Clark County Department of Air Quality & Environmental Management

Exceptional Event Documentation for

May 21, 2008, PM_{10} High-Wind Exceedance Event

March 31, 2011

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ACRONYMS AND ABBREVIATIONS

Acronyms

APC	Air Pollution Control
AFB	Air Force Base
AQI	Air Quality Index
AQR	Clark County Air Quality Regulation
AQS	Air Quality System
BACM	Best Available Control Measures
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
PDT	Pacific Daylight Time
SIP	State Implementation Plan
SRRS	Service Records Retention System

Abbreviations

agl	above ground level
mb	millibar
mph	miles per hour
$\mu g/m^3$	micrograms per cubic meter
$PM_{2.5}$	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 documentation. The DAQEM prepared this document to achieve three objectives. First, the high PM_{10} concentration recorded on May 21, 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 May 21, 2008, was due to an exceptional high-wind event. Second, Clark County wishes to eliminate consideration of the May 21, 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 May 21, 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 May 21, 2008 exceptional event is conceptually characterized as a high-wind event. First, a surface reservoir of dust evolved in the region over a period of three to four days, with no precipitation and light winds. Second, a short period preceding the arrival of a cold front brought wind speeds high enough to raise airborne dust. The entrained dust was kept aloft, and more was generated, by the turbulence and higher wind speeds associated with the rapidly moving cold front passing through the region. The single hour period during the extremely high wind speeds and the frontal passage was sufficient to trigger the PM_{10} exceedance for the day.

Clark County through its 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 May 21, 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 33 mph and gusts up to 44 mph. During the same time period the North Las Vegas Airport recorded sustained winds up to 36 mph and gust up to 49 mph. For the Nellis Air Force Base the sustained winds reached 34 mph with wind gust to 45 mph. During this wind event, the East Craig Road monitoring site in Clark County recorded a 24-hour average PM_{10} concentration of 168 $\mu g/m^3$, the second highest 24-hour average PM_{10} concentration recorded in years 2005 through 2008. The only higher concentration recorded during this time was on February 13, 2008, also characterized as an exceptional high-wind event.

Anthropogenic sources near the site played only a small role in PM_{10} levels. Clark County 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 1,417 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 May 21, 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 May 21, 2008. Subsections 1.3 and 1.4 of the report summarize the characteristics of the Valley with respect to predominant seasons and weather.

Subsections 2.1, 2.2, and 2.3 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; §2.4.1.2 explains why the event was not reasonably controllable or preventable; §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 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 weather prior to the event of May 21, 2008. §3.1.5 presents weather data during the event using weather charts, data tables, graphs, and maps. §3.1.6 presents 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.)

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 at **J. D. Smith**, which did not exceed but showed similar trends.

Section 5.0 Compliance and Enforcement Activity covers Clark County SIP-required Best Available Control Measures (BACM). Discussions include activities the DAQEM took prior to the forecasted event, during the event, and after the event as follow-up to correction action orders (CAOs) and notices of violations (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 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 thresholds of sustained winds of 25 mph and/or gusts 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 of flagging the May 21, 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 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 whether 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 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 that 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, after which DAQEM may make revisions to the documentation. The documentation is then submitted to EPA for review and consideration for concurrence.

1.5 HIGH-WIND DUST EVENT

On May 21, 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. The Clark County DAQEM has reviewed the related data and determined that a high-wind natural event caused this exceedance. The U.S. Environmental Protection Agency (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 demonstrates the causal relationship between an exceedance on May 21, 2008, and a corresponding high-wind event in the Las Vegas Valley.

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

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

212, a PM_{10} nonattainment area. All six of the monitoring sites discussed in this exceptional event package are located in the Las Vegas Valley.

Official weather observations began in 1937 at what is now Nellis Air Force Base (AFB). In 1948, the U.S. Weather Bureau moved to McCarran Field (now McCarran International Airport), 7 miles south of downtown Las Vegas. The airport is approximately 5 miles southwest of, and 300 feet higher than, the lowest part of the valley.

Beyond formal climatic data publications, there is very little material 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 miles per hour (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 May 21, 2008 High Wind Exceptional Event document and the supporting Appendices on the Clark County DAQEM website for a 30-day comment period effective February 21, 2011 through March 25, 2011 at 5:00 PM. Clark County received no comments on the document or the appendices by close of business on March 25, 2011.

See Appendix E for the official web postings on the DAQEM web page.

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

2.0 EXCEPTIONAL EVENT DOCUMENTATION

2.1 SUMMARY OF EVENT DAY

On May 21, 2008, sustained high winds and strong wind gusts in the early morning throughout the Las Vegas Valley entrained dust into the atmosphere, causing PM_{10} exceedances at one site in the DAQEM monitoring network (Figure -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 showed an exceedance (Appendix A, Attachments 1–8). The wind direction varied southwest to north by northwest. The monitoring site that exceeded the NAAQS began recording very high PM_{10} masses at approximately 0300 Pacific Daylight Time (PDT), with the resulting high PM_{10} hourly concentrations. Anthropogenic sources near the monitoring site played only a small role in the PM_{10} levels at the site(see Figure 28 through 32).; Clark County 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 winds on this day were high enough to overwhelm all control measures. Therefore, this natural (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 DAQEM's *Natural Events Action Plan for High-Wind Events* (NEAP) for Clark County 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 the 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 Clean Air Act (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 particulate emissions 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 (CAA), as amended 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, as amended 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, as amended 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 May 21, 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 monitoring 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 hours of 0300 and 1000 PDT. Figure 1a shows the speeds of hourly sustained winds and the hourly average of maximum wind gusts on the event day.

Table 1. East Craig Road Monitoring Data for May 20, 2008

Year	Month	Day	Time	Wind Speed	Wind Dir.	Max. Gust	PM_{10} Concentration	PM_{10} Mass Accumulation
2008	5	20	0000	1.9	164	5.4	33	110
2008	5	20	0100	2.5	124	9	35	66
2008	5	20	0200	1.2	5	6.1	49	116
2008	5	20	0300	2.3	41	7.3	58	174
2008	5	20	0400	2.9	324	6.5	64	239
2008	5	20	0500	2	324	5	56	299
2008	5	20	0600	3.2	116	7.4	109	407
2008	5	20	0700	3.9	94	9.4	58	469
2008	5	20	0800	8.7	167	20.7	53	523
2008	5	20	0900	11.9	182	24	60	588
2008	5	20	1000	15.1	176	29.8	106	697
2008	5	20	1100	15.2	195	29.8	163	859
2008	5	20	1200	16.5	206	32.7	98	957
2008	5	20	1300	14	214	30.6	64	1023
2008	5	20	1400	11.3	211	26.1	36	1059
2008	5	20	1500	13.2	206	26.3	53	1113
2008	5	20	1600	11	229	20.5	43	1162
2008	5	20	1700	12.8	231	26.4	37	1198
2008	5	20	1800	13.5	227	26.4	47	1246
2008	5	20	1900	14	210	26.5	53	1300

Year	Month	Day	Time	Wind Speed	Wind Dir.	Max. Gust	PM_{10} Concentration	PM_{10} Mass Accumulation
2008	5	20	2000	13.2	207	27.3	63	1363
2008	5	20	2100	14.2	219	27.3	53	1419
2008	5	20	2200	15	227	30.8	69	999
2008	5	20	2300	11.6	212	25.7	96	108

Table 2. East Craig Road Monitoring Data for May 22, 2008

Year	Month	Day	Time	Wind Speed	Wind Dir.	Max. Gust	PM_{10} Concentration	PM_{10} Mass Accumulation
2008	5	22	0000	13.7	306	23.0	19	100
2008	5	22	0100	13.3	307	23.5	18	46
2008	5	22	0200	13.4	306	22.6	12	62
2008	5	22	0300	17.1	305	28.1	7	69
2008	5	22	0400	15.2	305	26.0	19	91
2008	5	22	0500	17.3	305	29.5	28	116
2008	5	22	0600	18.7	304	31.2	19	137
2008	5	22	0700	16.9	304	30.3	27	161
2008	5	22	0800	15.8	309	31.5	20	183
2008	5	22	0900	13.3	309	24.8	23	207
2008	5	22	1000	6.0	327	21.9	7	215
2008	5	22	1100	7.0	64	20.5	18	233
2008	5	22	1200	5.7	334	21.2	12	243
2008	5	22	1300	4.5	343	17.8	4	250
2008	5	22	1400	4.7	327	20.7	10	258
2008	5	22	1500	3.0	286	12.6	8	268
2008	5	22	1600	3.6	321	14.5	6	272
2008	5	22	1700	4.4	25	24.3	13	286
2008	5	22	1800	5.3	321	30.0	9	295
2008	5	22	1900	2.6	47	10.4	15	312
2008	5	22	2000	7.4	61	14.6	20	333
2008	5	22	2100	6.2	75	13.3	6	341
2008	5	22	2200	4.2	69	8.9	11	349
2008	5	22	2300	2.8	125	7.7	8	356

Table 3. East Craig Road Monitoring Data for May 21, 2008

Year	Month	Day	Time	Wind Speed	Wind Dir.	Max. Gust	PM_{10} Concentration	PM_{10} Mass Accumulation
2008	5	21	0000	14.2	227	27.8	136	122
2008	5	21	0100	11.3	239	24.8	140	244
2008	5	21	0200	12.4	269	38.6	109	365
2008	5	21	0300	27.7	303	45.7	361	766
2008	5	21	0400	28.1	296	49.9	802	682
2008	5	21	0500	24.4	296	42.9	309	310
2008	5	21	0600	27.0	299	44.1	299	624
2008	5	21	0700	27.6	306	45.5	339	969
2008	5	21	0800	28.4	310	45.0	346	1323
2008	5	21	0900	26.9	308	45.1	319	244
2008	5	21	1000	24.3	301	41.7	140	261
2008	5	21	1100	23.8	306	38.9	93	357
2008	5	21	1200	21.8	300	40.5	56	412
2008	5	21	1300	21.3	307	36.8	59	471
2008	5	21	1400	17.9	307	35.8	40	515
2008	5	21	1500	18.8	313	34.6	41	556
2008	5	21	1600	17.2	318	33.2	38	594
2008	5	21	1700	16.6	308	30.7	26	619
2008	5	21	1800	14.4	307	28.2	26	647
2008	5	21	1900	9.7	346	23.8	23	671
2008	5	21	2000	9.0	17	24.0	46	718
2008	5	21	2100	8.7	25	20.0	32	752
2008	5	21	2200	7.6	15	22.5	22	773
2008	5	21	2300	9.9	341	21.9	19	789

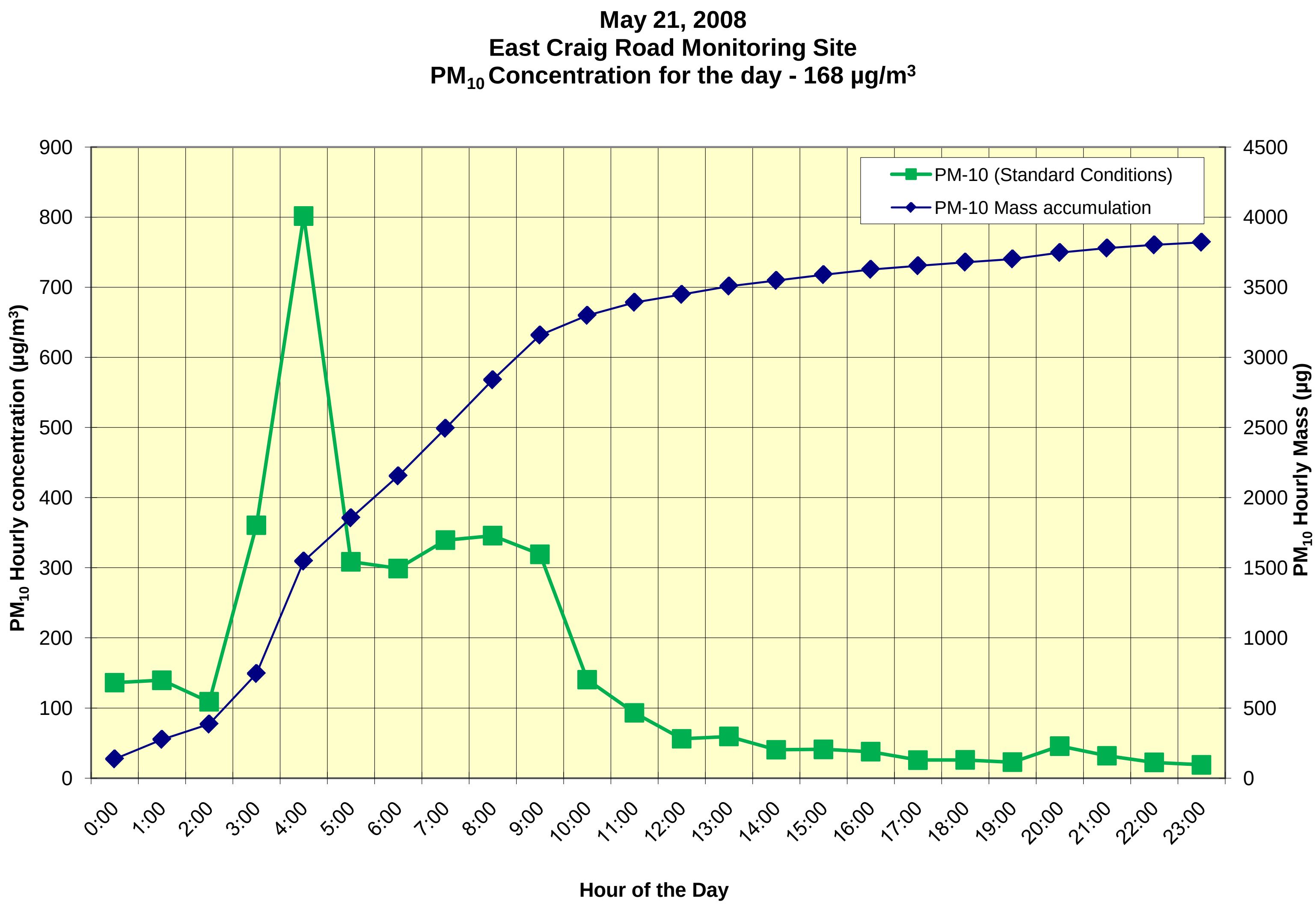


Figure 1. **PM_{10} Concentrations at East Craig Road Monitoring Site, May 21, 2008.**

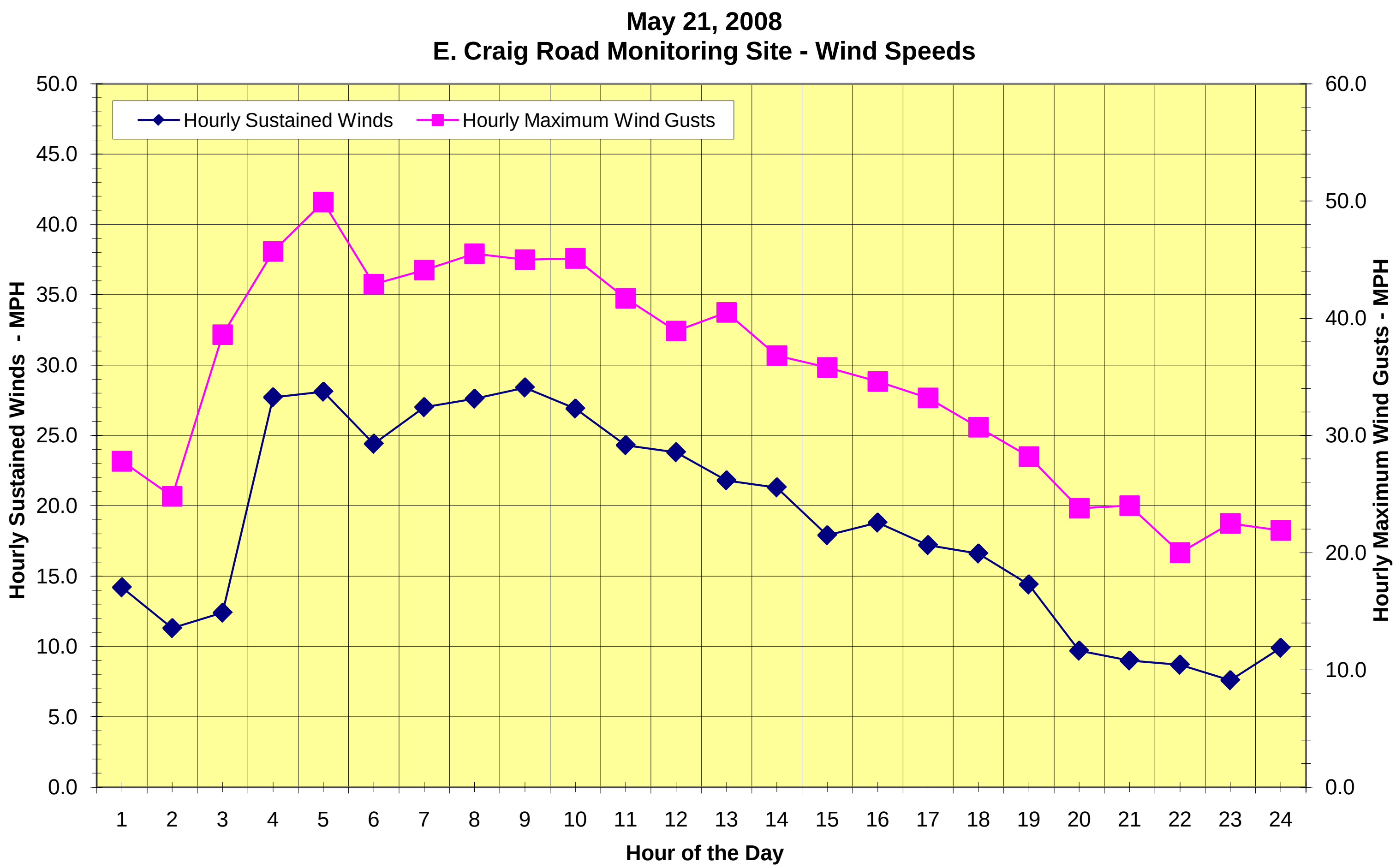


Figure 1a. Wind Speeds at East Craig Road Monitoring Site, May 21, 2008.

2.4.1.2 <u>The event was not reasonably controllable or preventable.</u>

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 168 µg/m^3 at the East Craig Road site on May 21, 2008, was the highest 24-hour average PM_{10} concentration recorded in the Las Vegas Valley between 2005 and 2008, with the exception of the high-wind event on February 13, 2008. This was the highest 24-hour average PM_{10} concentration recorded in a four-year period, with the exception of the February 13, 2008 event, which indicates an unusual natural event.

