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Air Quality

Clark County Department of Air Quality & Environmental Management

Exceptional Event Documentation for

February 13, 2008, PM_{10} High-Wind Exceedance Event

February 8, 2011

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ACRONYMS AND ABBREVIATIONS

Acronyms

APC	Air Pollution Control
AQI	Air Quality Index
AQR	Clark County Air Quality Regulation
AQS	Air Quality System
CAA	Federal Clean Air Act
CAO	Corrective Action Order
CFR	Code of Federal Regulations
DAQEM	Clark County Department of Air Quality & Environmental Management
EPA	U.S. Environmental Protection Agency
HYSPLIT	Hybrid Single-Particle Lagrangian Integrated Trajectory
LCD	Local Climatological Data
NAAQS	National Ambient Air Quality Standard
NEAP	Natural Events Action Plan
NOAA	National Oceanic and Atmospheric Administration
NOV	Notice of Violation
PST	Pacific Standard Time
SIP	State Implementation Plan

Abbreviations

agl	above ground level
$\mu g/m^3$	micrograms per cubic meter
mb	millibar
mph	miles per hour
$PM_{2.5}$	Particulate Matter 2.5 microns or less in aerodynamic diameter
PM_{10}	Particulate Matter 10 microns or less in aerodynamic diameter

1.0 INTRODUCTION

1.1 CLARK COUNTY EXCEPTIONAL EVENT DOCUMENTATION OBJECTIVES

Clark County through its Department of Air Quality and Environmental Management (DAQEM) is requesting U.S. Environmental Protection Agency (EPA) to review this exceptional event documentation. The DAQEM prepared this exceptional event documentation to achieve three objectives. First, the high PM_{10} concentration recorded on February 13, 2008, if used for regulatory purposes, will inaccurately inflate the design value for the PM_{10} Maintenance Plan, currently under development by the DAQEM. Clark County therefore wishes to eliminate this 24-hour recorded value from regulatory consideration by obtaining EPA concurrence that the PM_{10} concentration recorded on February 13, 2008, was due to an exceptional high-wind event. Second, Clark County wishes to eliminate consideration of the February 13, 2008 PM_{10} concentration in future assessments of historical fluctuations of PM_{10} concentrations. Finally, Clark County DAQEM prepared this exceptional event documentation to provide a margin of safety in the event that additional PM_{10} exceedance days occur in the year 2010.

1.2 EXCEPTIONAL EVENT CONCEPTUAL MODEL

On February 13, 2008, an exceedance of the 24-hour National Ambient Air Quality Standard (NAAQS) for particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) occurred in the Las Vegas Valley (Valley). The February 13, 2008 exceptional event is conceptually characterized as a high-wind event. During this event, a cold front moved through southern Nevada, generating high winds. Second, measurable precipitation had not occurred for over one week prior to this event, and this lack of moisture facilitated a reservoir buildup of entrainable particulate matter in the Valley. Last, wind turbulence and abrupt changes in wind direction occurred, which kept particulate matter aloft in the area. It was during this three-hour period of extreme winds in which the exceedance occurred.

DAQEM has established wind thresholds in Clark County for exceptional high-wind events: these values are 25 mph sustained wind speeds and 40 mph wind gusts. Wind speeds during the February 13, 2008 event significantly exceeded these thresholds; National Oceanic and Atmospheric Administration (NOAA) weather observations at McCarran International Airport on this day recorded sustained winds up to 41 mph and gusts up to 64 mph. During this wind event, the East Craig Road monitoring site in Clark County recorded a 24-hour average PM_{10} concentration of 203 $\mu g/m^3$, the highest 24-hour average PM_{10} concentration recorded in a four-year period.

Anthropogenic sources near the site played only a small role in PM_{10} levels. DAQEM has stringent controls in place to reduce dust from anthropogenic sources, including Best Available Control Measures (BACM) required by the PM_{10} State Implementation Plan (SIP) and Clark County air quality regulations (AQRs). This wind event, however, overwhelmed both BACM and natural desert conditions, and resulted in the PM_{10} exceedance. As documented in Section 5, a total of 1,408 construction notices were issued for this wind event, and DAQEM Compliance staff conducted inspections throughout the Valley to assure Air Quality Regulation (AQR) compliance. These inspections document the implementation of BACM on all relevant sources of emissions.

The meteorological analysis, established science based wind speed particulate entrainment thresholds, and implementation of BACM on relevant sources of particulate emissions detailed in the following sections of this document demonstrate that during this high-wind event, PM_{10} emissions were not reasonably controllable, and the exceedance was not reasonably preventable. The February 13, 2008 exceedance would not have occurred but for the high wind event.

1.3 DOCUMENT OVERVIEW

This document sets forth justification for exceptional event classification of the high-wind event that occurred in the Las Vegas Valley of Clark County, Nevada, on February 13, 2008. Subsections 1.4 and 1.5 of the report summarize the characteristics of the valley with respect to predominant seasons and weather.

Subsections 2.1, 2.2, and 2.3 of the document summarize the event; the Clark County's Natural Event Action Plan (NEAP) for high winds, and the parameters for which action is required by the DAQEM to protect public health; and the Exceptional Event Rule documentation requirements for demonstration submittals. Subsection 2.4 contains EPA's four-part test as outlined in 40 CFR § 50.14(c)(3)(iii). Specifically, § 2.4.1 provides demonstration that the event satisfies the criteria set forth in 40 CFR § 50.1(j); § 2.4.1.1 describes how the event affected air quality; § 2.4.2 describes the clear causal connection between the exceedances and the exceptional event; § 2.4.3 explains how the event is associated with a measured concentration in excess of normal historical fluctuations, including background; and § 2.4.4 describes how there would have been no exceedance or violation but for the event.

Section 3.0, "Event Data," presents a discussion with references to data tables, graphs, and figures to make the case for the exceptional event finding. Subsection 3.1 covers the "Meteorology Assessment," an essential element of the conceptual model for the event demonstration. § 3.1.1 summarizes the weather associated with the event. § 3.1.2 outlines the weather data resources used with the documentation package. §§ 3.1.2.1 through 3.1.2.3 illustrate and highlight data sources, such as local climatological data, Clark County Air Quality Monitoring Stations data, and weather charts used in the document. § 3.1.3 contains the monitoring network measurement background, and a description of how the system works and how data is obtained. § 3.1.4 provides an explanation using data charts and maps of the weather prior to the event of February 13, 2008. § 3.1.5 presents weather data during the event through weather charts, data tables, graphs, and maps. § 3.1.6 presents the weather data tables and conditions experienced after the event. § 3.1.7 contains NOAA HYSPLIT Modeling_results and graphical illustrations of the event. Subsection 3.2 contains media coverage of the wind event. (Appendix B contains copies of the news releases from local newspapers and a video news spot from local television station.)

Section 4.0, "Emission Sources and Activity," covers all monitoring sites discussed in the report, including documentation of adjacent sources and activities, maps, and aerial photography. § 4.1.1 includes discussion, maps, and aerials of the monitoring site located at **East Craig Road,** the exceedance site. § 4.1.2 includes discussion, maps, and aerials of the monitoring site located at **Joe Neal**, which did not exceed but showed similar trends. § 4.1.3 includes discussion, maps, and aerials of the **Lone Mountain** monitoring site, which did not exceed but showed similar trends. § 4.1.4 includes discussion, maps, and aerials of the monitoring site located at **Paul Meyer**, which did not exceed but showed similar trends. § 4.1.5 includes discussion, maps, and aerials of the monitoring site located at **Green Valley**, which did not exceed but showed similar trends. § 4.1.6 includes discussion, maps, and aerials of the monitoring site located at **Jean** (Ivanpah Valley), which did not exceed but showed similar trends.

Section 5.0, "Compliance and Enforcement Activity," covers Clark County SIP-required BACM. Discussions include activities the DAQEM took prior to the forecasted event, during the event, and after the event as a follow-up to Corrective Action Orders (CAOs) and Notices of Violation (NOVs). Subsection 5.1 outlines actions taken by the compliance and enforcement divisions of DAQEM that ensured BACM was in effect throughout the local areas of high winds the day before, the day of, and the day after the event. (Appendix D of this document offers a complete list of inspections, CAOs, and NOV actions.) Subsection 5.2, "Precipitation in Potential Fugitive Dust Source Region," contains discussion of soil moisture contribution to fugitive dust in Clark County. Further, there is discussion of precipitation levels experienced in the county during 2007 and 2008 along with tables, maps, and figures to illustrate. Subsection 5.3, "Establishing Wind Thresholds for Clark County," outlines the wind tunnel studies conducted in Clark County. These studies established wind thresholds of sustained winds of 25 mph and/or wind gust of 40 mph or more that overwhelm BACM, native desert, and disturbed stabilized vacant land. Appendix C contains the "Summary of Refined PM_{10} Aeolian Emission Factors for Native Desert and Disturbed Vacant Land Areas" (full report included in CD format).

Section 6.0, "Conclusion," summarizes the document findings and requests EPA concurrence with flagging the February 13, 2008 exceedance as an exceptional high-wind event.

1.4 CLARK COUNTY EXCEPTIONAL EVENT PROCESSES

The Clark County Natural Events Action Plan and internal DAQEM policy set forth the process for minimizing public health effects from high concentrations of particulate matter generated by high winds. The DAQEM performs meteorological forecasting to predict when winds are likely to generate elevated concentrations of particulate matter. When wind speeds are predicted to reach established thresholds for high particulate concentrations, a wind advisory is broadcast to the public through multiple media channels. The DAQEM Compliance Division initiates an enhanced proactive enforcement program to ensure that all applicable Best Available Control Measures (BACM) are fully employed. This entails deploying all available field enforcement staff to inspect emission sources prior to the high-wind event; during the event; and the day following the event. Field inspection reports are utilized to document that BACM was fully deployed during the event and to help identify sources that may have contributed to an exceedance, if applicable.

Following the event, the DAQEM Planning and Engineering Division staff conducts a preliminary assessment to determine what may have caused the exceedance and if an initial data flag is appropriate. If a data flag for high wind conditions is warranted, the Planning Division initiates a more in-depth assessment to determine if all of the conditions necessary to document a high-wind exceptional event are applicable to the exceedance. The Planning Division, in collaboration with the Engineering and Compliance Divisions, documents that timely wind advisories were issued; that wind speed thresholds for an exceptional event were met; that there is a clear casual relationship between the wind speeds and exceedance(s); that proactive enforcement occurred; and the implementation of BACM was documented. If these requirements are met, the Planning Division develops detailed exceptional events documentation. Following completion of the documentation, a minimum of 30-days is provided for public comment. Following public comment, DAQEM may make revisions to the documentation, after which the documentation is submitted to EPA for review and consideration for concurrence.

1.5 HIGH-WIND DUST EVENT

On February 13, 2008, an exceedance of the 24-hour National Ambient Air Quality Standard (NAAQS) for particulate matter with an aerodynamic diameter of 10 microns or less (PM_{10}) occurred at the East Craig Road monitoring site in the Las Vegas valley. DAQEM has reviewed the related data and determined that a high-wind natural event caused this exceedance. EPA final rule, "Treatment of Data Influenced by Exceptional Events" (Title 40, Parts 50 and 51 of the Code of Federal Regulations (40 CFR 50 and 51)), holds states responsible for establishing a clear causal relationship between a measured exceedance and an exceptional event. This document sets forth the causal relationship between the exceedance of February 13, 2008, and a corresponding high-wind event.

1.6 GEOGRAPHY, POPULATION, AND CLIMATE

The Las Vegas Valley is located in Clark County, at the southern tip of Nevada. It encompasses about 600 square miles, running northwest to southeast; a downward slope from west to east affects local climatology, driving variations in wind, precipitation, and storm water runoff. The surrounding mountains extend 2,000 to 10,000 feet above the valley floor. The Sheep Range bounds the valley on the north, and the Black Mountains bound it on the south. The Spring Mountains, at the west edge of the valley, include Mount Charleston, the region's highest peak at 11,918 feet. There are several smaller ranges on the eastern rim, including the Muddy Mountains and the Eldorado Range.

The Las Vegas Valley is one of the fastest growing metropolitan areas in the nation, although growth has slowed during the current economic downturn. The population expanded from about 400,000 in 1980 to 1.9 million in 2008.[1] The cities of Las Vegas, North Las Vegas, and Henderson comprise the Las Vegas metropolitan area, which is located in Hydrographic Area (HA) 212, a PM_{10} nonattainment area. Five of the monitoring sites discussed in this exceptional event package are located in the Las Vegas Valley; the sixth is located in Jean, in the Ivanpah Valley, which is approximately 14 miles southwest of Las Vegas.

Official weather observations began in 1937 at what is now Nellis Air Force Base. In 1948, the U.S. Weather Bureau moved to McCarran Field (now McCarran International Airport). McCarran

[1] *Clark County, Nevada 2008 Population Estimates*, Clark County Department of Comprehensive Planning.

is located in unincorporated Clark County, 7 miles south of downtown Las Vegas and approximately 5 miles southwest of, and 300 feet higher than the lowest part of the valley.

Beyond formal climatic data publications, there are very few publications containing summaries of extreme wind events relevant to this exceptional event submittal. The valley climate is pleasant most of the year; however, during the summer (June through August), temperatures normally climb above 100 °F and the relative humidity can rise above 90.

Summers are characterized by hot days, warm nights, and mild winds, especially during these drier years. The relative humidity increases for several weeks each summer in association with a moist "monsoonal flow" from the south, typically during July and August. These moist winds support the development of spectacular desert thunderstorms, which are frequently associated with significant flash flooding and/or strong downburst winds.

Winters are mild and pleasant. Afternoon temperatures average near 60 degrees and skies are mostly clear. Pacific storms occasionally produce rainfall in the Las Vegas Valley, but in general, the Sierra Nevada Mountains of eastern California and the Spring Mountains immediately west of the Las Vegas Valley act as effective barriers to moisture.

The spring and fall seasons are generally considered ideal. Although sharp temperature changes can occur, outdoor activities are seldom hampered. Strong winds are the most persistent weather hazard in the area. Winds over 50 mph are infrequent, but can occur with vigorous storms. Winter and spring wind events often generate widespread areas of blowing dust and sand. Problematic windstorms (high-wind event level) are common during late winter and spring, with winds predominantly coming from the southwest. Strong wind episodes in the summertime are usually connected with thunderstorms, and are thus more isolated and localized.[2]

1.7 30-DAY PUBLIC COMMENT PERIOD

Clark County posted the February 13, 2008 High Wind Exceptional Event document and the supporting Appendices on the Clark County DAQEM website for a 30-day comment period effective January 6, 2011 through February 6, 2011 at 5:00 PM. Clark County received no comments on the document or the appendices by close of business on February 7, 2011.

In discussion with EPA, Region 9, Air Quality Analysis Office, more information with respect to monitoring site error codes or malfunctions during the February 13, 2008 High Wind Event was requested. This information is provided in Appendix E.

See Appendix E for the official web postings on the DAQEM web page and additional monitoring station status updates.

[2]Andrew S. Gorelow, 2005: “Climate of Las Vegas, Nevada,” National Oceanic and Atmospheric Administration Technical Memorandum NWS WR-271.

2.0 EXCEPTIONAL EVENTS DOCUMENTATION

2.1 SUMMARY OF EVENT DAY

On February 13, 2008, sustained high winds and strong wind gusts throughout the Las Vegas Valley in the late afternoon entrained dust into the atmosphere, causing PM_{10} exceedances at one site in the DAQEM monitoring network (Figure 1-graphical display of event and Figure 7-map of the event analysis sites). Five other sites in the network displayed similar trends that day, but none of them showed an exceedance (Appendix A, Attachments 1-8). The wind direction varied between south and southwest during the first half of the day, but around 1700 Pacific Standard Time (PST) it changed to north by northwest. It was during this abrupt direction change that the exceeding site started recording high PM_{10} masses, with the resulting high PM_{10} hourly concentrations. Anthropogenic sources near the site played only a small role in PM_{10} levels (See Figures 25 through 29); DAQEM has stringent controls in place to reduce dust from anthropogenic sources, including Best Available Control Measures (BACM) required by the PM_{10} state implementation plan (SIP) and Clark County air quality regulations (AQRs). However, the sustained winds of up to 41 mph and gust of up to 64 mph on this day were high enough to overwhelm all control measures. Therefore, this high-wind event and the associated exceedance were not reasonably controllable or preventable.

2.2 CLARK COUNTY NATURAL EVENTS ACTION PLAN FOR HIGH-WIND EVENTS

The Clark County Board of County Commissioners adopted Clark County's natural events action plan (NEAP) for high wind events in April 2005. Clark County through its DAQEM developed the NEAP with the assistance of stakeholders from many Clark County agencies, organizations, and private citizens. The only EPA guidance in effect when the NEAP was developed was a 1996 policy memorandum entitled "Areas Affected by PM_{10} Natural Events," which described the requirements for natural event data flagging and for developing a NEAP. The policy allowed air quality data to be flagged so it would not count toward an area's attainment status if it could be shown there was a clear causal relationship between the data and one of three categories of natural events: volcanic and seismic activity, unwanted wildland fires, or high wind events. On March 22, 2007, EPA promulgated the final rule addressing the review and handling of air quality monitoring data influenced by exceptional events in the *Federal Register*. Events deemed "exceptional" are those for which the normal planning and regulatory process established by the CAA is not appropriate.

Clark County NEAP procedures have been very effective since their adoption, and changes reflecting the exceptional event final rule requirements have created an even stronger program. Clark County through its DAQEM now provides more information to EPA in event submittals, and has adopted many procedures to enhance early warning processes and better inform the public. Protection of the public health is the foundation of the NEAP, which contains detailed information about the actions implemented in Clark County to minimize public exposure to potentially high levels of PM_{10} caused by winds. The primary components of the NEAP are:

- A high-wind event notification system that includes an early warning procedure.
- Education and outreach programs.
- Enhanced enforcement and compliance programs to reduce emissions.
- A system of required documentation submitted to EPA in the event of an exceedance.

The NEAP protects public health by warning of impending wind events, notifying the public of wind events in progress, and educating the citizens of Clark County on the health hazards of particulate matter. There is further instruction on how people can reduce airborne particulates by avoiding certain individual or collective activities.

Improvements or enhancements to Clark County's natural events program are made as needed. One example is the high wind exceptional event exercise drill, conducted each year before the windy season to refamiliarize staff with procedures and identify potential problem areas. This drill, along with other enhancements, provides an essential tool to evaluate processes, which helps DAQEM reduce the health and environmental effects of particulate matter.

2.3 EXCEPTIONAL EVENTS RULE DOCUMENTATION REQUIREMENTS

The Clean Air Act, as amended (CAA) Section 319(b)(3)(B)(i) requires a state air quality agency to demonstrate through "reliable, accurate data that is promptly produced" that an exceptional event occurred. CAA Section 319(b)(3)(B)(ii) requires that "a clear causal relationship be established" between a measured exceedance of a NAAQS and the exceptional event demonstrating "that the exceptional event caused a specific air pollution concentration at a particular location" (40 CFR 50 and 51 Treatment of Data Influenced by Exceptional Events; Final Rule FR Vol. 72, No. 55, p 13561).
According to EPA's "four-part test" [§50.14(c)(3)(iii)],

The demonstration to justify data exclusion shall provide evidence that:

(A) The event satisfies the criteria set forth in 40 CFR 50.1(j);

(B) There is a clear causal relationship between the measurement under consideration and the event that is claimed to have affected the air quality in the area;

(C) The event is associated with a measured concentration in excess of normal historical fluctuations, including background; and

(D) There would have been no exceedance or violation but for the event."

In accordance with CAA Section 319, EPA defines the term “exceptional event” in 40 CFR 50.1(j) to mean “an event that affects air quality, is not reasonably controllable or preventable, is an event caused by human activity that is unlikely to recur at a particular location or a natural event, and is determined by the Administrator in accordance with 40 CFR 50.14 to be an exceptional event. It does not include stagnation of air masses or meteorological inversions, a meteorological event involving high temperatures or lack of precipitation, or air pollution relating to source noncompliance.”

2.4 EXCEPTIONAL EVENT CRITERIA

The data and analysis in this document show that the exceedance of the PM_{10} NAAQS at the East Craig Road monitoring site on February 13, 2008, satisfied the following exceptional event criteria.

2.4.1 The Event Satisfies the Criteria Set Forth in 40 CFR 50.1(j)

2.4.1.1 <u>The Event Affected Air Quality.</u>

Tables 1 and 2 show that PM_{10} concentrations at the East Craig Road site were low on the days before and after the high wind event. Table 3 and Figure 1 show that PM_{10} concentrations increased rapidly with the arrival of high winds, most significantly between the 1700 and 2100 PST. Figure 1a shows the hourly sustained wind speeds and the hourly average of the maximum wind gusts on the event day.

Table 1. East Craig Road Monitoring Site (CAMS-20, AQS#32-003-0020) Data for February 12, 2008

Year	Month	Day	Time	CR_WS	CR_WD	CR_Gust	PM_{10} Concentration	PM_{10} Mass Accumulation
2008	2	12	0000	3.4	257	10.2	4	36
2008	2	12	0100	7.6	288	16.5	10	17
2008	2	12	0200	4.7	328	11.6	18	38
2008	2	12	0300	3.2	310	11.6	8	49
2008	2	12	0400	3.1	315	7.5	15	66
2008	2	12	0500	3.0	304	7.9	21	94
2008	2	12	0600	3.7	296	10.8	51	148
2008	2	12	0700	3.7	139	7.8	56	207
2008	2	12	0800	5.7	206	10.8	56	266
2008	2	12	0900	5.4	177	10.6	20	289
2008	2	12	1000	3.2	210	7.7	12	304
2008	2	12	1100	2.5	296	8.0	5	312
2008	2	12	1200	3.6	88	7.3	8	322
2008	2	12	1300	4.6	72	10.1	7	333
2008	2	12	1400	4.6	49	13.3	11	346
2008	2	12	1500	5.5	54	12.3	10	359

Year	Month	Day	Time	CR_WS	CR_WD	CR_Gust	PM_{10} Concentration	PM_{10} Mass Accumulation
2008	2	12	1600	6.4	62	11.1	9	372
2008	2	12	1700	4.7	78	9.5	36	411
2008	2	12	1800	5.8	63	9.5	28	441
2008	2	12	1900	4.4	51	8.7	15	461
2008	2	12	2000	3.0	325	5.8	17	480
2008	2	12	2100	3.2	304	7.8	14	497
2008	2	12	2200	3.4	316	7.0	18	517
2008	2	12	2300	3.7	319	7.4	15	535

Table 2. East Craig Road Monitoring Site (CAMS-20, AQS#32-003-0020) Data for February 14, 2008

Year	Month	Day	Time	CR_WS	CR_WD	CR_Gust	PM_{10} Concentration	PM_{10} Mass Accumulation
2008	2	14	0000	18.3	315	32.5	7	23
2008	2	14	0100	17.1	314	27.9	6	16
2008	2	14	0200	15.1	315	25.7	2	19
2008	2	14	0300	15.6	301	25.4	1	23
2008	2	14	0400	13.6	309	23.4	5	30
2008	2	14	0500	11.0	321	25.9	2	36
2008	2	14	0600	6.2	332	15.5	12	51
2008	2	14	0700	3.4	70	7.8	10	64
2008	2	14	0800	11.3	314	22.1	18	86
2008	2	14	0900	13.7	303	25.9	10	97
2008	2	14	1000	11.7	308	31.9	7	108
2008	2	14	1100	8.3	52	20.1	8	120
2008	2	14	1200	10.3	50	24.1	19	141
2008	2	14	1300	9.7	52	21.7	12	157
2008	2	14	1400	10.5	39	21.9	15	176
2008	2	14	1500	10.0	39	24.3	16	194
2008	2	14	1600	9.1	37	20.7	12	210
2008	2	14	1700	5.7	3	15.4	12	225
2008	2	14	1800	5.5	10	15.4	7	234
2008	2	14	1900	4.9	21	11.2	4	241
2008	2	14	2000	6.5	33	15.4	7	251
2008	2	14	2100	6.5	30	20.0	8	263
2008	2	14	2200	6.0	13	14.2	7	272
2008	2	14	2300	6.7	359	16.7	10	283

Table 3. East Craig Road Monitoring Site (CAMS-20, AQS#32-003-0020) Data for February 13, 2008

Year	Month	Day	Time	CR_WS	CR_WD	CR_Gust	PM_{10} Concentration	PM_{10} Mass Accumulation
2008	2	13	0000	3.4	311	7.1	12	31
2008	2	13	0100	4.7	323	9.3	11	26
2008	2	13	0200	3.5	320	6.3	6	35
2008	2	13	0300	3.0	321	6.2	19	58
2008	2	13	0400	3.0	340	6.4	31	92
2008	2	13	0500	2.4	299	5.3	47	143
2008	2	13	0600	2.6	320	6.1	34	183
2008	2	13	0700	2.2	337	4.5	93	282
2008	2	13	0800	2.2	16	5.7	138	423
2008	2	13	0900	8.0	80	16.1	69	494
2008	2	13	1000	7.9	98	17.8	29	525
2008	2	13	1100	4.3	72	8.5	12	542
2008	2	13	1200	4.8	54	12.0	18	563
2008	2	13	1300	11.2	184	28.1	53	628
2008	2	13	1400	17.3	217	34.3	215	839
2008	2	13	1500	12.1	227	26.8	64	910
2008	2	13	1600	17.8	232	33.5	100	1022
2008	2	13	1700	23.4	277	47.7	243	983
2008	2	13	1800	36.2	301	59.0	921	619
2008	2	13	1900	35.6	308	57.9	1496	828
2008	2	13	2000	26.7	309	49.6	621	200
2008	2	13	2100	24.9	305	39.3	70	274
2008	2	13	2200	16.2	312	32.9	21	299
2008	2	13	2300	20.2	308	32.0	8	308

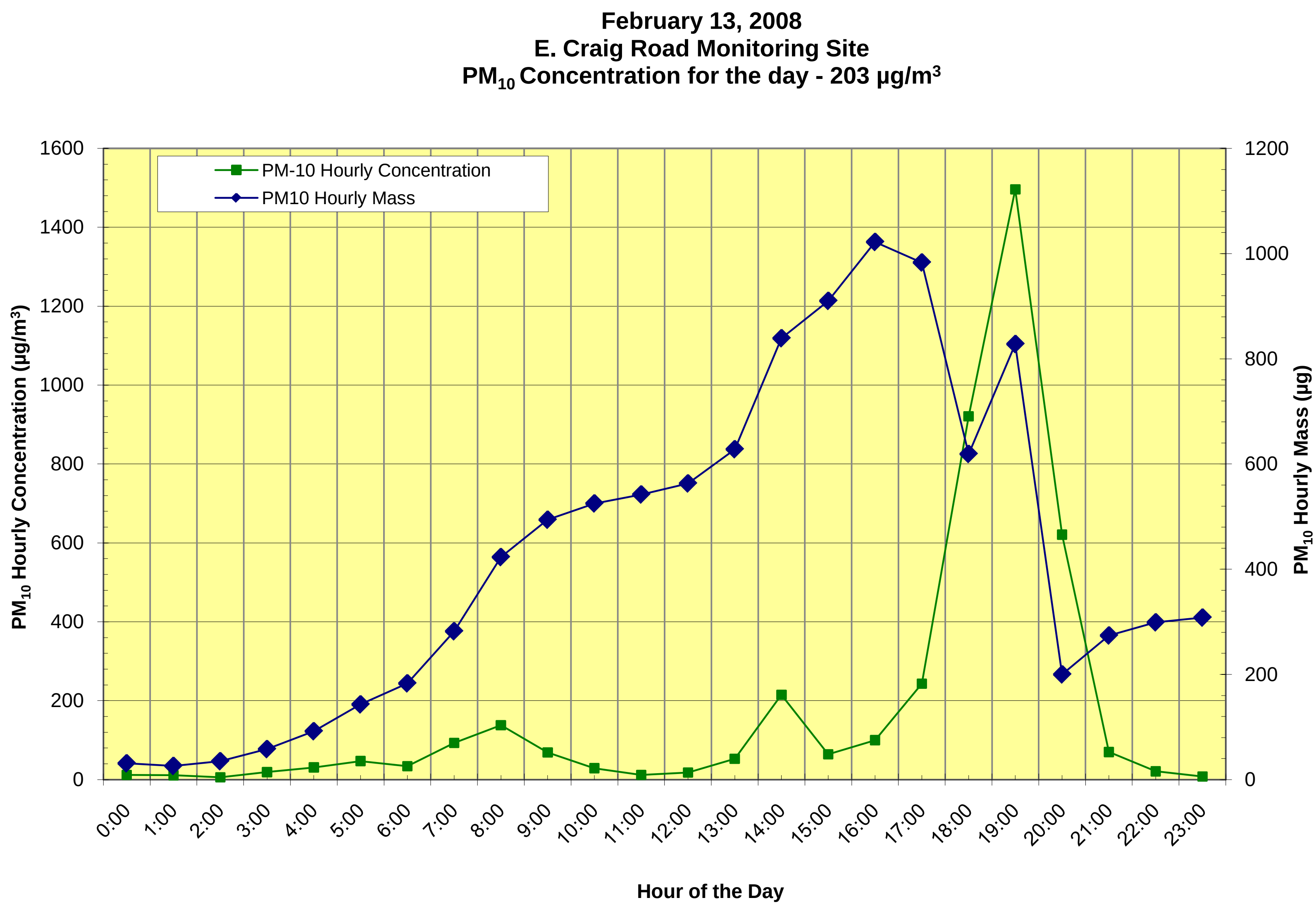


Figure 1. PM_{10} Concentrations at East Craig Road Monitoring Site, February 13, 2008.

