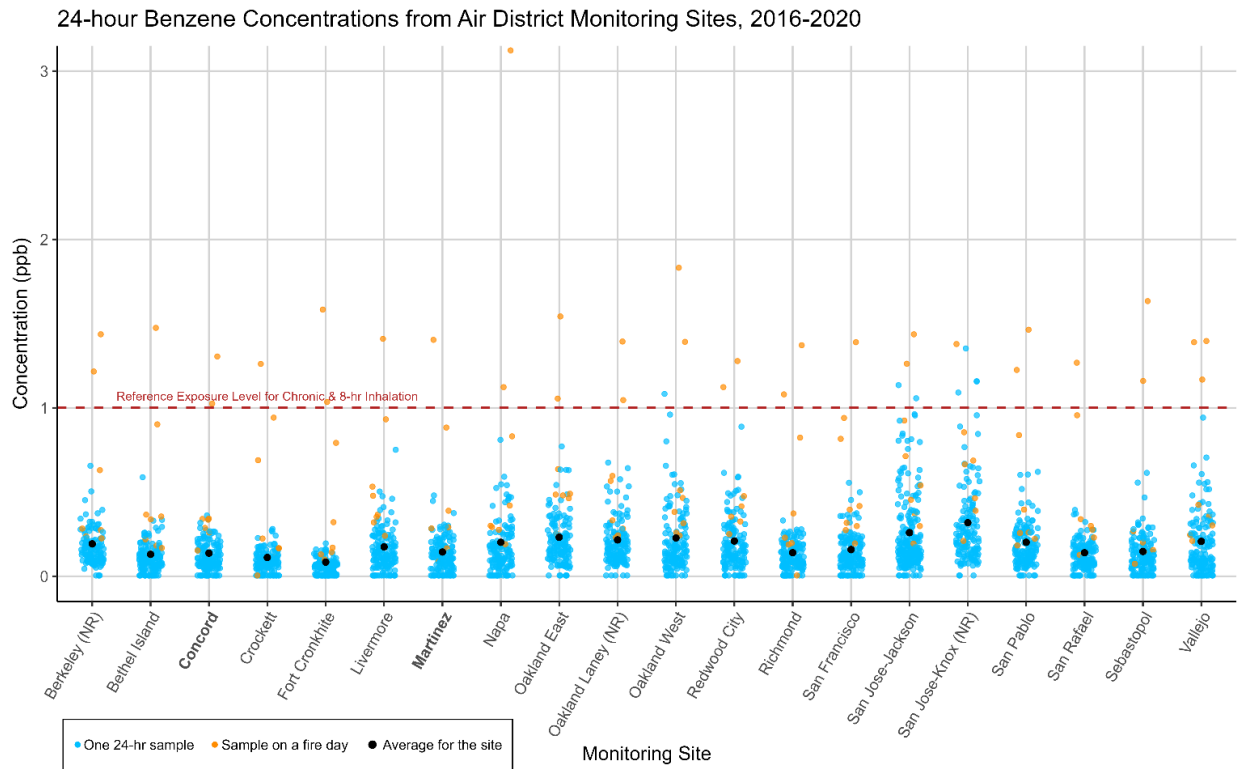
**Figure E-20 - Historical H<sub>2</sub>S Concentrations and Map of H<sub>2</sub>S Monitor Locations**