Figure 2 illustrates the highest recorded Air Quality Index (AQI) concentrations for PM_{10} monitored 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 (Figure 2), maximum AQI concentrations vary from year to year, depending on meteorological conditions. They are not the best indicators of long-term trends; the 95th percentile is less influenced by extreme events, and probably provides a better indication of the underlying trend in the data.

Figure 3 shows little change in 95th percentile data in Las Vegas over the last six years; Figure 4 shows a less than 20 percent change in the 99th percentile data for the same period. Figure 5 shows both the 95th and 99th percentiles for 2008, and where the exceedance fell in that year. Figure 6 shows sustained wind speeds and maximum wind gusts in 2008, and contrasts the high-wind event on May 21 with other wind speed values measured during the year. The measured wind values on May 21, 2008, and February 13, 2008, are exceptionally high for the Las Vegas Valley: the mean sustained wind and maximum wind gust values for the year are 6.8 and 24.2 mph, respectively. The exceedance AQI concentration value for PM_{10} for May 21 has occurred less than 1 percent of the time over the last four years, and falls outside normal seasonal variations.

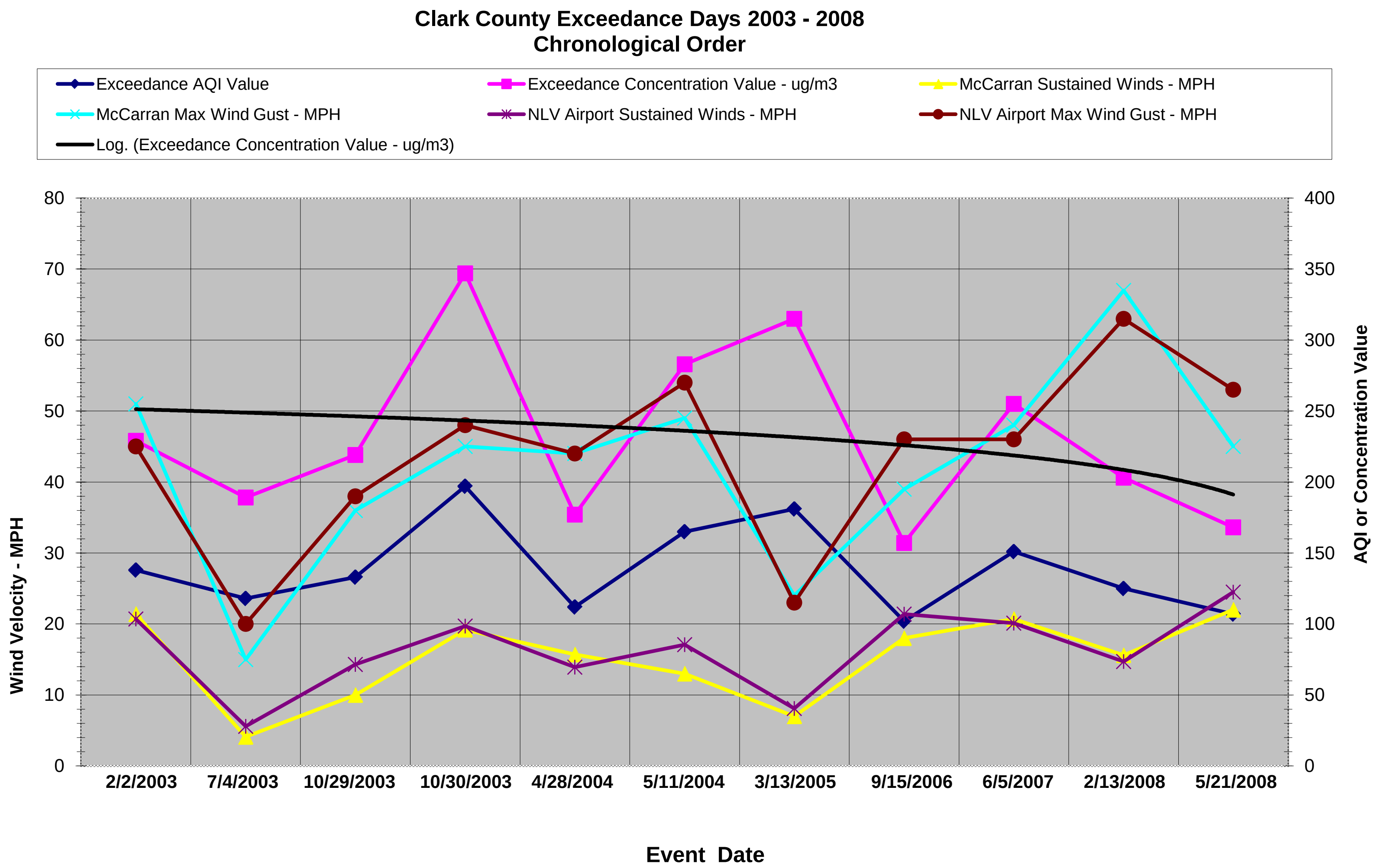


Figure 2. Clark County Exceedance Days in Chronological Order, 2003–2008.

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	Month & Year	AQI 95th Percentile	AQI 99th Percentile	$\mu g/m^3$ 95th Percentile	$\mu g/m^3$ 99th Percentile
197	347	195	224	Oct 2003	68.8	105.2	90.6	163.4
181	315	179	203	Mar 2005	64	86.96	81	126.92
165	283	163	183	May 2004	65	88.9	83	130.8
151	255	150	165	Jun 2007	60.8	79.16	74.6	111.32
138	229	137	148	Feb 2003	68.8	105.2	90.6	163.4
133	219	132	141	Oct 2003	68.8	105.2	90.6	163.4
125	203	124	131	Feb 2008	57	85.7	67	124.4
118	189	117	122	Jul 2003	68.8	105.2	90.6	163.4
112	177	111	114	Apr 2004	65	88.9	83	130.8
107	168	106	108	May 2008	57	85.7	67	124.4
102	157	101	101	Sep 2006	62	78.88	77	78.88

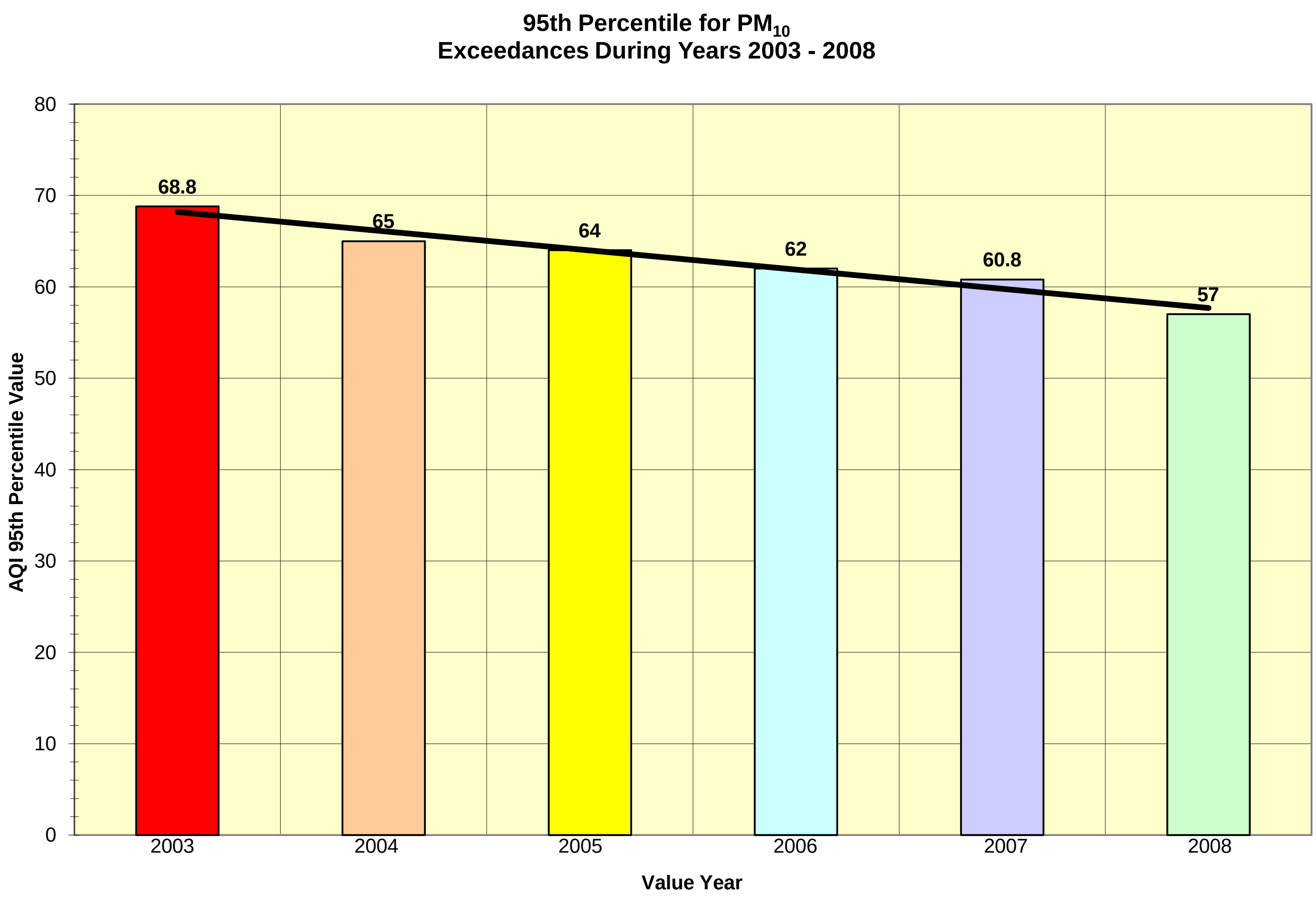


Figure 3. **95th Percentile for PM_{10} Exceedances Between 2003 and 2008.**

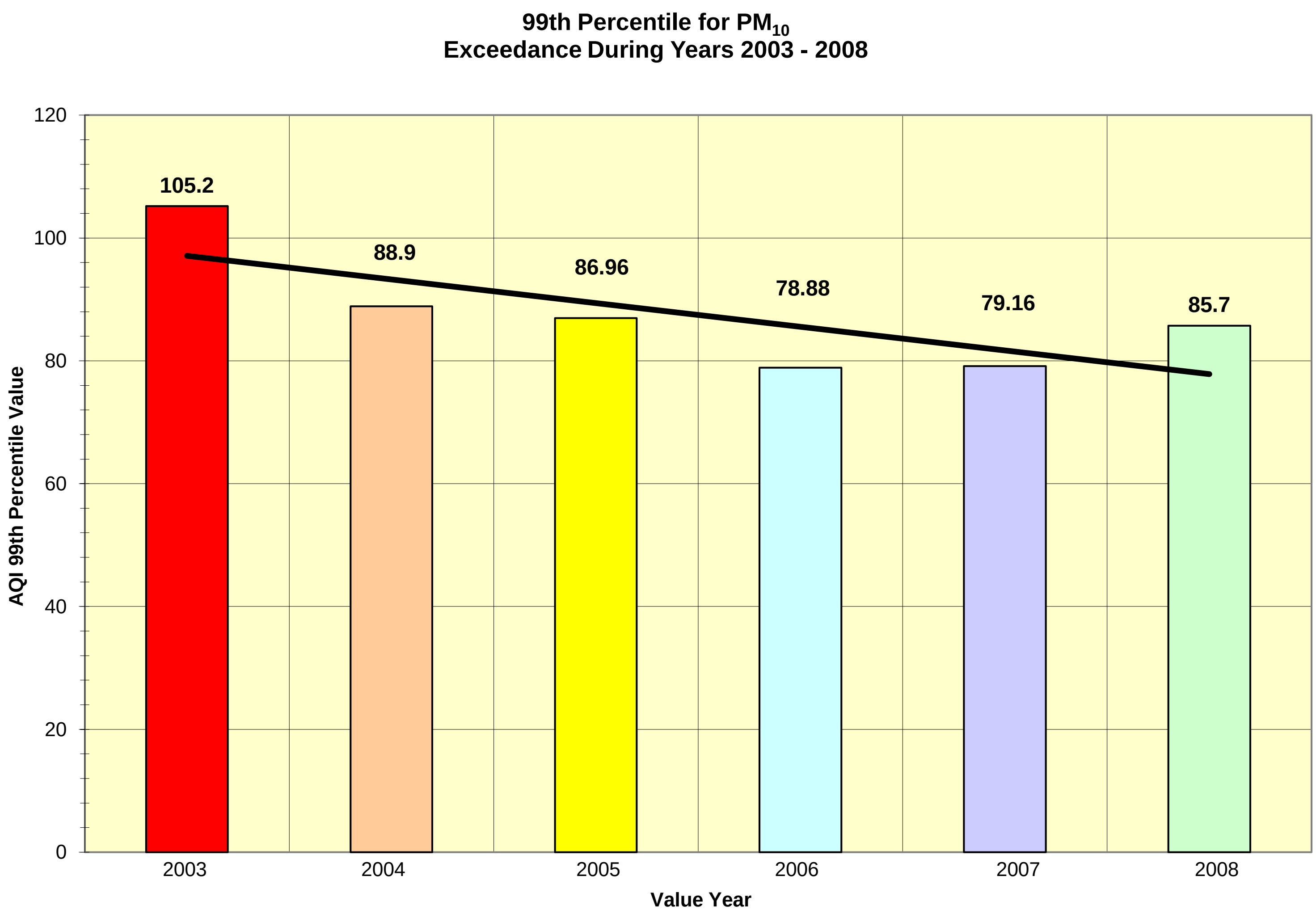


Figure 4. **99^{th} Percentile for PM_{10} Exceedances Between 2003 and 2008.**

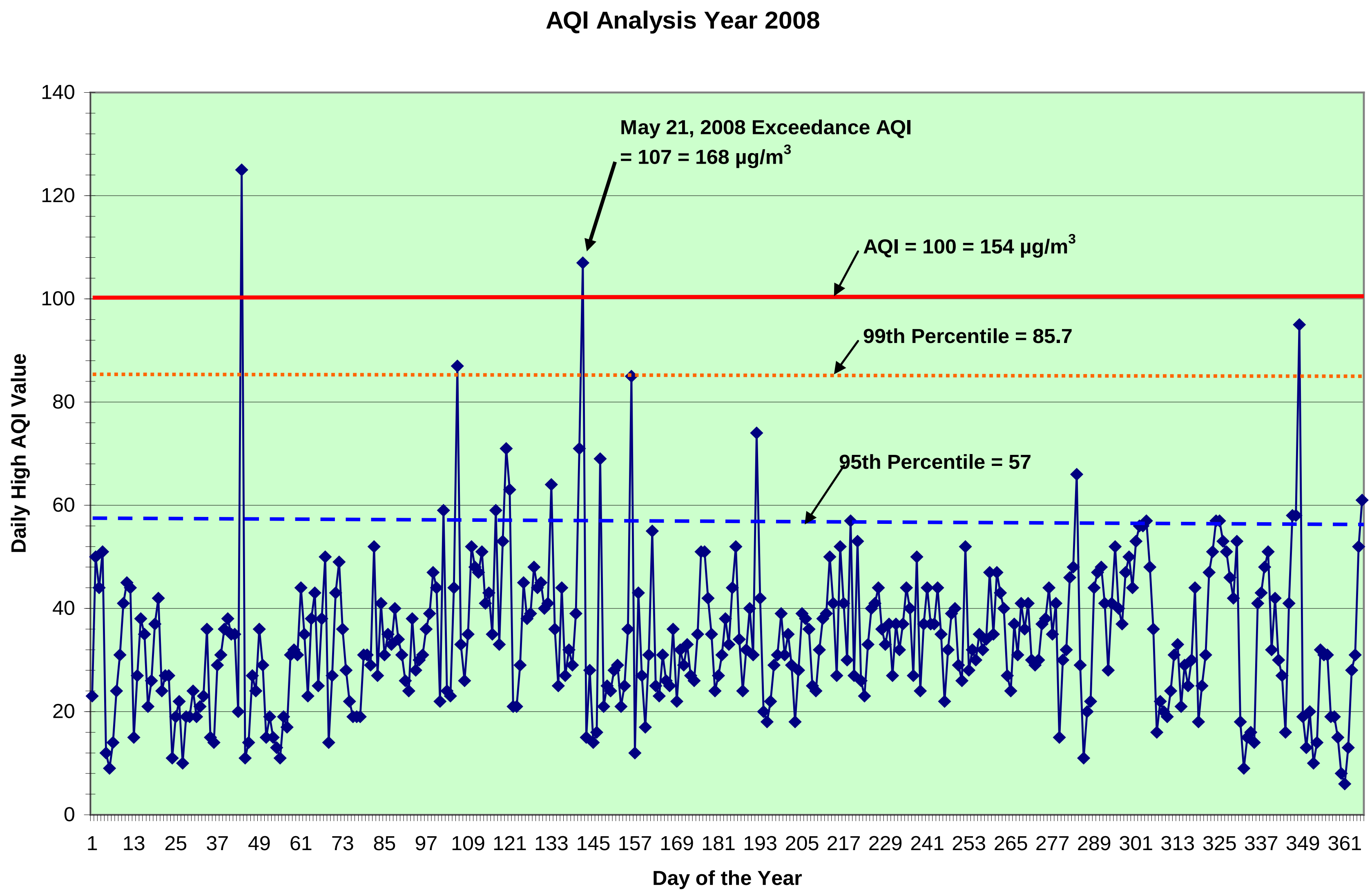


Figure 5. AQI Analysis for 2008.