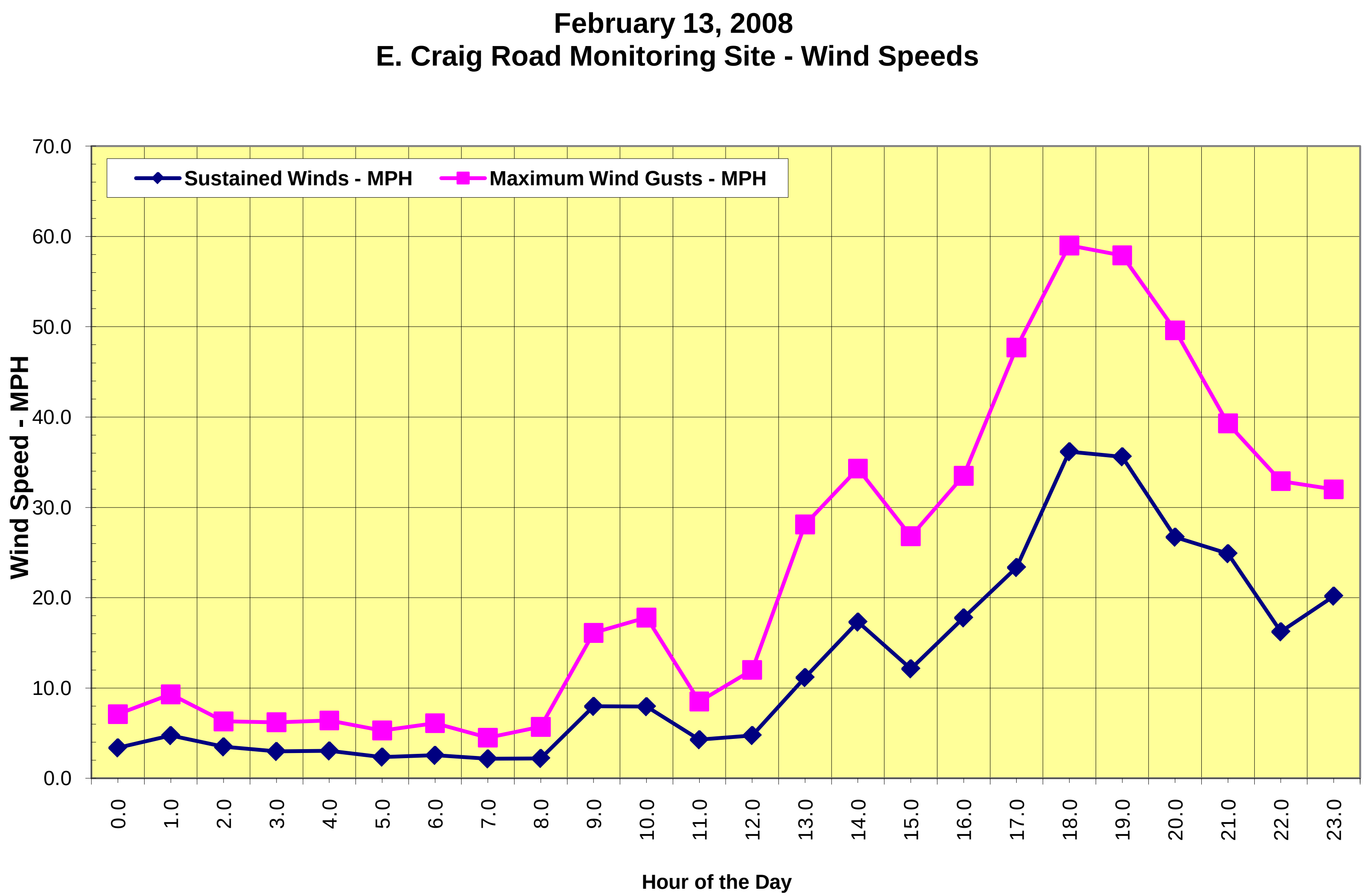


Figure 1a. Wind Speeds at East Craig Road Monitoring Site, February 13, 2008.

2.4.1.2 The Event Was Not Reasonably Controllable or Preventable.

As described in the Compliance & Enforcement Activity section (Section 5.0), of this document there were no unusual emission activities on the event day that, if controlled, would have prevented the event.

2.4.2 There Is a Clear Causal Connection Between the Exceedances and the Exceptional Event

The causal connection is demonstrated by the dramatic increase in hourly PM_{10} concentrations that coincided with high winds.

2.4.3 The Event Is Associated with a Measured Concentration in Excess of Normal Historical Fluctuations, Including Background

The 24-hour average PM_{10} concentration of 203 μg/m^3 at East Craig Road on February 13, 2008, was the highest 24-hour average PM_{10} concentration recorded in the Las Vegas Valley between 2005 and 2008. This was the highest 24-hour average PM_{10} concentration recorded in a four-year period, indicating an unusual natural event.

Figure 2 illustrates the highest recorded Air Quality Index (AQI) concentrations for PM_{10} in Clark County between 2003 and 2008; Table 4 contains the calculated 95th and 99th percentiles for PM_{10}, which is the value that exceeds all but the highest 5% and 1% of the values respectively (Appendix A, Section 4, Attachment 11). Maximum PM_{10} AQI/concentrations in Clark County have reached as much as 195–224 percent of the NAAQS. Like the number of exceedances in Figure 2, maximum concentrations vary from year to year, depending on meteorological conditions. As a result, they are not necessarily the best indicator of long-term trends. The 95th percentile is less influenced by extreme events, so it likely provides a better indication of underlying data trends.

Figure 3 shows little change in PM_{10} 95th percentile readings in the Las Vegas area over the last six years. Figure 4 shows a less than 20 percent change in 99th percentile values for the last six years. Figure 5 depicts the 95th and 99th percentiles for the year 2008 and shows where the February 13 exceedance fell. Figure 6 shows sustained and maximum wind gusts for 2008, and contrasts the exceedance event with other wind speed values measured during the year. The measured wind speeds on both February 13 and June 4 (a non-event day) are wind values that are deemed “outliers” and exceptionally high for the Las Vegas Valley. The mean sustained and maximum wind gust values for 2008 are 6.8 and 24.2 mph, respectively. The exceedance AQI value on February 13 has occurred less than 1 percent of the time over the last six years, and falls outside normal seasonal variations.

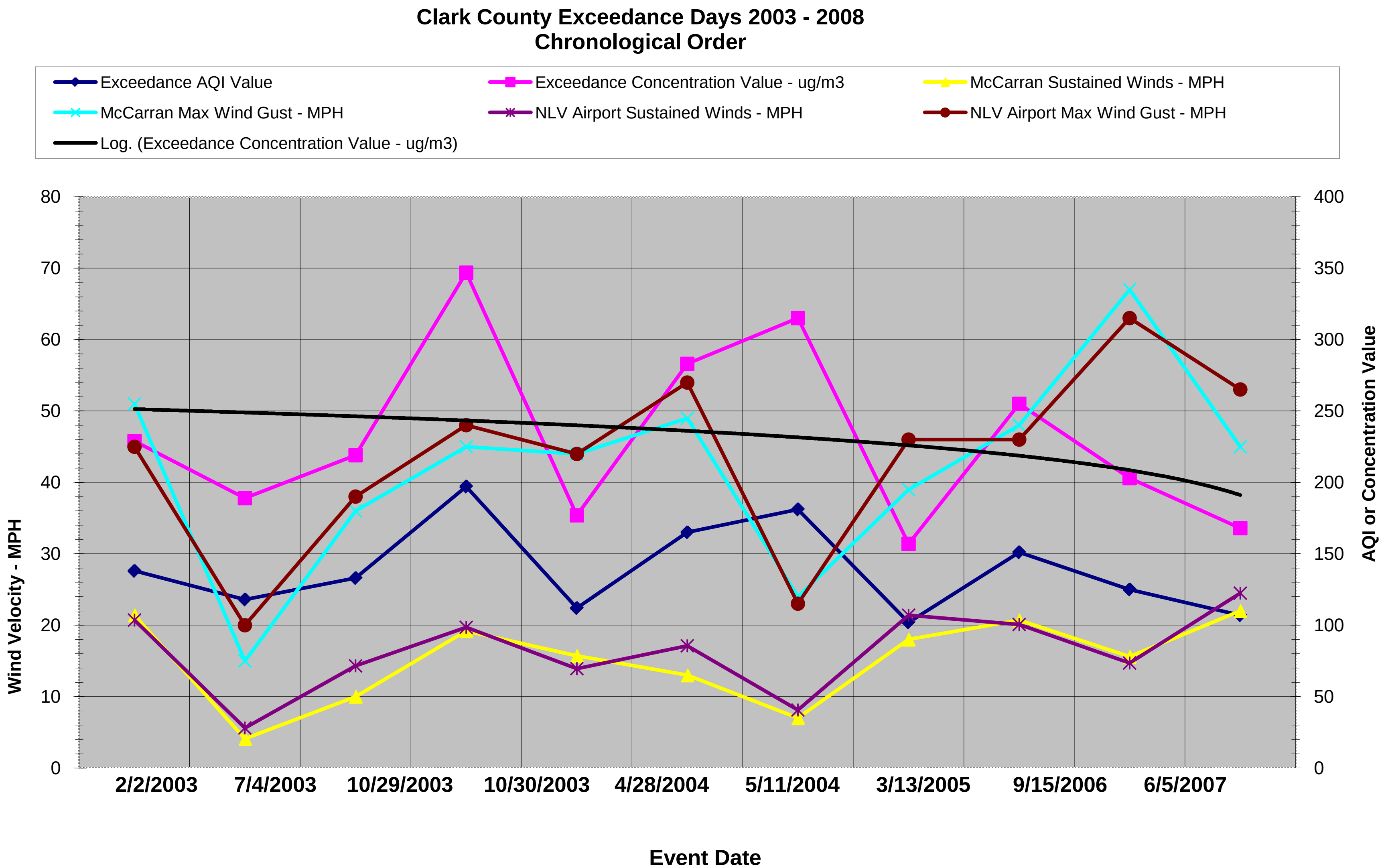


Figure 2. Clark County Exceedance Days, 2003-2008.

Table 4. PM_{10} AQI and Concentration Percentages of NAAQS and AQI 95th/99th Percentiles

AQI Value	Micrograms per meter cubed ($\mu g/m^3$)	AQI % of Value 101	$\mu g/m^3$ % of 155 NAAQS	Date of Event	AQI 95th Percentile	AQI 99th Percentile	$\mu g/m^3$ 95th Percentile	$\mu g/m^3$ 99th Percentile
197	347	195	224	Oct-03	68.8	105.2	90.6	163.4
181	315	179	203	Mar-05	64	86.96	81	126.92
165	283	163	183	May-04	65	88.9	83	130.8
151	255	150	165	Jun-07	60.8	79.16	74.6	111.32
138	229	137	148	Feb-03	68.8	105.2	90.6	163.4
133	219	132	141	Oct-03	68.8	105.2	90.6	163.4
125	203	124	131	Feb-08	57	85.7	67	124.4
118	189	117	122	Jul-03	68.8	105.2	90.6	163.4
112	177	111	114	Apr-04	65	88.9	83	130.8
107	168	106	108	May-08	57	85.7	67	124.4
102	157	101	101	Sep-06	62	78.88	77	78.88

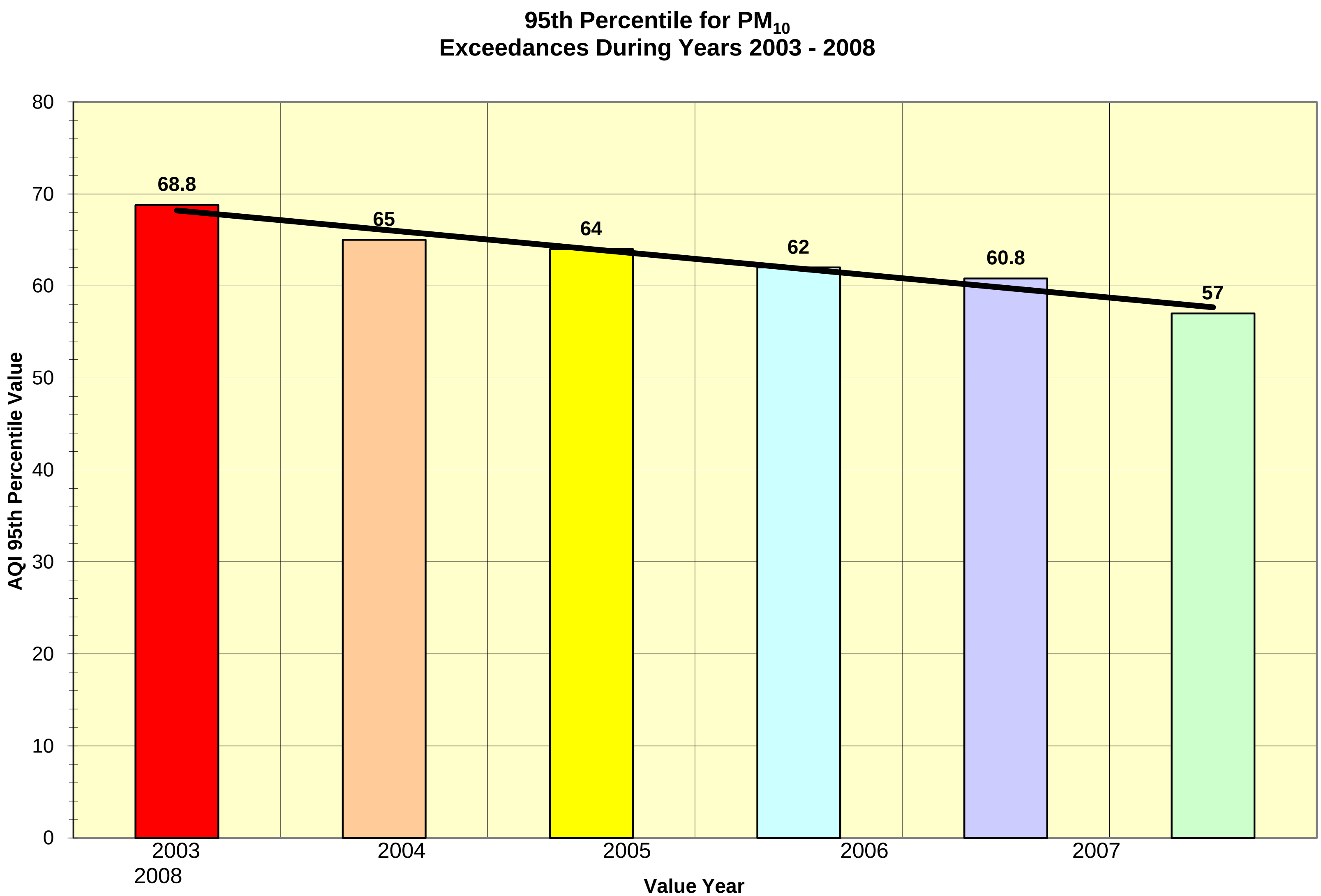


Figure 3. 95th Percentile of PM_{10} Exceedances, 2003-2008.

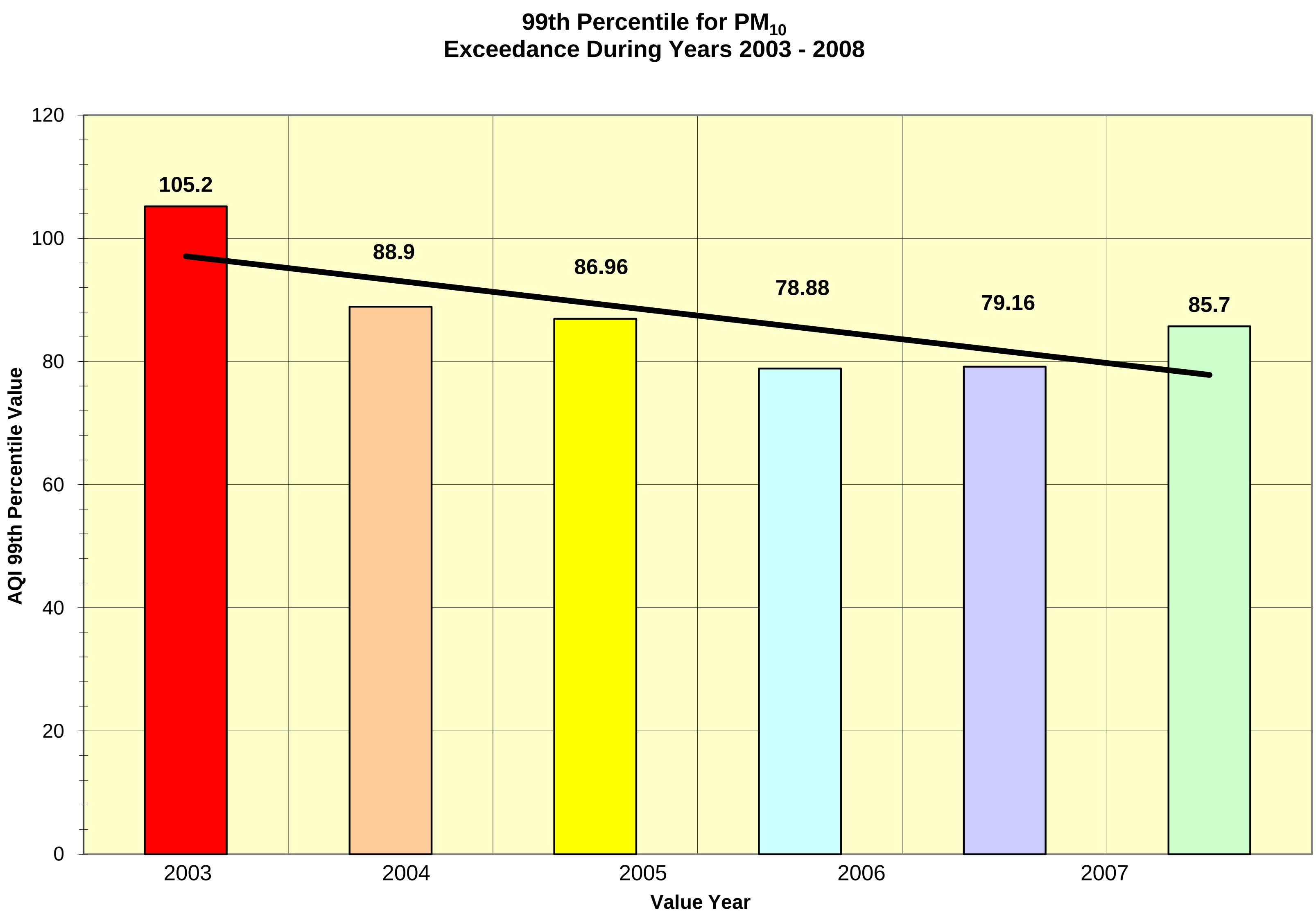


Figure 4. 99th Percentile of PM_{10} Exceedances, 2003-2008.

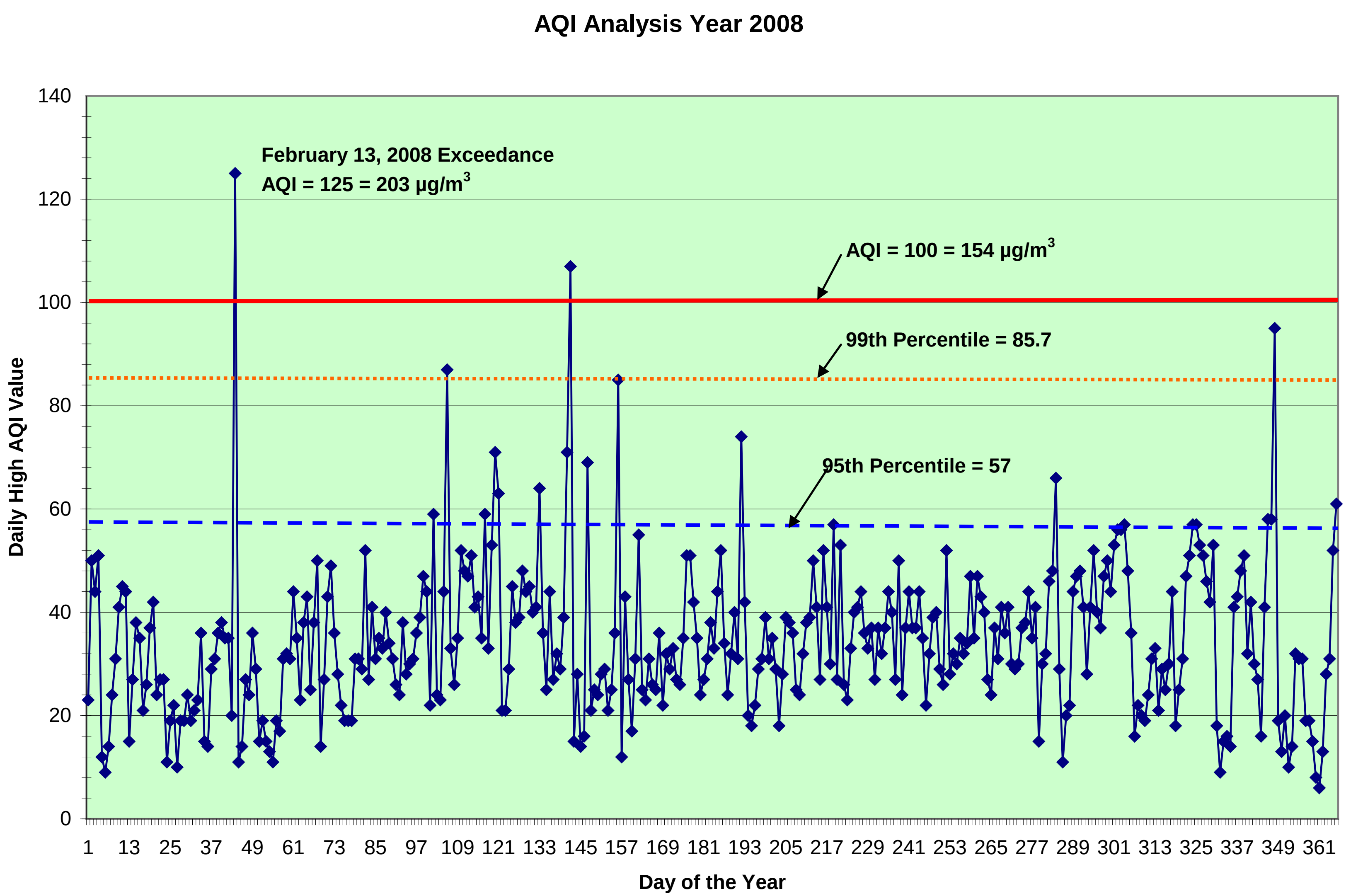


Figure 5. AQI Analysis for 2008.

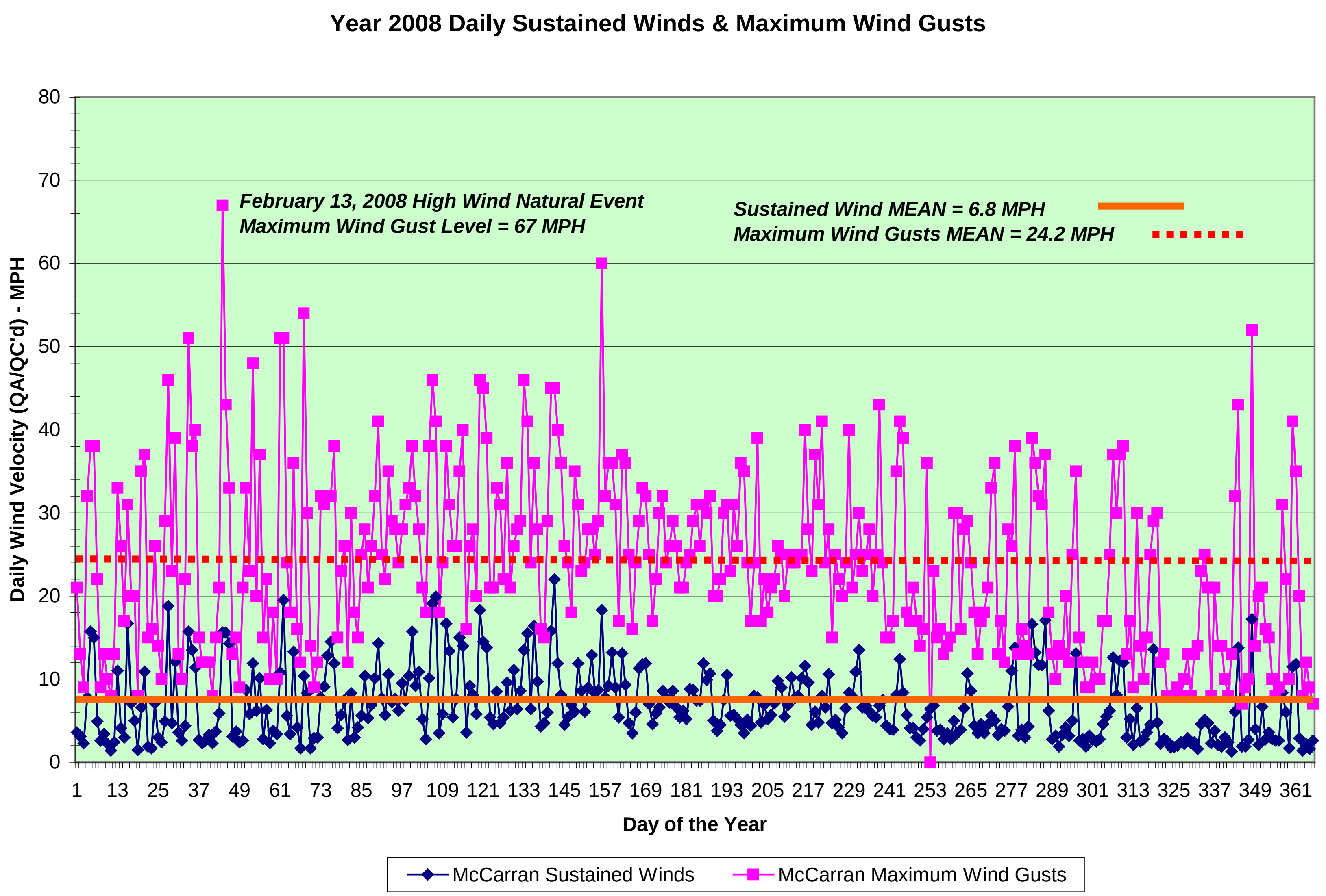


Figure 6. Daily Sustained Winds and Maximum Wind Gusts for 2008.

Table 4a shows the nonattainment area's exceedance history between 2003 and 2008. These cases were submitted under EPA's 1996 natural event policy (i.e., the Mary Nichols memorandum), and the table indicates whether EPA concurred with the exceedance. Exceedances caused by anthropogenic activity were not submitted for EPA review.

Table 4a. HA 212 Exceedances, 2003-2008

Date	AQI Value	µg/m³	Site ID	Site Name	EPA Concurrence Date	MCWS[1] (mph)	MCMWG[2] (mph)	NLVWS[3] (mph)	NLVMWG[4] (mph)
20030202	138	229	32-003-0020	E. Craig Rd	No documentation submitted - anthropogenic	21.4	51	20.7	45
20030704	118	189	32-003-2002	J.D. Smith	No documentation submitted - anthropogenic	4.1	15	5.6	20
20031029	133	219	32-003-0020	E. Craig Rd	Yes - 7/22/04	10	36	14.3	38
20040428	112	177	32-003-0020	E. Craig Rd	Yes - 8/13/04	15.7	44	13.9	44
20040511	165	283	32-003-0020	E. Craig Rd	Yes - 8/13/04	13	49	17.1	54
20060915	102	157	32-003-0020	E. Craig Rd	No documentation submitted - anthropogenic	18	39	21.4	46
20080213	125	203	32-003-0020	E. Craig Rd	Pending	15.6	67	14.7	63
20080521	107	168	32-003-0020	E. Craig Rd	Pending	22	45	24.5	53

[1]MCWS = Resultant Daily Average Wind (McCarran International Airport).
[2]MCMWG = Maximum Daily Average Wind Gust (McCarran International Airport).
[3]NLVWS = Resultant Daily Average Wind (North Las Vegas Airport).
[4]NLVMWG = Maximum Daily Average Wind Gust (North Las Vegas Airport).

Table 4b shows the measured mean average values for sustained winds and maximum wind gusts between 2003 and 2008 at the McCarran International and North Las Vegas Airports. Tables 4c through 4f contain statistical evaluations for the McCarran International and North Las Vegas Airports: they show the mean averages for daily sustained wind speeds and maximum wind gusts in the Las Vegas Valley during the month of February between 2003 and 2008. Attachment 9 of Appendix A provides a six-year trend summary of AQI values and wind speeds recorded during the month of February in Clark County. Although the valley often experiences elevated winds in February, the sustained winds and wind gusts of February 13, 2008, are rare.

Table 4b. Annual Mean Wind Velocities for Sustained Winds and Maximum Wind Gusts at McCarran International and North Las Vegas Airport for 2003-2008

MCWS[1] (mph)	MCMWG[2] (mph)	NLVWS[3] (mph)	NLVMWG[4] (mph)	Year[5]
7	21	8	24	2003
8	22	9	24	2004
5	20	6	19	2005
6	19	7	21	2006
8	23	8	25	2007
7	23	8	24	2008
7	21	8	23	
8	22	Annual Average of the two Airports		

[1]MCWS = Resultant Daily Average Wind (McCarran International Airport).
[2]MCMWG = Maximum Daily Average Wind Gust (McCarran International Airport).
[3]NLVWS = Resultant Daily Average Wind (North Las Vegas Airport).
[4]NLVMWG = Maximum Daily Average Wind Gust (North Las Vegas Airport).
[5]Annual local climatological data for 2003-2008 from National Oceanic and Atmospheric Administration's National Climatic Data Center

Table 4c. February Daily Sustained Wind Speed Statistics for McCarran International Airport

Statistics Category	2003-2008	2003	2004	2005	2006	2007	2008
Mean	6.41262	6.55714	7.48620	5.44285	5.9464	7.45357	6.517241
Standard error	0.256406	0.782284	0.668719	0.369914	0.707957	0.722932	0.883846
Median	5.2	5.8	6.7	5	4.7	5.65	3.8
Mode	4.2	4	3.7	3.4	4.2	5	2.6
Standard deviation	3.60795	4.13946	3.60116	1.95740	3.74615	3.82540	4.759657

Table 4d. February Daily Maximum Wind Gusts Statistics for McCarran International Airport

Statistics Category	2003-2008	2003	2004	2005	2006	2007	2008
Mean	21.12121	21.28571	22.34482	19.5	18.46428	22.71428	23.89655
Standard error	0.723558	1.88411	1.85647	1.38634	1.52621	2.07839	2.79044
Median	18	21.5	21	19	15	18	20
Mode	12	10	12	24	12	16	15
Standard deviation	10.18137	9.96979	9.99741	7.33585	8.07594	10.99783	15.02698

Table 4e. February Daily Sustained Wind Speed Statistics for North Las Vegas Airport

Statistics Category	2003-2008	2003	2004	2005	2006	2007	2008
Mean	7.27828	7.78571	8.81724	5.93928	6.89285	8.02857	7.48275
Standard error	0.287068	0.854132	0.852496	0.454004	0.747074	0.838221	0.867134
Median	5.75	6.9	8.1	5.15	5.75	6.1	5.8
Mode	4.6	9	14	3.7	4	4.6	2.4
Standard deviation	4.03941	4.51964	4.59083	2.40236	3.95314	4.43545	4.66966

Table 4f. February Daily Maximum Wind Gusts Statistics for North Las Vegas Airport

Statistics Category	2003-2008	2003	2004	2005	2006	2007	2008
Mean	22.35353	24.25	24.41379	18.96428	20.78571	24.5	24.44827
Standard error	0.690157	1.78368	1.77940	1.28120	1.57724	2.11100	2.40052
Median	21	26	25	18	20.5	21.5	22
Mode	12	28	31	12	12	14	14
Standard deviation	9.71138	9.43839	9.58241	6.77950	8.34602	11.17039	12.92723

Tables 4g and 4h contain statistical evaluations of AQI and concentration values for the month of February between 2003 and 2008. These tables show AQI and concentration values in the Clark County monitoring network, and the downward trend in mean average value during the six-year analysis period.

Table 4g. February PM_{10} AQI Statistics for Clark County Monitoring Network

Data Range	2003-2008	2003	2004	2005	2006	2007	2008
Count	170	28	29	28	28	28	29
Mean	34.61176	40.5	34.44827	28.10714	40.53571	36.67857	27.65517
Standard error	1.34878	4.18314	2.78436	2.02780	3.21063	2.62217	3.84114
Median	33	37	33	25.5	41	36.5	24
Mode	36	37	36	23	53	57	36
Standard deviation	17.58603	22.13510	14.99425	10.73015	16.98906	13.87524	20.68518

Table 4h. February PM_{10} Concentration (µg/m^3) Statistics for Clark County Monitoring Network

Data Range	2003-2008	2003	2004	2005	2006	2007	2008
Count	170	28	29	28	28	28	29
Mean	38.56471	46.85714	37.68965	29.85714	45.64285	39.89285	31.72413
Standard error	2.00750	7.29058	3.28194	2.22819	4.61571	3.09648	6.36200
Median	35	39	35	27.5	44	38.5	25
Mode	38	39	38	24	59	67	38
Standard deviation	26.17463	38.57816	17.67383	11.79049	24.42405	16.38504	34.26044

2.4.4 There Would Have Been No Exceedance or Violation but for the Event

There are several indications the PM_{10} NAAQS would not have been exceeded on February 13, 2008, but for the presence of high winds. DAQEM's exceptional event data shows the impact of the high winds: PM_{10} concentrations in Clark County were low until winds began to increase. From the data this document provides, DAQEM concludes that the PM_{10} NAAQS would not have been exceeded on February 13 if high winds had not been present.