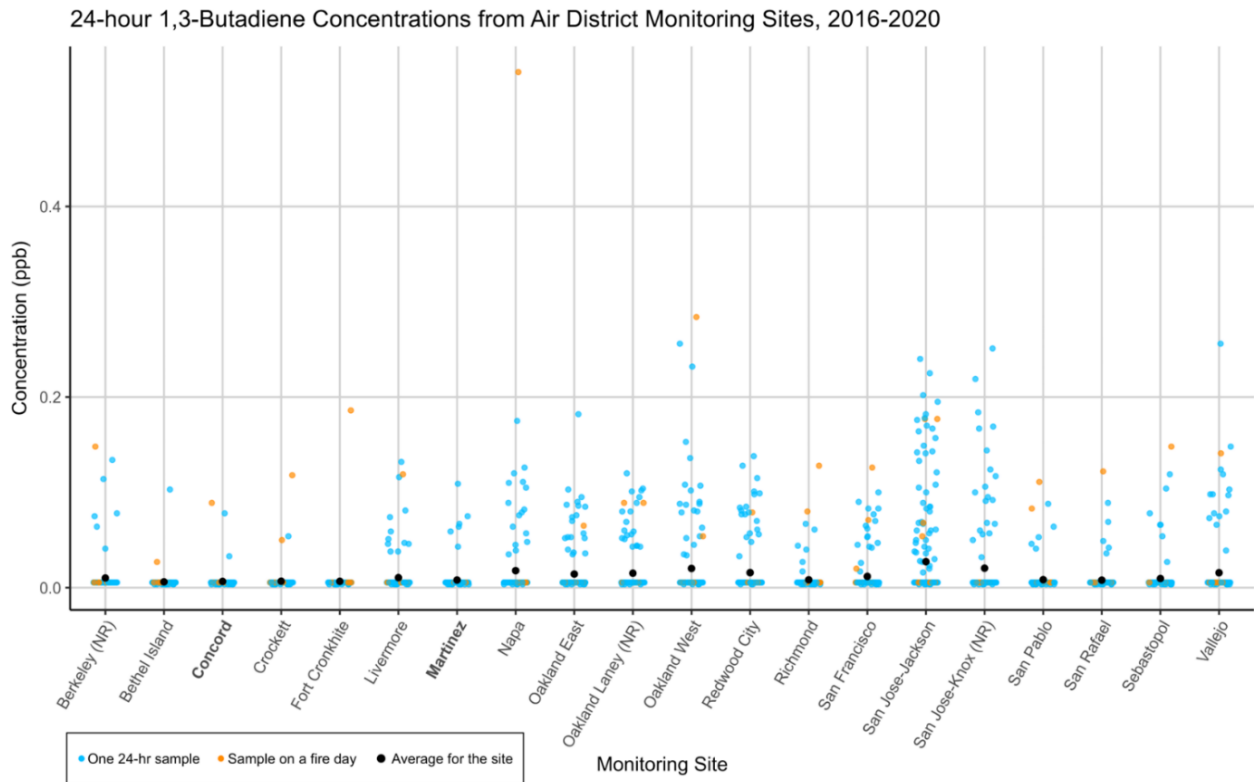
The Air District measures selected volatile organic compounds (VOCs), many of which are TACs, at several of its monitoring sites, including at the nearby Martinez and Concord monitoring sites. These VOCs are measured by collecting air into a canister over 24 hours, and the collected samples are then analyzed at the Air District’s laboratory. VOC samples are collected at these monitoring sites every twelfth day. VOCs can come from many kinds of facilities, operations, processes, and consumer products, as well as smoke from wildfires and other combustion.

Measurements from Air District monitoring sites from 2016 to 2020 for benzene and 1,3-butadiene are provided in Figure E-21 and Figure E-22, respectively. Benzene and 1,3-butadiene are among the five compounds found to be responsible for more than 90% of the cancer risk attributed to emissions as part of the previously mentioned CARE study.

**Figure E-21 - Historical Benzene Concentrations**



**Figure E-22 - Historical 1,3-Butadiene Concentrations**



Most of the measured benzene concentrations have been below 0.5 ppb across the Air District's monitoring network and well below the California Office of Environmental Health Hazard's chronic Reference Exposure Level (REL) for benzene of 1 ppb. Most measurements above 1 ppb occurred during periods of wildfire smoke. Overall, levels of measured benzene concentrations at the Martinez and Concord monitoring sites have been similar to each other and show fewer occurrences of relatively higher levels of benzene compared to San Jose - Knox, San Jose - Jackson, Oakland West, and Vallejo (and other air monitoring sites). Benzene is emitted during the processing of crude oil and through other refinery operations, but a primary source of benzene in the atmosphere is vehicle exhaust.

Most of the 1,3-butadiene samples (over 95% of the samples at the Martinez and Concord monitoring sites) yielded no detectable concentration. Of the few samples with detectable levels of 1,3-butadiene, concentrations were generally low at the Martinez and Concord monitoring sites (less than 0.2 ppb). Several other monitoring sites, such as San Jose - Jackson, San Jose - Knox, Oakland West, and Vallejo (among others) had more frequent occurrences of relatively higher concentrations of 1,3-butadiene. While 1,3-butadiene emissions result from petroleum refining operations, the bulk of 1,3-butadiene in the atmosphere comes from traffic, which is ubiquitous in the Bay Area urban environment.

As was noted in Figure E-13 and Table E-3, the Air District formerly operated an air monitoring station in north Concord along Arnold Industrial Way, which monitored for selected VOCs during the period May 2000 to May 2002. A cursory review of data from the former monitoring station in comparison with data from the Air District's Concord - Treat Blvd. monitoring station showed relatively similar concentrations of most of the measured VOCs between the two locations, as summarized in Table E-4. Measured concentrations of benzene and toluene were slightly higher at the Treat Blvd. monitoring station, while measured concentrations of methyl chloroform and methyl tertiary butyl ether were higher at the former Arnold Industrial Way monitoring station.