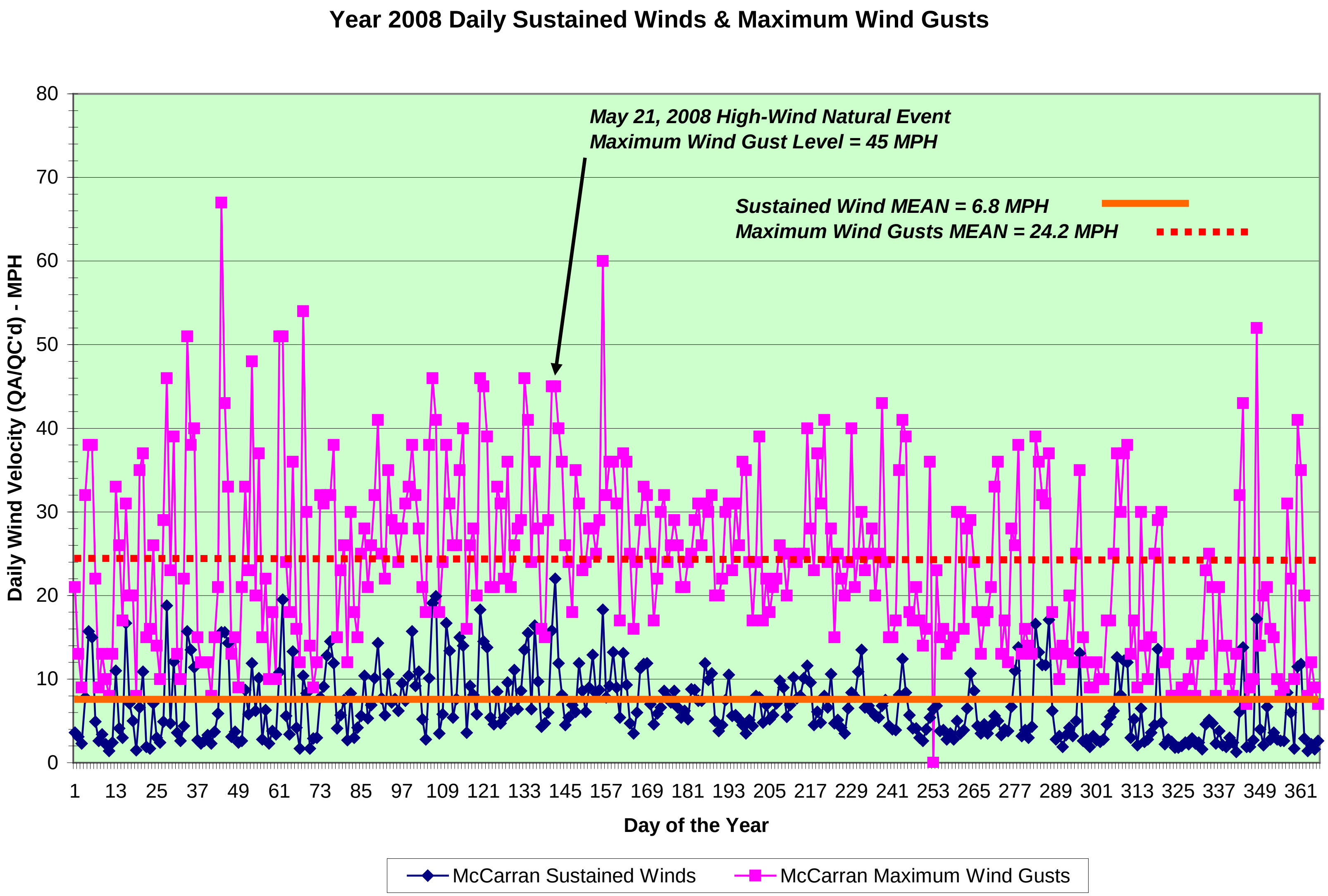


Figure 6. Sustained Winds and Maximum Wind Gusts in 2008.

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. Exceedance History for Hydrographic Area 212, 2003–2008

Date	AQI Value	µg/m³	Site ID	Name	EPA Concurrence	MCWS[1]	MCMWG[2]	NLVWS[3]	NLVMWG[4]
2/2/03	138	229	32-003-0020	E. Craig Rd	No doc. submitted: anthropogenic	21.4	51	20.7	45
7/4/03	118	189	32-003-2002	J.D. Smith	No doc. submitted: anthropogenic	4.1	15	5.6	20
10/29/03	133	219	32-003-0020	E. Craig Rd	Yes, 7/22/04	10	36	14.3	38
4/28/04	112	177	32-003-0020	E. Craig Rd	Yes, 8/13/04	15.7	44	13.9	44
5/11/04	165	283	32-003-0020	E. Craig Rd	Yes, 8/13/04	13	49	17.1	54
915/06	102	157	32-003-0020	E. Craig Rd	No doc. submitted: anthropogenic	18	39	21.4	46
2/13/08	125	203	32-003-0020	E. Craig Rd	Pending	15.6	67	14.7	63
5/21/08	107	168	32-003-0020	E. Craig Rd	Pending	22	45	24.5	53

[1]MCWS = Daily average wind speed at McCarran International Airport.
[2]MCMWG = Maximum daily average wind gust at McCarran International Airport.
[3]NLVWS = Daily average wind speed at North Las Vegas Airport.
[4]NLVMWG = Maximum daily average wind gust at North Las Vegas Airport.

Table 4b shows the measured mean average values for sustained winds and maximum 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 May between 2003 and 2008. Attachment 9 of Appendix A shows a six-year trend summary of AQI values and wind speeds recorded during the month of May in Clark County. Although the valley often experiences elevated winds in May, the sustained winds and wind gusts experienced on May 21, 2008, are rare.

Table 4b. Annual Mean Wind Velocities for Sustained Winds and Maximum Wind Gusts at McCarran International and North Las Vegas Airports, 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. May Daily Sustained Wind Speed Statistics for McCarran International Airport

Statistics Category	2003–2008	2003	2004	2005	2006	2007	2008
Mean	8.59189	8.13225	9.79032	8.54666	7.80645	8.33548	8.93870
Standard error	0.26445	0.55312	0.67785	0.67035	0.57522	0.59216	0.78152
Median	7.8	7.8	9.8	7.2	7	6.9	8.1
Mode	6.4	8.5	11.5	8.4	4.3	4.6	5.4
Standard deviation	3.59702	3.07965	3.77415	3.67167	3.20270	3.29702	4.35137

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

Statistics Category	2003–2008	2003	2004	2005	2006	2007	2008
Mean	26.43548	23.96774	26.41935	25.09677	25.41935	28.12903	29.58064
Standard error	0.57975	1.14955	1.37158	1.53269	1.44562	1.29742	1.54556
Median	25	24	28	23	25	28	28
Mode	22	25	28	21	17	30	21
Standard deviation	7.90679	6.40043	7.63664	8.53367	8.04890	7.22376	8.60532

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

Statistics Category	2003–2008	2003	2004	2005	2006	2007	2008
Mean	8.87945	8.16129	10.57666	8.72258	8.35161	8.35806	9.16129
Standard error	0.30085	0.52659	0.75906	0.80255	0.86582	0.59171	0.78802
Median	8	7.7	9.65	7.4	6.7	7.8	8.1
Mode	6.7	5.3	6.7	7.4	6.7	10.6	5.8
Standard deviation	4.09213	2.93197	4.15755	4.46846	4.82071	3.29451	4.38753

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

Statistics Category	2003–2008	2003	2004	2005	2006	2007	2008
Mean	27.46486	24.87096	28.13333	25.96774	26.48387	29.32258	30.03225
Standard error	0.60738	1.21703	1.70983	1.44317	1.42094	1.52145	1.47996
Median	26	24	25.5	24	26	30	31
Mode	24	18	24	24	31	30	37
Standard deviation	8.26136	6.77614	9.36513	8.03527	7.91147	8.47107	8.24008

Tables 4g and 4h contain statistical evaluations of AQI values and the resulting concentrations for the month of May 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. May PM_{10} AQI Statistics for the Clark County Monitoring Network

Data Range	2003–2008	2003	2004	2005	2006	2007	2008
Count	186	31	31	31	31	31	31
Mean	39.91397	43.41935	47.41935	33.90322	40.12903	37.38709	37.22580
Standard error	1.27343	2.61088	4.63919	2.28522	2.53226	1.96948	3.49306
Median	38	46	42	31	38	38	32
Mode	31	58	45	19	31	31	21
Standard deviation	17.36735	14.53679	25.82992	12.72361	14.09903	10.96563	19.44858

Table 4h. May PM_{10} Concentration ($\mu g/m^3$) Statistics for the Clark County Monitoring Network

Data Range	2003–2008	2003	2004	2005	2006	2007	2008
Count	186	31	31	31	31	31	31
Mean	45.20430	48.90322	56.45161	37.22580	44.80645	40.77419	43.06451
Standard error	2.01806	3.33420	8.51877	2.97289	3.77097	2.56976	5.45261
Median	41	49	45	33	41	41	34
Mode	33	69	48	20	33	33	22
Standard deviation	27.52279	18.56404	47.43053	16.55236	20.99590	14.30782	30.35889

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 May 21, 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, Clark County DAQEM concludes that the PM_{10} NAAQS would not have been exceeded on May 21 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). In all years analyzed, most AQI values for PM_{10} fell below the 95th percentile. Values above the 99th percentile were rare, and not all were exceedance values. Attachment 10 shows that the calculated annual AQI mean in 2003 was 47, whereas the calculated annual AQI mean in 2008 was 34. This improvement clearly demonstrates that the AQR program has been successful. Comparing the monthly mean AQI for May 2003 (43) to the monthly AQI mean for May 2008 (37) confirms a trend of improving air quality. As a direct result of Clark County's AQR program, air quality improved even though monthly mean sustained winds and maximum mean wind gusts gradually increased at McCarran International and North Las Vegas Airports between May 2003 and May 2008 (Tables 4c-4f). Tables 4g and 4h, and the downward-trending exceedance line in Figure 2, illustrate the air quality improvements in Clark County since 2003.

Table 5 summarizes the readings at the East Craig Road monitoring site. Wind speeds were high enough to meet and exceed Clark County's criteria for this exceedance to qualify as a high wind event.

Table 5. High-wind event 24-Hour PM_{10} NAAQS Exceedance Data

Monitoring Site	Date of Event	Measured Concentration ($\mu g/m^3$)	Wind Dir.	Max. Wind Gust (mph)[1]
E. Craig Road CAMS #320030020	May 21, 2008	168	NW	49.9

[1] This maximum wind gust reading was measured at the monitoring site.

3.0 EVENT DATA

Tables 1-3 list readings for the days before, during, and after the exceptional event. These data clearly show that the event occurred on May 21, 2008, between 0300 and 1000 PDT. The wind direction was predominantly from the northwest, and the East Craig Road monitoring site measured peak gusts of 49.9 mph and sustained two-minute winds of 28.1 mph. Table 3 lists the average hourly wind speeds at the monitoring site, which ranged from 24.3 mph to 28.4 mph during the event. Attachment 12 of Appendix A provides the full meteorological data sheet for McCarran International Airport from the Climatic Data Center of the National Oceanic and Atmospheric Administration (NOAA); Attachments 12a and 12b contain the individual quality-assured data sheets for the McCarran International and North Las Vegas Airports, respectively. Attachments 1-8 of Appendix A contain readings from the other five PM_{10} monitoring sites in the monitoring network, which showed similar trends on May 21 but did not exceed the NAAQS.

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*.

If the dust sources contributing to a high-wind event are anthropogenic, the state must document the application of applicable reasonable control measures to those sources. The Compliance and Enforcement Activity section (Section 5.0), of this documentation describes the application of "best available control measures (BACM)" to these sources and DAQEM's enforcement activities on the days before, during, and after the event, including follow-up enforcement activity.

This document demonstrates that a high-wind event on May 21, 2008, affected the monitoring site that recorded a PM_{10} exceedance that day. Emissions generated by this event caused an exceedance of the 24-hour PM_{10} NAAQS, which would not have happened without the high wind conditions.

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

3.1 METEOROLOGY ASSESSMENT FOR THE HIGH-WIND EVENT

3.1.1 Weather Summary

Excessive ambient PM_{10} concentrations on May 21, 2008, were caused by two factors. First, a surface reservoir of dust evolved in the region over a period of three to four days, with no precipitation and light winds. Second, a short period preceding the arrival of a cold front brought wind speeds high enough to raise airborne dust. The entrained dust was kept aloft, and more was generated, by the turbulence and higher wind speeds associated with the rapidly moving cold front passing through the region. The single hour period during the extremely high wind speeds and the frontal passage was sufficient to trigger the PM_{10} exceedance for the day. Thus, 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 Local Climatological Data

Hourly and daily Local Climatological Data (LCD) reports from the McCarran International, North Las Vegas, and Nellis AFB Airports document surface weather conditions in the Las Vegas Valley. DAQEM obtains these quality-controlled data from NOAA's National Climatic Data Center.

The hourly LCD data consist of observations made in the last few minutes of the previous 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 Clark County Monitoring Stations

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

3.1.2.3 Weather Charts

DAQEM also used NOAA surface and upper-air pressure charts in its analysis. One set of charts, NOAA's "Daily Weather Maps," uses data from 1200 Zulu Time (1200 Z) (0700 EST, 0400 PDT). These charts feature:

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

- Lines of equal pressure (isobars), reduced to sea level, 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 semicircular 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.

Another source of surface charts is the National Climatic Data Center, through its Service Records Retention System (SRRS). These surface charts are similar to NOAA's Daily Weather Maps, but the spatial coverage is smaller and the SRRS charts contain information from more sites. These charts are produced for three-hour intervals, allowing more accurate pinpointing of the time frontal passages move through an area.

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 fronts that, in turn, generate high-speed wind gusts and turbulence that create airborne dust. A common representation of synoptic-scale weather conditions is the 500-mb pressure pattern chart. This pressure level occurs approximately 5,600 meters (about 18,000 feet) above mean sea level; it is approximately half the average sea level pressure. These 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 with 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.)

The SRRS upper-air charts only show pressure height lines in decameters. Their advantage is that they are produced from numerical model analyses at 6-hour intervals rather than 24-hour intervals.

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 (Section 3.1.7.) 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 stations were included in the analysis to show representative conditions across the valley.

Hourly values of PM_{10} concentration in micrograms per cubic meter ($\mu g/m^3$) provided the basic air quality information for this analysis, which also incorporates data on average wind speed, wind direction, and maximum gust speed from DAQEM monitoring stations and NOAA charts. A portion of the analysis uses AQS data corrected to standard conditions.

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 contain the monthly LCD for McCarran International Airport and the North Las Vegas Airport. They show that daily average wind speeds on May 16–19 did not exceed 7 mph, with maximum 5-second speeds on May 17–18 of about 15 mph. Increases were noted on May 19, when maximum 5-second speeds at McCarran International and North Las Vegas Airports were 29 and 23 mph, respectively. These gusts were short-lived, because the average speeds for that day remained low. No measurable precipitation was recorded in May at either airport prior to the event, although trace precipitation was recorded on May 5, 12, and 13 at McCarran International and on May 12 at the North Las Vegas Airport.

The synoptic charts for May 15–19 indicate a large, weak (i.e., small pressure gradient) high-pressure ridge in the western United States, meaning fair weather and low wind speeds. Figure 8 shows the “Daily Weather Map” surface chart from May 17, with a large high-pressure area in the Intermountain West (shown by broadly spaced isobars, i.e., lines of equal pressure) and a weak surface trough (shown by a brown dashed line) along the coast of California. This synoptic weather pattern is associated with low wind speeds and no precipitation.

As further indication of the fair weather during this period, the corresponding “Daily Weather Map” 500-millibar (500-mb) upper-air chart is shown in Figure 9. The pressure level is measured approximately 18,000 feet above the surface, so is usually free from local variations caused by land surface effects. The figure shows broadly spaced pressure-height lines (solid) and isotherms (dotted lines) in the Intermountain West; the wind data for upper-air stations in California and Arizona indicate low-speed northeasterly winds aloft in southern Nevada. The lack of significant weather events and the low wind speeds on May 17–19 support a description of fair weather.

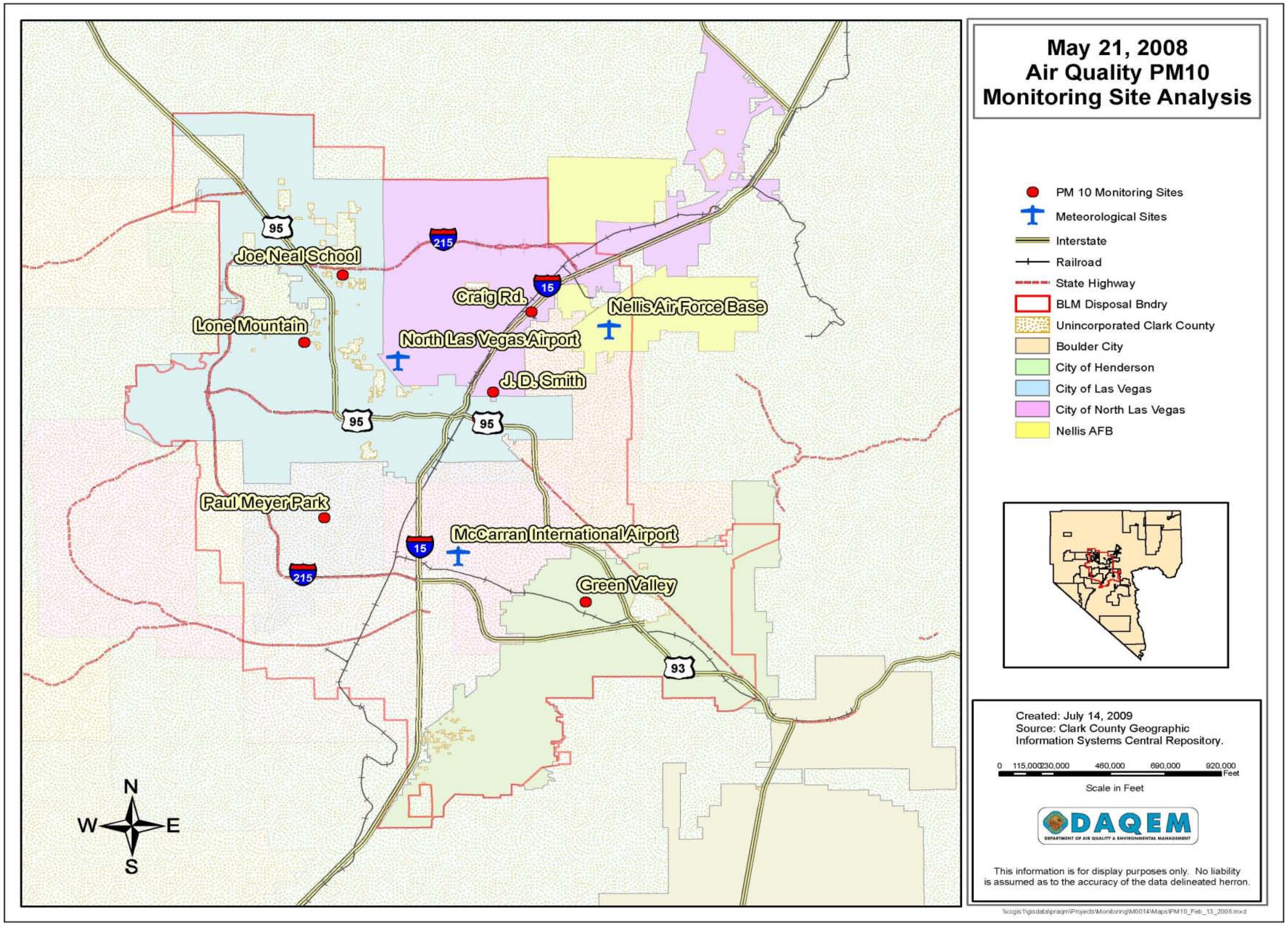


Figure 7. Map of Las Vegas Valley Air Quality Monitoring Analysis Sites, May 21, 2008.