Attachments 10 and 11 in Appendix A show AQI values and wind speeds in Clark County between 2003 and 2008, along with PM_{10} 95th and 99th percentile tables (including illustrations). Attachment 10 shows that the trend in air quality in Clark County for the calculated annual AQI mean in 2003 is 47, as opposed to a calculated annual AQI mean of 34 in 2008. This clearly demonstrates that the AQR program has been successful and air quality has improved. Comparing the monthly mean AQI for February 2003 (41) to the AQI monthly mean for February 2008 (28) confirms a trend of improving air quality. These improvements have come about even though monthly mean sustained winds and maximum mean wind gusts stayed relatively constant at both McCarran International and North Las Vegas Airport between February 2003 and February 2008.

Table 5 summarizes the readings at the East Craig Road monitoring site. Wind speeds were high enough for this exceedance to qualify as a high-wind exceptional event.

Table 5. High Wind Event 24-Hour PM_{10} NAAQS Exceedance Data

Monitoring Site Location	Date	Measured Concentration ($\mu g/m^3$)	Wind Dir.	Max. Wind Gust (mph)
E. Craig Road (CAMS #320030020)	2/13/2008	203	301° (NW)	59.0[1]
[1]Measured at the monitoring site (MET).				

3.0 EVENT DATA

Tables 1 through 3 list readings for the days before, during, and after the high wind event. The data clearly show the event occurred on February 13, 2008, between 1700 and 2100 PST. The wind was predominantly from the northwest, with peak gusts of 59 mph at the monitoring site and sustained two-minute winds of 36.2 mph. Table 3 shows most of the monitoring station's average hourly wind speeds, which ranged from 23.4 mph to 36.2 mph during the event. Attachment 12 in Appendix A contains the full meteorological data sheet for McCarran International from the Climatic Data Center of the National Oceanic and Atmospheric Administration (NOAA); Attachments 12a and 12b are the individual quality-assured (QA) data sheets for McCarran International and North Las Vegas Airport, respectively. Attachments 1 through 8 in Appendix A provide readings from the five other sites in the monitoring network that did not measure an exceedance on February 13, but showed similar trends.

Other supporting documentation includes meteorological data and analysis (e.g., wind speed and wind direction); Hybrid Single-Particle Lagrangian Integrated Trajectory (HYSPLIT) model and trajectory runs with full meteorological analysis; hourly PM_{10} sampled mass compared to wind data to support a source receptor relationship; precipitation data; and photographs and maps of the area showing emission sources. Appendix B contains local news accounts of the high-wind event published by the *Las Vegas Sun* and *Las Vegas Review-Journal*, along with newscasts aired on Channels 5 (Fox), 8 (CBS), and 13 (ABC) recorded and available on digital video diskette.

If the dust sources contributing to a high wind event are anthropogenic, the state must document the application of reasonably available control measures. This report outlines DAQEM's application of BACM-level controls to such sources, its enforcement activities before and during the high wind event, and its follow-up enforcement activities afterwards.

This document demonstrates that a high-wind natural event on February 13, 2008, affected the monitoring site that recorded an exceedance that day. Emissions generated by this event caused an exceedance of the 24-hour PM_{10} NAAQS when the monitoring station recorded elevated PM_{10} concentrations, which would not have happened without the high wind conditions.

In June 2008, Clark County through its DAQEM sent the affected air quality data to EPA for inclusion in the Air Quality System (AQS) database, as required by 40 CFR 50 and 51. Clark County through its DAQEM requested this data be flagged to indicate that a natural (high-wind) event was involved. The high-wind natural event affected the East Craig Road monitoring site (AQS CAMS #32-003-0020), located at 4701 Mitchell Street in North Las Vegas, Nevada.

3.1 METEOROLOGY ASSESSMENT

3.1.1 Weather Summary

Excessive ambient PM_{10} concentrations on February 13, 2008, were caused by two factors. First, a surface reservoir of dust evolved in the region over a period of seven days with no precipitation and light winds. Second, a short period preceding the arrival of a cold front brought increasing wind speeds sufficient to raise airborne dust. The entrained dust was kept aloft, and more was generated, during the turbulence and higher wind speeds associated with the rapidly moving cold front passing through the region. There is a clear causal relationship between the PM_{10} exceedance and the exceptionally high wind speeds during the hour corresponding to the cold front's passage through the Las Vegas area. Generally high wind speeds in the valley and surrounding region generated elevated PM_{10} concentrations; however, but for the higher wind speeds at the East Craig Road station and its open exposure to airflow from the northwest, the exceedance might not have occurred.

3.1.2 Weather Data Resources

3.1.2.1 <u>Local Climatological Data</u>

Hourly and daily summary Local Climatological Data (LCD) reports from McCarran International Airport and North Las Vegas Airport document surface weather conditions in the Las Vegas Valley. DAQEM obtains these quality-controlled data from NOAA's National Climatic Data Center. The hourly data consist of observations made during a few minutes at the end of the hour; gusts are denoted when wind speeds exceed 10 knots above the hourly average during the observation period. Observations may also include notes on weather occurrences, such as blowing dust and rain. Special observations are included when rapidly developing weather conditions warrant.

A monthly summary of daily LCD data is calculated from automated data recording devices, so their average and maximum 5-second and 2-minute wind speeds are based on continuous data rather than hourly observations.

3.1.2.2 <u>Clark County Monitoring Stations</u>

DAQEM's exceptional event analysis includes hourly values for wind speed average, wind speed gusts, and wind direction obtained from six monitoring stations. The hourly sampling period at these stations is distinctly different from the LCD observations, which are made over just a few minutes at the end of each hour.

3.1.2.3 <u>Weather Charts</u>

DAQEM also used surface and upper-air pressure charts produced by NOAA in its analysis. One set of charts, NOAA's "Daily Weather Maps," uses data from 1200 Zulu Time (1200 Z) (0700 EST, 0500 PST). These charts feature:

- Areas of high and low pressure are shown with words. Precipitation is illustrated by green shaded areas.

- Lines of equal pressure, reduced to sea level (isobars), are shown with pressure value labels in millibars (mb). Closely spaced isobars typically indicate areas of stronger winds.

- Cold fronts are shown in blue as triangular wedges, and warm fronts are shown in red as semi circular shapes. Both shapes point toward the direction of motion. A red and blue line with a mixture of cold and warm front symbols depicts a stationary front, showing a boundary between two air masses without appreciable motion.

- Purple lines with circles and wedges show an occluded front, which is a mixture of cold and warm fronts overlapping in the vertical direction. An orange dashed line indicates a trough, i.e., an area of low pressure.

Upper-air synoptic charts illustrate the pressure systems aloft, which strongly influence near-surface conditions. Strong low-pressure systems, often called cyclones, can generate strong cold front systems that, in turn, generate high-speed wind gusts and turbulence that create airborne dust to be generated. A common representation of synoptic-scale weather conditions is the 500-mb pressure pattern chart. This pressure level occurs approximately 5,600 meters (m) (about 18,000 feet (ft)) above mean sea level (MSL); it is approximately half the average sea level pressure. The charts include the following features:

- The solid lines on the charts are heights of the 500-mb pressure surface in decameters, so a height of 5,600 m appears as 560. As in the surface chart, closely spaced lines indicate stronger winds.

- Areas of low and high pressure are noted. A circular pattern of height lines around a low-pressure area is called a "closed Low" and indicates a strong system. A trough of low pressure typically appears as a V-shaped pattern of height lines; a ridge of high pressure typically appears as an inverted V-shaped pattern.

- The charts usually include wind data at the upper-air station, shown as arrow-shaped line figures. The shaft of the arrow shows the direction from which the wind is blowing, with the station's location as the reference point. The feathers on the back of the arrow shaft indicate speed: a solid line is 10 knots, a triangle is 50 knots (one knot is about 1.15 mph).

Trajectory plots are presented that were created using the NOAA HYSPLIT model run in the EPA AIRNow-Tech system. Features of the plots are discussed in the section with the trajectory results.

3.1.3 Monitoring Network Measurement Background

Figure 7 is a map of the Las Vegas Valley showing the locations of the monitoring and weather stations used in this exceptional event analysis. The East Craig Road station is in the northeastern portion of the valley; the other sites were included in the analysis to show representative conditions across the valley. Figure 8 shows the Jean monitoring site in Ivanpah Valley.

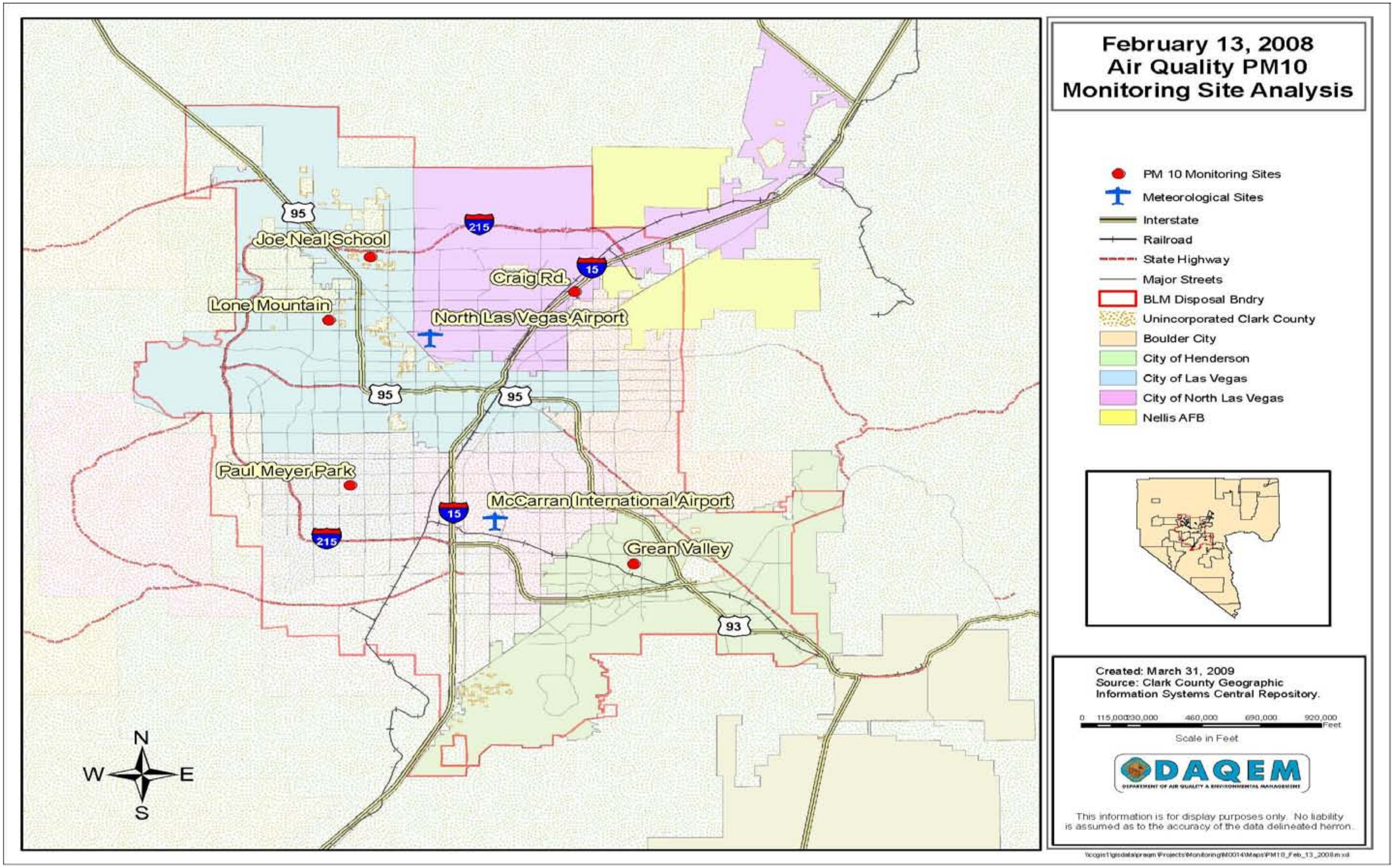


Figure 7. Air Quality PM_{10} Monitoring Sites in the Las Vegas Valley.

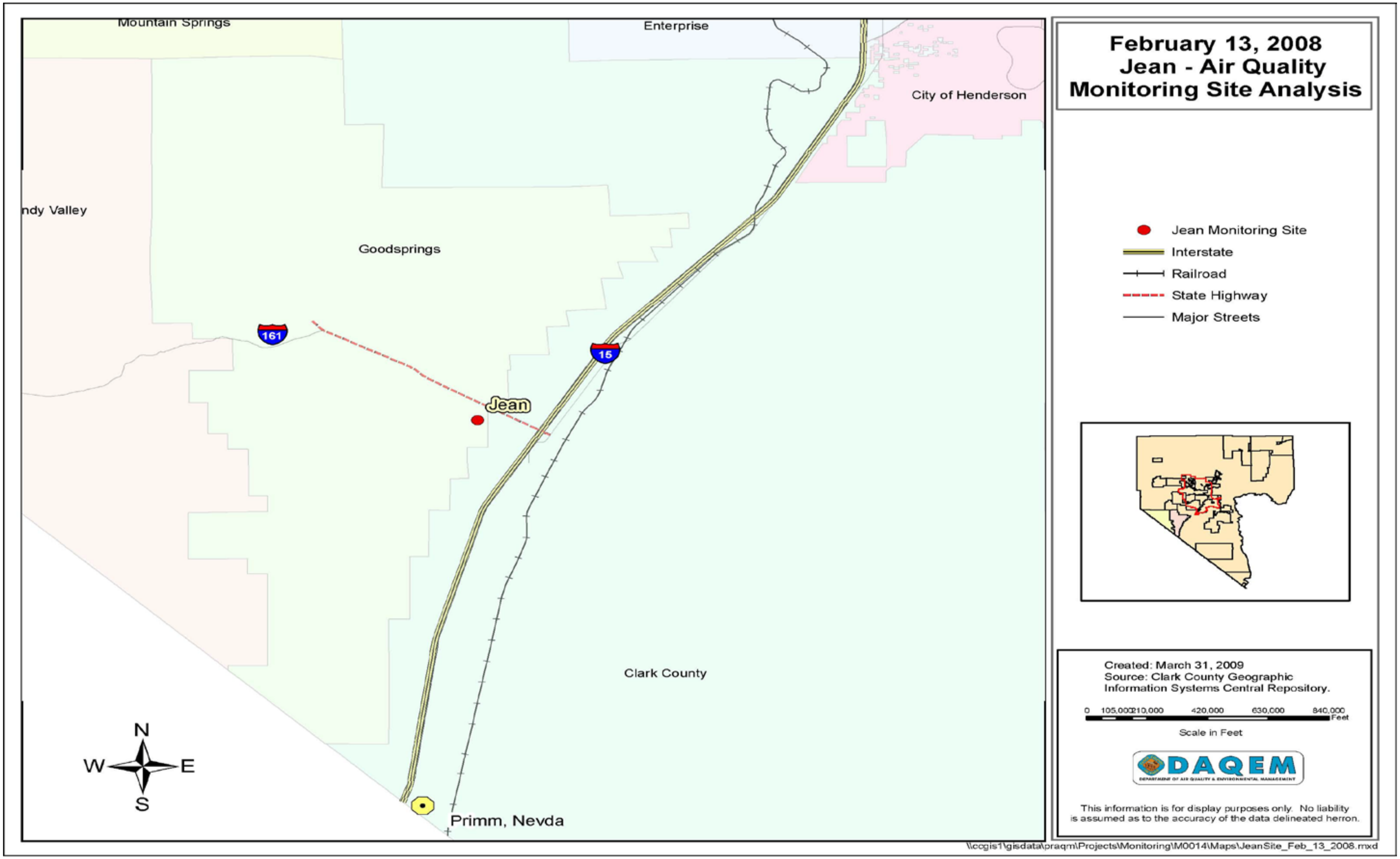


Figure 8. **Jean PM_{10} Monitoring Site.**

DAQEM PM_{10} samplers are operated in compliance with the EPA's designation mode. Air samples are collected on filter media and simultaneously exposed to beta radiation to determine the mass of material on the filter. The airflow rate is 1 m^3/hr. The samplers have two analog voltage output channels that the data system samples once a minute. The concentration channel signal is proportional to the running 60-minute average value, which is scaled from 0 to 1500 micrograms per cubic meter (µg/m^3). The mass accumulation channel signal passes through a digital filter with a 2-minute time constant, and is scaled to an accumulated mass from 0 to 1500 µg.

The data system calculates and records 5-minute averages of the concentration and accumulated mass channels; hourly values are calculated as the averages of the 5-minute data. Since the concentration channel itself is a 60-minute running average, the hourly concentrations are calculated from a two-hour period. Since the volume of air sampled in one hour is 1 m^3, the hourly incremental mass accumulation (difference from one hour to the next) is equivalent to an ambient conditions concentration in µg/m^3.

The maximum signal value for the concentration channel is 1500 µg/m^3, and it is 1500 µg for the mass channel. When the sampler registers the 1500 µg mass value, it briefly interrupts sampling to advance the filter material and reset the mass signal to a zero base level. This cycle is evident in the 5-minute data, and can readily be factored into hourly or daily concentration values based on the mass accumulation channel. Under typical operations, directly measured concentrations are virtually identical to concentrations calculated from incremental mass accumulation values over a few hours. When PM_{10} increases rapidly, the reset process can produce erroneous values without corrections for short times—the February 13, 2008, data from the East Craig Road site exemplifies this factor. The correct 24-hour average PM_{10} concentration at ambient conditions for this date is 201 µg/m^3, and the average of the one-hour concentrations is 180 µg/m^3. The official reported value, calculated for standard conditions, was 203 µg/standard-m^3.

In order to focus on meteorological conditions during the few hours associated with higher PM_{10} concentrations, hourly concentrations were calculated from the five-minute mass data (micrograms). The hourly concentration data from the East Craig Road station during February 13, 2008, which were calculated from the accumulated mass channel using hourly periods beginning at 1700, 1800, and 1900 PST are 500, 1835, and 1153 µg/m^3, respectively. If the 1835 µg/m^3 value during the hour beginning at 1800 had not been greater than 600 µg/m^3, then the 24-hour average would not have exceeded the NAAQS.

3.1.4 Weather Before Event

Weather in Las Vegas before the exceptional event was dry and fair, with light winds. Tables 6 and 7 show the monthly LCD for McCarran International Airport and North Las Vegas Airport.

Table 6. McCarran International Airport Climate Data

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
(final)
NOAA, National Climatic Data Center
Month: 02/2008

Station Location: MCCARRAN INTERNATIONAL AIRPORT (23169)
LAS VEGAS , NV
Lat. 36.079 Lon. -115.155
Elevation(Ground): 2127 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees							Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC Depth	1800 UTC Water Equiv	2400 LST Snow Fall	2400 LST Water Equiv	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	max 5-second Speed	max 5-second Dir	max 2-minute Speed	max 2-minute Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	53	34	44	-5	17	34	21	0	0641	1706		M	M	M	0.00	27.70	30.01	0.5	35	2.6	10	350	8	010	01
02	53	36	45	-5	25	37	20	0	0641	1707		M	M	M	0.00	27.64	29.93	2.2	19	4.4	22	180	18	190	02
03	57	41	49	-1	34	42	16	0	0640	1708	RA	M	M	M	T	27.32	29.59	10.9	21	15.7	51	230	37	230	03
04	51	36	44	-6	17	34	21	0	0639	1709		M	M	M	0.00	27.61	29.89	12.0	34	13.5	38	310	29	310	04
05	49	36	43	-7	9	31	22	0	0638	1710		M	M	M	0.00	27.93	30.24	9.3	35	11.4	40	340	31	330	05
06	52	33*	43*	-7	17	33	22	0	0637	1711		M	M	M	0.00	27.88	30.19	0.6	01	2.7	15	020	12	020	06
07	59	35	47	-4	22	37	18	0	0636	1712		M	M	M	0.00	27.85	30.15	0.5	19	2.3	12	080	10	080	07
08	64	41	53	2	24	40	12	0	0635	1714		M	M	M	0.00	27.83	30.12	1.1	25	2.6	12	220	10	220	08
09	67	42	55	4	23	41	10	0	0634	1715		M	M	M	0.00	27.86	30.15	2.4	22	3.3	12	080	9	260	09
10	68	44	56	5	29	43	9	0	0633	1716		M	M	M	0.00	27.83	30.11	1.9	23	2.3	8	200	8	200	10
11	71	43	57	5	27	44	8	0	0632	1717		M	M	M	0.00	27.79	30.07	0.9	04	3.7	15	010	12	010	11
12	71	47	59	7	25	44	6	0	0631	1718		M	M	M	0.00	27.81	30.08	2.8	03	5.9	21	040	17	020	12
13	76	44	60	8	23	42	5	0	0630	1719	BLDU VCBLDU	M	M	M	T	27.42	29.66	7.0	29	15.6	67	340	53	350	13
14	51	41	46	-6	10	33	19	0	0629	1720		M	M	M	0.00	27.58	29.86	14.2	01	15.6	43	360	30	350	14
15	59	42	51	-1	12	36	14	0	0628	1721		M	M	M	0.00	27.78	30.07	13.2	01	14.3	33	350	24	350	15
16	63	37	50	-3	15	37	15	0	0627	1722		M	M	M	0.00	27.77	30.06	0.3	12	3.1	13	090	9	090	16
17	66	40	53	0	19	39	12	0	0626	1723		M	M	M	0.00	27.76	30.04	1.0	01	3.7	15	010	12	010	17
18	62	40	51	-2	19	39	14	0	0625	1724		M	M	M	0.00	27.73	30.02	1.7	23	2.4	9	240	7	210	18
19	64	46	55	2	20	41	10	0	0623	1725		M	M	M	0.00	27.69	29.96	0.8	19	2.6	21	240	14	220	19
20	62	48	55	2	37	45	10	0	0622	1726	RA	M	M	M	0.04	27.56	29.82	4.4	25	8.7	33	280	28	280	20
21	63	41	52	-2	35	44	13	0	0621	1727	RA	M	M	M	T	27.59	29.86	3.1	19	5.8	23	200	18	190	21
22	62	48	55	1	37	45	10	0	0620	1728	RA	M	M	M	0.01	27.49	29.75	10.6	19	11.9	48	190	36	200	22
23	61	42	52	-2	32	43	13	0	0619	1729	RA	M	M	M	T	27.72	30.00	4.3	17	6.2	20	090	15	260	23
24	62	49	56	2	35	45	9	0	0617	1730	RA	M	M	M	T	27.66	29.94	8.7	22	10.1	37	250	26	260	24
25	67	43	55	1	28	43	10	0	0616	1731		M	M	M	0.00	27.86	30.14	1.2	30	2.8	15	190	13	200	25
26	68	46	57	3	25	43	8	0	0615	1731		M	M	M	0.00	27.96	30.25	3.4	04	6.3	22	050	17	050	26
27	71	46	59	5	27	44	6	0	0614	1732		M	M	M	0.00	27.78	30.06	1.3	22	2.3	10	070	8	220	27
28	76*	48	62	7	28	46	3	0	0612	1733		M	M	M	0.00	27.66	29.92	0.9	21	3.8	18	040	14	040	28
29	75	50	63*	8	30	47	2	0	0611	1735		M	M	M	0.00	27.77	30.03	1.2	19	3.4	10	090	8	100	29
	62.9	42.0	52.5		24.2	40.4	12.3	0.0	<-----Monthly Averages | Totals----->				M	M	0.05	27.71	30.00	1.1	29	6.5	<Monthly Average				
	-0.1	0.6	0.3	<-----------Departure From Normal----------->									-0.64												

Greatest 24-hr Precipitation: 0.04 Date: 20
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

Sea Level	Pressure	Date	Time (LST)
Maximum	30.35	26	0944
Minimum	29.35	13	1556

Degree Days

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	358	-17	1706	-190
Cooling:	0	-1	0	-1

Number of Days with -------->
Max Temp >=90: 0
Max Temp <=32: 0
Thunderstorms : 0
Min Temp <=32: 0
Min Temp <=0 : 0
Heavy Fog : 0
Precipitation >=.01 inch: 2
Precipitation >=.10 inch:
Snowfall >=1.0 inch : 0

* EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.

Data Version: VER3

Table 7. North Las Vegas Airport Climate Data

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
(final)
NOAA, National Climatic Data Center
Month: 02/2008

Station Location: NORTH LAS VEGAS AIRPORT (53123)
LAS VEGAS , NV
Lat. 36.212 Lon. -115.196
Elevation(Ground): 2186 ft. above sea level

Date	Temperature (Fahrenheit)						Degree Days Base 65 Degrees		Sun		Significant Weather	Snow/Ice on Ground(In)		Precipitation (In)		Pressure(inches of Hg)		Wind: Speed=mph Dir=tens of degrees			max 5-second		max 2-minute		Date
	Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Heating	Cooling	Sunrise LST	Sunset LST		1200 UTC Depth	1800 UTC Water Equiv	2400 LST Snow Fall	2400 LST Water Equiv	Avg. Station	Avg. Sea Level	Resultant Speed	Res Dir	Avg. Speed	Speed	Dir	Speed	Dir	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
01	51	31	41	M	17	33	24	0	-	-		M	M	M	0.00	27.71	30.02	1.7	10	2.4	9	110	8	110	01
02	52	36	44	M	25	36	21	0	-	-		M	M	M	0.00	27.65	29.95	1.4	10	4.4	14	120	12	120	02
03	57	41	49	M	34	41	16	0	-	-	RA	M	M	M	0.05	27.29	29.58	11.6	22	18.4	52	220	41	220	03
04	50	37	44	M	17	34	21	0	-	-		M	M	M	0.00	27.61	29.90	15.4	34	16.0	37	320	29	320	04
05	49	34	42	M	10	30	23	0	-	-		M	M	M	0.00	27.94	30.26	7.8	35	11.1	32	330	24	330	05
06	51	30*	41*	M	18	32	24	0	-	-		M	M	M	0.00	27.88	30.21	1.0	02	3.2	14	100	12	090	06
07	58	32	45	M	23	36	20	0	-	-		M	M	M	0.00	27.83	30.16	0.1	35	2.7	10	090	9	080	07
08	63	39	51	M	24	39	14	0	-	-		M	M	M	0.00	27.83	30.14	0.8	18	3.5	12	160	10	300	08
09	66	41	54	M	23	41	11	0	-	-		M	M	M	0.00	27.87	30.16	1.6	32	3.3	17	320	16	320	09
10	67	43	55	M	28	43	10	0	-	-		M	M	M	0.00	27.83	30.12	3.6	33	4.3	20	330	16	320	10
11	71	43	57	M	26	44	8	0	-	-		M	M	M	0.00	27.80	30.08	1.9	36	5.8	24	020	21	020	11
12	72	50	61	M	24	44	4	0	-	-		M	M	M	0.00	27.81	30.08	8.4	36	10.4	28	350	22	350	12
13	76*	41	59	M			6	0	-	-	HZ	M	M	M	0.00	27.43	29.67	8.3	31	14.7	63	330	51	330	13
14	49	39	44	M			21	0	-	-		M	M	M	0.00	27.59	29.87	12.3	36	13.8	33	360	25	350	14
15	59	40	50	M	12	36	15	0	-	-		M	M	M	0.00	27.78	30.09	11.6	35	12.7	35	330	26	330	15
16	62	38	50	M	15	36	15	0	-	-		M	M	M	0.00	27.78	30.08	2.1	33	3.8	17	340	15	330	16
17	65	39	52	M	20	39	13	0	-	-		M	M	M	0.00	27.76	30.05	0.6	09	4.3	21	320	16	320	17
18	62	38	50	M	20		15	0	-	-		M	M	M	0.00	27.76	M	2.0	31	2.4	8	200	7	320	18
19	63	43	53	M	21		12	0	-	-		M	M	M	0.00	M	M	0.6	14	2.8	13	100	9	120	19
20	62	48	55	M	38	45	10	0	-	-	RA	M	M	M	0.01	27.57	29.83	2.9	24	10.6	35	210	29	220	20
21	60	38	49	M	35	44	16	0	-	-		M	M	M	T	27.60	29.87	4.0	18	8.1	28	180	21	180	21
22	60	44	52	M	39	46	13	0	-	-	RA	M	M	M	0.06	27.49	29.75	8.8	17	11.8	36	280	25	280	22
23	60	42	51	M	34	43	14	0	-	-	RA	M	M	M	0.01	27.72	30.01	3.4	10	8.0	22	130	17	130	23
24	62	47	55	M	35	45	10	0	-	-	RA	M	M	M	T	27.66	29.94	7.2	24	10.8	36	240	28	250	24
25	67	44	56	M	28	43	9	0	-	-		M	M	M	0.00	27.86	30.15	4.8	34	7.4	25	330	21	320	25
26	68	49	59	M	25	43	6	0	-	-		M	M	M	0.00	27.96	30.26	4.3	02	8.9	22	350	17	100	26
27	70	44	57	M	27	44	8	0	-	-		M	M	M	0.00	27.78	30.07	2.6	31	3.5	15	330	13	330	27
28	75	48	62	M	28	46	3	0	-	-		M	M	M	0.00	27.66	29.93	1.7	34	3.3	17	350	14	350	28
29	74	49	62*	M	30	47	3	0	-	-		M	M	M	0.00	27.78	30.04	0.7	28	4.6	14	120	10	160	29
	62.1	41.0	51.6		M	M	13.3	0.0	<-----Monthly Averages | Totals----->				M	M	0.13s	27.73	30.01	2.1	33	7.5	<Monthly Average				
	M	M	M	<-----------Departure From Normal----------->									M												

Greatest 24-hr Precipitation: 0.06 Date: 22
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

Sea Level Pressure		Date	Time (LST)
Maximum	30.35	26	1009
Minimum	29.32	13	1707

Degree Days	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	385	M	M	M
Cooling:	0	M		

Number of Days with -------->

Max Temp >=90: 0
Max Temp <=32: 0
Thunderstorms : 0
Min Temp <=32: 3
Min Temp <=0 : 0
Heavy Fog : 0
Precipitation >=.01 inch: 4
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

* EXTREME FOR THE MONTH - LAST OCCURRENCE IF MORE THAN ONE.

Data Version: VER2

The tables show that daily average wind speeds from February 6–10 ranged from 2.3 to 2.7 mph, with maximum 5-second speeds from 8 to 15 mph. Slight increases were noted on February 11 and 12, with average speeds of 3.7 and 5.9 mph, respectively, and 5-second speeds of 15 and 21 mph. The last precipitation measured before the event day fell on February 3, when there was a trace at McCarran and 0.05 inches at North Las Vegas. The lack of significant weather and low wind speeds occurring during the period from February 4 through 12, 2008 support the fair-weather description of this period.