**Figure E-4 - Summary of Measured VOC Concentrations at Air District Monitoring Stations in Concord, May 2000 to May 2002**

Pollutant	Concord - Arnold Industrial Way				Concord - Treat Blvd.			
	2-year average	Max	Min	% Non-Detects	2-year average	Max	Min	% Non-Detects
Benzene	0.53	1.50	0.10	0%	0.63	2.20	0.10	0%
Carbon tetrachloride	0.10	0.14	0.08	0%	0.12	0.15	0.09	0%
Chloroform	0.01	0.04	0.00	66%	0.02	0.09	0.00	63%
Dichloromethane	0.02	0.60	0.00	97%	0.01	0.50	0.00	98%
Ethylene dibromide	0.00	0.00	0.00	100%	0.00	0.00	0.00	100%
Ethylene dichloride	0.00	0.00	0.00	100%	0.00	0.00	0.00	100%
Methyl chloroform	0.16	0.63	0.08	0%	0.05	0.10	0.00	11%
Methyl tertiary butyl ether	0.72	2.30	0.00	29%	0.57	3.20	0.00	48%
Tetrachloroethylene	0.05	0.19	0.01	0%	0.05	0.18	0.01	0%
Toluene	1.12	3.00	0.20	0%	2.53	5.50	0.60	0%
Trichloroethylene	0.00	0.08	0.00	98%	0.00	0.10	0.00	97%
Vinyl chloride	0.00	0.00	0.00	100%	0.00	0.00	0.00	100%

## Stakeholder Input

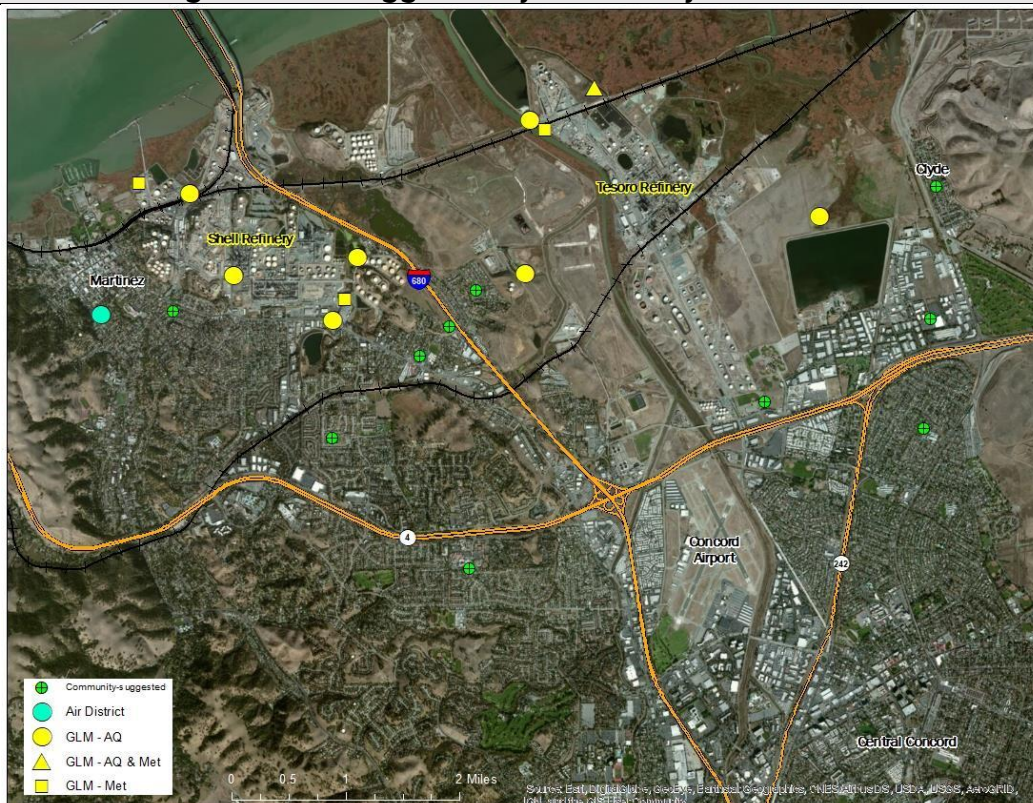
The Air District responds to and investigates all air pollution complaints. We reviewed complaint data between January 1, 2019, and December 31, 2023, for the following zip codes around the Marathon Refinery: 94510, 94519, 94520, 94523, 94529, and 94553. During this period, the Air District received 591 complaints in these zip codes (none received in the 94529 zip code). Table E-5 shows a breakdown of the number of complaints by zip code and by complaint type. Based on the data, there were 63 complaints (primarily odor-related) associated with the Marathon Refinery.