Table 6. Local Climatological Data for McCarran International Airport, May 2008

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
(final)
NOAA, National Climatic Data Center
Month: 05/2008

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) Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Degree Days Base 65 Degrees Heating	Cooling	Sun Sunrise LST	Sunset LST	Significant Weather	Snow/Ice on Ground(In) 1200 UTC Depth	1800 UTC Water Equiv	Precipitation (In) 2400 LST Snow Fall	2400 LST Water Equiv	Pressure(inches of Hg) Avg. Station	Avg. Sea Level	Wind: Speed=mph Dir=tens of degrees Resultant Speed	Res Dir	Avg. Speed	max 5-second Speed	Dir	max 2-minute Speed	Dir	Date
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	71	51*	61	-10	4	41	4	0	0448	1827	VCBLDU	M	M	M	0.00	27.68	29.92	12.9	02	13.8	39	030	28	360	01
02	74	53	64	-7	4	42	1	0	0447	1828		M	M	M	0.00	27.71	29.98	3.8	06	5.4	21	050	17	060	02
03	84	58	71	0	12	47	0	6	0446	1829		M	M	M	0.00	27.55	29.79	2.1	10	4.6	21	090	17	080	03
04	87	65	76	4	18	50	0	11	0445	1830		M	M	M	0.00	27.44	29.65	7.3	18	8.5	33	140	25	200	04
05	85	62	74	2	22	50	0	9	0444	1830		M	M	M	T	27.48	29.70	1.0	17	4.7	31	100	24	090	05
06	90	62	76	3	23	52	0	11	0443	1831		M	M	M	0.00	27.45	29.66	3.3	20	5.4	22	180	16	180	06
07	89	65	77	4	29	53	0	12	0442	1832		M	M	M	0.00	27.43	29.64	6.1	22	9.6	36	210	26	250	07
08	86	63	75	2	28	53	0	10	0441	1833		M	M	M	0.00	27.48	29.70	0.9	24	6.2	21	260	18	260	08
09	88	67	78	5	23	52	0	13	0440	1834		M	M	M	0.00	27.42	29.63	10.3	20	11.1	26	180	20	180	09
10	85	68	77	4	22	51	0	12	0439	1835		M	M	M	0.00	27.62	29.84	5.0	04	6.4	28	050	22	060	10
11	93	64	79	5	24	53	0	14	0438	1835		M	M	M	0.00	27.47	29.68	6.6	21	8.6	29	250	22	190	11
12	83	64	74	0	29	52	0	9	0438	1836	RA	M	M	M	T	27.37	29.58	5.5	35	13.5	46	030	37	020	12
13	81	60	71	-4	14	46	0	6	0437	1837		M	M	M	T	27.62	29.85	13.1	02	15.5	41	050	31	050	13
14	90	60	75	-1	21	51	0	10	0436	1838		M	M	M	0.00	27.66	29.89	3.2	04	6.4	24	320	18	320	14
15	91	73	82	6	33	56	0	17	0435	1839		M	M	M	0.00	27.68	29.90	15.2	04	16.4	36	050	29	070	15
16	90	71	81	5	23	53	0	16	0434	1840		M	M	M	0.00	27.79	30.02	6.7	04	9.7	28	050	22	050	16
17	98	69	84	8	26	56	0	19	0433	1840		M	M	M	0.00	27.71	29.93	1.2	16	4.3	16	080	12	030	17
18	104	73	89	13	24	57	0	24	0433	1841		M	M	M	0.00	27.58	29.78	2.4	20	4.7	15	250	10	210	18
19	108*	79	94*	18	27	59	0	29	0432	1842		M	M	M	0.00	27.49	29.67	2.8	22	6.0	29	260	18	200	19
20	101	82	92	16	24	58	0	27	0431	1843	VCBLDU	M	M	M	0.00	27.37	29.56	15.0	21	15.8	45	210	31	240	20
21	82	62	72	-5	23	50	0	7	0431	1844	VCBLDU	M	M	M	0.00	27.24	29.42	19.9	33	22.0	45	330	36	320	21
22	74	59	67	-10	20	46	0	2	0430	1844		M	M	M	0.00	27.09	29.29	9.2	35	11.9	40	340	26	340	22
23	67	53	60	-17	39	49	5	0	0429	1845	TSRA RA	M	M	M	0.03	27.30	29.52	6.6	17	8.1	36	190	30	190	23
24	65	52	59*	-19	45	51	6	0	0429	1846	RA BR	M	M	M	0.10	27.57	29.83	2.1	08	4.5	26	090	22	090	24
25	72	55	64	-14	38	51	1	0	0428	1847		M	M	M	0.00	27.49	29.73	3.7	21	5.4	24	220	13	200	25
26	77	55	66	-12	31	50	0	1	0428	1847		M	M	M	0.00	27.52	29.74	6.4	19	6.9	18	180	15	190	26
27	84	60	72	-6	29	51	0	7	0427	1848		M	M	M	0.00	27.53	29.76	3.3	23	6.1	35	150	18	240	27
28	82	63	73	-5	28	52	0	8	0427	1849		M	M	M	0.00	27.56	29.78	11.2	21	11.9	31	170	21	230	28
29	85	63	74	-5	22	51	0	9	0426	1849		M	M	M	0.00	27.58	29.81	7.6	21	8.6	23	200	16	240	29
30	89	65	77	-3	18	51	0	12	0426	1850		M	M	M	0.00	27.62	29.83	3.4	14	6.1	24	090	18	090	30
31	94	65	80	0	17	52	0	15	0426	1851		M	M	M	0.00	27.57	29.78	8.2	20	9.0	28	220	18	210	31
	85.5	63.3	74.4		23.9	51.2	0.5	10.2	<-----Monthly Averages | Totals----->				M	M	0.13	27.58	29.74	0.6	22	8.9	<Monthly Average				
	-2.3	0.4	-1.0	<-----------Departure From Normal----------->									-0.11												

Degree Days Monthly Season to Date

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	17	1	1879	-360
Cooling:	316	-7	447	5

Greatest 24-hr Precipitation: 0.10 Date: 24
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

Sea Level Pressure		Date	Time (LST)
Maximum	30.12	16	0904
Minimum	29.23	22	1756

Number of Days with -------->
Max Temp >=90: 10
Max Temp <=32: 0
Thunderstorms : 1
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. Local Climatological Data for North Las Vegas Airport, May 2008

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
(final)
NOAA, National Climatic Data Center
Month: 05/2008

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) Max.	Min.	Avg.	Dep From Normal	Avg. Dew pt.	Avg Wet Bulb	Degree Days Base 65 Degrees Heating	Cooling	Sun Sunrise LST	Sunset LST	Significant Weather	Snow/Ice on Ground(In) 1200 UTC Depth	1800 UTC Water Equiv	Precipitation (In) 2400 LST Snow Fall	2400 LST Water Equiv	Pressure(inches of Hg) Avg. Station	Avg. Sea Level	Wind: Speed=mph Dir=tens of degrees Resultant Speed	Res Dir	Avg. Speed	max 5-second Speed	max 5-second Dir	max 2-minute Speed	max 2-minute Dir	Date
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	71	50*	61	M	5	40	4	0	-	-		M	M	M	0.00	27.68	29.93	11.5	35	14.0	37	360	28	320	01
02	73	52	63	M	6	42	2	0	-	-		M	M	M	0.00	27.73	29.99	2.0	06	4.6	29	070	20	060	02
03	81	57	69	M	13	46	0	4	-	-		M	M	M	0.00	27.57	29.81	3.4	12	4.8	21	150	15	140	03
04	86	62	74	M	18	50	0	9	-	-		M	M	M	0.00	27.44	29.65	7.7	19	8.9	36	160	31	150	04
05	85	59	72	M	22	50	0	7	-	-		M	M	M	0.00	27.50	29.71	0.8	02	7.0	31	150	25	150	05
06	90	66	78	M	25	52	0	13	-	-		M	M	M	0.00	27.45	29.66	0.8	30	7.6	28	250	18	130	06
07	89	64	77	M	32	53	0	12	-	-		M	M	M	0.00	27.44	29.65	5.6	16	13.7	37	240	29	220	07
08	85	65	75	M	27	52	0	10	-	-		M	M	M	0.00	27.48	29.70	3.1	33	7.8	26	330	22	330	08
09	88	62	75	M	23	52	0	10	-	-		M	M	M	0.00	27.42	29.63	4.8	22	8.1	29	190	24	180	09
10	85	68	77	M	23	51	0	12	-	-		M	M	M	0.00	27.63	29.85	2.6	36	5.2	24	350	21	340	10
11	92	61	77	M	24	52	0	12	-	-		M	M	M	0.00	27.47	29.69	6.7	22	9.5	31	190	23	190	11
12	82	64	73	M	29	51	0	8	-	-		M	M	M	T	27.38	29.58	9.1	36	14.1	37	360	30	350	12
13	81	58	70	M	15	46	0	5	-	-		M	M	M	0.00	27.63	29.87	9.5	02	13.1	43	340	29	350	13
14	90	60	75	M	22	52	0	10	-	-		M	M	M	0.00	27.66	29.90	5.3	03	10.1	33	260	24	320	14
15	91	71	81	M	34	57	0	16	-	-		M	M	M	0.00	27.68	29.90	11.4	06	13.8	33	080	28	070	15
16	90	69	80	M	25	54	0	15	-	-		M	M	M	0.00	27.79	30.03	7.2	09	9.7	32	090	25	090	16
17	97	68	83	M	29	56	0	18	-	-		M	M	M	0.00	27.71	29.94	0.8	18	3.7	15	130	12	130	17
18	103	71	87	M	26	57	0	22	-	-		M	M	M	0.00	27.59	29.79	1.2	25	4.2	15	240	13	240	18
19	107*	74	91*	M	27	59	0	26	-	-		M	M	M	0.00	27.50	29.68	3.1	28	5.8	23	260	17	270	19
20	101	78	90	M	25	57	0	25	-	-		M	M	M	0.00	27.38	29.56	10.4	23	13.0	39	240	31	250	20
21	82	62	72	M	24	50	0	7	-	-		M	M	M	0.00	27.24	29.42	23.2	33	24.5	53	320	43	330	21
22	73	58	66	M	21	46	0	1	-	-		M	M	M	0.00	27.10	29.30	12.7	35	13.8	35	350	29	350	22
23	67	53	60	M	39	49	5	0	-	-	TSRA RA	M	M	M	0.08	27.29	29.52	8.1	17	10.6	40	230	33	230	23
24	64	52	58*	M	44	50	7	0	-	-	RA	M	M	M	0.03	27.58	29.84	4.5	15	5.9	25	140	21	150	24
25	71	55	63	M	37	50	2	0	-	-		M	M	M	0.00	27.50	29.74	3.1	19	5.8	22	100	15	240	25
26	76	57	67	M	32	50	0	2	-	-		M	M	M	0.00	27.52	29.75	3.9	17	5.8	22	140	16	160	26
27	82	57	70	M	29	51	0	5	-	-		M	M	M	0.00	27.54	29.77	3.8	25	6.7	25	250	20	250	27
28	82	63	73	M	28	52	0	8	-	-		M	M	M	0.00	27.55	29.78	8.9	21	11.0	33	220	23	220	28
29	84	60	72	M	22	50	0	7	-	-		M	M	M	0.00	27.59	29.82	4.6	21	6.2	24	220	17	210	29
30	87	60	74	M	19	50	0	9	-	-		M	M	M	0.00	27.62	29.84	2.5	12	5.4	22	160	16	150	30
31	93	63	78	M	19	52	0	13	-	-		M	M	M	0.00	27.57	29.79	6.8	20	9.6	31	200	23	190	31
	84.8	61.9	73.4		24.6	50.9	0.6	9.2	<-----Monthly Averages | Totals----->				M	M	0.11s	27.52	29.74	0.6	30	9.2	<Monthly Average				
	M	M	M	<-----------Departure From Normal----------->									M												

Degree Days Monthly Season to Date

	Monthly Total	Monthly Departure	Season to Date Total	Season to Date Departure
Heating:	20	M	M	M
Cooling:	286	M		

Greatest 24-hr Precipitation: 0.08 Date: 23-24
Greatest 24-hr Snowfall: M Date: M
Greatest Snow Depth: M Date: M

Sea Level	Pressure	Date	Time (LST)
Maximum	30.14	16	0857
Minimum	29.23	22	1708

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

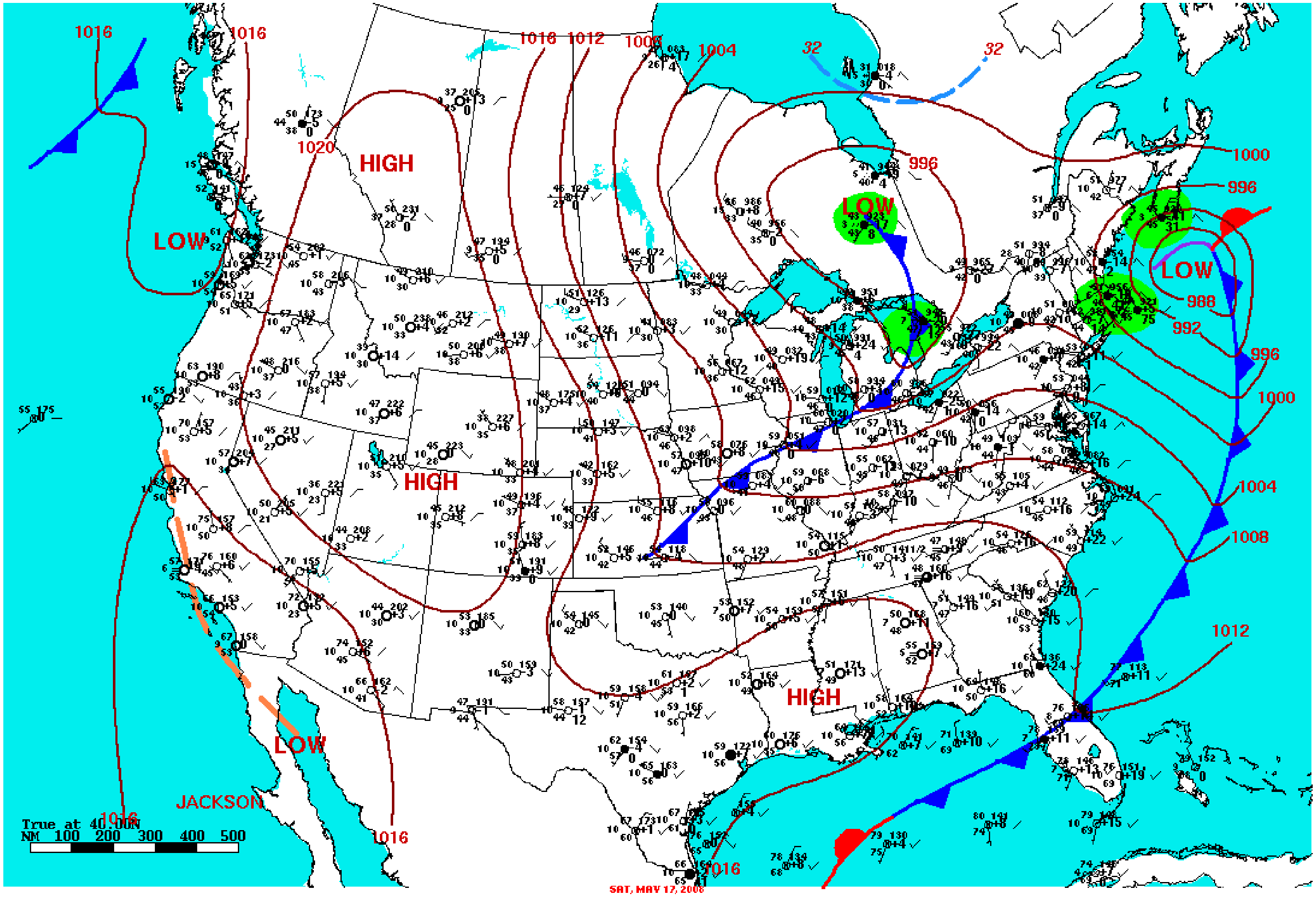
Max Temp >=90: 10
Max Temp <=32: 0
Thunderstorms : 1

Min Temp <=32: 0
Min Temp <=0 : 0
Heavy Fog : 0

Precipitation >=.01 inch: 2
Precipitation >=.10 inch:
Snowfall >=1.0 inch : M

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

Data Version: VER2



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

Figure 8. Daily Weather Map Surface Chart for May 17, 2008.

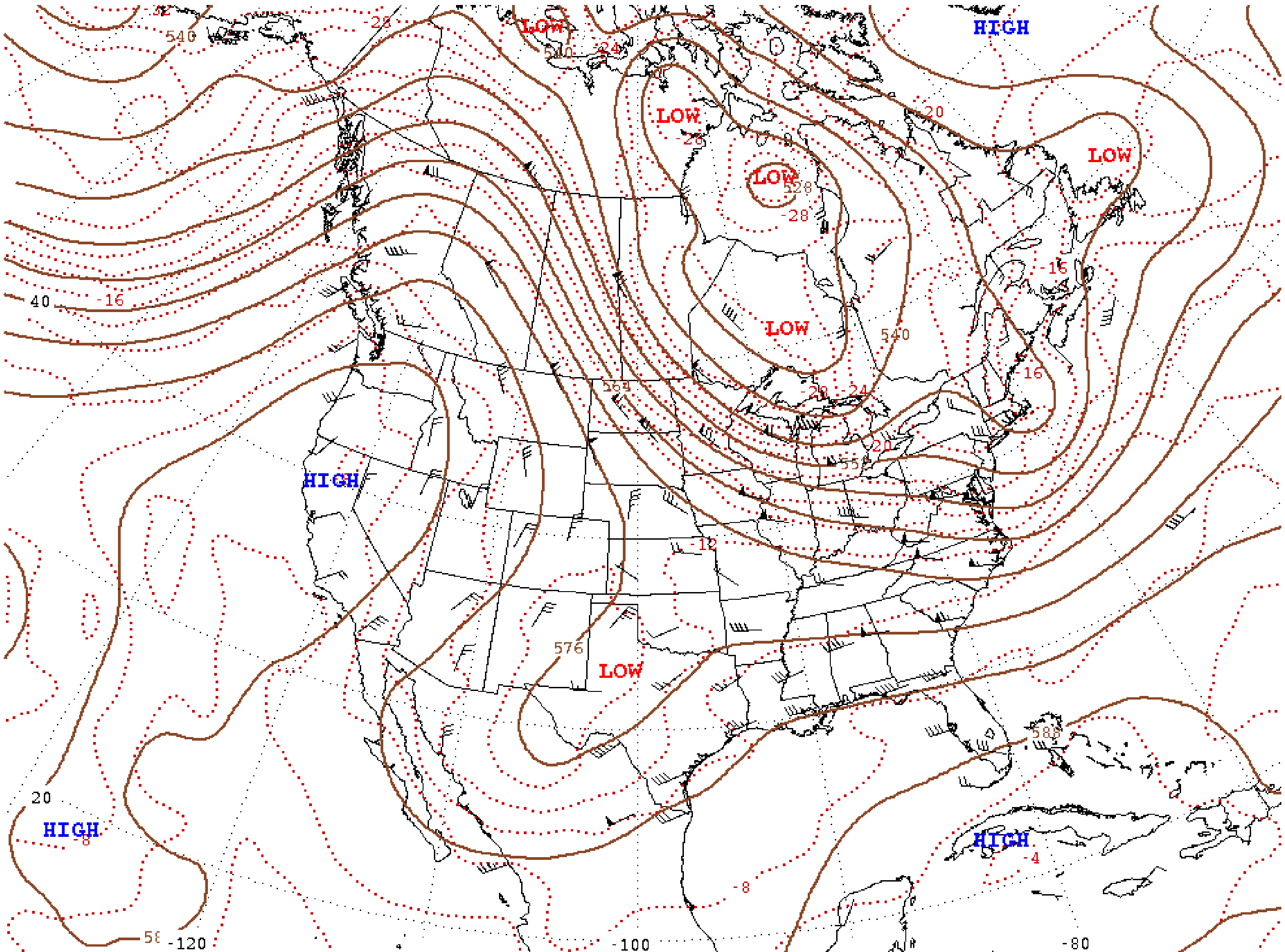


Figure 9. Daily Weather Map 500-mb Chart for May 17, 2008.