Figure 9 is an example of the synoptic weather pattern during this time: NOAA's "Daily Weather Map" surface chart for February 10, with a large high-pressure area in the Intermountain West and broadly spaced isobars (i.e., lines of equal pressure). This pattern is associated with low wind speeds and no precipitation. In a further indication of the atmosphere's stability, Figure 10 shows the corresponding 500-mb upper-air chart. The pressure level is measured approximately 18,000 ft above the surface, so is usually free from local variations caused by land surface effects. Figure 10 shows broadly spaced pressure height lines (solid) and isotherms (dotted lines). The wind data for upper-air stations in California and Arizona indicate low-speed westerly winds aloft in southern Nevada, although these pressure patterns at the surface and aloft are generally associated with low wind speeds near ground level.

The dry conditions and low wind speeds are conducive to building up a reservoir of loose dust on the surface, which can readily become airborne when wind speeds exceed 15–20 mph. These threshold speeds were measured during field studies in the Las Vegas area (Appendix C).

3.1.5 Weather During the Event

Following a quiet period from February 6–12, a deep, strong low-pressure system approached southern Nevada, with increasing wind speeds and an associated cold front at the surface. Figures 11 through 15 provide the "Daily Weather Map" surface and 500-mb pressure charts for the mornings of February 13 and 14, 2008. The surface charts show a cold front (blue line with triangles) first through northern California and Nevada, then through Arizona the next day.

As the closely spaced isobar lines illustrate, this rapidly moving strong front is associated with an upper-level low-pressure trough in Oregon and Washington early on February 13, which developed into a closed low-pressure system in eastern Nevada early on February 14. Figure 15 is a high-resolution surface weather map of the southwestern United States based on observations made at 1900 PST on February 13 (0300 Zulu Time (0300 Z) on February 14). This time corresponds to the passage of the cold front through the Las Vegas area.

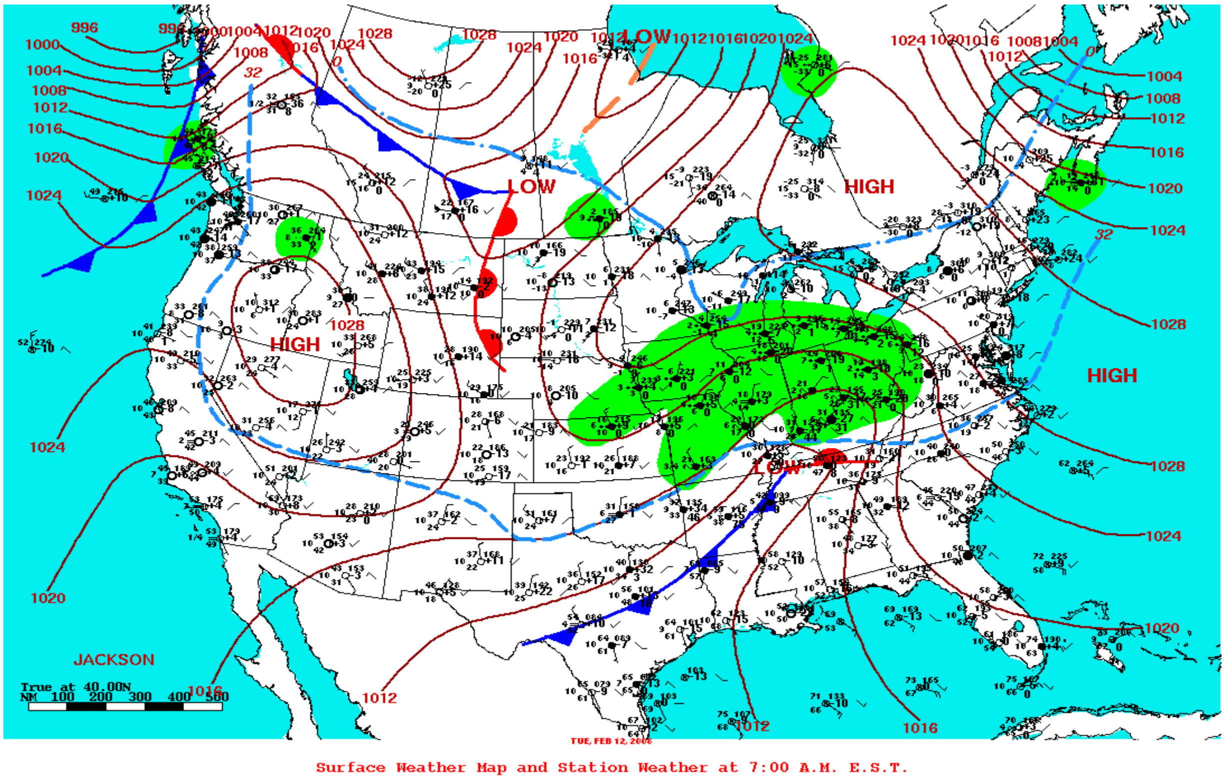


Figure 9. Daily Weather Map Surface Chart for February 10, 2008.

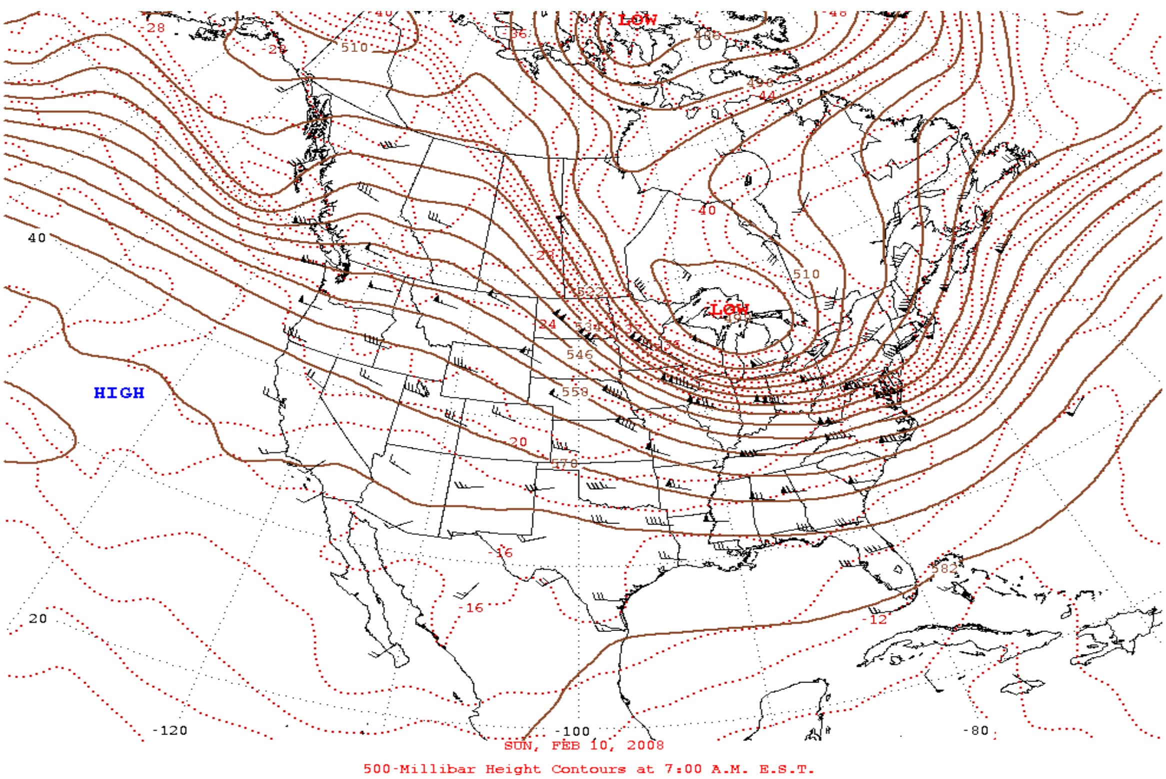


Figure 10. Daily Weather Map 500-mb Chart for February 10, 2008.

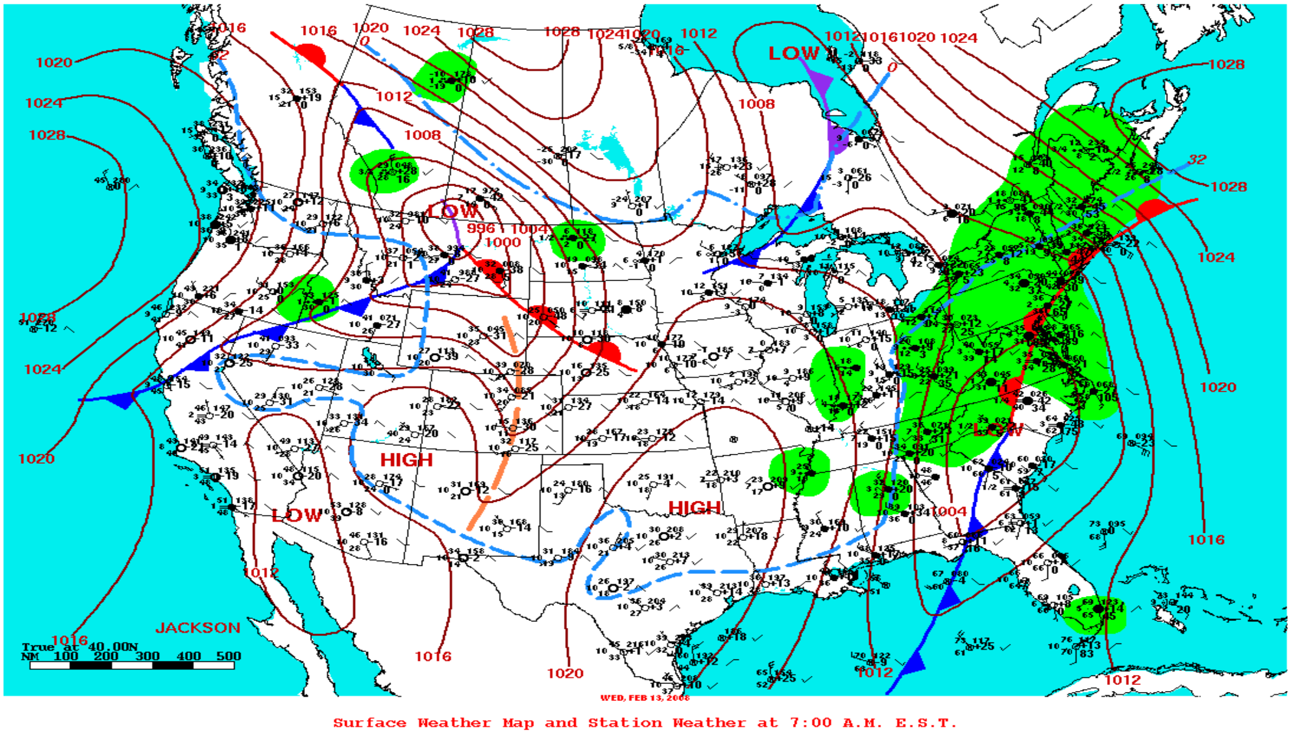


Figure 11. Daily Weather Map surface chart for February 13, 2008.

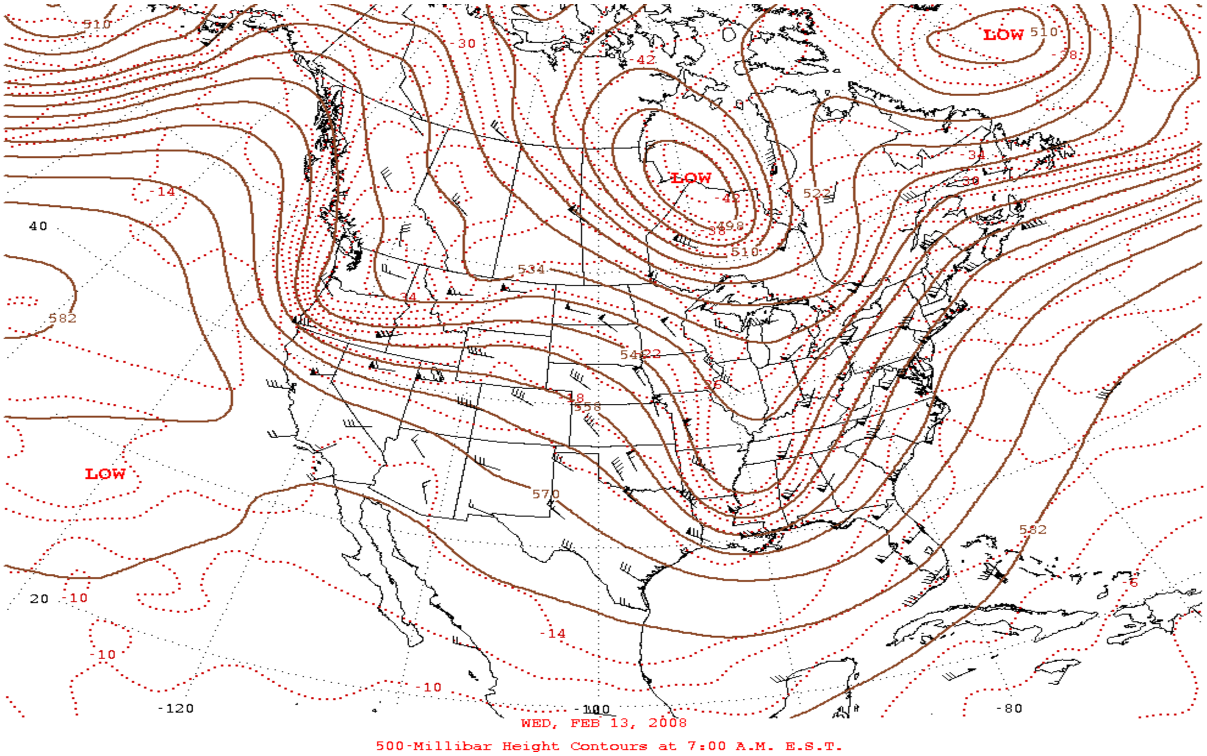
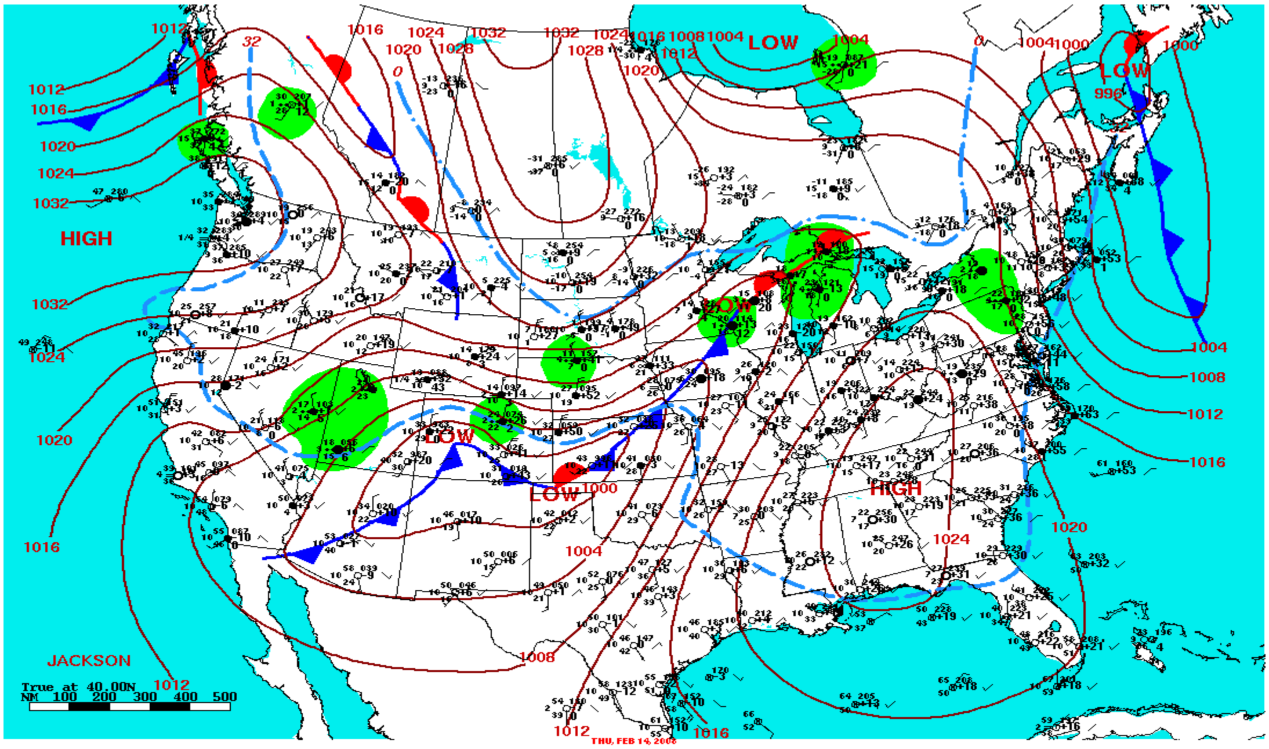
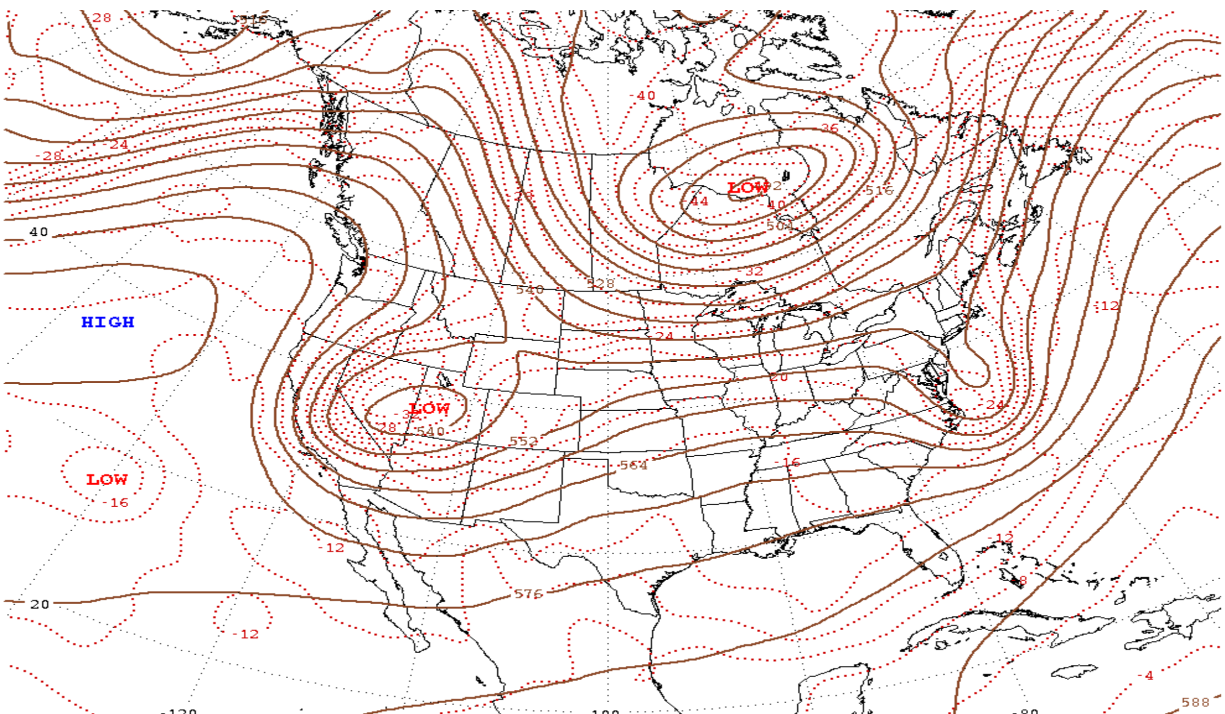


Figure 12. Daily Weather Map 500-mb chart for February 13, 2008.



Surface Weather Map and Station Weather at 7:00 A.M. E.S.T.

Figure 13. Daily Weather Map surface chart for February 14, 2008.



THU, FEB 14, 2008

500-Millibar Height Contours at 7:00 A.M. E.S.T.

Figure 14. Daily Weather Map 500-mb Chart for February 14, 2008.

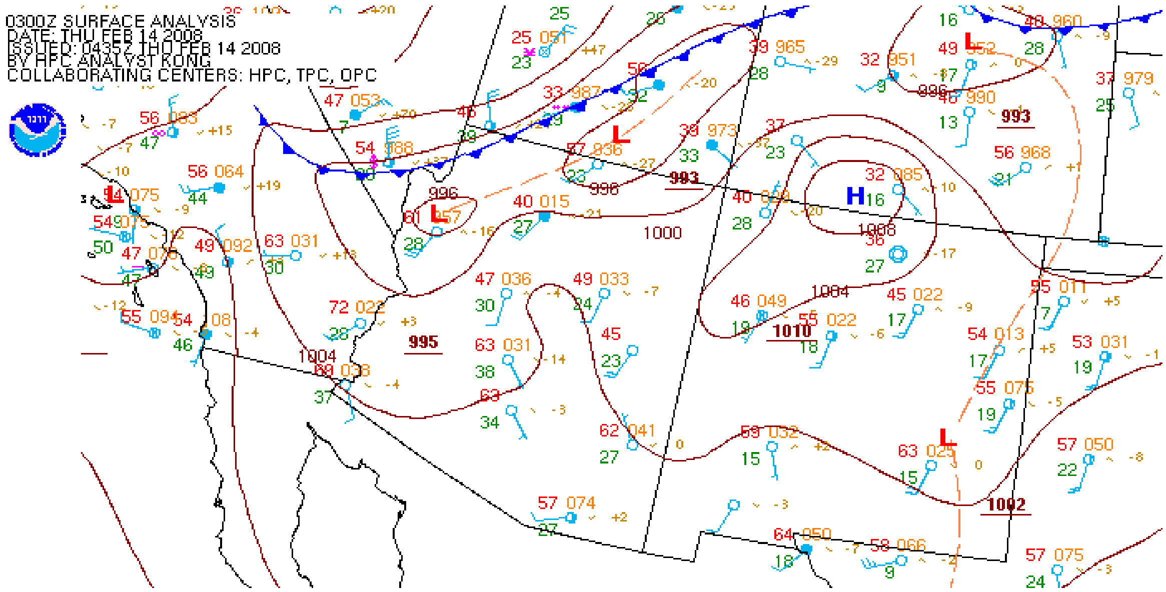


Figure 15. Surface Weather Map at 0300 Z on February 14, 2008 (1900 PST on February 13).

Table 8 shows LCD wind data for February 13 at McCarran International and North Las Vegas Airport. From 1200 through 1800 PST, speeds increased to 16–26 mph, with gusts of 23–40 mph. The wind came from the south to southwest, which is typical with a cold front approaching from the northwest.

A special observation at McCarran at 1806 PST showed the wind direction beginning to shift to the northwest, with a speed of 26 mph and gusts to 43 mph. Fifteen minutes later, another special observation showed the wind direction had shifted even more to the northwest, with a speed of 21 mph and gusts to 56 mph. The highest wind and gust speeds of the day were observed at 1856 PST: 41 mph average wind speed and a 64 mph gust. This observation included a note on blowing dust that restricted visibility.

The direction shift occurred about 18 minutes earlier at North Las Vegas Airport than at McCarran, which is reasonable given their geographic positions and the fact that this type of shift is associated with a frontal area passing through the observer's position.

Table 8. LCD Wind Data for February 13, 2008

	McCarran International			North Las Vegas Airport		
Time (PST)	**Speed (mph)**	**Direction (degrees)**	**Gusts (mph)**	**Speed (mph)**	**Direction (degrees)**	**Gusts (mph)**
0000	5	220		5	330	
0100	5	200		0	000	
0200	3	280		5	300	
0300	5	260		3	300	
0400	5	240		5	330	
0500	3	260		5	340	
0600	5	210		0	000	
0700	3	200		3	010	
0800	0	000		0	000	
0900	6	080		0	000	
1000	9	060		8	120	
1100	5	Variable		7	140	
1200	16	180	23	10	140	
1300	22	190	31	17	110	29
1331				7	Variable	28
1400	25	230	38	26	240	34
1500	26	230	40	11	260	29
1600	14	220	23	15	220	38
1700	24	250	37	28	250	44
1738				45	330	54
1800	22	250	32	37	320	59
1806	26	310	43			
1821	21	340	56			
1900	41	340	64	38	330	54
2000	29	330	55	33	330	51
2100	28	330	52	36	330	56
2200	26	350	45	18	340	24
2300	29	350	39	24	340	29

Figures 16 through 21 plot the hourly average wind speed and maximum wind gusts recorded at several monitoring stations on February 13. The stations were chosen to represent conditions throughout the Las Vegas Valley and to the south (i.e., Jean). Figures 7 and 8 showed the site locations. These data show that wind speeds at the East Craig Road station from 1800–2100 were higher than those observed at McCarran International Airport, while the rest of the stations show speeds less than those observed at McCarran. The East Craig Road monitoring station has an exposure that can exacerbate the effects of strong winds from the northwest.

In addition to DAQEM's wind data, each figure shows the wind speed observed on the hour at McCarran to facilitate comparisons. The DAQEM data are averages and maximum values recorded throughout the hour, while the McCarran data come from a short observation period a few minutes ahead of the time listed. However, the similarity between McCarran observations and DAQEM monitoring sites indicates the regional-scale influence of the weather system affecting the area.

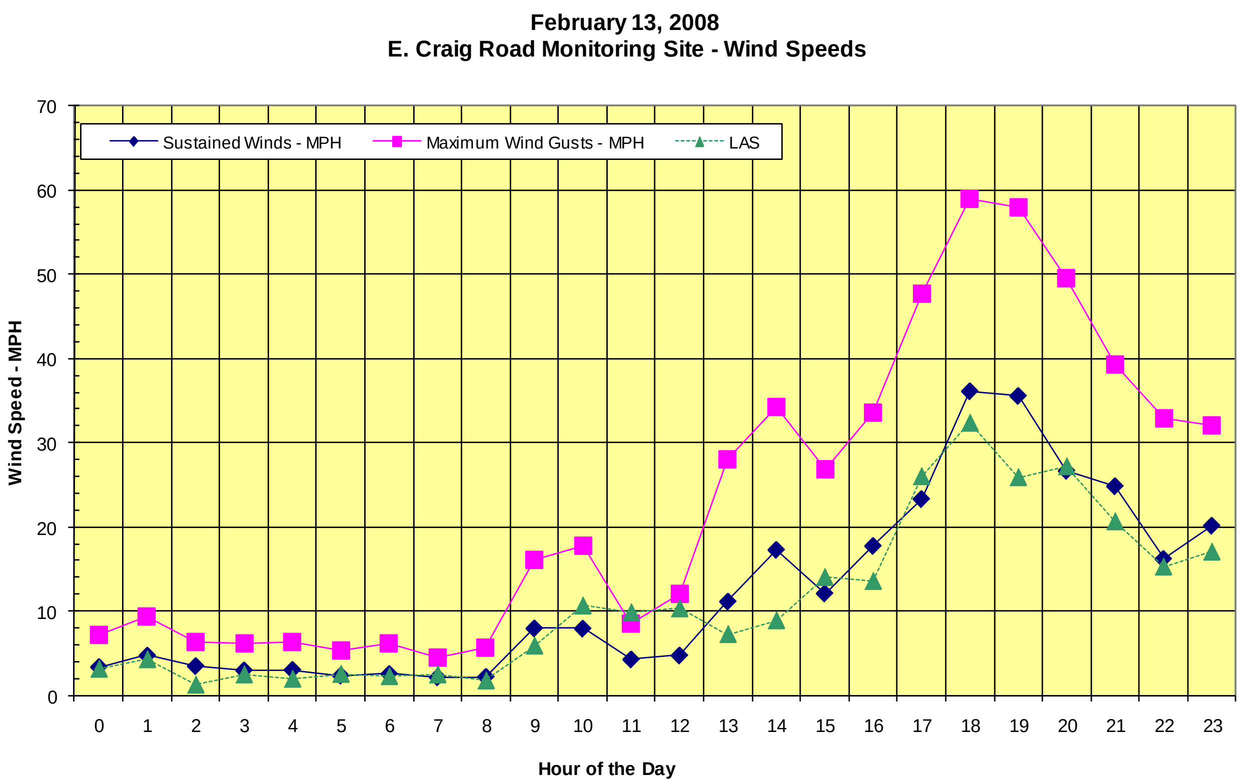


Figure 16. Comparison of Wind Speed Patterns Between McCarran Observation Site and DAQEM's East Craig Road Monitoring Site.

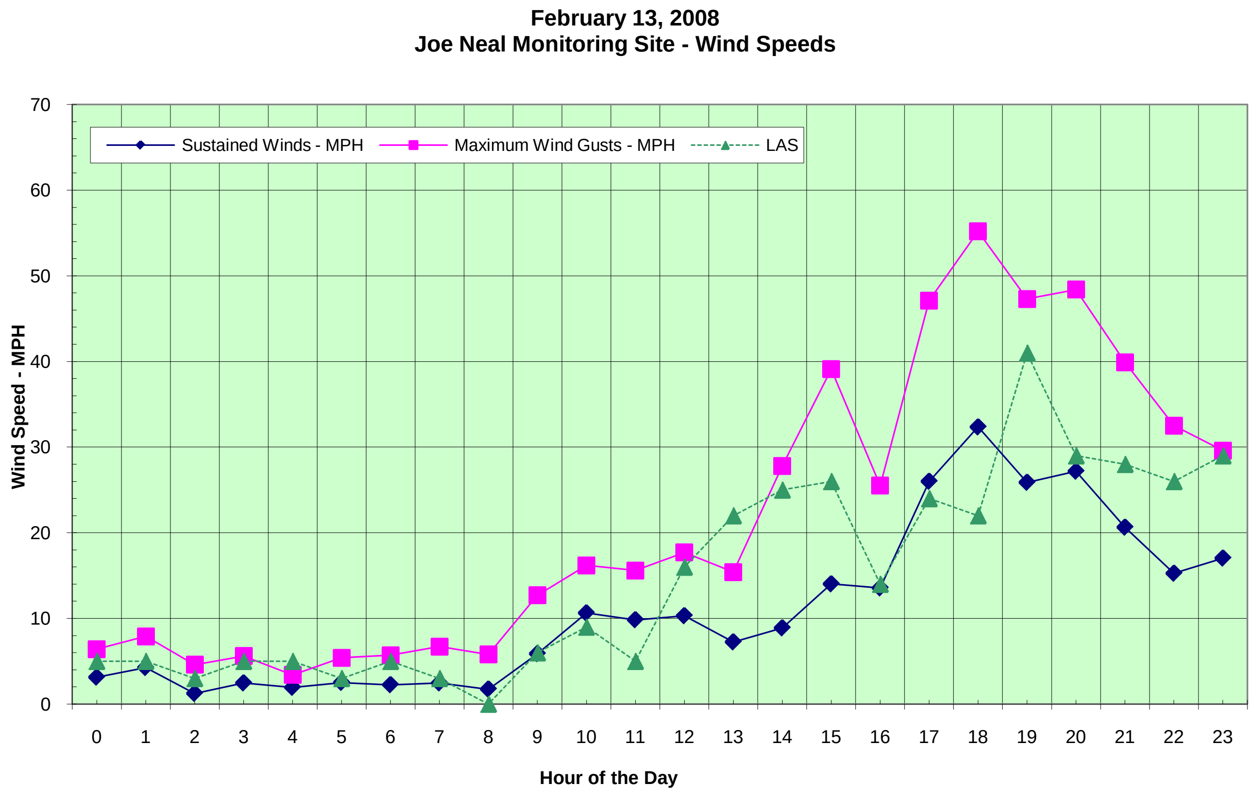


Figure 17. Comparison of Wind Speed Patterns Between McCarran Observation Site and DAQEM's Joe Neal Monitoring Site.