**Table E-5 - Complaints by Zip Code and Type between January 1, 2019 and December 31, 2023**

Zip Code	Asbestos	Dust	Indoor Fire	Outdoor Fire	Gas Station Nozzle	Odor	Other	Smoke	Soot	Total
94510	0	13	0	0	0	118	15	38	0	184
94519	3	0	1	2	1	15	1	0	0	23
94520	2	3	0	0	1	88	0	2	0	96
94523	11	2	0	5	1	6	0	1	0	26
94553	4	31	1	12	3	153	37	18	3	262
Total	20	49	2	19	6	380	53	59	3	591

Figure E-23 shows suggested locations for future air monitoring as proposed by community members at a workshop held in Martinez in March 2018. Several locations were suggested, including within the City of Martinez, the unincorporated Vine Hill community east of Martinez and between the two refineries, the far northern part of the City of Concord, and the unincorporated community of Clyde.

**Figure E-23 - Monitoring Locations Suggested by Community Members in 2018**



## **Recommended Priority Search Area for the Marathon Major Stationary Source Community Air Monitoring Station**

As noted in the Executive Summary, no single fixed monitoring location will capture all the emissions from a given facility. Variability in the meteorological conditions coupled with differences in the characteristics (e.g., temperature or height) of emissions mean there is a chance that any area nearby could experience the impacts of the facilities, particularly for short duration emissions or incidents. In this case, several key factors stand out:

- Due to the complex and variable wind patterns in the area around the Marathon Refinery, there is not any one neighborhood or area that is consistently downwind of the refinery.
  - For locations nearer the Carquinez Strait and the Marathon and MRC refineries, winds are predominantly from the west, northwest, or southwest, which would tend to transport refinery-related emissions eastward and away from more densely populated communities (such as central Martinez and central Concord) but potentially toward Clyde and far northern Concord. However, winds from other directions, such as from the northeast, also occur, which may transport emissions toward Vine Hill, Mountain View, and Martinez.
  - For locations further inland (south) from the Carquinez Strait, winds have a prominent southerly component, but also are more variable and often are from the west or northwest as well.
  - Lighter and more variable winds also occur frequently, particularly overnight and away from the Carquinez Strait, which can limit dispersion of pollutants.
- Historical monitoring data for SO<sub>2</sub>, H<sub>2</sub>S, and VOCs do not strongly point to any one location over another for establishing a new air monitoring station. There were more occurrences of relatively higher SO<sub>2</sub> concentrations at the Marathon - Waterfront GLM (which is in an unpopulated area north of the Marathon Refinery) compared to other nearby monitors, and there were more occurrences of relatively higher H<sub>2</sub>S concentrations at the Marathon - Gun Club and Marathon - Waterfront GLMs (which are west and north of the Marathon Refinery, respectively). The VOC data are less informative given their coarse spatial and temporal resolution.
- Consistent with the prevailing wind data, a health risk screening assessment shows estimated cancer risk contours extending from the Marathon refinery eastward toward Clyde and northern Concord.
- Among census tracts nearest the Marathon Refinery, the census tract south of the refinery, which includes portions of northern Concord (the Hillcrest neighborhood), Pacheco, and the Concord-Buchanan Airport, has the highest composite CalEnviroScreen score (above the 80<sup>th</sup> percentile) as an overburdened community. However, adjacent census tracts that include other parts of northern Concord, as well as Clyde and Vine Hill, also have relatively high composite scores (above the 70<sup>th</sup> percentile).
- Other than the refineries, five stationary sources have also paid fees under Regulation 3, Schedule X. Two of those facilities are co-located with the Marathon refinery and the other two are generally located between the Marathon and MRC refineries.
- Of the ten locations suggested by community members in 2018, seven are in the areas of Vine Hill, northern Concord, and Clyde.



On balance, these factors support placement of the Marathon Major Stationary Source Community Air Monitoring station in northern Concord, Clyde, or Vine Hill as was shown in Figure E-1, and the Hillcrest neighborhood is suggested as a starting place within the recommended search area for identifying potential locations for a new air monitoring station. Importantly, a separate new air monitoring station under Schedule X is also pending near the MRC Refinery. The recommended search areas for the new air monitoring stations near the MRC Refinery (discussed in Appendix D) and the Marathon Refinery overlap slightly in the Vine Hill community east of I-680. The selection of locations for both stations should consider the proximity of one station to another to avoid potential redundancy.