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).

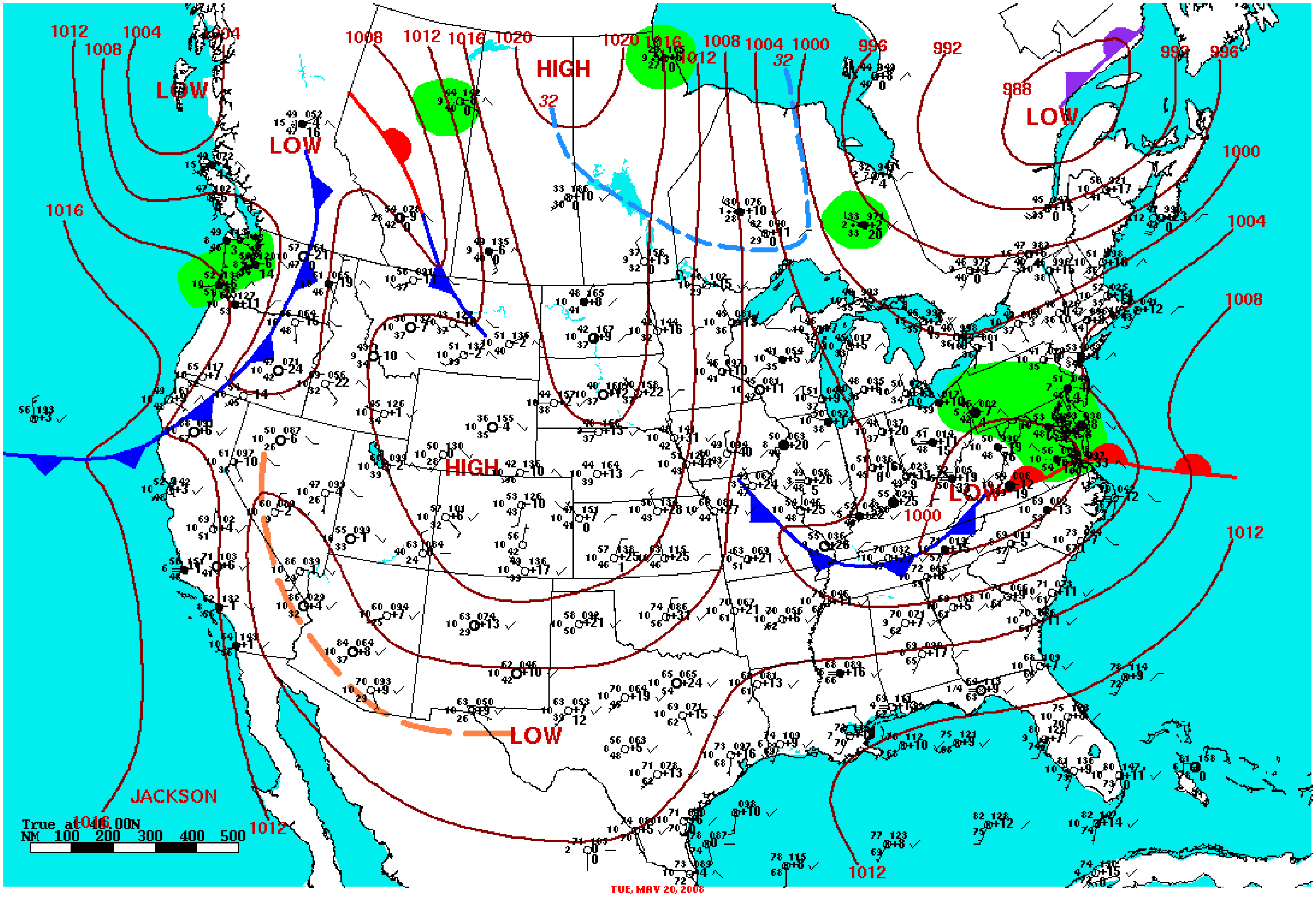
3.1.5 Weather During the Event

Following a quiet period from May 15–19, the strong low-pressure system that appeared on May 20 moved rapidly into southern Nevada, with increasing wind speeds and an associated cold front at the surface. This was the beginning of the major wind event on May 21. Figures 10 and 11 provide the “Daily Weather Map” surface and 500-mb charts for May 20 (based on 0400 PDT observations of conditions aloft). The surface and upper-air features in place before May 20 shifted eastward as a surface low-pressure system in southwestern Canada and an associated cold front trailed through Washington and Oregon; a corresponding upper-air low-pressure trough was evident along the northwestern coast.

Tables 8 and 9 list the hourly observations made at McCarran International and the North Las Vegas Airport on May 20. Wind speeds increased from the southwest, reaching 20 mph by midday; the average speed had reached 25 mph and gusts had increased to 40 mph by evening, with the direction remaining from the southwest. The last two hours of the day included observations of blowing dust of unknown intensity in the vicinity.

Tables 10–12 list the hourly observations made at the McCarran, North Las Vegas, and Nellis AFB Airports on May 21. These airports are approximately 11.5 miles south-southwest (McCarran), six miles west-southwest (North Las Vegas), and three miles east (Nellis AFB) of the East Craig Road monitoring station. These tables show average wind speeds exceeding 25 mph and gusts exceeding 40 mph in the early morning hours at all three airports, with the direction changing from southwest to northwest at the time of the surface front passage.

Figures 12 and 13 show the “Daily Weather Map” surface and 500-mb pressure charts for the morning of May 21. Correlating these two figures with Figures 4 and 5, for May 20, the surface charts show a cold front (blue line with triangles) passing first through northern California and then into southern Nevada. The closely spaced isobar lines behind (northwest of) the surface front indicate an area of strong surface winds, and this strong front is associated with the upper-level low-pressure trough that moved rapidly from the northwestern U.S. coast on May 20 to a north-south line through eastern Nevada by 0400 PDT on May 21.



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

Figure 10. Daily Weather Map Surface Chart for May 20, 2008.

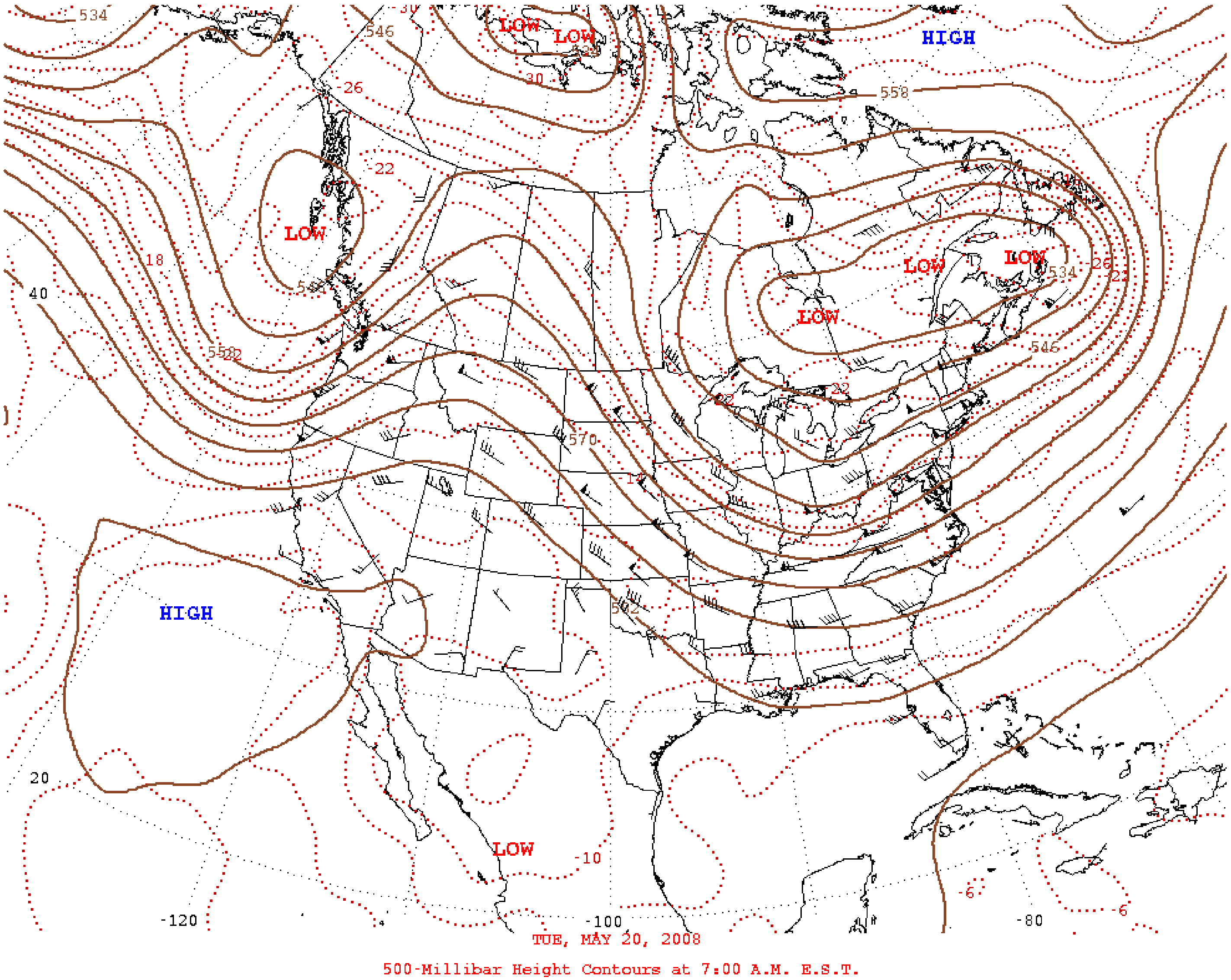


Figure 11. Daily Weather Map 500-mb Chart from May 20, 2008.

Table 8. Hourly Observations for McCarran International Airport, May 20, 2008

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
MCCARRAN INTERNATIONAL AIRPORT (23169)
LAS VEGAS , NV
(05/2008)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 2127 ft. above sea level
Latitude: 36.079
Longitude: -115.155
Data Version: VER3

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp (F)	Dry Bulb Temp (C)	Wet Bulb Temp (F)	Wet Bulb Temp (C)	Dew Point Temp (F)	Dew Point Temp (C)	Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
20	0056	11	FEW250	10.00		91	32.8	58	14.4	27	-2.8	10	8	190		27.48	1	005	29.65	AA		29.75
20	0156	11	FEW250	10.00		89	31.7	58	14.1	28	-2.2	11	8	200		27.47			29.64	AA		29.74
20	0256	11	FEW250	10.00		86	30.0	57	13.7	29	-1.7	13	11	180		27.47			29.64	AA		29.74
20	0356	11	FEW250	10.00		86	30.0	57	13.7	29	-1.7	13	11	190		27.48	5	001	29.65	AA		29.75
20	0456	11	BKN250	10.00		85	29.4	56	13.4	29	-1.7	13	13	190		27.48			29.65	AA		29.75
20	0556	11	BKN250	10.00		86	30.0	57	13.7	29	-1.7	13	11	190		27.49			29.67	AA		29.76
20	0656	11	BKN250	10.00		89	31.7	57	13.9	26	-3.3	10	14	190		27.49	1	006	29.67	AA		29.76
20	0756	11	FEW180 BKN250	10.00		93	33.9	58	14.5	24	-4.4	8	9	170	21	27.50			29.67	AA		29.77
20	0856	11	FEW180 BKN250	10.00		97	36.1	60	15.3	24	-4.4	7	11	170		27.50			29.67	AA		29.77
20	0956	11	BKN200	10.00		98	36.7	59	15.0	20	-6.7	6	18	190	23	27.49	8	002	29.66	AA		29.76
20	1056	11	FEW150 BKN220	10.00		100	37.8	60	15.7	22	-5.6	6	17	190	25	27.48			29.65	AA		29.75
20	1156	11	SCT160 BKN250	10.00		99	37.2	59	14.8	15	-9.4	5	20	200	28	27.46			29.63	AA		29.73
20	1256	11	BKN160 BKN250	10.00		98	36.7	59	14.9	19	-7.2	6	21	220	32	27.43	8	017	29.61	AA		29.70
20	1356	11	BKN160 BKN250	10.00		98	36.7	58	14.7	16	-8.9	5	14	220	24	27.40			29.57	AA		29.67
20	1456	11	BKN160 BKN250	10.00		98	36.7	58	14.6	15	-9.4	5	16	230	29	27.37			29.55	AA		29.64
20	1556	11	BKN160 BKN250	10.00		98	36.7	59	14.9	19	-7.2	6	14	220	29	27.34	8	033	29.50	AA		29.60
20	1656	11	BKN160 BKN250	9.00		97	36.1	59	15.1	23	-5.0	7	20	220	36	27.30			29.47	AA		29.56
20	1756	11	BKN160 BKN250	7.00		96	35.6	60	15.6	29	-1.7	9	20	220	41	27.28			29.44	AA		29.54
20	1856	11	FEW150 SCT250	10.00		92	33.3	58	14.3	25	-3.9	9	22	230	32	27.28	6	021	29.44	AA		29.54
20	1956	11	CLR	10.00		89	31.7	58	14.4	30	-1.1	12	25	230	36	27.27			29.43	AA		29.53
20	2056	11	CLR	10.00		87	30.6	56	13.3	25	-3.9	10	21	230	32	27.24			29.41	AA		29.50
20	2156	11	FEW220	10.00		85	29.4	54	12.4	22	-5.6	10	23	220	33	27.22	8	018	29.38	AA		29.48
20	2256	11	FEW220	10.00	VCBLDU	83	28.3	55	12.5	26	-3.3	12	20	220	34	27.22			29.38	AA		29.48
20	2356	11	FEW220	10.00	VCBLDU	82	27.8	55	12.6	28	-2.2	14	11	200		27.22			29.38	AA		29.48

Dynamically generated Tue Jun 09 17:59:26 EDT 2009 via http://cdo.ncdc.noaa.gov/qclcd/QCLCD

Table 9. Hourly Observations for North Las Vegas Airport, May 20, 2008

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final)
HOURLY OBSERVATIONS TABLE
MCCARRAN INTERNATIONAL AIRPORT (23169)
LAS VEGAS , NV
(05/2008)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 2127 ft. above sea level
Latitude: 36.079
Longitude: -115.155
Data Version: VER3

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp (F)	Dry Bulb Temp (C)	Wet Bulb Temp (F)	Wet Bulb Temp (C)	Dew Point Temp (F)	Dew Point Temp (C)	Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
21	0056	11	FEW220	10.00	VCBLDU	80	26.7	55	12.5	30	-1.1	16	18	230	29	27.20	8	008	29.36	AA		29.45
21	0156	11	CLR	10.00	VCBLDU	79	26.1	53	11.6	26	-3.3	14	7	220	18	27.21			29.37	AA		29.46
21	0256	11	CLR	10.00		76	24.4	52	11.3	28	-2.2	17	13	260	17	27.23			29.40	AA		29.49
21	0356	11	CLR	10.00	VCBLDU	75	23.9	51	10.7	26	-3.3	16	21	340	30	27.26	3	022	29.44	AA		29.52
21	0456	11	FEW160	10.00	VCBLDU	72	22.2	51	10.3	28	-2.2	19	23	320	30	27.27			29.44	AA		29.53
21	0556	11	FEW150	10.00		73	22.8	50	10.0	24	-4.4	16	18	340	31	27.29			29.47	AA		29.55
21	0656	11	FEW150	10.00	VCBLDU	72	22.2	51	10.7	30	-1.1	21	25	320	41	27.32	3	017	29.50	AA		29.58
21	0736	11	FEW150	10.00	VCBLDU	72	22.0	51	10.3	28	-2.0	19	25	330	44	27.31			M	SP		29.57
21	0756	11	FEW120	10.00	VCBLDU	72	22.2	51	10.5	29	-1.7	20	33	320	44	27.31			29.49	AA		29.57
21	0856	11	CLR	10.00	VCBLDU	74	23.3	52	10.8	28	-2.2	18	20	330	29	27.30			29.48	AA		29.56
21	0956	11	FEW100	10.00		75	23.9	52	10.9	27	-2.8	17	21	350	30	27.30	6	006	29.48	AA		29.56
21	1056	11	FEW100	10.00		78	25.6	53	11.4	26	-3.3	15	26	340	37	27.26			29.44	AA		29.52
21	1156	11	FEW100	10.00		78	25.6	52	11.3	25	-3.9	14	25	350	40	27.24			29.43	AA		29.50
21	1256	11	SCT100	10.00		80	26.7	53	11.7	25	-3.9	13	28	350	40	27.23	6	021	29.42	AA		29.49
21	1356	11	SCT080 BKN130	10.00		79	26.1	52	11.1	22	-5.6	12	23	340	31	27.21			29.40	AA		29.47
21	1456	11	SCT080 SCT130	10.00		80	26.7	52	11.0	20	-6.7	11	17	350	29	27.19			29.37	AA		29.44
21	1556	11	SCT080 SCT130	10.00		78	25.6	51	10.7	21	-6.1	12	28	340	33	27.19	6	016	29.37	AA		29.44
21	1656	11	SCT080 SCT130	10.00		78	25.6	51	10.6	20	-6.7	11	24	320	32	27.18			29.36	AA		29.43
21	1756	11	SCT080 SCT130	10.00		75	23.9	50	9.7	19	-7.2	12	22	340	32	27.17			29.36	AA		29.42
21	1856	11	SCT080 SCT130	10.00		73	22.8	49	9.1	18	-7.8	12	25	340	34	27.20	3	004	29.39	AA		29.45
21	1956	11	SCT130	10.00		71	21.7	48	8.6	18	-7.8	13	22	350	30	27.21			29.41	AA		29.47
21	2056	11	SCT130	10.00		69	20.6	47	8.0	17	-8.3	14	22	340	34	27.22			29.42	AA		29.48
21	2156	11	FEW130	9.00		66	18.9	45	7.2	17	-8.3	15	20	340	37	27.22	1	010	29.43	AA		29.48
21	2256	11	FEW130	10.00	VCBLDU	65	18.3	45	7.0	17	-8.3	16	22	340	29	27.22			29.42	AA		29.48
21	2356	11	CLR	10.00	VCBLDU	63	17.2	43	6.3	16	-8.9	16	25	340	33	27.20			29.39	AA		29.45