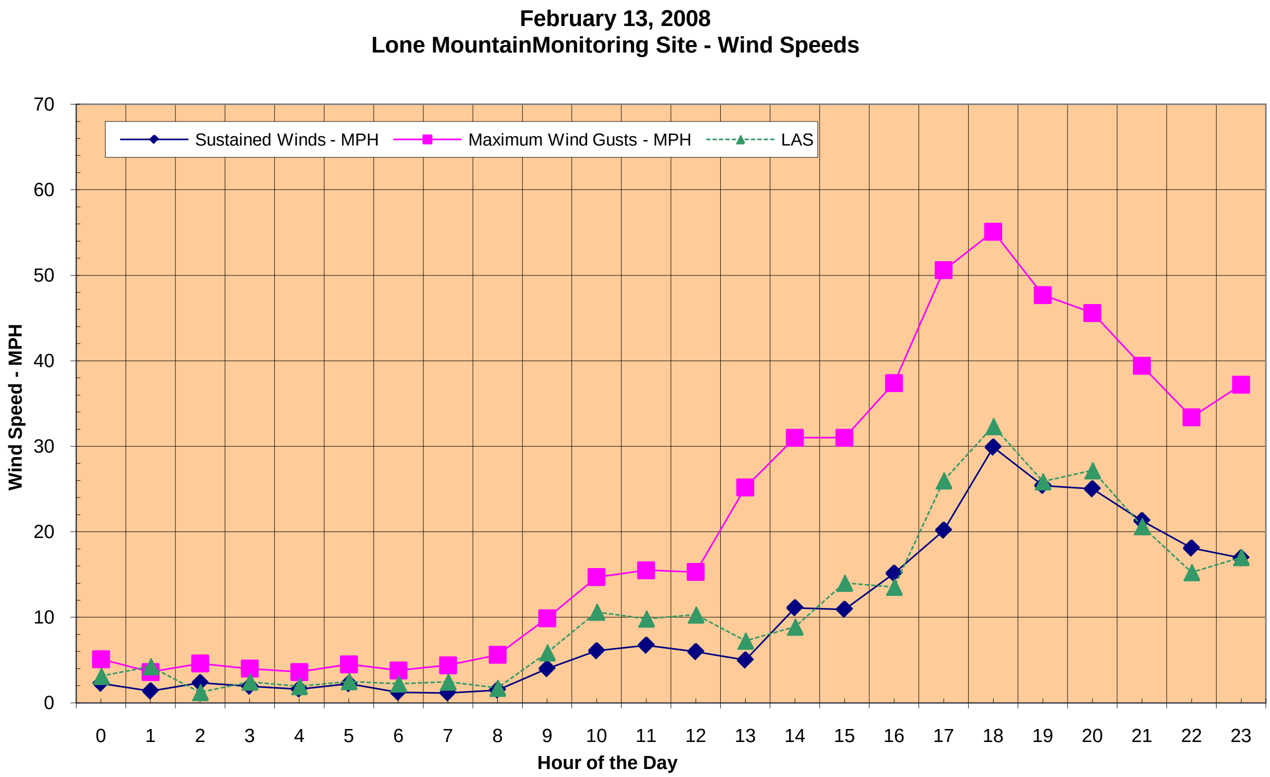


Figure 18. Comparison of Wind Speed Patterns Between McCarran Observation Site and DAQEM's Lone Mountain Monitoring Site.

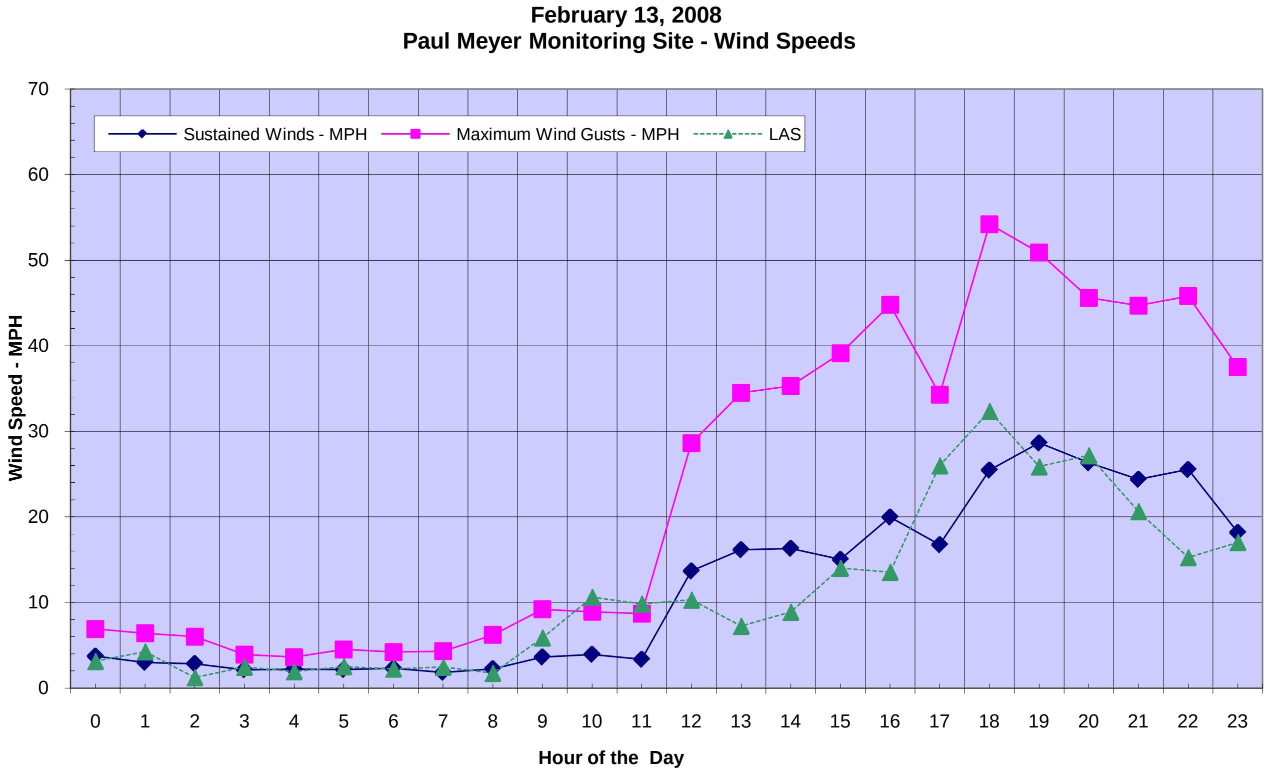


Figure 19. Comparison of Wind Speed Patterns Between McCarran Observation Site and DAQEM's Paul Meyer Monitoring Site.

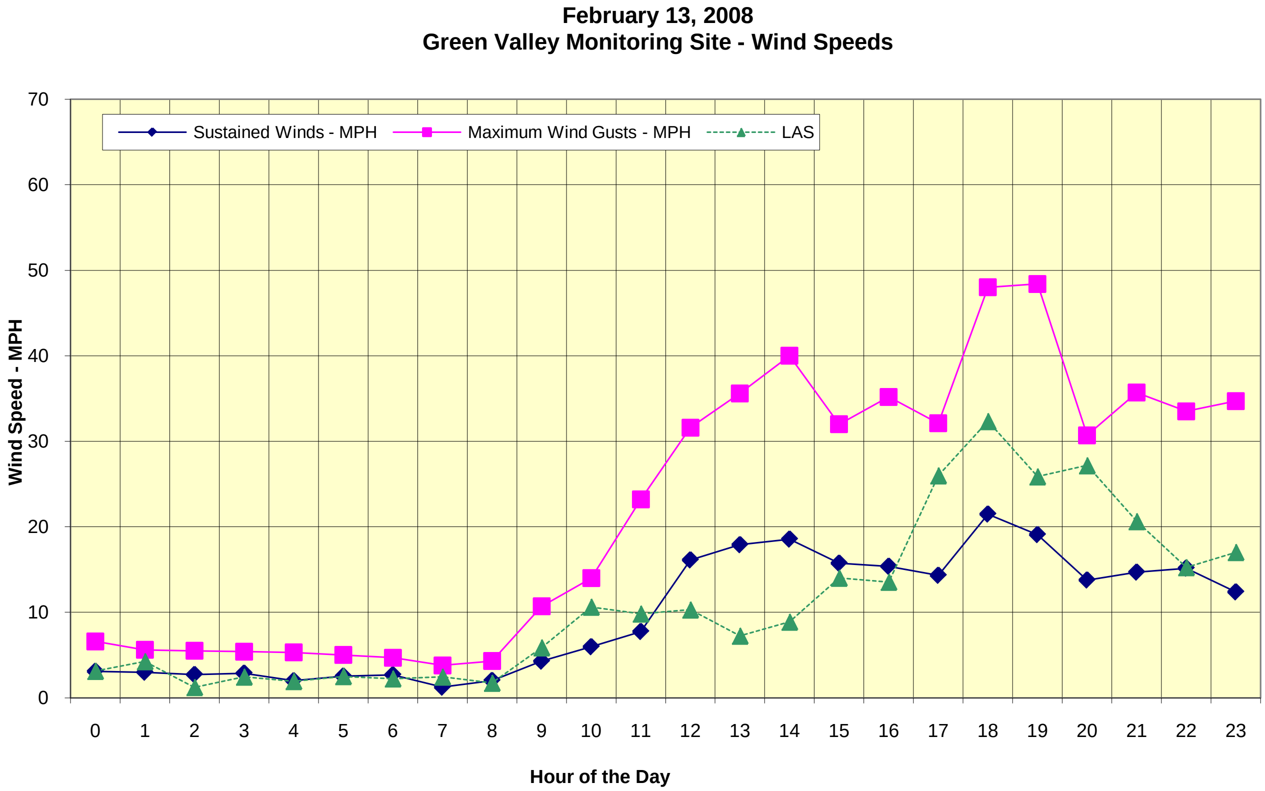


Figure 20. Comparison of Wind Speed Patterns Between McCarran Observation Site and DAQEM's Green Valley Monitoring Site.

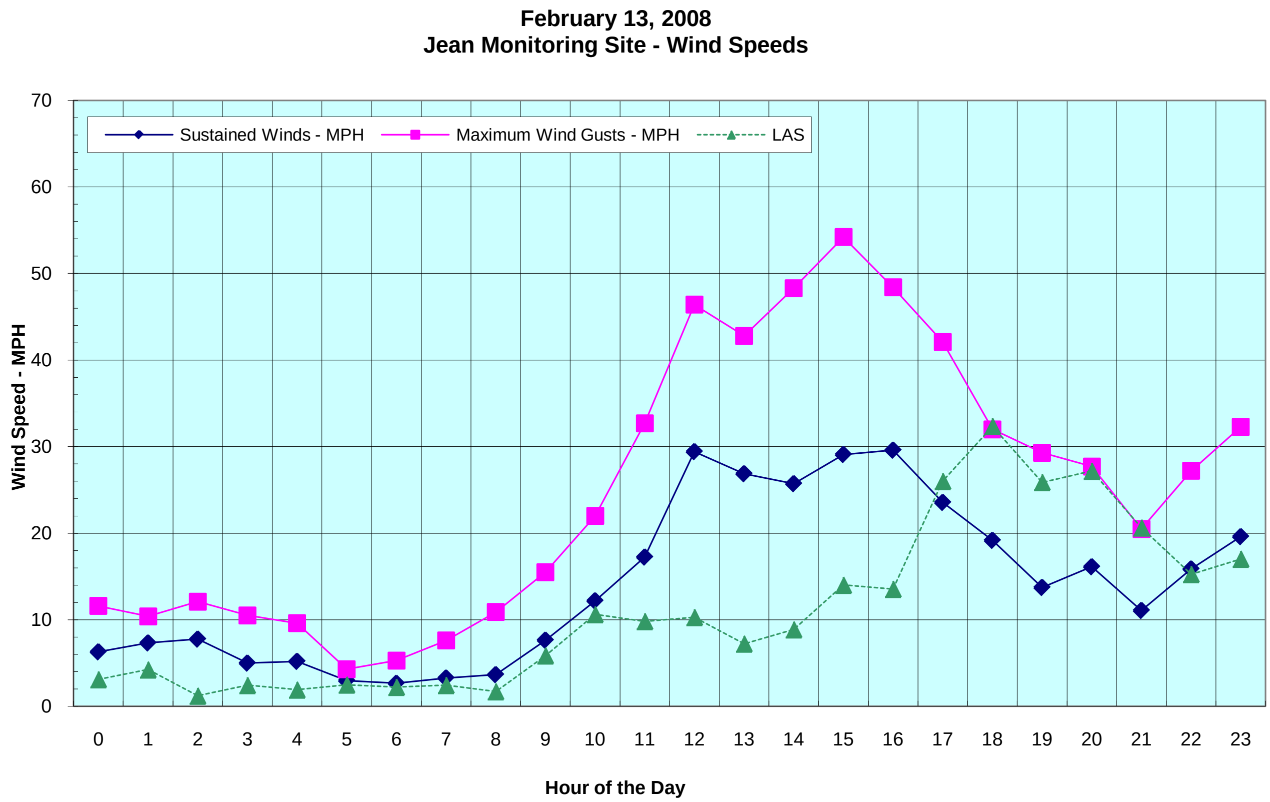


Figure 21. Comparison of Wind Speed Patterns Between McCarran Observation Site and DAQEM's Jean Monitoring Site.

High-speed winds occurred earlier in Jean than in Las Vegas, although the direction shift in Jean before and during the frontal passage was similar to that in the valley. By night, the wind at the Jean station was coming from the northeast; winds at the stations in the Las Vegas Valley continued from the northwest. The difference could have been caused by offset channeling effects from topography in the two different basin areas.

Wind observations and weather charts support the conclusion that, after many days of dry and fair conditions, a strong weather system with a cold front passed through southern Nevada on February 13, creating high wind speeds between 1800 and 1900 PST. Table 9 lists wind data from the East Craig Road monitoring station and McCarran, along with PM_{10} concentrations at the East Craig Road station, for February 13. It shows routine hourly concentrations during the highest wind speeds and the frontal passage; the higher time resolution concentration data, which were calculated from the five-minute mass accumulation data, are shown in brackets.

Except for maximum wind gusts, the wind data from DAQEM's East Craig Road station are averages for each one-hour period, beginning at the time specified. The McCarran data are observations made a few minutes before the time specified. This explains any apparent discrepancy in the time of maximum wind speed and direction shift.

Table 9. PM_{10} Concentration and Wind Data from East Craig Road Station and McCarran Airport on February 13, 2008

E. Craig Road Hourly Averages (except gusts)					McCarran Observations (a few minutes before time shown)		
Time (PST)	**PM_{10} (µg/m^3)**	**Wind Speed (mph)**	**Wind Direction (degrees)**	**Wind Gust (mph)**	**Wind Speed (mph)**	**Wind Direction (degrees)**	**Wind Gust (mph)**
0000	12	3.4	311	7.1	5	220	
0100	11	4.7	323	9.3	5	200	
0200	6	3.5	320	6.3	3	280	
0300	19	3.0	321	6.2	5	260	
0400	31	3.0	340	6.4	5	240	
0500	47	2.4	299	5.3	3	260	
0600	34	2.6	320	6.1	5	210	
0700	93	2.2	337	4.5	3	200	
0800	138	2.2	16	5.7	0	000	
0900	69	8.0	80	16.1	6	080	
1000	29	7.9	98	17.8	9	060	
1100	12	4.3	72	8.5	5	Variable	
1200	18	4.8	54	12.0	16	180	23
1300	53	11.2	184	28.1	22	190	31
1400	215	17.3	217	34.3	25	230	38
1500	64 [44]	12.1	227	26.8	26	230	40
1600	100 [186]	17.8	232	33.5	14	220	23
1700	243 [500]	23.4	277	47.7	24	250	37
1800	921 [1835]	36.2	301	59.0	22	250	32
1900	1496 [1153]	35.6	308	57.9	41	340	64
2000	621 [160]	26.7	309	49.6	29	330	55
2100	70 [27]	24.9	305	39.3	28	330	52
2200	21	16.2	312	32.9	26	350	45
2300	8	20.2	308	32.0	29	350	39

The data in Table 9 show PM_{10} concentrations increasing rapidly with wind speed. Between 1700 and 1900, average wind speed at the East Craig Road station increased to 35 mph and gusts increased to well over 40 mph. Maximum wind speeds and the shift in wind direction, from southwest to northwest, took place during the 1800 hour. Winds stayed out of the northwest for the next few hours, with an average speed of nearly 30 mph and gusts from 39–55 mph.

This period of maximum wind speed corresponds to the maximum one-hour PM_{10} concentration, based on the higher time resolution five-minute mass data—1,835 µg/m^3. The next highest hourly PM_{10} value—1,153 µg/m^3—was measured during the following hour, when the average wind speed was 35 mph and gusts were 58 mph. Wind speeds decreased slowly after that as

PM_{10} levels dropped rapidly during the rest of the day. If the PM_{10} concentration at 1900 had not exceeded 600 $\mu g/m^3$, the 24-hour standard would not have been exceeded.

3.1.6 Weather After the Event

As the surface weather map in Figure 15 shows, the front continued through Arizona after passing through Las Vegas. The data in Table 9 show continued strong northwesterly winds, with PM_{10} concentrations diminishing to less than 10 $\mu g/m^3$ by the end of the day.

McCarran wind data show the northwesterly winds changing to northeasterly around noon on February 14, with speeds quickly diminishing to less than 20 mph and gusts in the mid-20s or lower. The 24-hour average PM_{10} concentration at East Craig Road on February 14 was 12 $\mu g/std\text{-}m^3$.

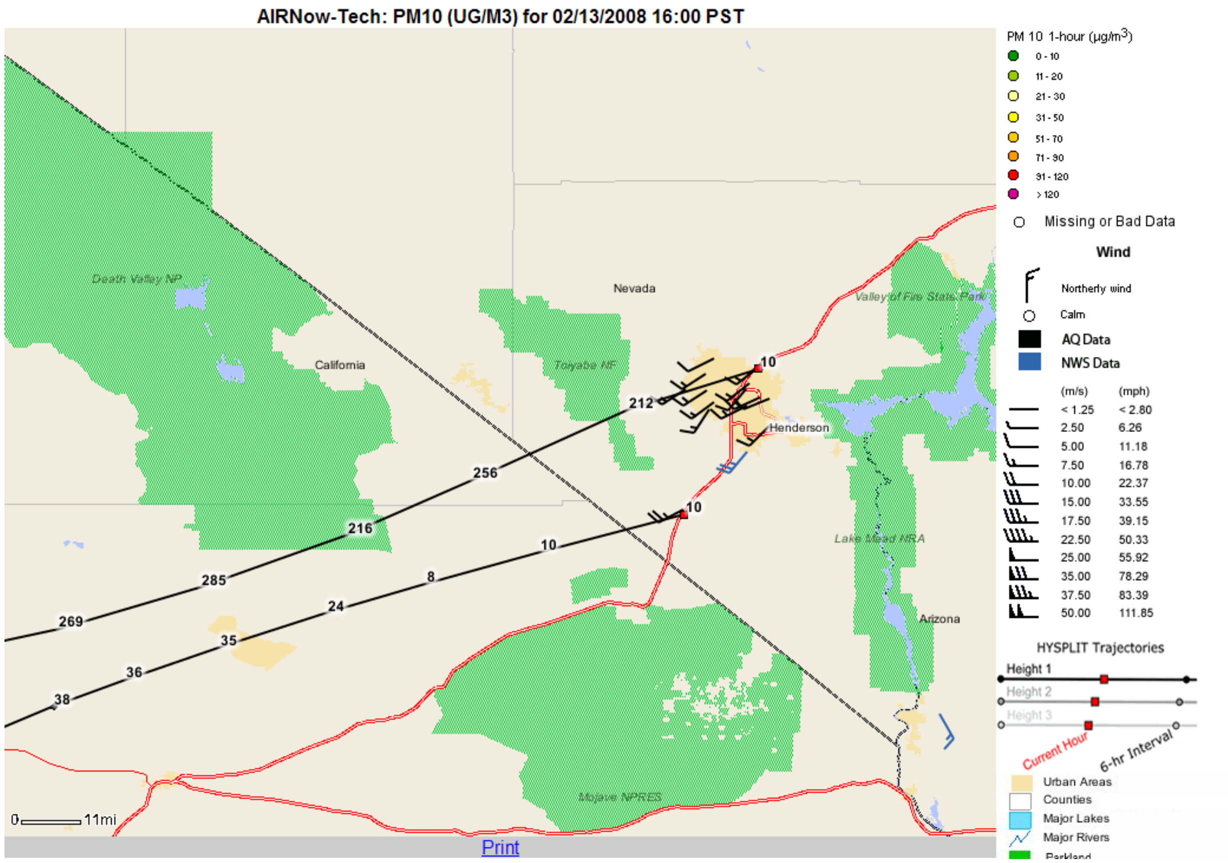
The rapidly diminishing PM_{10} concentrations during moderately high winds—about 25 mph continually, with gusts up to 40 mph—demonstrate the low amount of airborne material entrained once a dust reservoir that was built up over many days has been depleted early in a high wind event.

3.1.7 Trajectory Modeling Results

To investigate the exceptional event on February 13, 2008, DAQEM used the NOAA HYSPLIT model from the EPA AIRNow Tech system. This model can render large errors during periods of rapidly changing conditions and significant differences in conditions over short distances, both of which occur during a strong frontal passage. A detailed trajectory analysis was therefore not necessary, but the results are presented to demonstrate this analytical approach.

The numbers shown along the trajectory paths in Figures 22-24 are the heights above ground level (agl) in meters of the centerline of the plume at hourly intervals. Closely spaced plume heights indicate lower speed winds than height values spaced farther apart. The model does not determine where along the trajectory surface-generated material entered the air mass. Unlike other trajectory illustrations, this one does not include PM_{10} data because hourly PM_{10} values are not available in the AIRNow-Tech system.

Figure 22 illustrates the trajectory result at 10 m agl for two paths ending at the Jean and East Craig Road stations at 1600 PST, during the prefrontal southwesterly airflow. The path toward the Jean station shows that the PM_{10} causing the increased concentrations appears to have originated southwest of the station, possibly in the dry lake areas near the Nevada-California state line along Interstate 15.

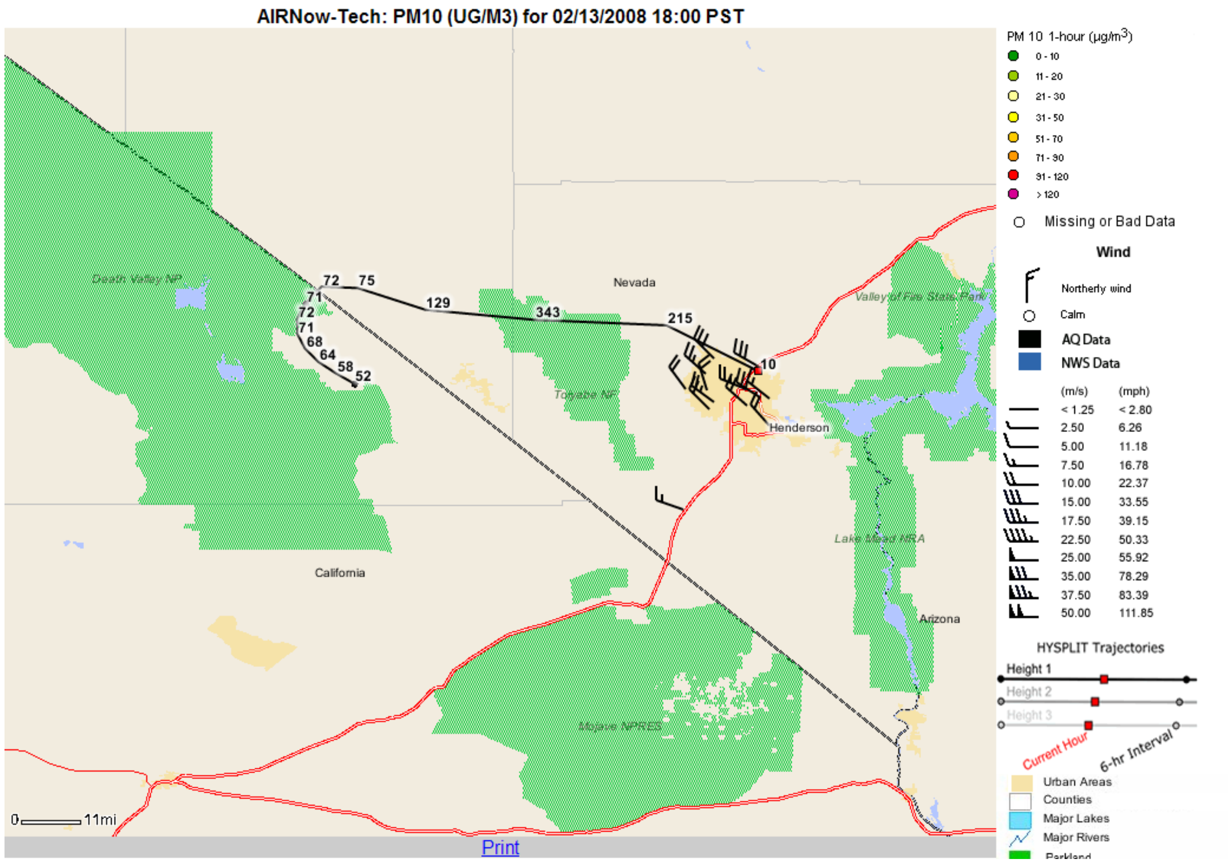


Note: Trajectory path heights are shown at hourly intervals.

Figure 22. HYSPLIT Trajectory for Paths Ending at the Jean and East Craig Road Stations at 1600 PST.

The heights associated with the trajectory line ending at the Jean station south of the Las Vegas valley are all less than 50 m agl. In contrast, the heights associated with the trajectory path toward the East Craig Road station are all more than 200 m agl. This path crossed through the Las Vegas Valley from the southwest to the northeast.

Figure 23 illustrates the trajectory result at 10 m agl for a path ending at the East Craig Road station at 1800 PST, near the time of the frontal passage. It shows that the air mass originated in southeastern California and accelerated through western Clark County toward the East Craig Road station. The heights indicated on this trajectory line start below 100 m agl and rise to more than 300 m agl, crossing the mountains west of the Las Vegas Valley before dropping to the valley floor near the East Craig Road site.

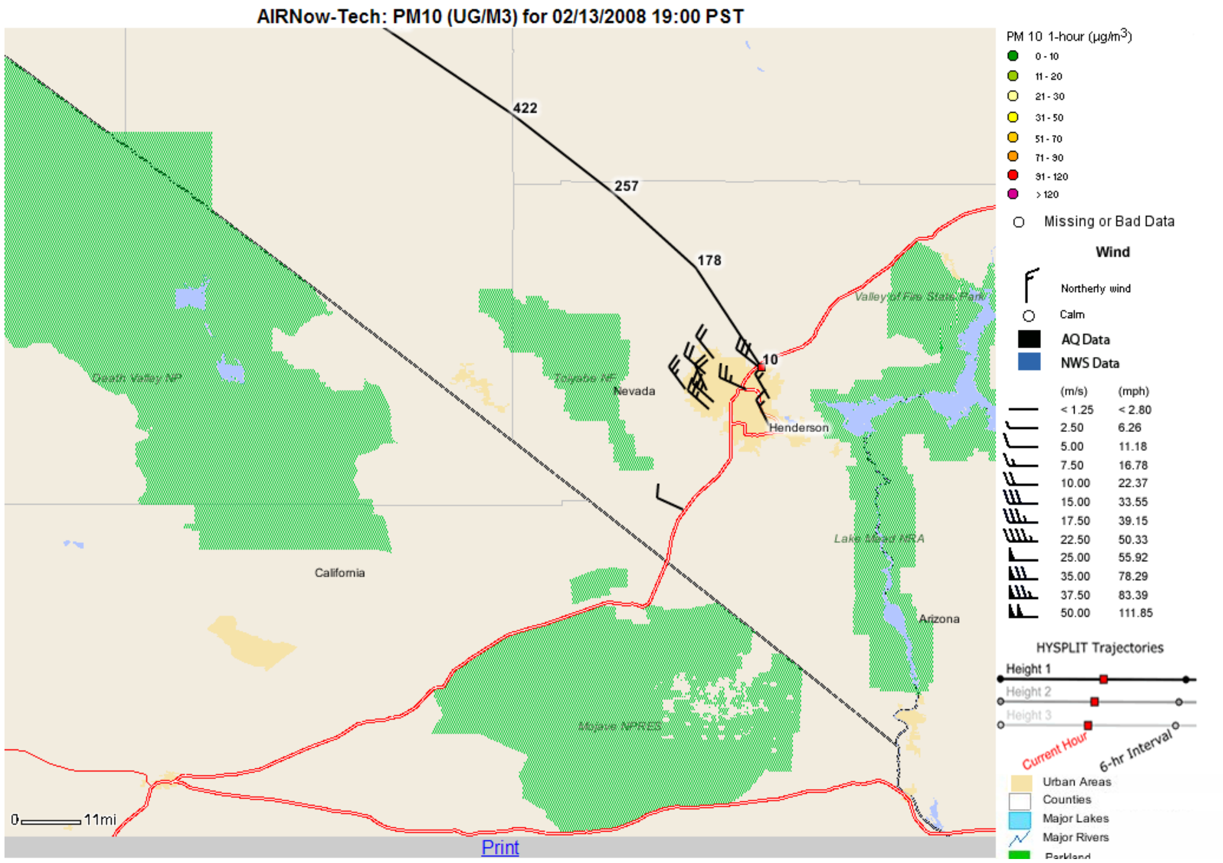


Note: Trajectory path heights are shown at hourly intervals.

Figure 23. HYSPLIT Trajectory for Path Ending at East Craig Road Station at 1800 PST.

Figure 24 illustrates the trajectory result at 10 m agl for a path ending at the East Craig Road station at 1900 PST, soon after the frontal passage. This path shows the air mass to have originated in southern Nevada, moving rapidly through northwestern Clark County toward the East Craig Road station. The heights indicated on this trajectory are a few hundred meters agl, again impacting the surface near the East Craig Road station.

In summary, the trajectory paths generally follow anticipated routes based on the winds observed during the frontal passage period. Early in the period, the regional winds were from the southwesterly direction, and after the front from the northwesterly direction. In between, the turbulent period of rapid wind direction changes and frontal passage show an irregular pathway.



Note: Trajectory path heights are shown at hourly intervals.

Figure 24. HYSPLIT Trajectory for Path Ending at East Craig Road Station at 1900 PST.

3.2 MEDIA COVERAGE OF WIND EVENT

Clark County television news coverage from February 13 confirms high winds and blowing dust with video footage and eyewitness accounts. Television weather coverage described the meteorology producing the event, as well as wind damage throughout the area. The local Fox News affiliate (KVVU) ran several special reports and videos of the event. KLAS Channel 8 ran a story, titled "Windy Weather Blows Las Vegas Away," that contained photos and video of uprooted trees, collapsed signs, and awnings that had fallen onto parked cars. McCarran International Airport experienced a "ground stop," where planes on the tarmac are held in place during a natural event. Nevada Power worked through the night to restore power to 18,000 homes throughout the Las Vegas Valley. And, finally, the *Las Vegas Review-Journal* and *Las Vegas Sun* ran similar articles on the wind event in their daily editions. Appendix B provides news releases, photos, video, stories, and other media coverage from February 13-14, 2008, documenting the high-wind event.

4.0 EMISSION SOURCES AND ACTIVITY

4.1 EAST CRAIG ROAD

DAQEM's East Craig Road monitoring site (CAMS-20, EPA 32-003-0020) (Figure 25) sits in the northeast part of the Las Vegas Valley, in a predominantly industrial area. Figures 26-29 provide aerial views of the site, whose purpose is to monitor spatial-scale neighborhood emissions of PM_{10} from individual sources in the area. There is a major transportation corridor (I-15) located directly west of the site; the nearest road is Mitchell, which is mostly travelled by the heavy-duty vehicles and transfer trucks that serve the industrial warehouses in the area.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a small contributor to PM emissions at the site, whose monitoring objective is classified as "High Concentration." It remains a high-concentration site, although sources are less intense than during previous high concentration episodes. Land development has decreased the intensity of PM emissions in the area; however, some sources and land uses to the north-northwest, even though well stabilized, can cause elevated dust conditions when high wind thresholds occur. This is also true when the predominant wind direction in the valley changes from southwest to northwest. Attachments 13 and 14 in Appendix A contain the wind and pollution roses, respectively, for the event day at this site; Attachment 15 contains the standard wind rose for McCarran International Airport that day, showing the predominant wind direction (south-southwest) throughout the Las Vegas Valley.

Figure 25. East Craig Road Monitoring Station.

Figure 26. East Craig Road Monitoring Site, Aerial View #1.

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Figure 27. East Craig Road Monitoring Site, Aerial View #2.

Figure 28. East Craig Road Monitoring Site, Aerial View #3.

Figure 29. East Craig Road Monitoring Site, Aerial View #4.

4.2 JOE NEAL

The Joe Neal monitoring site (CAMS-75, EPA 32-003-0075) (Figure 30) sits in the northwest part of the Las Vegas Valley, in a predominantly residential area. Figures 31-34 provide aerial views of the site, whose purpose is to monitor spatial-scale neighborhood emissions of PM_{10} from individual sources in the area. A middle school and a small city park surround the site, whose monitoring objective is classified as "Population Exposure." There is no major transportation route in the area, although the Bruce Woodbury Beltway (I-215) passes approximately three-quarters of a mile to the north.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a small contributor to PM emissions at the site. Vacant land east of the site is well stabilized and fenced off or barricaded, as required by the Clark County AQRs. Land development has decreased the intensity of PM emissions in the area; however, some sources and land uses to the north-northeast, even though well stabilized, can cause elevated dust conditions when high wind thresholds occur. The predominant wind direction is southwest, but in general, this site no longer runs high concentrations with high winds from that direction. Occasional high concentrations occur when wind direction changes drastically, as it did during the exceptional event. However, this site had no measured PM_{10} exceedances that day.

Figure 30. Joe Neal Monitoring Station.

Figure 31. Joe Neal Monitoring Site, Aerial View #1.

Figure 32. Joe Neal Monitoring Site, Aerial View #2.

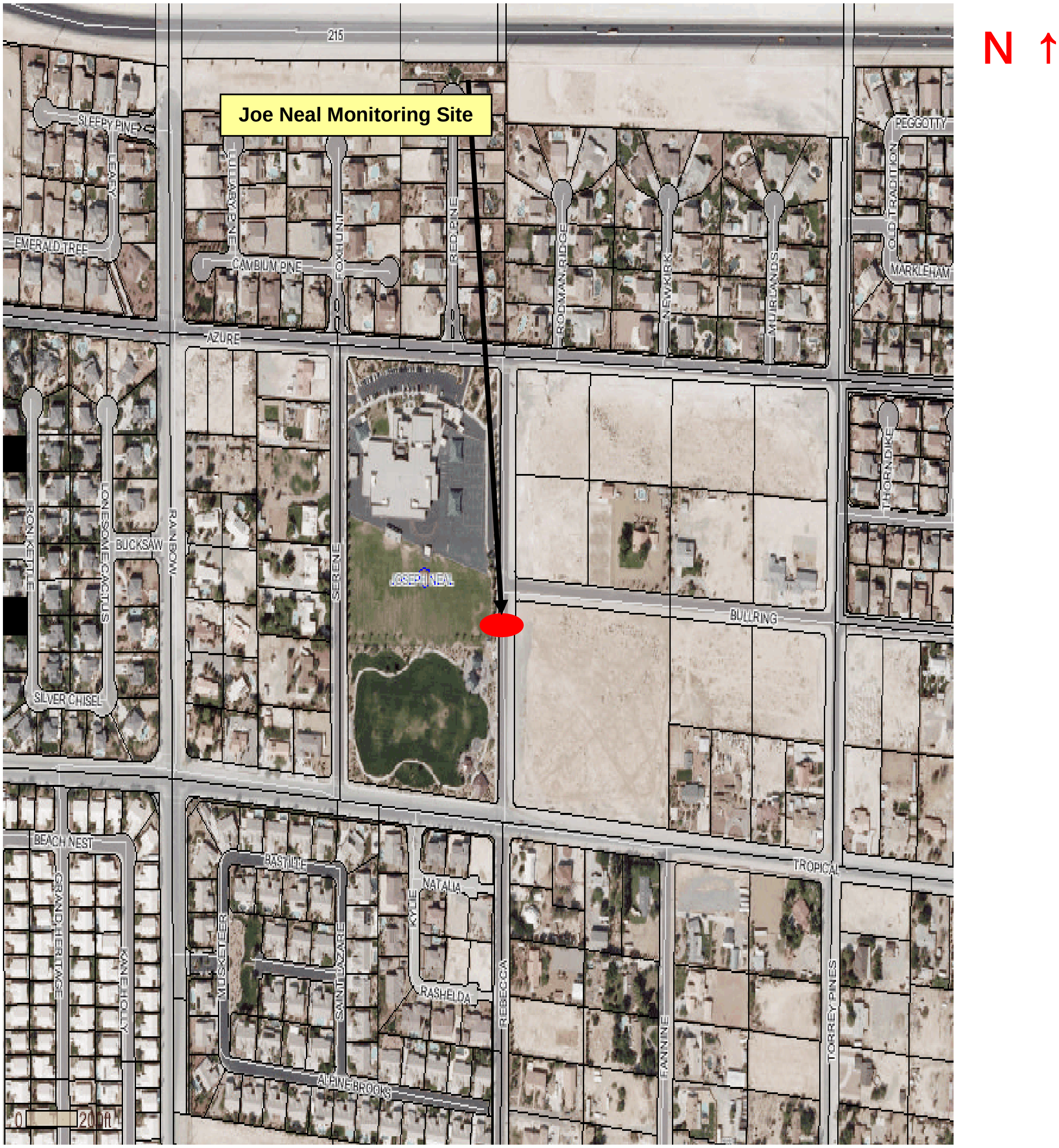

Figure 33. Joe Neal Monitoring Site, Aerial View #3.

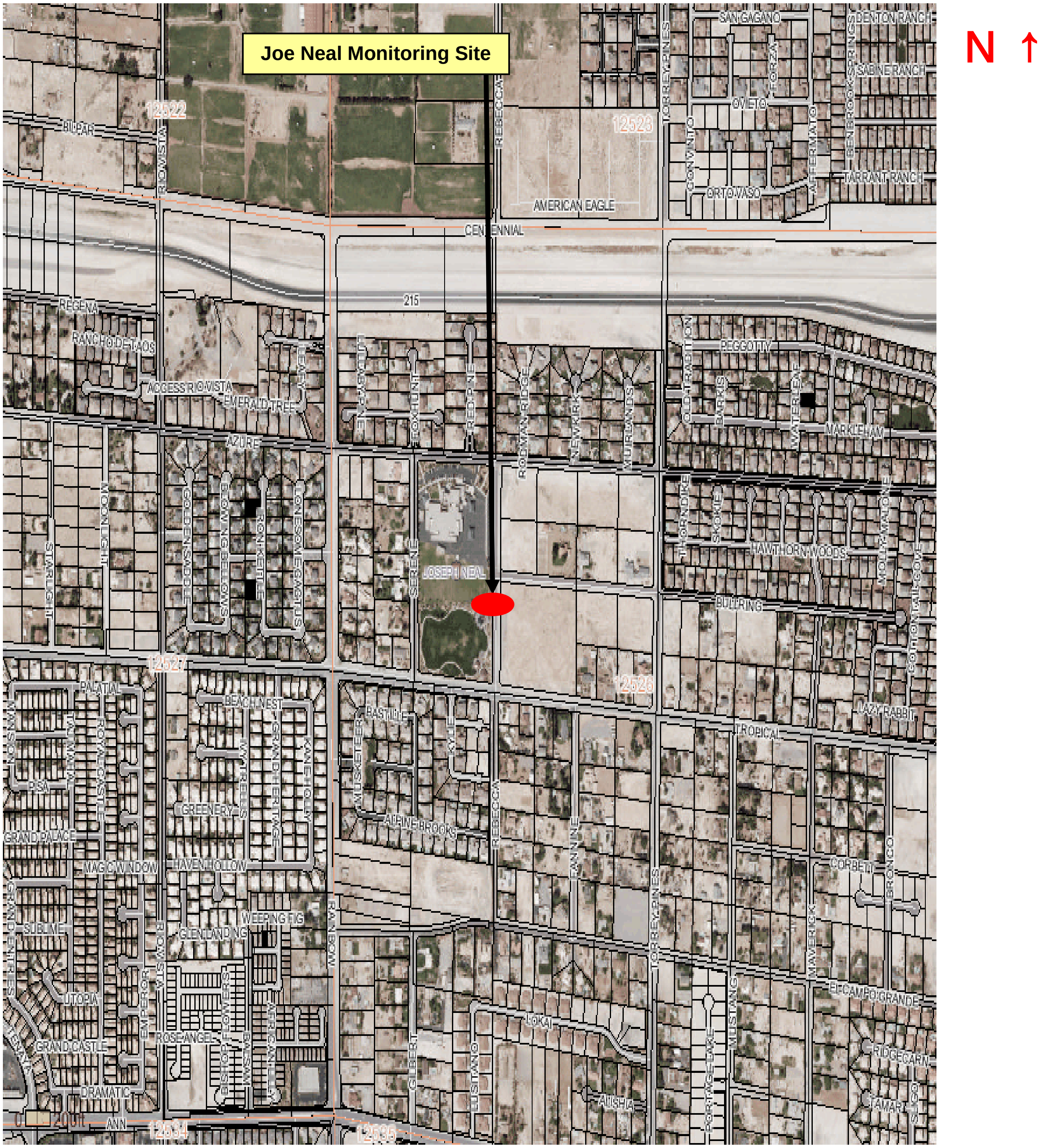

Figure 34. Joe Neal Monitoring Site, Aerial View #4.

4.3 LONE MOUNTAIN

The Lone Mountain monitoring site (CAMS-72, EPA 32-003-0072) (Figure 35) sits in the northwest part of the Las Vegas Valley, in a predominantly residential area with light commercial amenities and three schools. Figures 36-39 provide aerial views of the site, whose purpose is to monitor spatial-scale neighborhood emissions of PM_{10} from individual sources in the area. A day care/preschool and a small city park surround the site, whose monitoring objective is classified as "Population Exposure." There is no major transportation route in the area.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a small contributor to PM emissions at the site. There is no vacant or undeveloped land in the area of influence around the site, and land development has decreased the intensity of PM emissions in the area. The monitoring station is in a fenced compound owned by the Southern Nevada Water District; the adjacent parking area is gravel, which meets the requirements of the Clark County AQRs. The predominant wind direction is southwest. Occasional high concentrations occur when wind direction changes drastically, as it did during the exceptional event. However, this site had no measured PM_{10} exceedances that day.

Figure 35. Lone Mountain Monitoring Station.

Figure 36. Lone Mountain Monitoring Site, Aerial View #1.

Figure 37. Lone Mountain Monitoring Site, Aerial View #2.

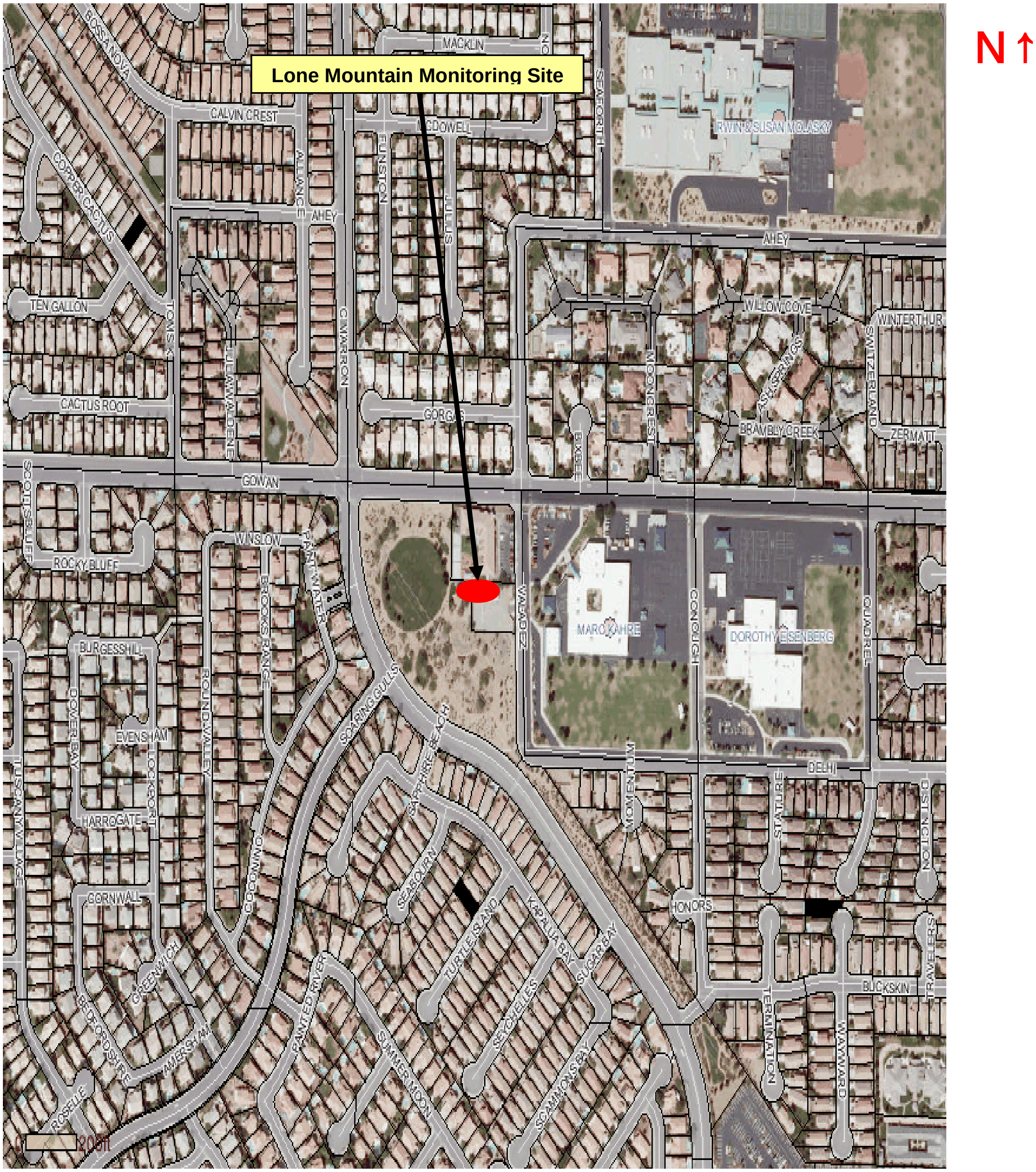

Figure 38. Lone Mountain Monitoring Site, Aerial View #3.

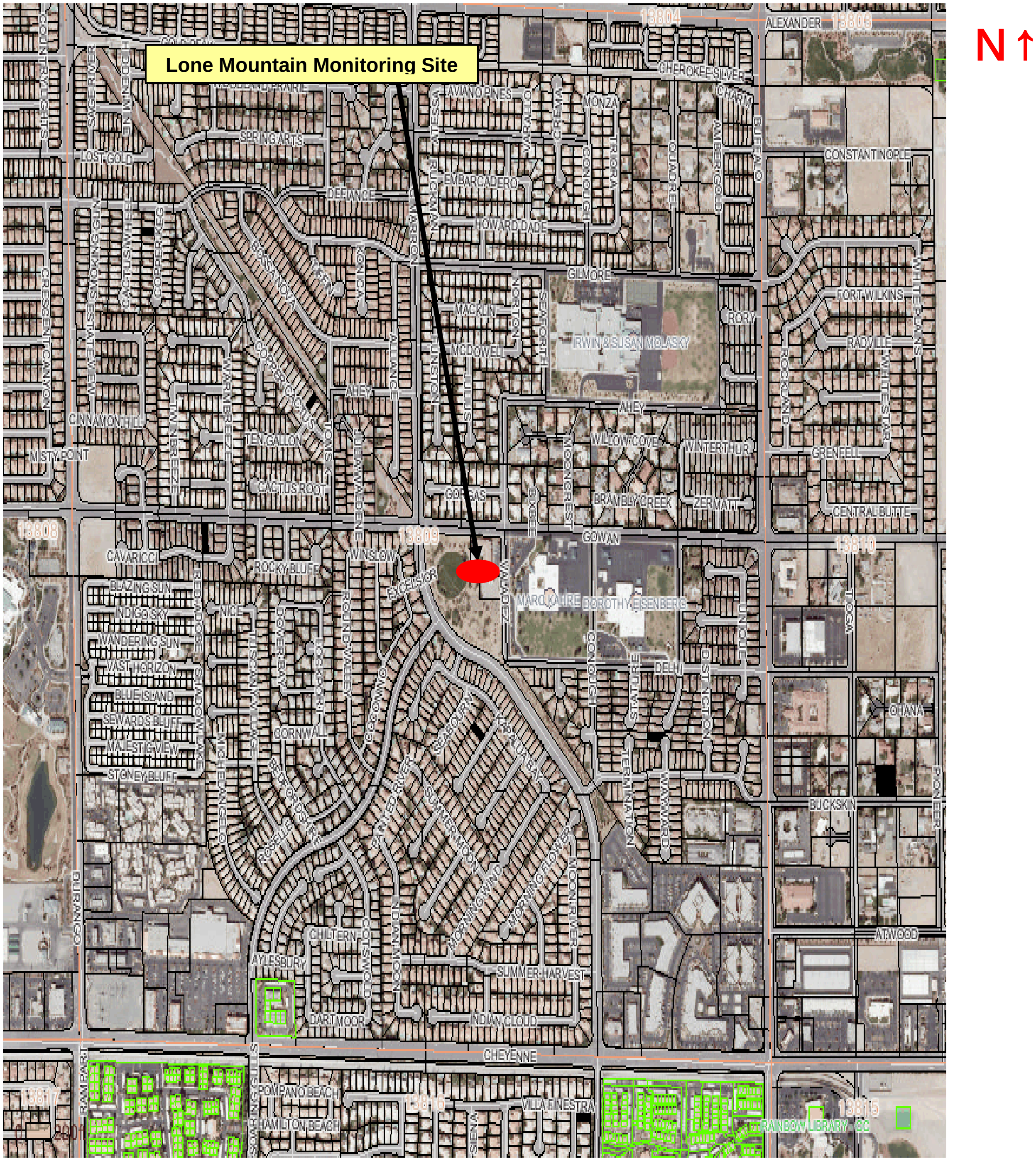

Figure 39. Lone Mountain Monitoring Site, Aerial View #4.

4.4 PAUL MEYER

The Paul Meyer monitoring site (CAMS-43, EPA 32-003-0043) (Figure 40) sits in the western part of the Las Vegas Valley, in a predominantly residential area with commercial amenities, a sports/city park, a community center, and a school. Figures 41-44 provide aerial views of the site, whose purpose is to monitor spatial-scale neighborhood emissions of PM_{10} from individual sources in the area. The park and community center surround the site, whose monitoring objective is classified as “population exposure,” with a Christian academy and school nearby. There is no major transportation route in the area.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a small contributor to PM emissions at the site. There is no vacant or undeveloped land in the area of influence around the site, and land development has decreased the intensity of PM emissions in the area. The park uses the required soils to keep dust levels down during sports events, and shows signs of appropriate upkeep. The school and academy grounds are paved with asphalt. The monitoring station sits within a fenced compound inside the community center, and the adjacent parking area is paved. The predominant wind direction is southwest. Occasional high concentrations occur when wind direction changes drastically, as it did during the exceptional event. However, the site had no measured PM_{10} exceedances on that day.

Figure 40. Paul Meyer Monitoring Site.

Figure 41. Paul Meyer Monitoring Site, Aerial View #1.

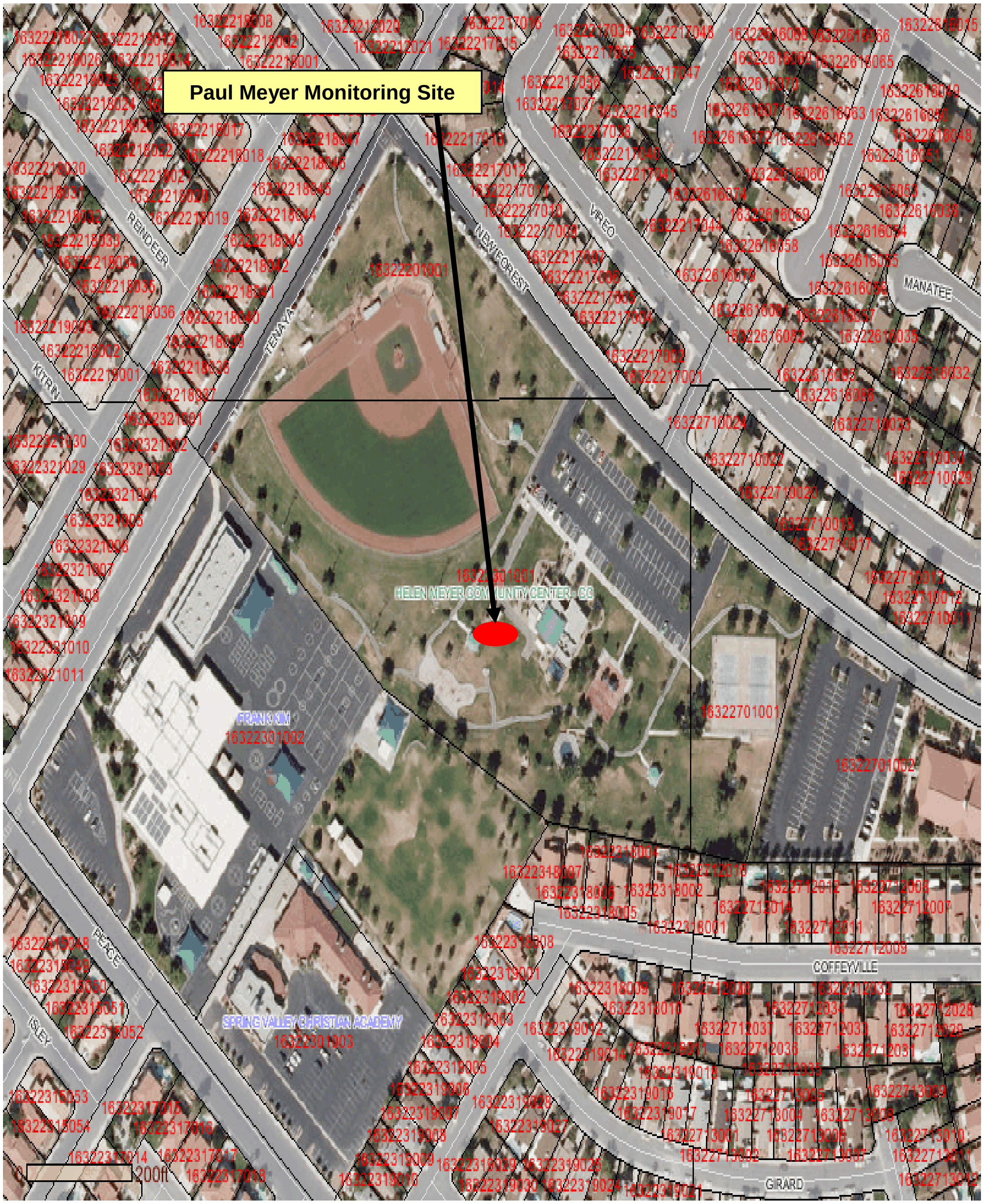

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Figure 42. Paul Meyer Monitoring Site, Aerial View #2.

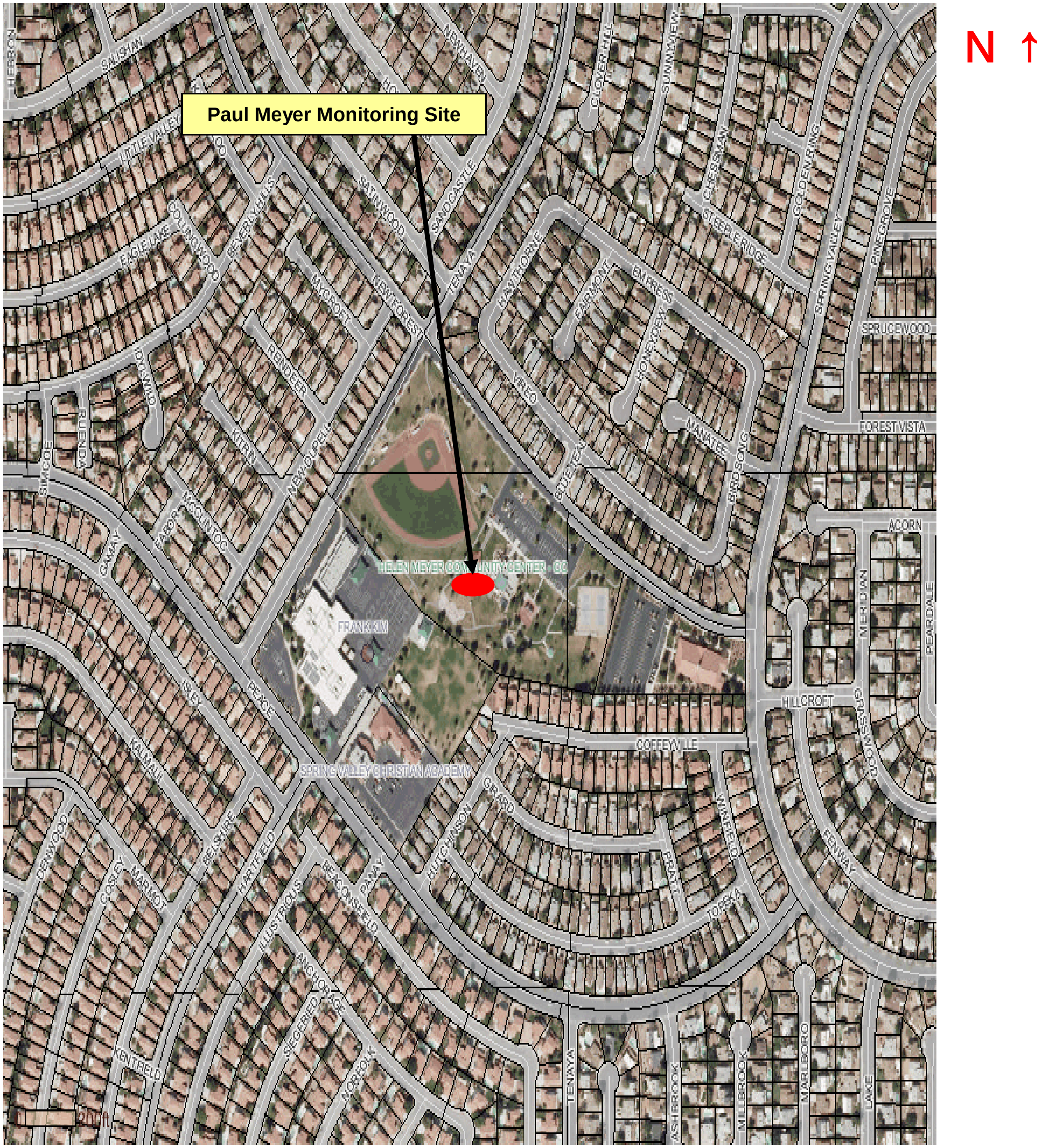


Figure 43. Paul Meyer Monitoring Site, Aerial View #3.

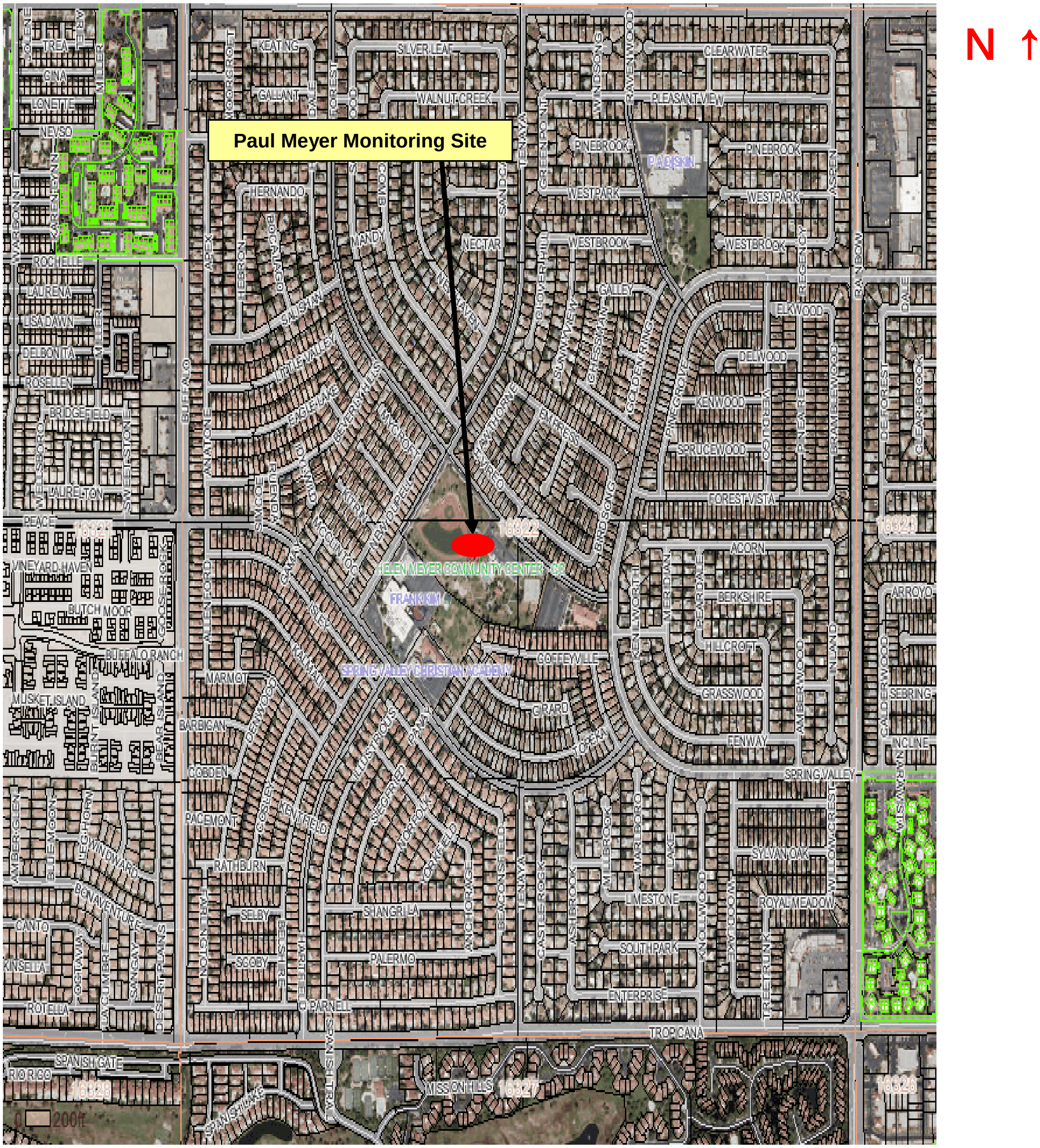


Figure 44. Paul Meyer Monitoring Site, Aerial View #4.