Dynamically generated Tue Jun 09 17:56:21 EDT 2009 via http://cdo.ncdc.noaa.gov/qclcd/QCLCD

Table 10. Hourly Observations for McCarran International Airport, May 21, 2008

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA (final) HOURLY OBSERVATIONS TABLE NORTH LAS VEGAS AIRPORT (53123) LAS VEGAS , NV (05/2008)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 2186 ft. above sea level
Latitude: 36.212
Longitude: -115.196
Data Version: VER2

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp (F)	Dry Bulb Temp (C)	Wet Bulb Temp (F)	Wet Bulb Temp (C)	Dew Point Temp (F)	Dew Point Temp (C)	Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
21	0053	12	CLR	10.00		80	26.7	55	12.5	30	-1.1	16	21	270	26	27.19	6	016	29.35	AA		29.47
21	0153	12	CLR	10.00		80	26.7	54	12.2	28	-2.2	15	18	260	28	27.20			29.36	AA		29.48
21	0253	12	CLR	10.00		78	25.6	52	11.0	23	-5.0	13	34	330	41	27.22			29.37	AA		29.50
21	0353	12	CLR	10.00		73	22.8	51	10.7	29	-1.7	20	26	330	39	27.25	3	021	29.43	AA		29.54
21	0453	12	CLR	10.00		71	21.7	51	10.3	29	-1.7	21	28	330	40	27.25			29.44	AA		29.54
21	0553	12	CLR	10.00		71	21.7	50	9.9	27	-2.8	19	34	330	41	27.29			29.47	AA		29.58
21	0653	12	CLR	7.00		70	21.1	51	10.4	31	-0.6	24	33	330	47	27.29	1	012	29.47	AA		29.58
21	0753	12	CLR	10.00		71	21.7	51	10.6	31	-0.6	23	36	340	49	27.28			29.47	AA		29.57
21	0853	12	CLR	10.00		73	22.8	52	11.1	31	-0.6	21	30	330	43	27.28			29.47	AA		29.57
21	0953	12	CLR	10.00		75	23.9	52	11.0	28	-2.2	18	22	340	41	27.28	5	001	29.47	AA		29.57
21	1053	12	CLR	10.00		77	25.0	52	11.0	25	-3.9	14	26	330	38	27.27			29.47	AA		29.56
21	1153	12	CLR	10.00		78	25.6	53	11.4	26	-3.3	15	26	340	33	27.25			29.44	AA		29.54
21	1253	12	CLR	10.00		79	26.1	53	11.3	24	-4.4	13	24	340	37	27.24	8	015	29.42	AA		29.53
21	1353	12	CLR	10.00		80	26.7	52	11.2	21	-6.1	11	22	330	34	27.22			29.40	AA		29.50
21	1453	12	CLR	10.00		80	26.7	52	11.3	22	-5.6	12	25	340	34	27.19			29.37	AA		29.47
21	1553	12	CLR	10.00		79	26.1	52	11.2	23	-5.0	12	22	350	38	27.18	6	020	29.37	AA		29.46
21	1653	12	CLR	10.00		77	25.0	51	10.3	20	-6.7	12	23	330	31	27.18			29.37	AA		29.46
21	1753	12	CLR	10.00		76	24.4	50	10.0	19	-7.2	12	21	360	30	27.19			29.38	AA		29.47
21	1853	12	CLR	10.00		72	22.2	48	9.0	19	-7.2	13	16	350	25	27.20	3	005	29.40	AA		29.48
21	1953	12	CLR	10.00		70	21.1	47	8.4	18	-7.8	14	25	350	36	27.21			29.40	AA		29.49
21	2053	12	CLR	10.00		68	20.0	46	7.9	18	-7.8	15	20	350	28	27.23			29.43	AA		29.51
21	2153	12	CLR	10.00		66	18.9	45	7.4	18	-7.8	16	17	340	25	27.24	1	012	29.44	AA		29.52
21	2253	12	CLR	10.00		64	17.8	44	6.9	18	-7.8	17	18	350	31	27.24			29.44	AA		29.52
21	2353	12	CLR	10.00		62	16.7	43	6.2	17	-8.3	17	20	340	29	27.21			29.41	AA		29.49

Dynamically generated Tue Jun 09 18:04:28 EDT 2009 via http://cdo.ncdc.noaa.gov/qclcd/QCLCD

Table 11. Hourly Observations for North Las Vegas Airport, May 21, 2008

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
(final)
HOURLY OBSERVATIONS TABLE
NELLIS AFB AIRPORT (23112)
LAS VEGAS , NV
(05/2008)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 0 ft. above sea level
Latitude: 36.236
Longitude: -115.034
Data Version: VER2

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp (F)	Dry Bulb Temp (C)	Wet Bulb Temp (F)	Wet Bulb Temp (C)	Dew Point Temp (F)	Dew Point Temp (C)	Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
21	0055	0	CLR	10.00		81	27.4	56	13.3	33	0.6	18	21	230	25	27.52	8	013	29.38	AA		29.46
21	0155	0	CLR	10.00		80	26.7	55	12.9	32	0.0	17	16	240		27.52			29.39	AA		29.46
21	0255	0	CLR	10.00		79	26.2	54	12.3	30	-0.9	17	17	240		27.53			29.39	AA		29.47
21	0305	0	CLR	10.00		81	27.0	54	12.0	25	-4.0	13	20	300	24	27.53			29.39	AA		29.47
21	0355	0	CLR	6.00	HZ	76	24.3	53	11.8	31	-0.5	19	30	290	40	27.56	3	013	29.44	AA		29.50
21	0455	0	CLR	10.00		72	22.4	52	11.1	32	-0.1	23	36	300	43	27.57			29.46	AA		29.51
21	0555	0	CLR	10.00		73	22.5	52	11.0	30	-1.0	20	30	290	41	27.61			29.51	AA		29.56
21	0655	0	CLR	10.00		72	22.1	53	11.6	35	1.5	26	34	290	45	27.60	0	017	29.51	AA		29.55
21	0755	0	CLR	10.00		73	22.7	53	11.5	33	0.8	23	34	290	44	27.61			29.52	AA		29.56
21	0855	0	CLR	10.00		75	23.9	53	11.8	32	-0.1	21	23	310	37	27.62			29.52	AA		29.57
21	0955	0	CLR	10.00		77	24.8	54	12.0	31	-0.8	19	23	310	33	27.61	0	003	29.52	AA		29.56
21	1055	0	CLR	10.00		79	26.0	54	12.0	28	-2.3	15	31	290	39	27.60			29.49	AA		29.54
21	1155	0	CLR	10.00		80	26.5	54	12.1	27	-2.8	14	24	300	38	27.58			29.48	AA		29.52
21	1255	0	SCT130	10.00		82	27.5	54	12.4	26	-3.4	13	29	300	39	27.57	6	019	29.47	AA		29.51
21	1330	0	SCT130	10.00		82	28.0	54	12.0	23	-5.0	11	20	040	28	27.56			29.46	AA		29.50
21	1355	0	OVC130	10.00		79	26.3	52	11.3	23	-5.0	12	11	350	25	27.55			29.46	AA		29.49
21	1455	0	BKN130	10.00		82	27.8	53	11.8	22	-5.5	11	18	290	28	27.52			29.42	AA		29.46
21	1555	0	BKN140	10.00		80	26.8	53	11.8	25	-4.0	13	22	320	32	27.51	6	016	29.42	AA		29.45
21	1655	0	BKN120	10.00		80	26.4	53	11.4	22	-5.4	12	21	310	31	27.50			29.41	AA		29.44
21	1755	0	BKN140	10.00		78	25.3	52	10.9	22	-5.8	12	14	340	21	27.51			29.42	AA		29.45
21	1855	0	BKN120	10.00		74	23.1	50	10.0	22	-5.5	14	23	020	30	27.52	3	001	29.44	AA		29.46
21	1955	0	CLR	10.00		71	21.8	49	9.2	22	-5.7	16	25	010		27.55			29.47	AA		29.49
21	2055	0	CLR	10.00		69	20.8	47	8.5	20	-6.6	15	17	010		27.57			29.49	AA		29.51
21	2155	0	CLR	10.00		68	19.8	47	8.2	20	-6.5	16	23	360	30	27.57	0	016	29.49	AA		29.51
21	2255	0	CLR	10.00		65	18.6	45	7.4	20	-6.7	18	18	340	25	27.57			29.50	AA		29.51
21	2355	0	CLR	10.00		64	18.0	45	6.9	18	-8.0	17	15	340	22	27.56			29.48	AA		29.50

Dynamically generated Tue Jun 09 18:14:02 EDT 2009 via *http://cdo.ncdc.noaa.gov/qclcd/QCLCD*

Table 12. Hourly Observations for Nellis Air Force Base, May 21, 2008

U.S. Department of Commerce
National Oceanic & Atmospheric Administration

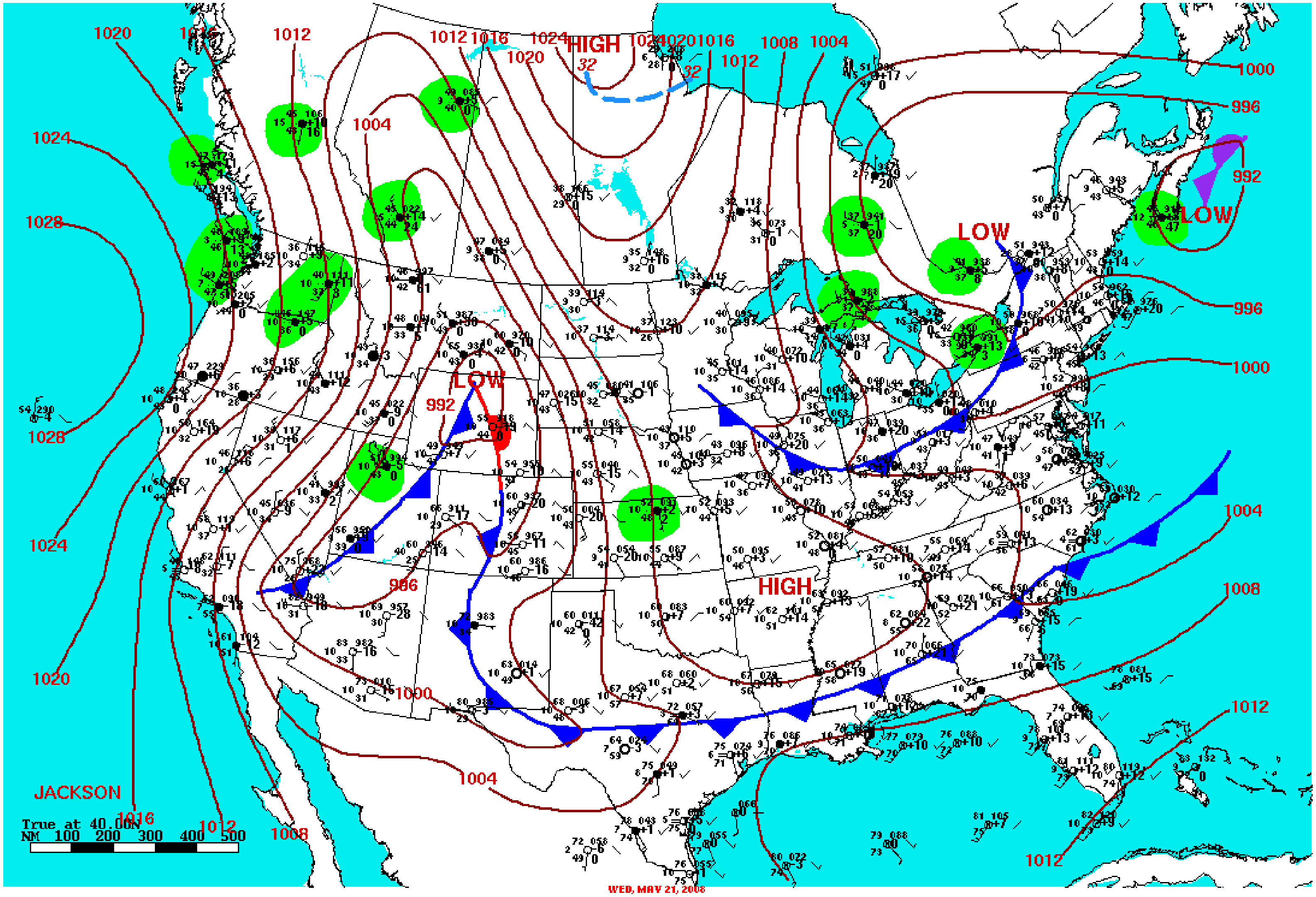
QUALITY CONTROLLED LOCAL CLIMATOLOGICAL DATA
(final)
HOURLY OBSERVATIONS TABLE
NELLIS AFB AIRPORT (23112)
LAS VEGAS , NV
(05/2008)

National Climatic Data Center
Federal Building
151 Patton Avenue
Asheville, North Carolina 28801

Elevation: 0 ft. above sea level
Latitude: 36.236
Longitude: -115.034
Data Version: VER2

Date	Time (LST)	Station Type	Sky Conditions	Visibility (SM)	Weather Type	Dry Bulb Temp (F)	Dry Bulb Temp (C)	Wet Bulb Temp (F)	Wet Bulb Temp (C)	Dew Point Temp (F)	Dew Point Temp (C)	Rel Humd %	Wind Speed (MPH)	Wind Dir	Wind Gusts (MPH)	Station Pressure (in. hg)	Press Tend	Net 3-hr Chg (mb)	Sea Level Pressure (in. hg)	Report Type	Precip. Total (in)	Alti-meter (in. hg)
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
21	0055	0	CLR	10.00		81	27.4	56	13.3	33	0.6	18	21	230	25	27.52	8	013	29.38	AA		29.46
21	0155	0	CLR	10.00		80	26.7	55	12.9	32	0.0	17	16	240		27.52			29.39	AA		29.46
21	0255	0	CLR	10.00		79	26.2	54	12.3	30	-0.9	17	17	240		27.53			29.39	AA		29.47
21	0305	0	CLR	10.00		81	27.0	54	12.0	25	-4.0	13	20	300	24	27.53			29.39	AA		29.47
21	0355	0	CLR	6.00	HZ	76	24.3	53	11.8	31	-0.5	19	30	290	40	27.56	3	013	29.44	AA		29.50
21	0455	0	CLR	10.00		72	22.4	52	11.1	32	-0.1	23	36	300	43	27.57			29.46	AA		29.51
21	0555	0	CLR	10.00		73	22.5	52	11.0	30	-1.0	20	30	290	41	27.61			29.51	AA		29.56
21	0655	0	CLR	10.00		72	22.1	53	11.6	35	1.5	26	34	290	45	27.60	0	017	29.51	AA		29.55
21	0755	0	CLR	10.00		73	22.7	53	11.5	33	0.8	23	34	290	44	27.61			29.52	AA		29.56
21	0855	0	CLR	10.00		75	23.9	53	11.8	32	-0.1	21	23	310	37	27.62			29.52	AA		29.57
21	0955	0	CLR	10.00		77	24.8	54	12.0	31	-0.8	19	23	310	33	27.61	0	003	29.52	AA		29.56
21	1055	0	CLR	10.00		79	26.0	54	12.0	28	-2.3	15	31	290	39	27.60			29.49	AA		29.54
21	1155	0	CLR	10.00		80	26.5	54	12.1	27	-2.8	14	24	300	38	27.58			29.48	AA		29.52
21	1255	0	SCT130	10.00		82	27.5	54	12.4	26	-3.4	13	29	300	39	27.57	6	019	29.47	AA		29.51
21	1330	0	SCT130	10.00		82	28.0	54	12.0	23	-5.0	11	20	040	28	27.56			29.46	AA		29.50
21	1355	0	OVC130	10.00		79	26.3	52	11.3	23	-5.0	12	11	350	25	27.55			29.46	AA		29.49
21	1455	0	BKN130	10.00		82	27.8	53	11.8	22	-5.5	11	18	290	28	27.52			29.42	AA		29.46
21	1555	0	BKN140	10.00		80	26.8	53	11.8	25	-4.0	13	22	320	32	27.51	6	016	29.42	AA		29.45
21	1655	0	BKN120	10.00		80	26.4	53	11.4	22	-5.4	12	21	310	31	27.50			29.41	AA		29.44
21	1755	0	BKN140	10.00		78	25.3	52	10.9	22	-5.8	12	14	340	21	27.51			29.42	AA		29.45
21	1855	0	BKN120	10.00		74	23.1	50	10.0	22	-5.5	14	23	020	30	27.52	3	001	29.44	AA		29.46
21	1955	0	CLR	10.00		71	21.8	49	9.2	22	-5.7	16	25	010		27.55			29.47	AA		29.49
21	2055	0	CLR	10.00		69	20.8	47	8.5	20	-6.6	15	17	010		27.57			29.49	AA		29.51
21	2155	0	CLR	10.00		68	19.8	47	8.2	20	-6.5	16	23	360	30	27.57	0	016	29.49	AA		29.51
21	2255	0	CLR	10.00		65	18.6	45	7.4	20	-6.7	18	18	340	25	27.57			29.50	AA		29.51
21	2355	0	CLR	10.00		64	18.0	45	6.9	18	-8.0	17	15	340	22	27.56			29.48	AA		29.50

Dynamically generated Tue Jun 09 18:14:02 EDT 2009 via http://cdo.ncdc.noaa.gov/qclcd/QCLCD



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

Figure 12. Daily Weather Map Surface Chart for May 21, 2008.