4.5 GREEN VALLEY

The Green Valley monitoring site (CAMS-0298, EPA 32-003-0298) (Figure 45) sits in the southern part of the Las Vegas Valley, in a predominantly residential area with commercial amenities and a large sports complex/city park. Figures 46-49 provide aerial views of the site, whose purpose is to monitor middle-scale spatial emissions of PM_{10} from individual sources in the area. The sports park and a community center surround the site, whose monitoring objective is classified as "Population Exposure." There is no major transportation route in the area.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a small contributor to PM emissions at the site. There is vacant and undeveloped land in the area of influence around the site, which has blocked access and is stabilized. A major drainage easement/flood basin area nearby also has blocked access and is stabilized. Land development has decreased the intensity of dust emissions in the area. The sports park uses the required soils to keep dust levels down during sports events, and shows signs of appropriate upkeep. The monitoring station sits inside a fenced compound next to one of the park maintenance areas, and the adjacent parking area is paved. The predominant wind direction is southwest. Occasional high concentrations occur when wind direction changes drastically, as it did during the exceptional event. However, this site had no measured PM_{10} exceedances on that day.

Figure 45. Green Valley Monitoring Site.

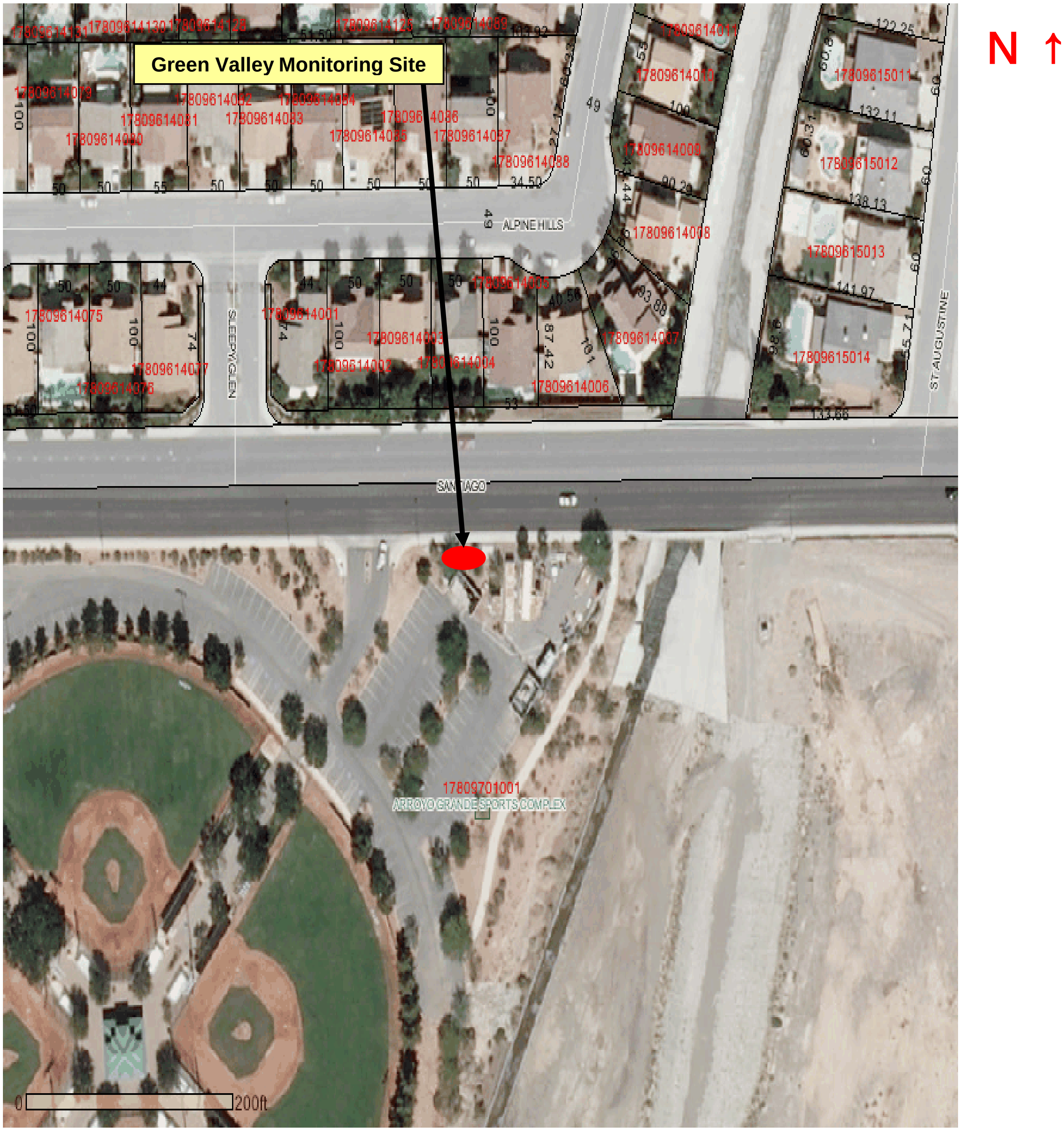


Figure 46. Green Valley Monitoring Site, Aerial View #1.

Figure 47. Green Valley Monitoring Site, Aerial View #2.

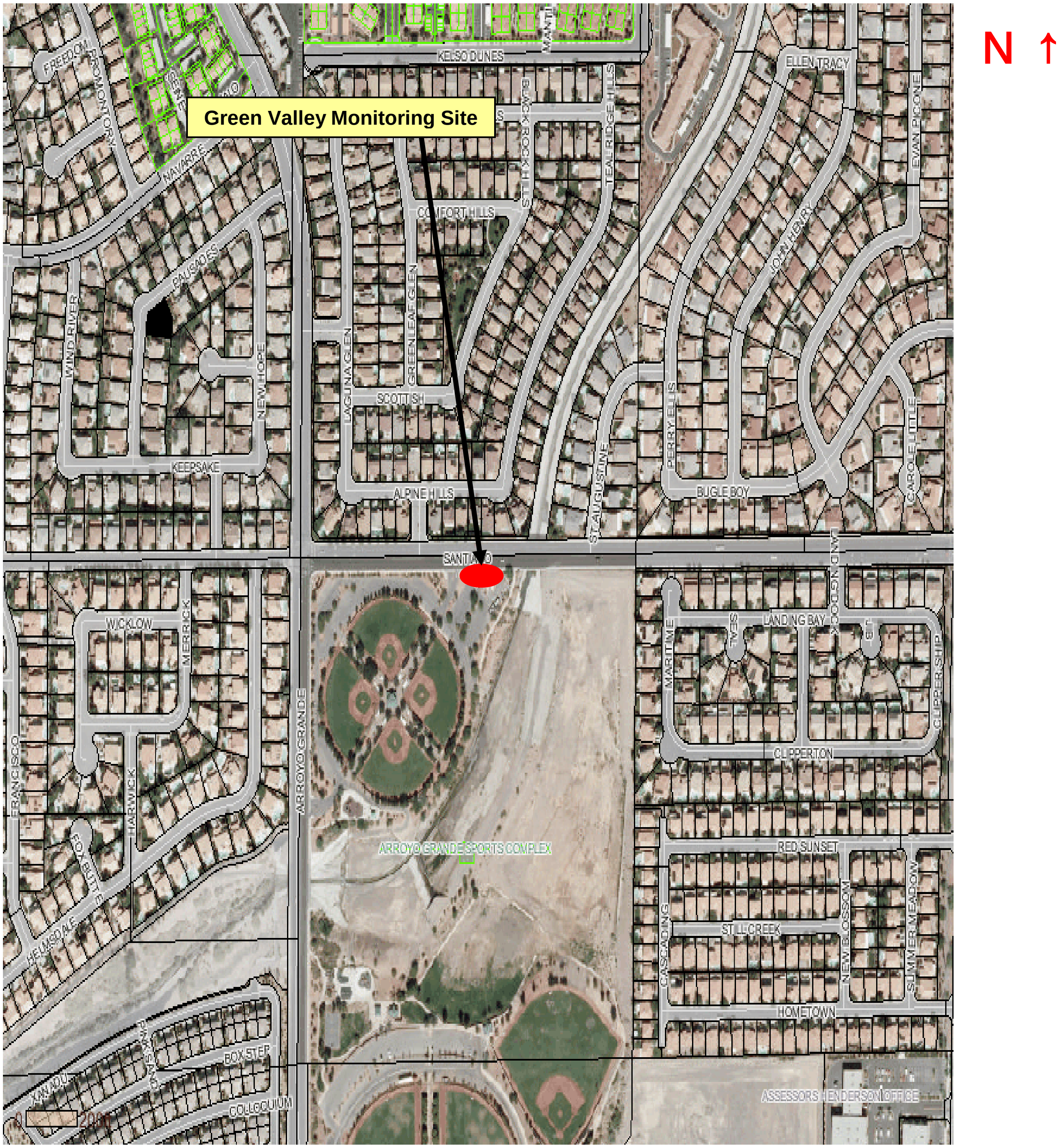


Figure 48. Green Valley Monitoring Site, Aerial View #3.

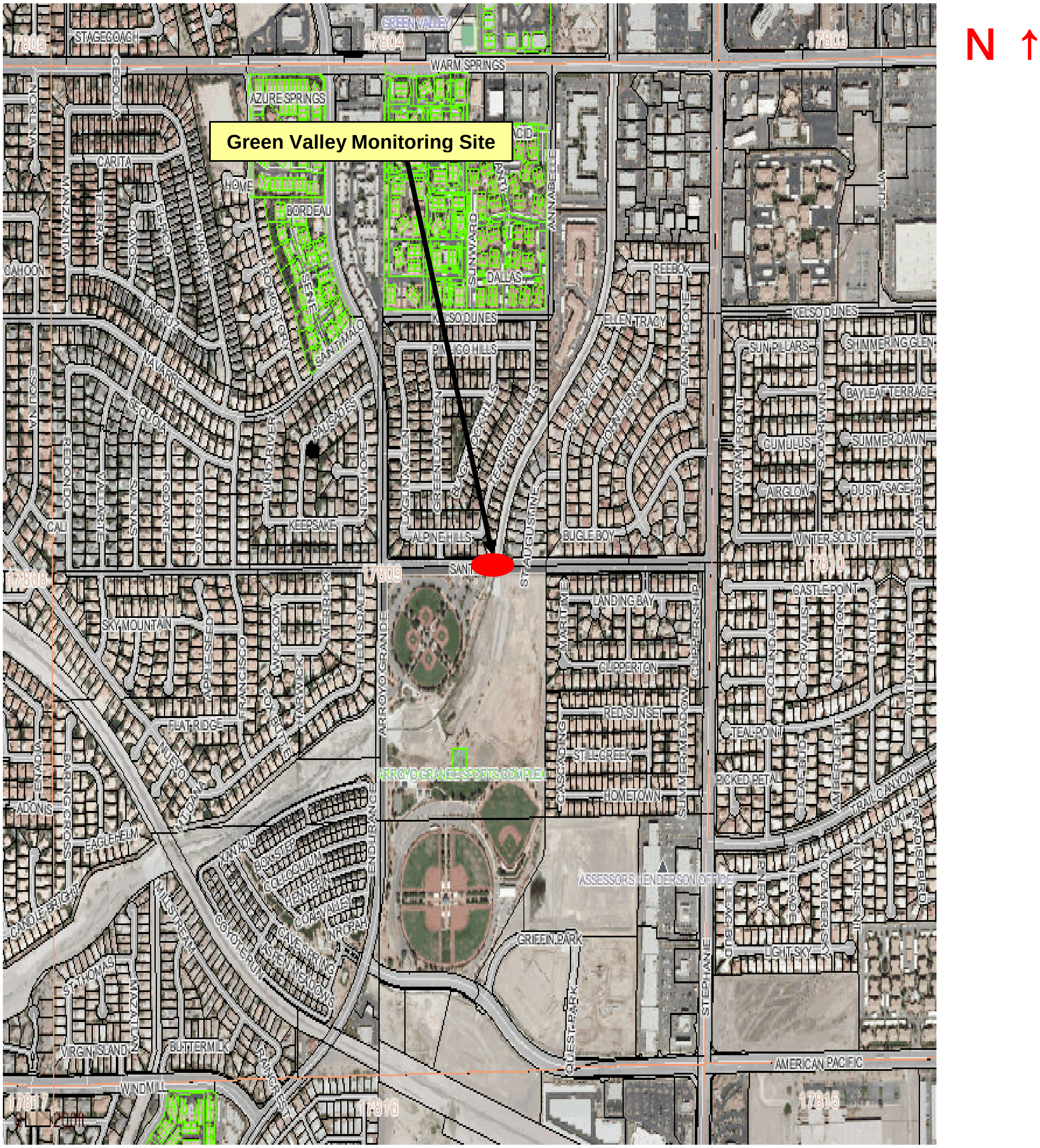


Figure 49. Green Valley Monitoring Site, Aerial View #4.

4.6 JEAN

The Jean monitoring site (CAMS-1019, EPA 32-003-1019) (Figure 50) sits in southern Clark County, off State Highway 161. Figures 51-54 provide aerial views of the site, whose purpose is to monitor regional-scale emissions of PM_{10} from local sources and transported pollutants from locations south of the Las Vegas Valley. Its monitoring objective is classified as "Background," with the primary purpose of monitoring transported pollutants from southern California. There is a major transportation route (I-15) within a mile of the site.

Paved-road dust (both $PM_{2.5}$ and PM_{10}) is a small contributor to PM emissions at the site, which is surrounded by native desert and undeveloped land (stable surfaces). Land development in Jean, east of the site, has decreased the intensity of dust emissions in the area. The monitoring station is in a fenced compound; the adjacent parking area is gravel, with a gravel access road that runs past the station to State Highway 161. The predominant wind direction is southwest. Occasional high concentrations occur when wind speed increases because of an approaching cold front or other weather event, which can bring transported pollutants into southern Nevada.

The Jean station measured high wind speeds earlier than the Las Vegas stations on the day of the exceptional event. The shift in wind direction before and during the frontal passage elevated PM_{10} concentrations on February 13; however, the site had no measured PM_{10} exceedances.

Figure 50. Jean Monitoring Site.

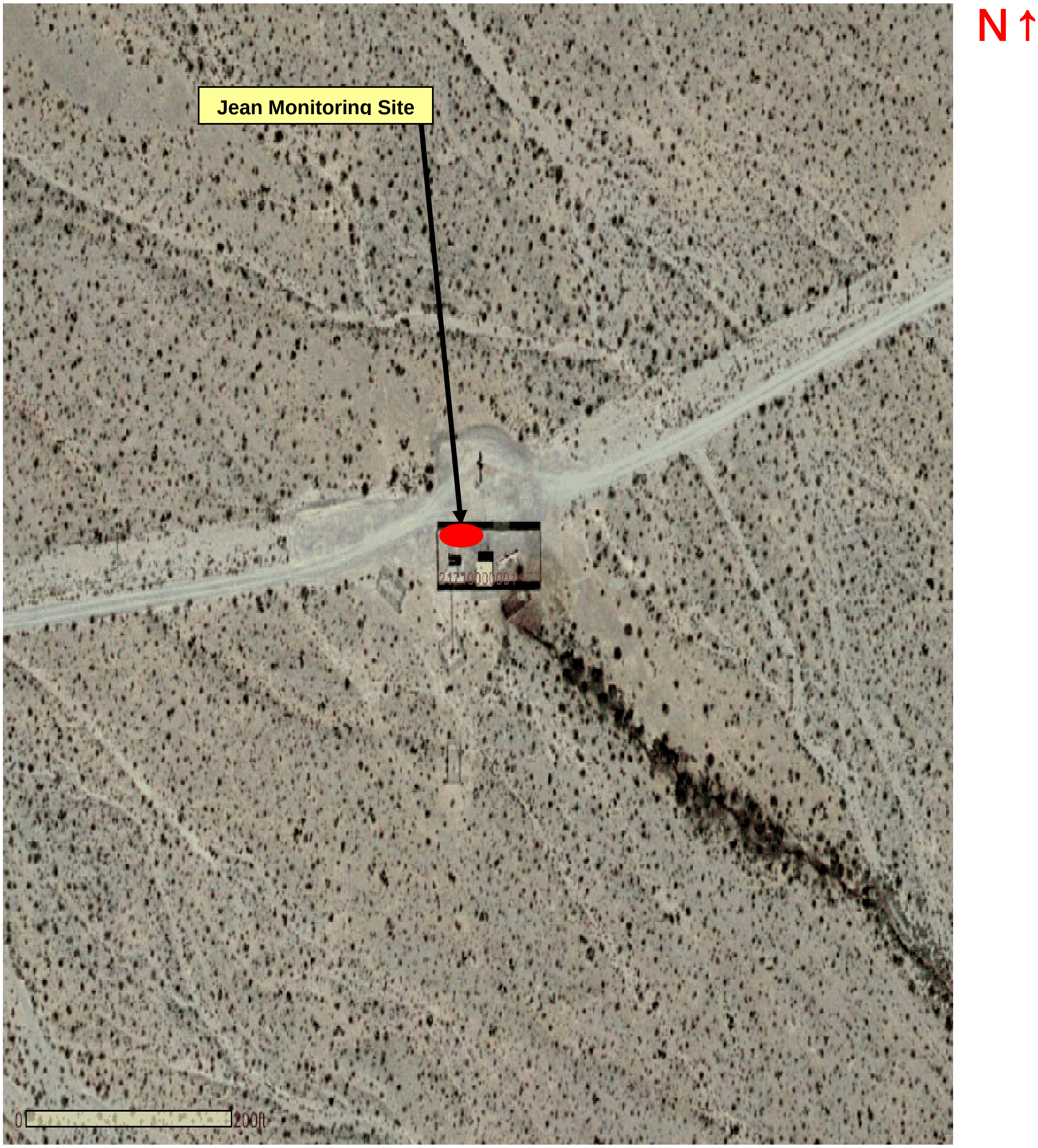


Figure 51. Jean Monitoring Site, Aerial View #1.

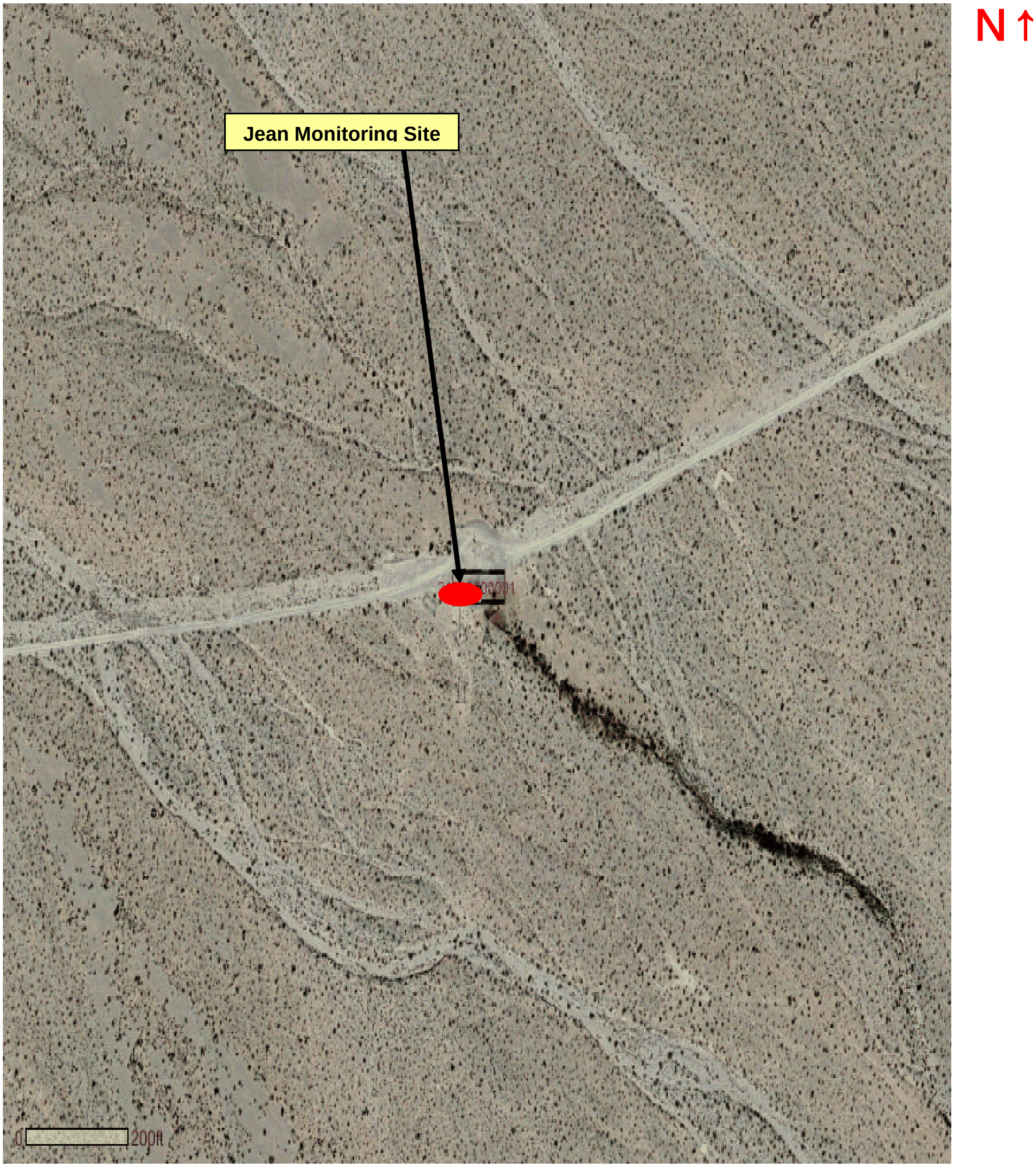


Figure 52. Jean Monitoring Site, Aerial View #2.

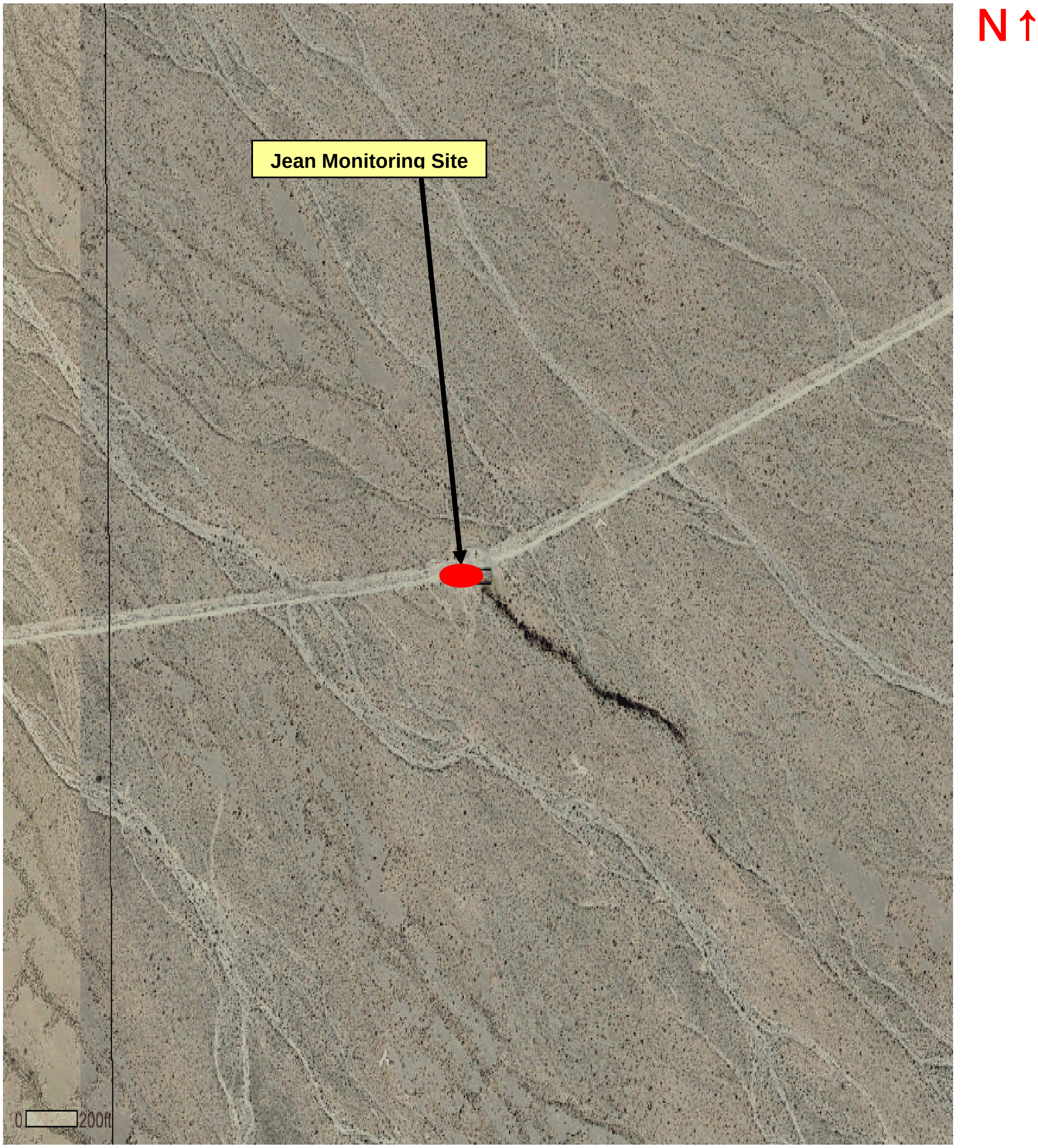


Figure 53. Jean Monitoring Site, Aerial View #3.

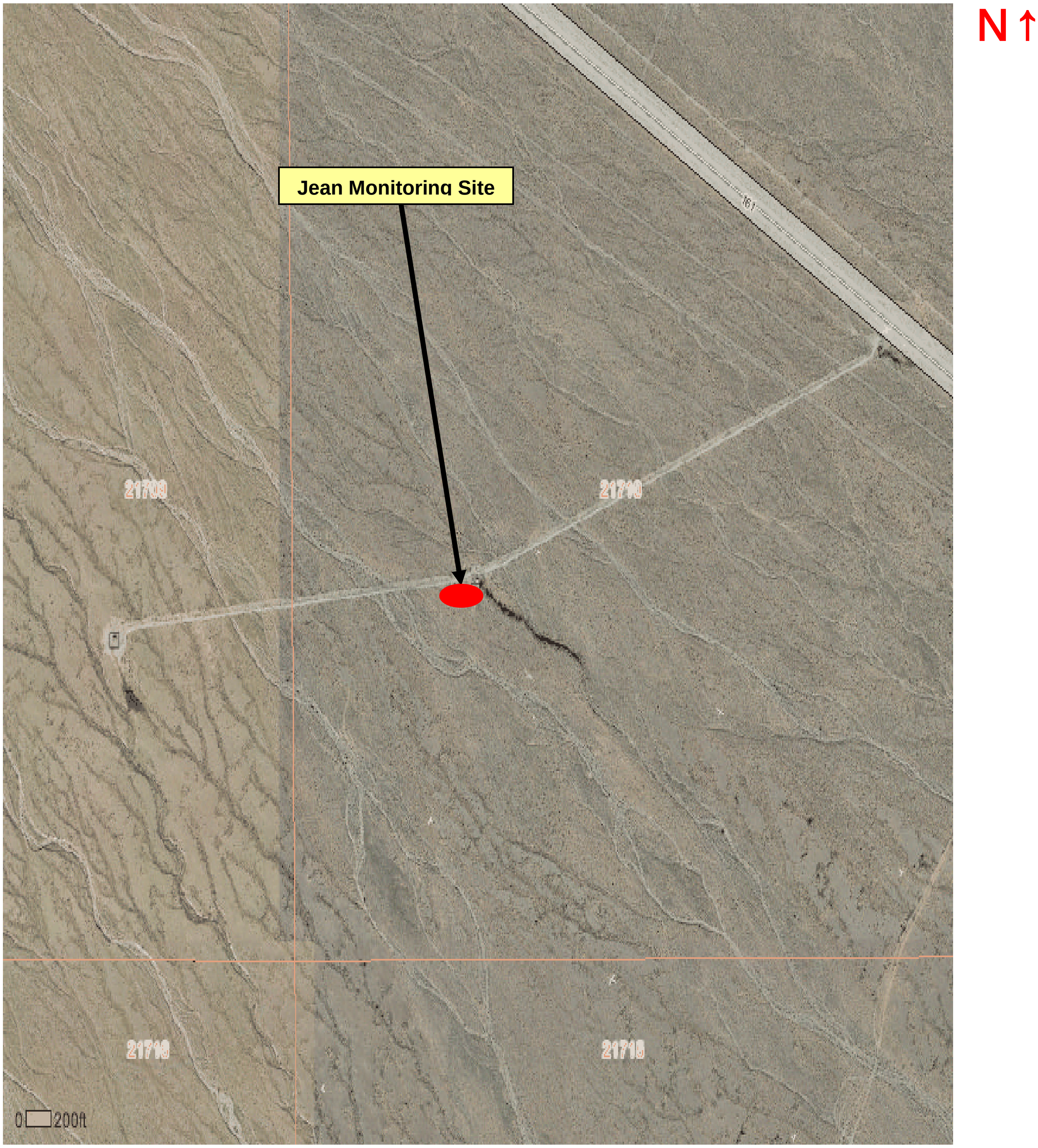


Figure 54. Jean Monitoring Site, Aerial View #4.

5.0 COMPLIANCE AND ENFORCEMENT ACTIVITY

5.1 BEST AVAILABLE CONTROL MEASURES

AQR Sections 90, 91, 92, 93, and 94 cover the BACM applicable to the single exceedance site. These regulations require stabilization of open areas and disturbed vacant lands; stabilization of unpaved roads; stabilization of unpaved parking lots; stabilization of unpaved shoulders on paved roads; and use of soil-specific best management practices for construction activities.

On February 12, 2008, the day before the event, 17 enforcement officers were active in the field, 15 on ten-hour shifts and 2 on nine-hour shifts. Five management and administrative staff were supporting field enforcement efforts. All 17 officers continued enforcement activities until approximately 1800 PST, depending on their location. Inspectors contacted 51 permitted construction sites that day, and by 1730, few were still active. One standby officer was on duty from 1700 to 2200; one dust complaint was called in, and a Corrective Action Order (CAO) was issued to Spirit Underground for track-out issues.

Many permitted construction sites had prepared for the high winds forecast for February 13, based on a faxed construction notice (Appendix D, Attachment 1) or other considerations. Only a few sites were not in compliance. Most contractors were aware of the notice and responded appropriately, using their training from DAQEM’s dust control classes. However, enforcement officers issued 15 CAOs for failure to employ BACM and fugitive dust violations. Problems observed included track-out; dust control permits that were missing, expired, or not on site; lack of dust control records for self-inspection; absent gravel pad; and material loading without adequate mitigation. A total of 1,406 construction notices were sent for this wind event on February 12: 1,162 were sent via fax, 135 were sent via e-mail, and 109 failed to reach the intended recipient. Enforcement staff conducted follow-up inspections to ensure AQR compliance at sites that received a CAO and issued one Notice of Violation (NOV) to Meadow Valley Contractors for failing to employ BACM and for staging equipment on the property that was not covered by the dust permit issued for the site. The NOV was approved by the Air Pollution Control (APC) Hearing Officer on June 25, 2008, whereby Meadow Valley Contractors was found in violation and assessed a civil penalty which was paid.

On February 13, 2008, the day of the event, 23 enforcement officers were active in the field, 21 on ten-hour shifts and 2 on nine-hour shifts. Five management and administrative staff were supporting field enforcement efforts. All 23 officers continued enforcement activities until approximately 1800 PST, depending on their location. Inspectors contacted 66 construction sites, and by 1730, few were still active. One standby officer was on duty from 1700 to 2200. Three dust complaints were called into the standby officer, and one CAO was issued to Fantasy Construction for fugitive dust and failure to employ BACM. Attachment 2 in Appendix D provides a full list of site inspections, along with CAOs, and NOVs issued that day.

Many Permitted construction sites had prepared for high winds on February 13, based on the faxed dust advisory (Appendix D, Attachment 3) or other considerations. However, some sites were not in compliance. Most contractors were aware of the advisory and responded appropriately, using the training from their DAQEM dust classes. However, officers issued 34

CAOs for failure to employ BACM and fugitive violations at permitted construction. Problems observed included track-out; dust control permits that were missing, expired, or not on site; lack of dust control records for self-inspection; failure to post a dust control permit sign on-site in public view; failure to employ BACM; and material loading without adequate mitigation. Ten CAOs were issued for fugitive dust violations on privately held vacant land.

A total of 1,408 construction notices were sent for this wind event on February 13: 1,165 were sent via fax, 136 were sent via e-mail, and 107 failed to reach the intended recipient. The procedure for unsuccessful batch faxes is to review the failed faxed confirmation list provided by the DAQEM Information Technology section. Faxes that do not transmit to any company with three or more active dust control permits receive a follow-up call from Compliance staff to verify the fax number for a manual resend. If that is unsuccessful, staff call the company's landline and, at a minimum, read the dust advisory fax aloud over the phone.

On February 13, Compliance staff conducted follow-up inspections to assure AQR compliance at sites issued a CAO. Enforcement officers issued seven NOVs: (1) Helix Construction, for failure to employ BACM and fugitive dust crossing over the property line; (2) R.P. Weddell and Sons, for no active dust control permit; (3) PH Metro; (4) TWC Construction, for failure to employ BACM, improper acreage on dust permit, and fugitive dust issues; (5) Oltman's Construction, for failure to employ BACM and fugitive dust issues; (6) KB Home Nevada, Inc., for failure to employ BACM and fugitive dust issues; and (7) R.G. & Associates Development LLC, for failure to employ BACM, improper acreage on dust permit, and not having a dust control permit at the work site. DAQEM is not aware of any other construction site operators that failed to curtail construction activities in accordance with the high-wind provisions of Section 94 of the AQRs on the exceedance day. All the NOVs went to the APC Hearing Officer on June 25, 2008, except the one for TWC Construction, which went to the APC Hearing Officer on August 13, 2008. Oltman's Construction was the only company that contested its violation; however, it failed to appear in front of the APC Hearing Officer. Fines were assessed and paid by all contractors. Attachment 2 in Appendix D provides a full list of site inspections, along with CAOs and NOVs issued that day.

On February 14, 2008, the day after the event, DAQEM enforcement officers revisited problem sites from the day before and conducted their daily site inspections. Eighteen officers were active in the field, 16 on ten-hour shifts and 2 on nine-hour shifts. Five management and administrative staff were supporting field enforcement efforts. All 18 officers continued enforcement activities until approximately 1800 PST, depending on their location. Inspectors contacted 20 active construction sites. From 1700 to 2200, one standby officer was on duty; however, the officer received no calls after hours. Enforcement officers issued three NOVs for February 14: (1) Western States Contracting, for failure to employ BACM and fugitive dust violations; (2) Howard Hughes Corporation, for failure to employ BACM and fugitive dust violations; and (3) Hunt Building Company, for failing to comply with a CAO issued on February 13 for failure to employ BACM and fugitive dust violations. Attachment 2 in Appendix D provides a full list of site inspections, along with CAOs and NOVs issued that day.

All enforcement activity occurred within 24 hours of the exceptional event. This enhanced enforcement activity likely reduced the potential for exceedances of the PM_{10} 24-hour NAAQS in the Las Vegas Valley. The three-hour event took place in late evening, when all construction activity had stopped. Minimal population exposure occurred during the high concentrations of PM_{10} at the East Craig Road station in North Las Vegas on February 13, 2008; the site is surrounded by warehouses, batch plants, and other facilities that were closed during the event.

5.2 PRECIPITATION IN POTENTIAL FUGITIVE DUST SOURCE REGION

Figures 55 and 56 show 2007 and 2008 departures from normal precipitation in Nevada. By February 13, 2008, the Las Vegas Valley had received only 0.7 inches of measurable precipitation, according to National Weather Service records (Table 10). The absence of precipitation increased the amount of fugitive dust generated from native desert soils during the high wind event that day.

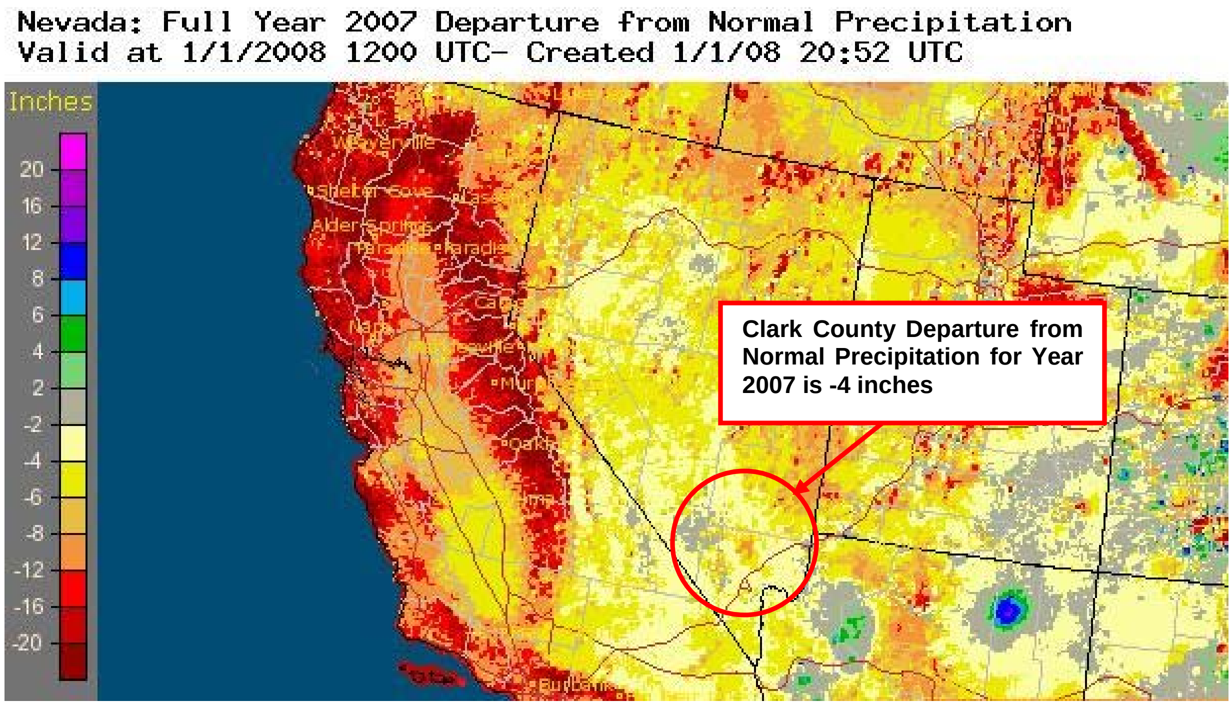
Soil moisture content is a significant factor in high wind dust events. The predominant soils in the area around the East Craig Road site were classified as “Moderate Low” in moisture content during a 2003 survey conducted to develop the particulate emission potential map (Figure 57). Soils with low moisture content during the driest time of the year are more easily entrained by strong winds; even with 100 percent BACM in place, stabilized native desert areas will emit dust when winds are at threshold levels (Section 5.3).

Table 10 demonstrates that the period preceding the high wind event in Clark County was not damp enough to limit blowing dust. The last rain event before February 13 was recorded at the North Las Vegas Airport on February 3, 2008, where 0.5 of an inch was recorded (Figures 58 and 59). Figure 60 shows that no measurable precipitation occurred on February 13.

5.3 ESTABLISHING WIND THRESHOLDS FOR CLARK COUNTY

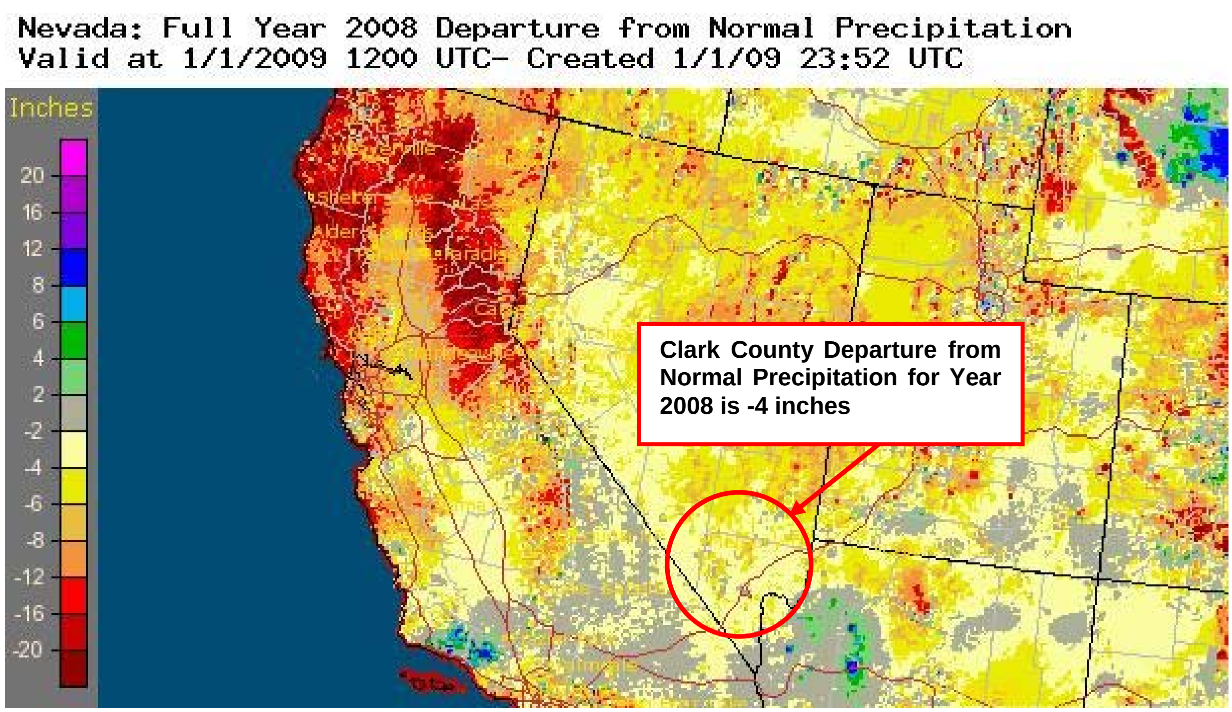
A key element in the DAQEM exceptional event action program was the determination of what speed thresholds wind overwhelmed undisturbed native soil surfaces and disturbed soil surfaces treated with BACM to generate sustained particulate emissions. Based on empirical wind tunnel studies described in this section, Clark County through its DAQEM established wind thresholds of sustained winds of 25 miles per hour or more, and/or wind gusts of 40 miles per hour or more, as the speeds at which winds will typically generate sustained emissions in the Las Vegas Valley. These wind speed thresholds are a key criterion for defining an exceptional event. Winds below these thresholds generally do not generate sustained particulate emissions from undisturbed native soils or disturbed soils treated with BACM and are therefore not considered exceptional events.

DAQEM conducted several wind tunnel studies with the University of Nevada, Las Vegas (UNLV) to establish emission factors for native desert and disturbed open areas and to validate the wind thresholds necessary for re-entrainment of soils. Appendix B of the PM_{10} SIP documents the wind tunnel tests and baseline studies from which UNLV developed the original emission factors for native desert soils. In 2003, DAQEM committed to additional studies to refine these emission factors. Appendix C contains the final report on these studies.



Source: National Weather Service
California-Nevada River Forecast Center

Figure 55. Nevada Departure from Normal Precipitation, 2007.



Source: National Weather Service
California-Nevada River Forecast Center

Figure 56. Nevada Departure from Normal Precipitation, 2008.

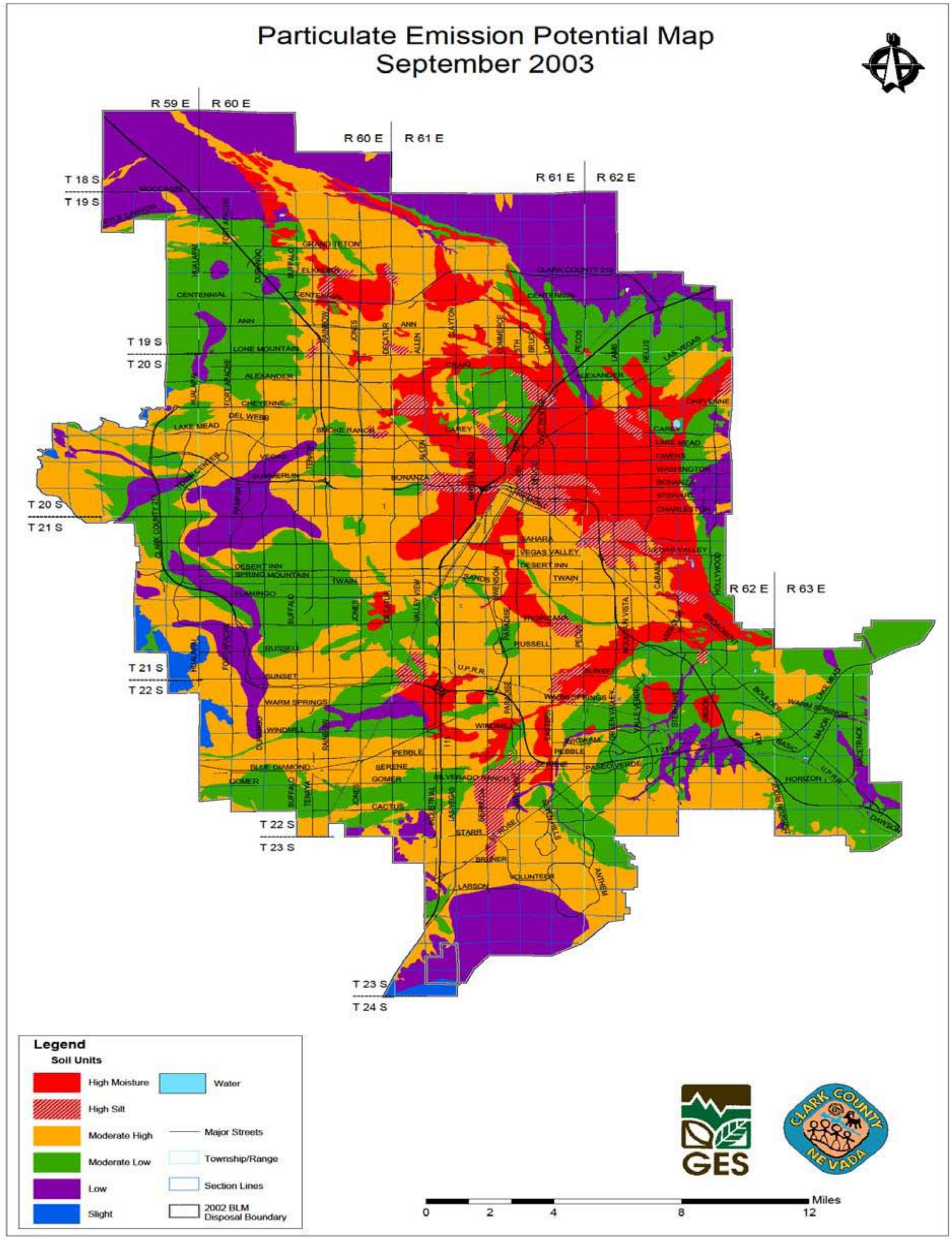
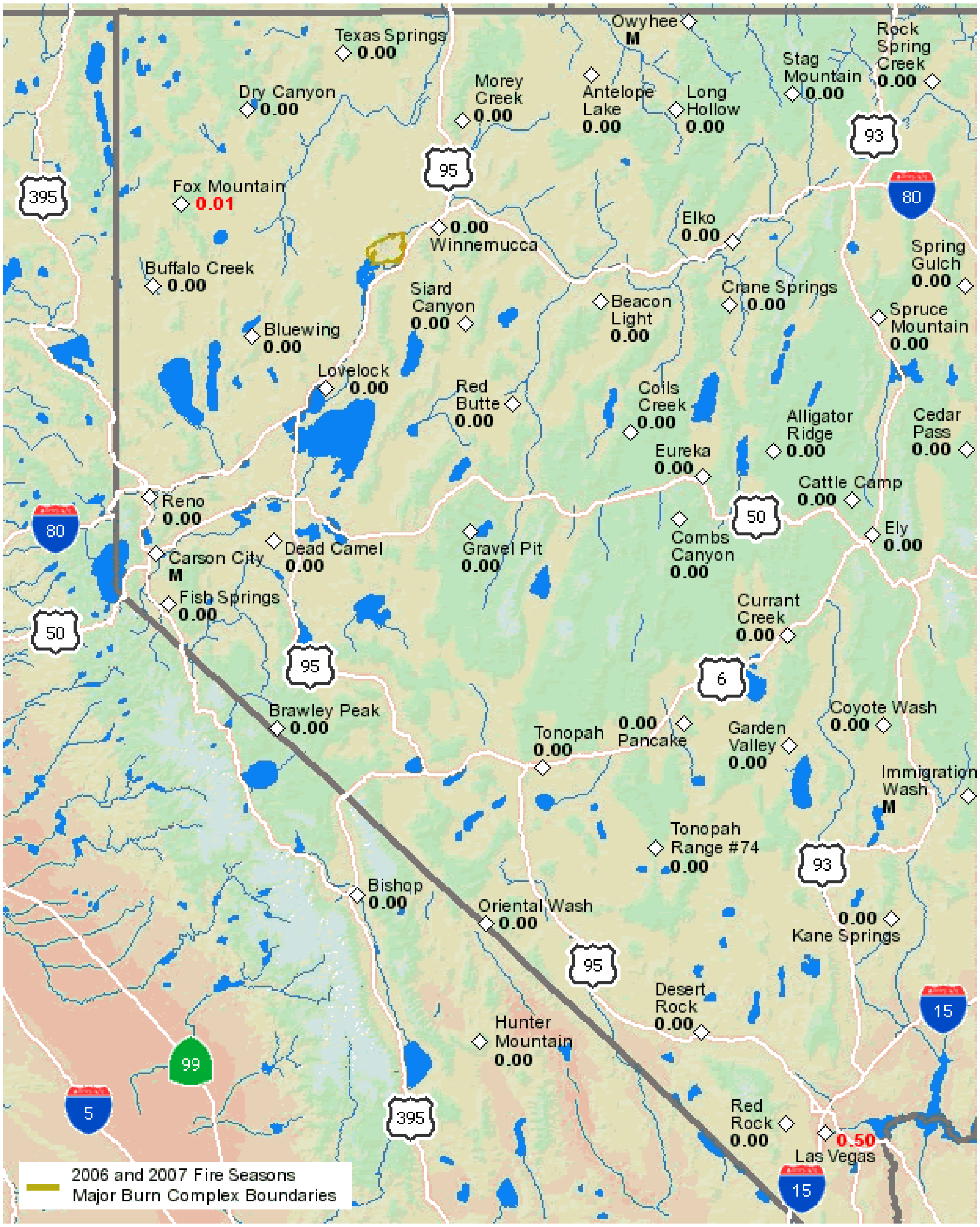


Figure 57. Particulate Emissions Potential Map of Las Vegas Valley, September 2003.

Table 10. Precipitation Summary for October 2007 to September 2008 (water year 2008)

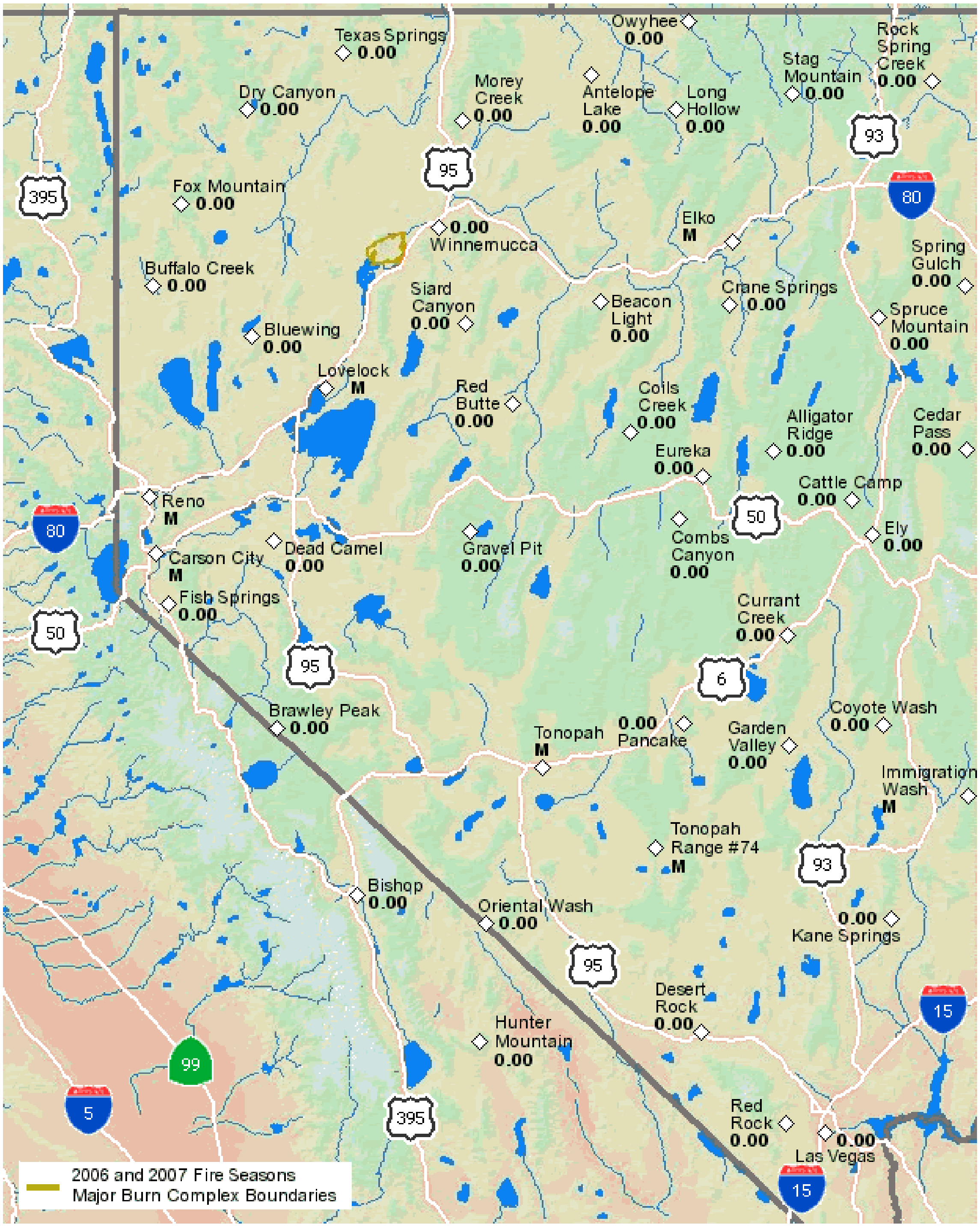
LOWER COLORADO															
ID	**Location**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**WY to Date**	**Pct Avg to Date**	**Pct Tot WY**
BLH	Blythe	0	1.11	0	0.77	0.02	0	0	0.19	0	0	0.15	0.06	2.3	57	57
BULA3	Bullhead City	0	0.15	1.13	2.07	0.59	0	0	0.12	0	0.2	0.68	0	4.94	85	85
CALN2	Caliente	0.01	0	1.47	1.27	0.85	0.17	0	0.22	0	2.04	0.1	0.07	6.2	63	63
DNWN2	Desert Nat'l Wildlife Refuge	0	0	0.7	0.68	0.07	0	0	0.01	0.02	0.88	0	M	M		
EED	Needles	0	0.73	0.31	1.1	0.49	0.02	0	0	M	M	M	M	M		
EGNN2	Elgin	0.03	0.6	3.28	1.98	1.75	0.24	0	0.93	0	1.1	0.51	M	M		
GUNU1	Gunlock Power House	M	M	M	M	M	M	0	0.89	0.02	0.7	0.06	0.06	M		
HIKN2	Hiko	0	0	1.23	0.76	1.36	0.07	0	0.31	0	1.25	0	0	4.98	86	86
LAUN2	Laughlin	0	0.05	1.76	2.04	0.47	0.02	0	0.1	0	0.26	0.43	0	5.13	122	122
LAVU1	La Verkin	0	0.46	2.9	2.19	2.2	0.14	0.03	0.21	0.11	1.55	0.24	0.02	10.05	84	84
LHCA3	Lake Havasu City	0	0.28	1.08	1.14	0.36	0	0	0.27	0	0.05	0.81	0	3.99	NA	NA
LUNN2	Lund	0.54	0	0.99	0.91	1.54	0.27	0	0.43	0.25	0.12	0.1	0.27	5.42	49	49
PWMN2	Pahranagat Wildlife Refuge	0	0	1.1	0.86	0.86	0.21	0	M	0	0.19	0.04	0	M		
SGUU1	St. George	0	1.2	2.91	0.59	1.32	0.2	0	0	0.05	0.16	0.16	0	6.59	75	75
SPVN2	Spring Valley State Park	0	0.1	1.82	1.36	2.43	0.28	0	0.56	0.14	2.61	0.35	0.12	9.77	80	80
SRCN2	Searchlight	0	0	1.82	1.52	0.96	0.08	0	0.3	0	0.52	1.3	0	6.5	78	78
SUNN2	Sunnyside	M	0	0.94	0.88	1.36	0.38	M	M	0	0.05	M	M	M		
VEF	Las Vegas	0	0.61	0.08	0.62	0.11	0.1	0	0.07	0	0.21	0.13	0.04	1.97	43	43
VEYU1	Veyo Power House	0	0.28	3.4	1.53	2.21	0.2	0	1.1	0.08	1.61	0.35	0.12	10.88	72	72
VOFN2	Valley of Fire State Park	0	0	1.66	0.13	0.33	0	0	0.48	0	0.32	0.03	0.05	3	46	46
WUPA3	Wikieup	0.05	0	1.5	2.29	0.96	0.03	0	0	0	0.88	2.63	0	8.34	84	84
YUM	Yuma	0	0.65	0.02	M	M	M	M	M	M	M	M	M	M		

Source: California-Nevada River Forecast Center, National Weather Service.



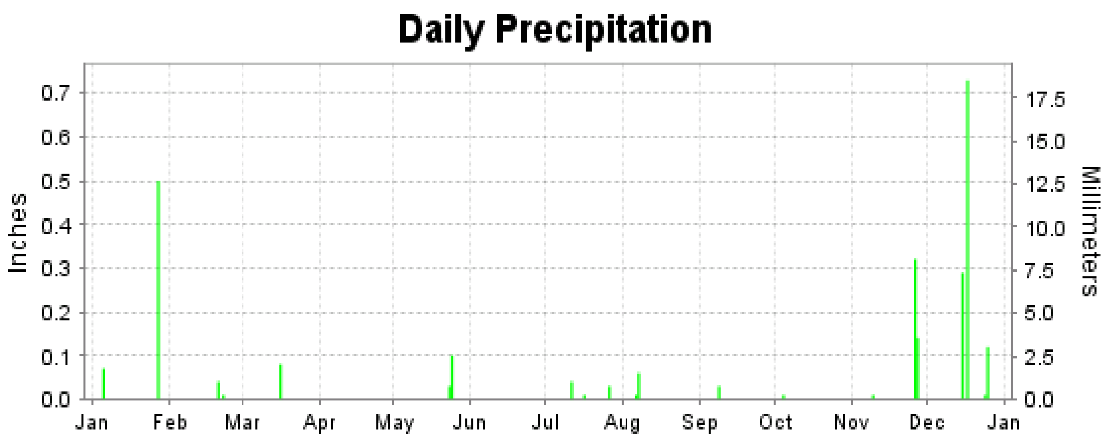
24 Hour Synoptic Precipitation (Inches) Ending Tue Feb 05 2008 at 12 UTC
NOAA / NWS / California Nevada River Forecast Center

Figure 58. Precipitation at North Las Vegas Airport on February 3, 2008.



24 Hour Synoptic Precipitation (Inches) Ending Wed Feb 13 2008 at 12 UTC
NOAA / NWS / California Nevada River Forecast Center

Figure 59. Precipitation at McCarran International Airport on February 13, 2008.



Source: National Weather Service, California-Nevada River Forecast Center

Figure 60. Daily Precipitation in Las Vegas Valley, 2008.

Data from UNLV wind tunnel tests showed that surface condition had more influence on the windblown particulate emission rate than soil classification or wind erodibility group. Characterizing undeveloped vacant land as “native desert,” “stable,” or “unstable” simplified application and provided a basis for using appropriate emissions factors. The 2004 refined emission factors study validated this approach.

Study data showed that fugitive dust emissions from undisturbed native desert soil increase considerably when average wind speeds exceed 25 mph, so that was where the wind threshold for native desert parcels was set. Since average hourly wind speeds did not reach that threshold on the design day, emissions for this category were set to zero. The 2004 study findings indicated that emission factors for the undisturbed native desert category were unchanged from the 1995 factors used in the 2001 Clark County PM_{10} SIP.

In 2006, UNLV used wind tunnel tests to deter mine the emissions factor for each soil type and surface condition in the Las Vegas Valley (James et al. 2006). To maximize data collection, UNLV first conducted tests on undisturbed locations in each test area, then mechanically disturbed the site and conducted a second set of tests. The findings and emissions factors in UNLV’s 2006 study validated the emissions factors in the PM_{10} SIP (Appendix C).

As Appendix B of the PM_{10} SIP describes (p. B-21), and recent UNLV studies have demonstrated, sustained wind speeds exceeding the 25 mph threshold, with wind gusts of 40-miles per hour or greater overwhelm the native desert environment and stabilized vacant land areas. Because of the unusual threshold-qualifying winds during the exceptional event, the East Craig Road monitoring site exceeded the PM_{10} 24-hour NAAQS.

6.0 CONCLUSION

DAQEM investigated emission-generating activities before, during, and after the high wind episode and found that PM_{10} emissions for BACM-controlled sources were well controlled throughout. DAQEM therefore concludes that the PM_{10} exceedance would not have occurred without the high winds that re-entrained surface dust. Based on the evidence of a high-wind natural event set forth in this report, Clark County through its DAQEM requests that EPA support the flagging of the PM_{10} exceedance at the East Craig Road monitoring site on February 13, 2008, in the AQS.