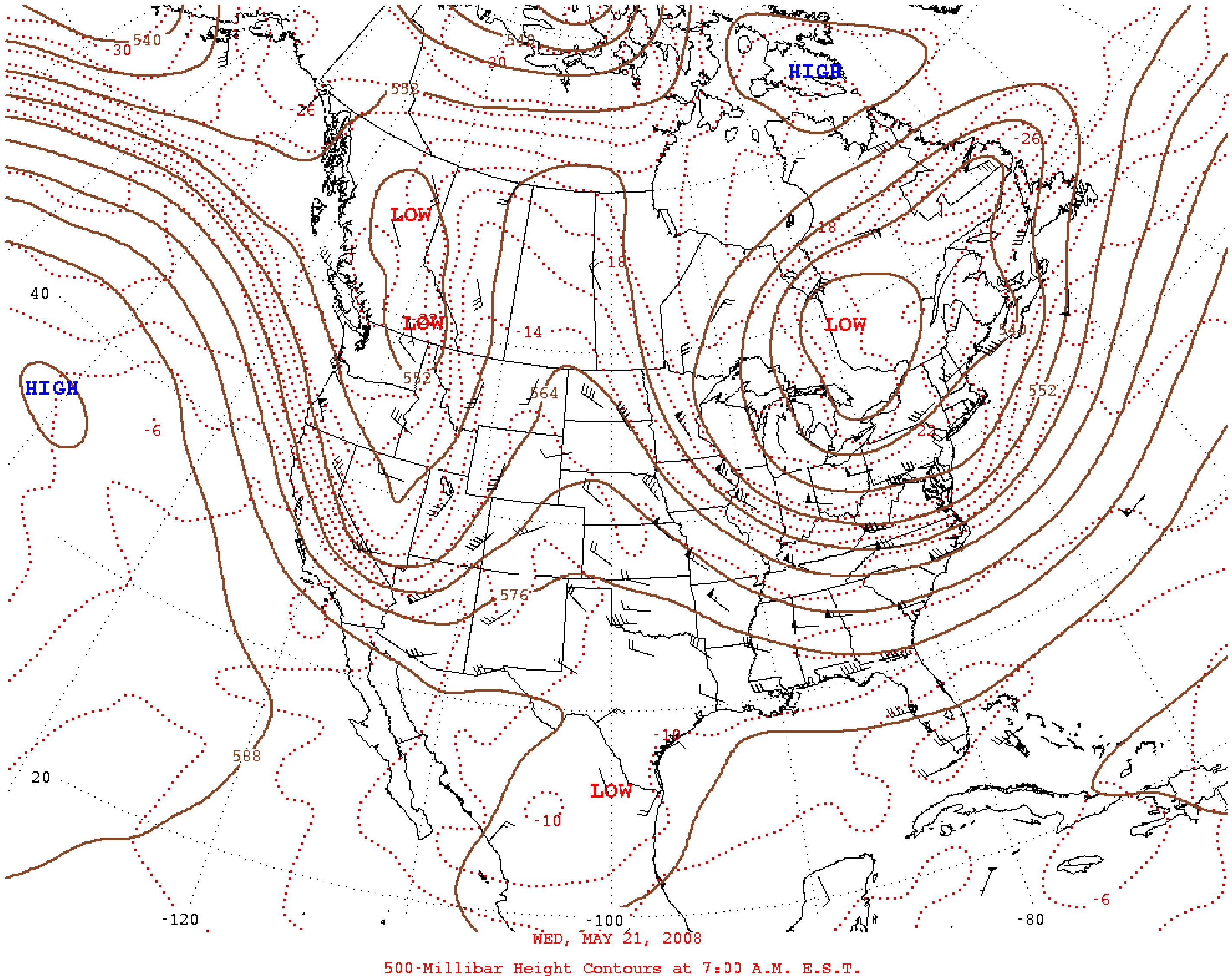


Figure 13. Daily Weather Map 500-mb Chart for May 21, 2008.

Figures 14 through 18 contain the SRRS chart plots from intermediate time periods between May 20 and 21, which show the rapid west-to-east movement of the weather system in detail. Figure 14 shows the SRRS surface chart from 2200 PDT on May 20 (0600 Z on May 21), with the cold front approaching the Desert Rock Airport station about 60 miles northwest of Las Vegas. Strong southwesterly winds are evident ahead (southeast) of the front, with strong northwesterly winds behind (northwest of) the front. Figures 15 and 16 show the front as it passes through Clark County according to the SRRS analysis for 0100 PDT (0900Z) and 0400 PDT (1200Z) on May 21. Figure 16 is the "Daily Weather Map" depiction of the surface chart during the period in Figure 12.

Figure 17 shows the SRRS upper-air chart from 2200 PDT on May 20 (0600Z on May 21), with the trough line oriented approximately north-south through western Nevada. Figure 18 shows the trough position in eastern Nevada according to the SRRS analysis for 0400 PDT (1200Z) on May 21. Figure 18 is the "Daily Weather Map" depiction of the 500-mb chart during the period in Figure 12.

Focusing on the wind occurrences specific to the East Craig Road monitoring station, Table 13 shows hourly PM_{10} concentrations, average wind speed and direction, and maximum wind gust speed (during the full hours) from 1300 PDT on May 20 through 1200 PDT on May 21. The table also lists hourly observations for McCarran International Airport during the same period. These data show a rapid increase in PM_{10} concentration beginning around 0300 PDT, at which time the average wind speed exceeded 25 mph, gusts exceeded 40 mph, and the wind direction shifted to the northwest at the East Craig Road station. The McCarran data show similar weather conditions, although there is a time difference because weather moves through the southern portion of the valley at different times than through the northern portion.

Figure 19 shows hourly PM_{10} concentrations and both average and gust wind speeds at the East Craig Road station during May 21. The horizontal axis shows hours in the day, corresponding to 0000 through 2300 PDT. For the first two hours on May 21, the average wind speed remained less than 15 mph, gusts were below about 30 mph, and PM_{10} concentrations were below 150 $\mu g/m^3$. Beginning in the fourth hour, average wind speeds exceeded 25 mph and gusts exceeded 40 mph. From then through hour 10, PM_{10} concentrations exceeded about 300 $\mu g/m^3$; the maximum hourly value at East Craig Road was 802 $\mu g/m^3$ during the first hour of the period with the strongest winds (hour 5, beginning at 0400 PDT), which includes a maximum gust of nearly 50 mph. The wind direction changed from southwesterly to northwesterly; the synoptic charts indicate passage of the surface cold front at approximately 0400 PDT. Wind speeds diminished gradually into the evening hours; PM_{10} concentrations dropped quickly during hour 11 (beginning at 1200 PDT) and stayed under 100 $\mu g/m^3$ for the rest of the day.

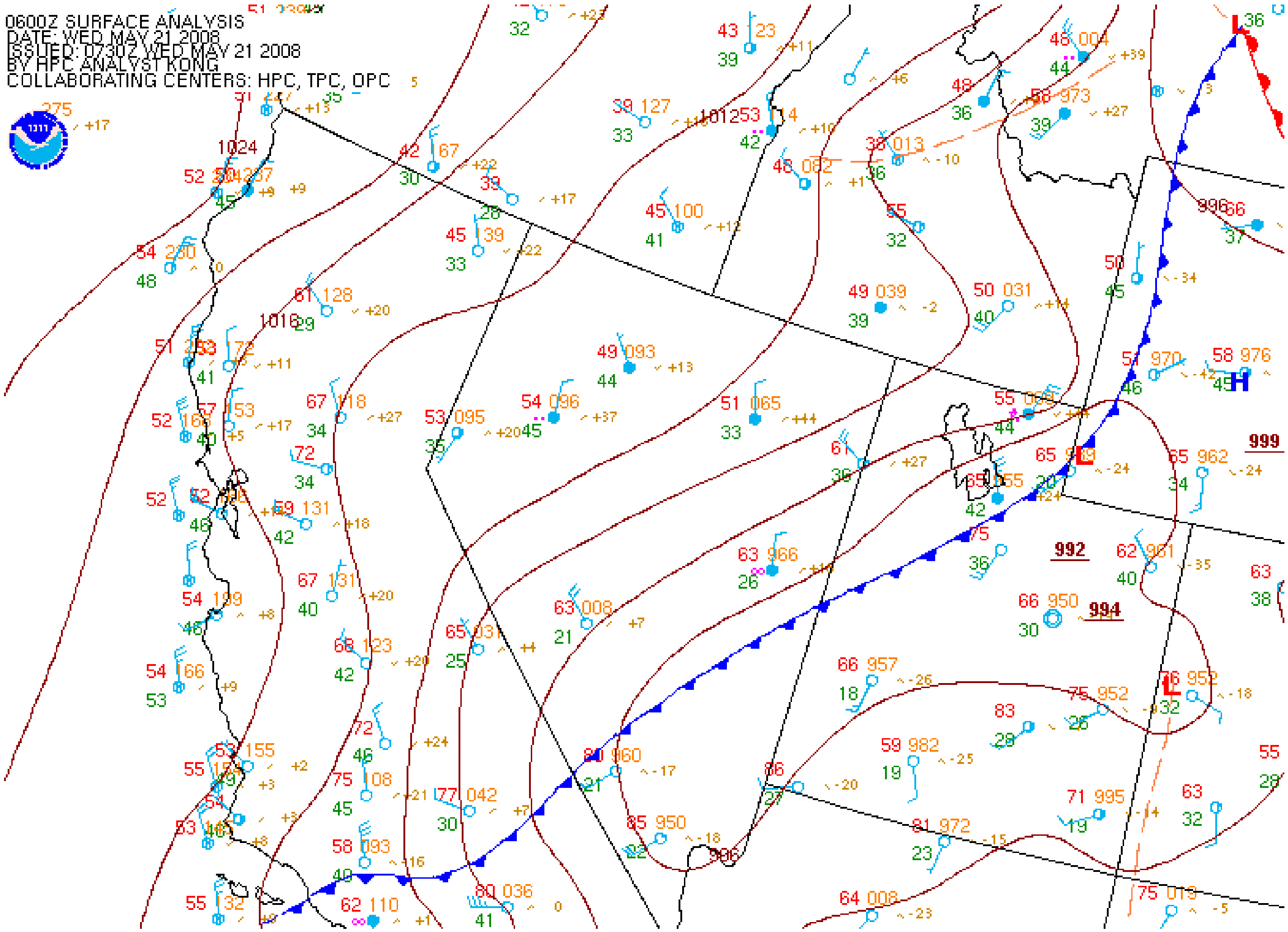


Figure 14. SRRS Surface Chart for May 21, 2008, at 0600 Z (2200 PDT May 20).

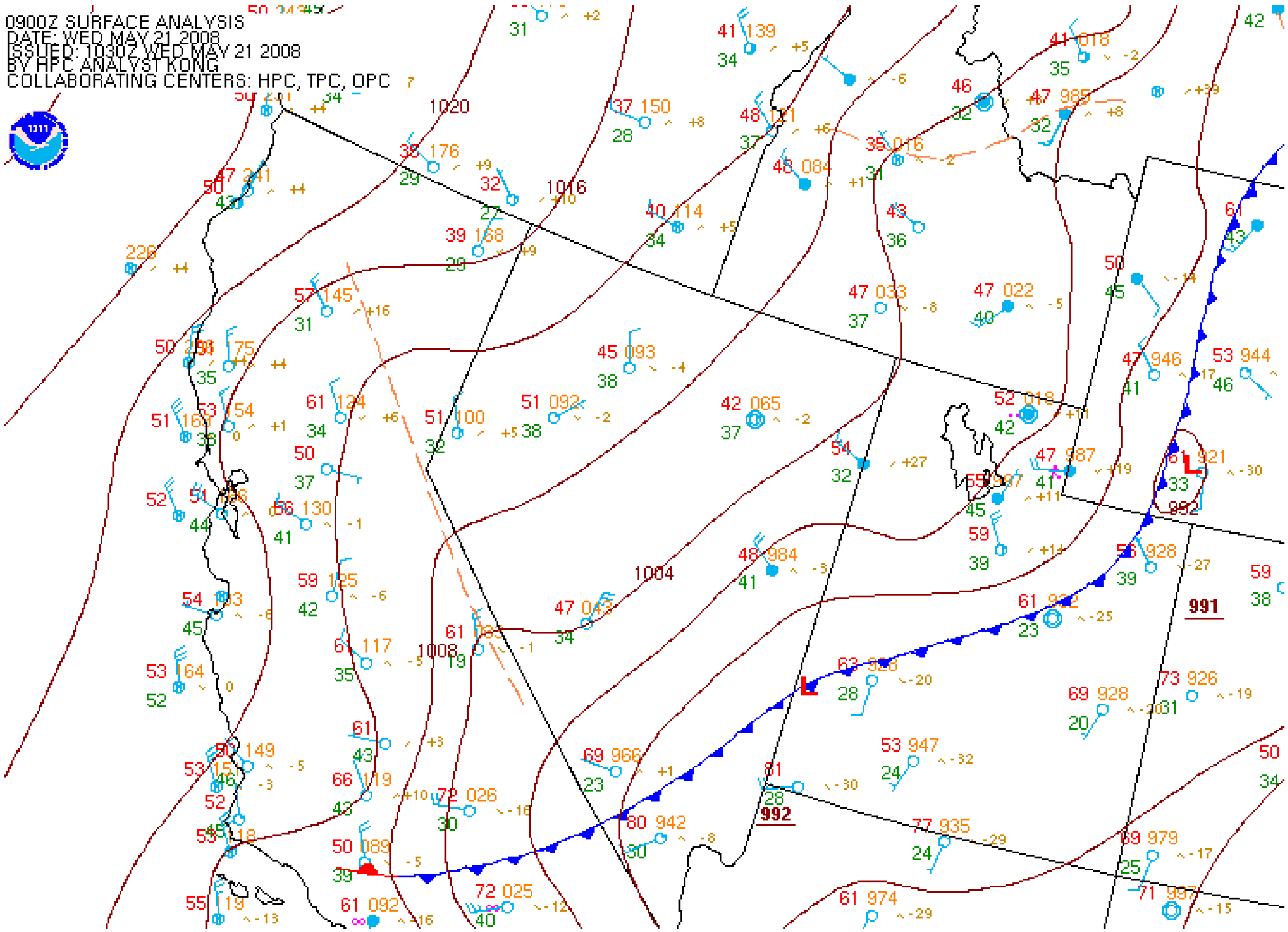


Figure 15. SRRS Surface Chart for May 21, 2008, at 0900 Z (0100 PDT).

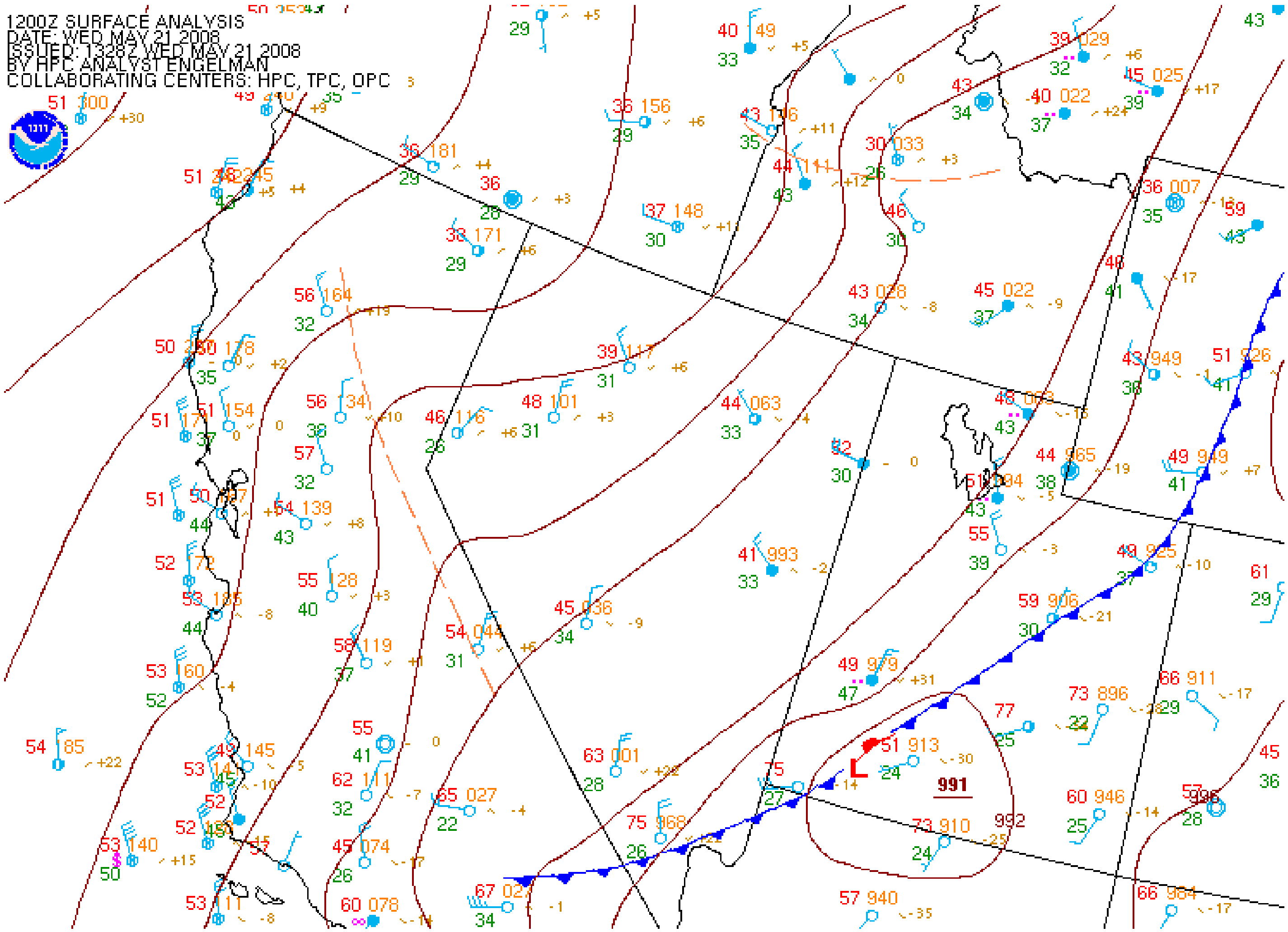


Figure 16. **SRRS Surface Chart for May 21, 2008, at 1200 Z (0400 PDT).**

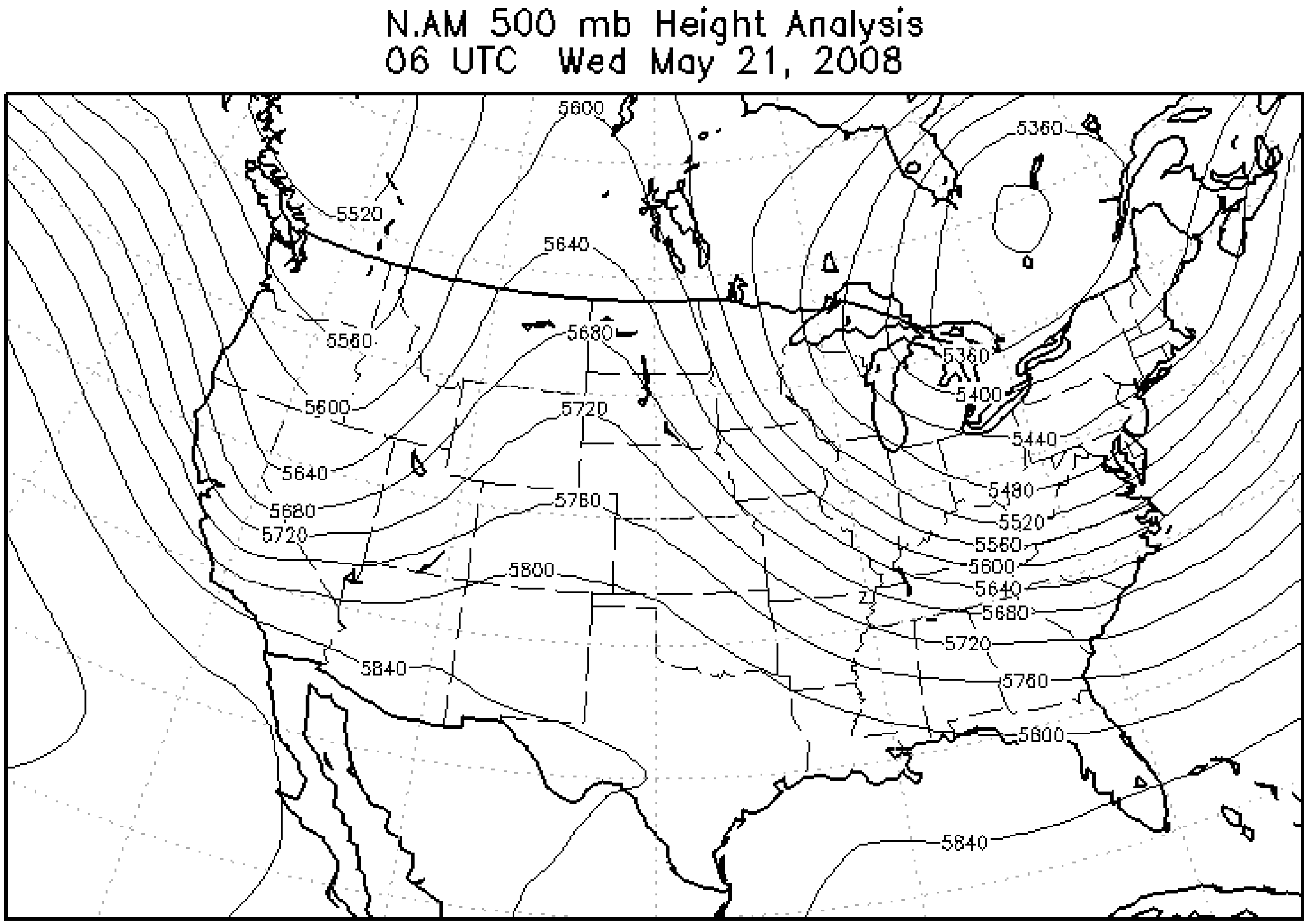


Figure 17. SRRS 500-mb Chart for May 21, 2008, at 0600 Z (2200 PDT May 20).

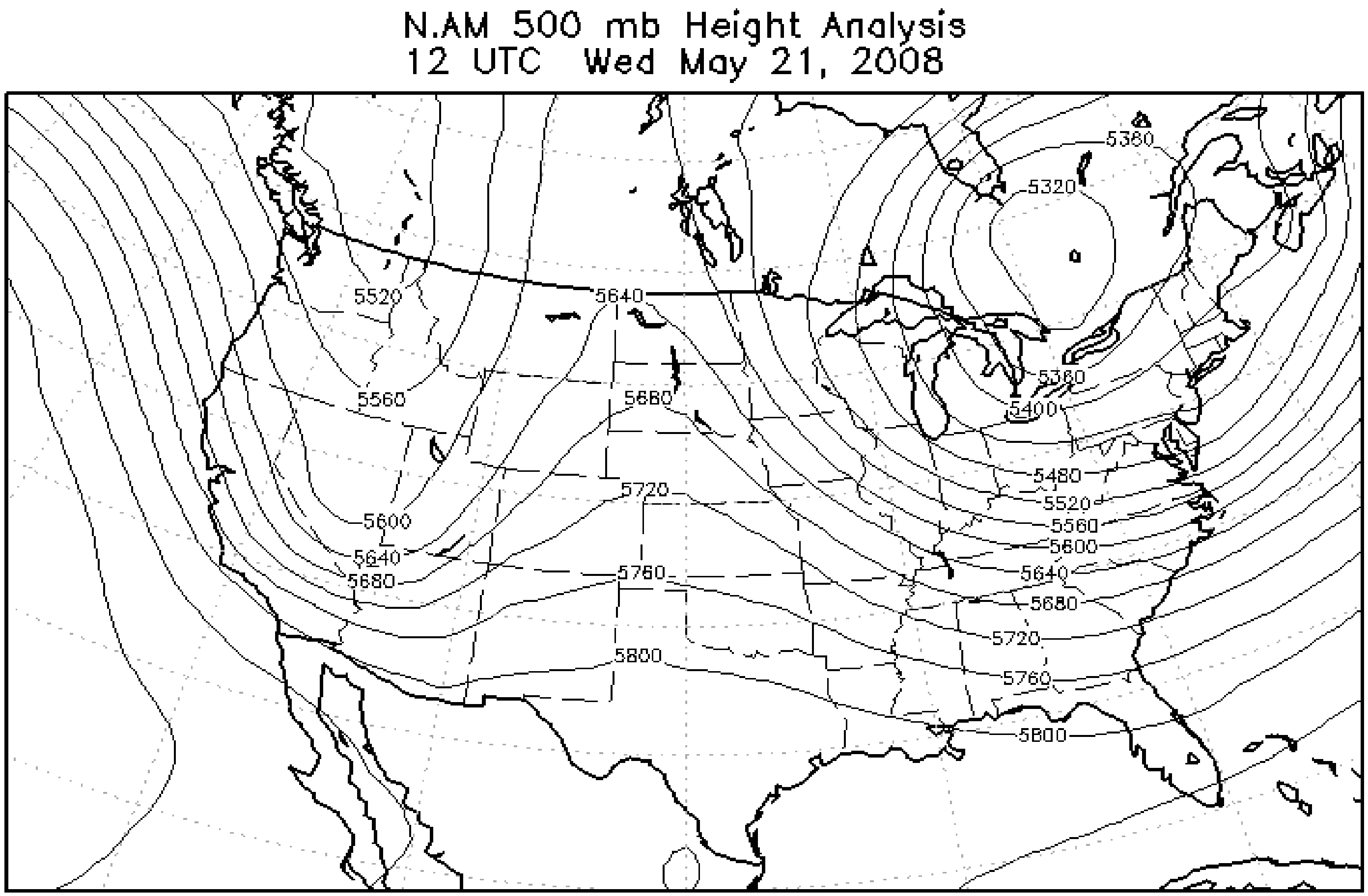


Figure 18. **SRRS 500-mb Chart for May 21, 2008, at 1200 Z (0400 PDT).**

Table 13. PM_{10} Concentrations and Wind Data From East Craig Road Station and McCarran International Airport, May 20-21, 2008

E. Craig Road (DAQEM Station 20) (hourly averages, except for extreme speed gust)					McCarran Int'l (observations a few minutes before time shown)		
Time (PDT)	PM_{10} ($\mu g/m^3$)	Wind Speed (mph)	Wind Dir. (degrees)	Wind Gust (mph)	Wind Speed (mph)	Wind Dir. (degrees)	Wind Gust (mph)
1300	64	14.0	214	30.6	21	220	32
1400	36	11.3	211	26.1	14	220	24
1500	53	13.2	206	26.3	16	230	29
1600	43	11.0	229	20.5	14	220	29
1700	37	12.8	231	26.4	20	220	36
1800	47	13.5	227	26.4	20	220	41
1900	53	14.0	210	26.5	22	230	32
2000	63	13.2	207	27.3	25	230	36
2100	53	14.2	219	27.3	21	230	32
2200	69	15.0	227	30.8	23	220	33
2300	96	11.6	212	25.7	20	220	34
0000	136	14.2	227	27.8	11	200	--
0100	140	11.3	239	24.8	18 V[1]	230	29
0200	109	12.4	269	38.6	7 V	220	18
0300	361	27.7	303	45.7	13	260	17
0400	802	28.1	296	49.9	21 V	340	30
0500	309	24.4	296	42.9	23 V	320	30
0600	299	27.0	299	44.1	18	340	31
0700	339	27.6	306	45.5	25 V	320	41
0800	346	28.4	310	45.0	33 V	320	44
0900	319	26.9	308	45.1	20 V	330	29
1000	140	24.3	301	41.7	21	350	30
1100	93	23.8	306	38.9	26	340	37
1200	56	21.8	300	40.5	25	350	40

[1]"V" indicates blowing dust of unknown intensity in the vicinity.

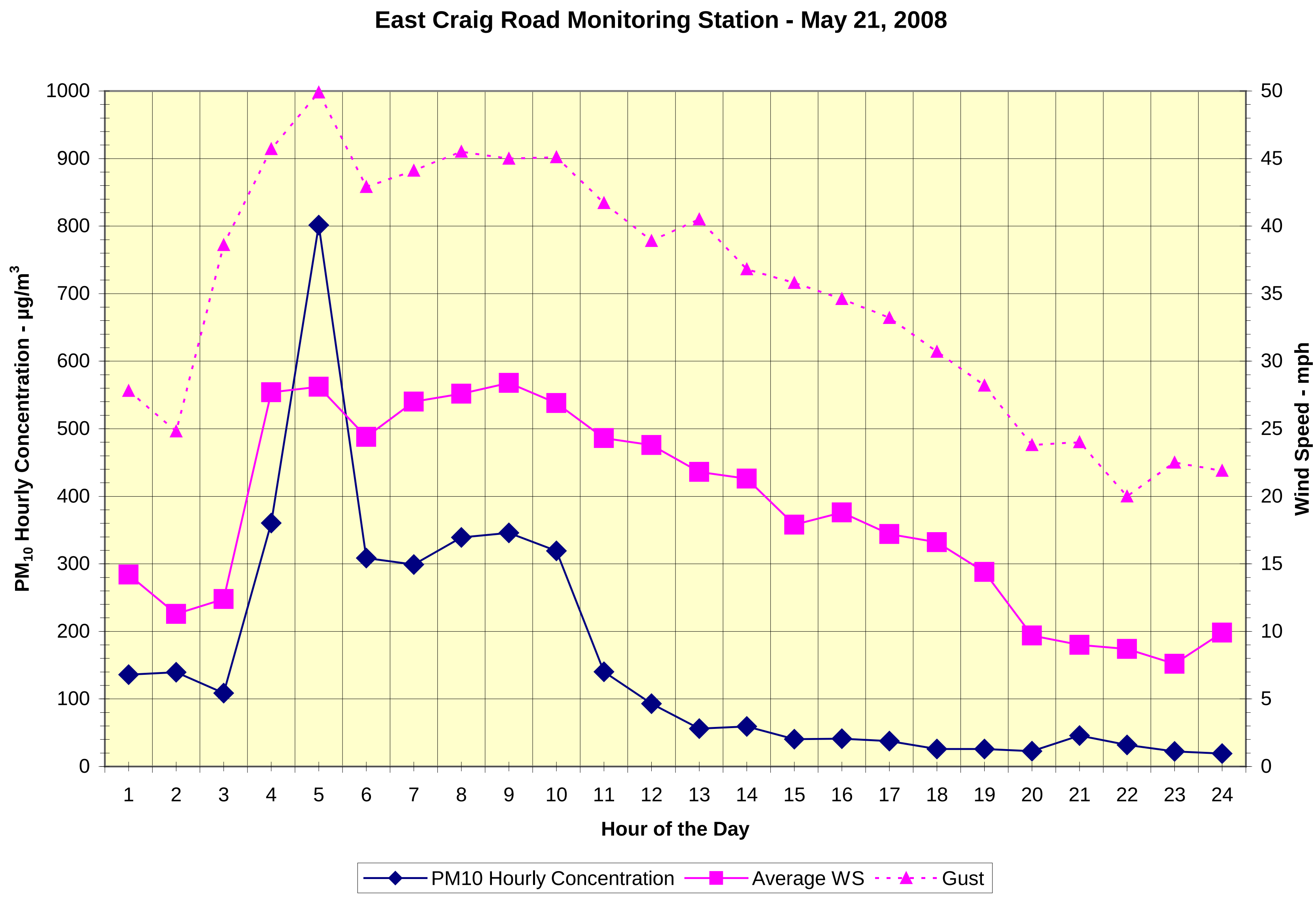


Figure 19. **PM_{10} Concentrations and Wind Speed at East Craig Road Monitoring Station.**

The 24-hour average PM_{10} concentration for May 21 was 159 μg/m^3 (i.e., ambient conditions). Without the maximum hourly value (802 μg/m^3), the 24-hour average would have been 131 μg/m^3. The corresponding value at standard reference conditions would be the reported 24-hour average of 168 μg/m^3. The 0400 single hour average was 847 μg/m^3 (at reference conditions); the daily average without the 0400 PDT hour would have been 139 μg/m^3, which is below the NAAQS for a 24-hour period (150 μg/m^3).

Figures 20 through 24 contain similar graphs from the other five DAQEM monitoring stations in the Las Vegas valley on May 21. The maximum one-hour concentration at the East Craig Road station far exceeds the maxima at the other stations. The time of highest hourly value varies among the other stations, primarily because of local winds. PM_{10} concentrations at all stations in the valley had dwindled by the afternoon hours, though wind speeds remained in the 20–30 mph range through the rest of the day. This pattern is typical, since PM_{10} concentrations decrease rapidly once the shallow surface dust reservoir has been depleted.

In summary, weather information clearly indicates the period from late May 20 into May 21 was affected by a strong cold front at the surface moving rapidly from west to east, passing through the Las Vegas area at about 0400 PDT. A closely associated upper-air trough of low pressure supported this surface front. Wind data from the McCarran, North Las Vegas, and Nellis AFB Airports support the wind readings at the East Craig Road monitoring station, where the time of maximum wind speed matched the highest hourly PM_{10} concentration.

3.1.6 Weather After the Event

The surface cold front and upper-air trough affecting southern Nevada on May 20 and 21, 2008, continued eastward, leaving the area by the next day. The wind and PM_{10} data from the East Craig Road station, shown in Table 13 and Figure 19, from the remainder of May 21 show continued strong northwesterly winds, with PM_{10} concentrations diminishing: the 24-hour concentration on May 22 was only 14 μg/m^3.

The rapidly diminishing PM_{10} concentrations during continuing wind speeds of at least 25 mph and gusts of up to 40 mph show the very low amount of airborne material entrained once the available dust reservoir, which had built up over many days, was depleted, early on in the high-speed wind event.

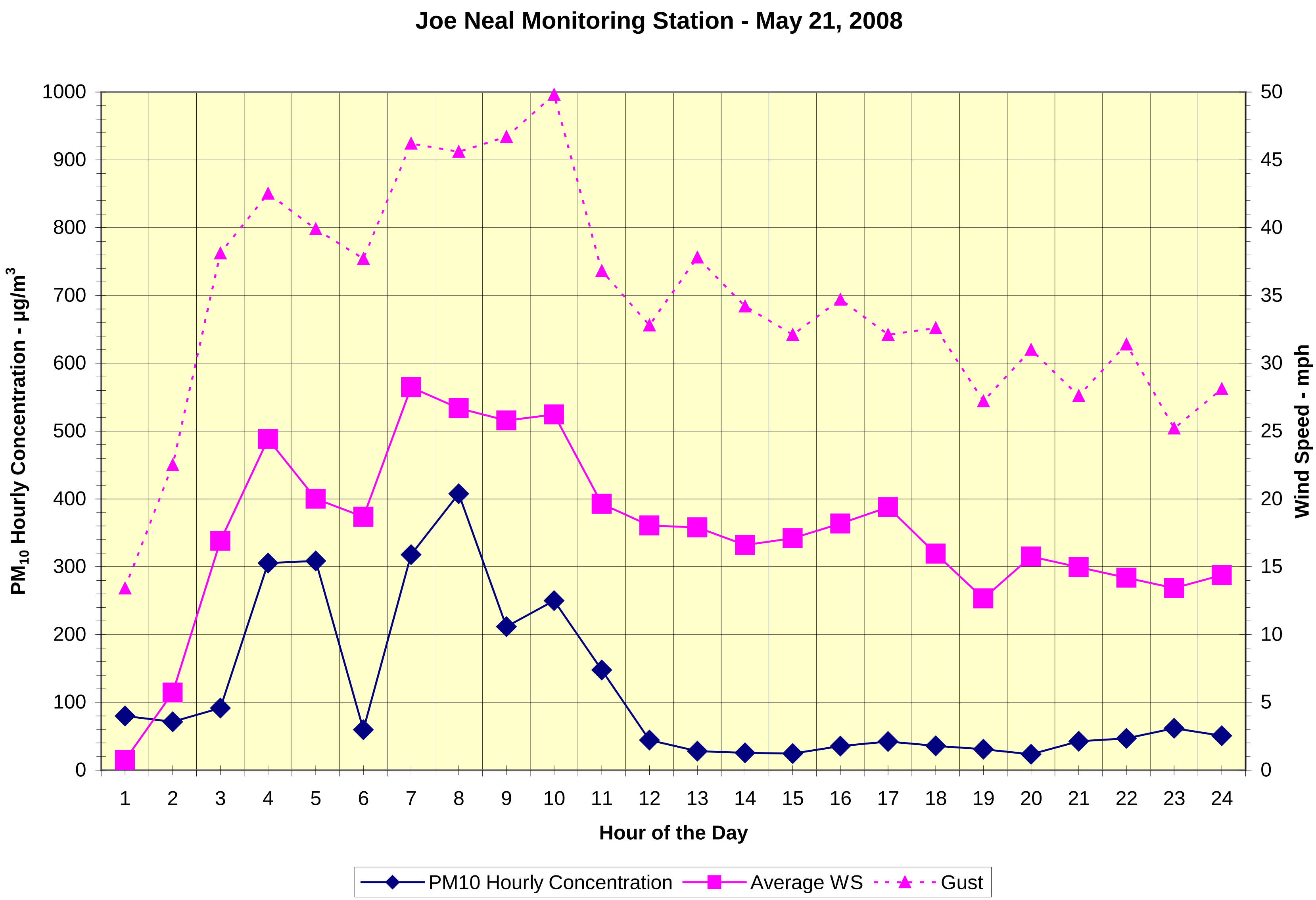


Figure 20. PM_{10} Concentrations and Wind Speed at Joe Neal Monitoring Station.

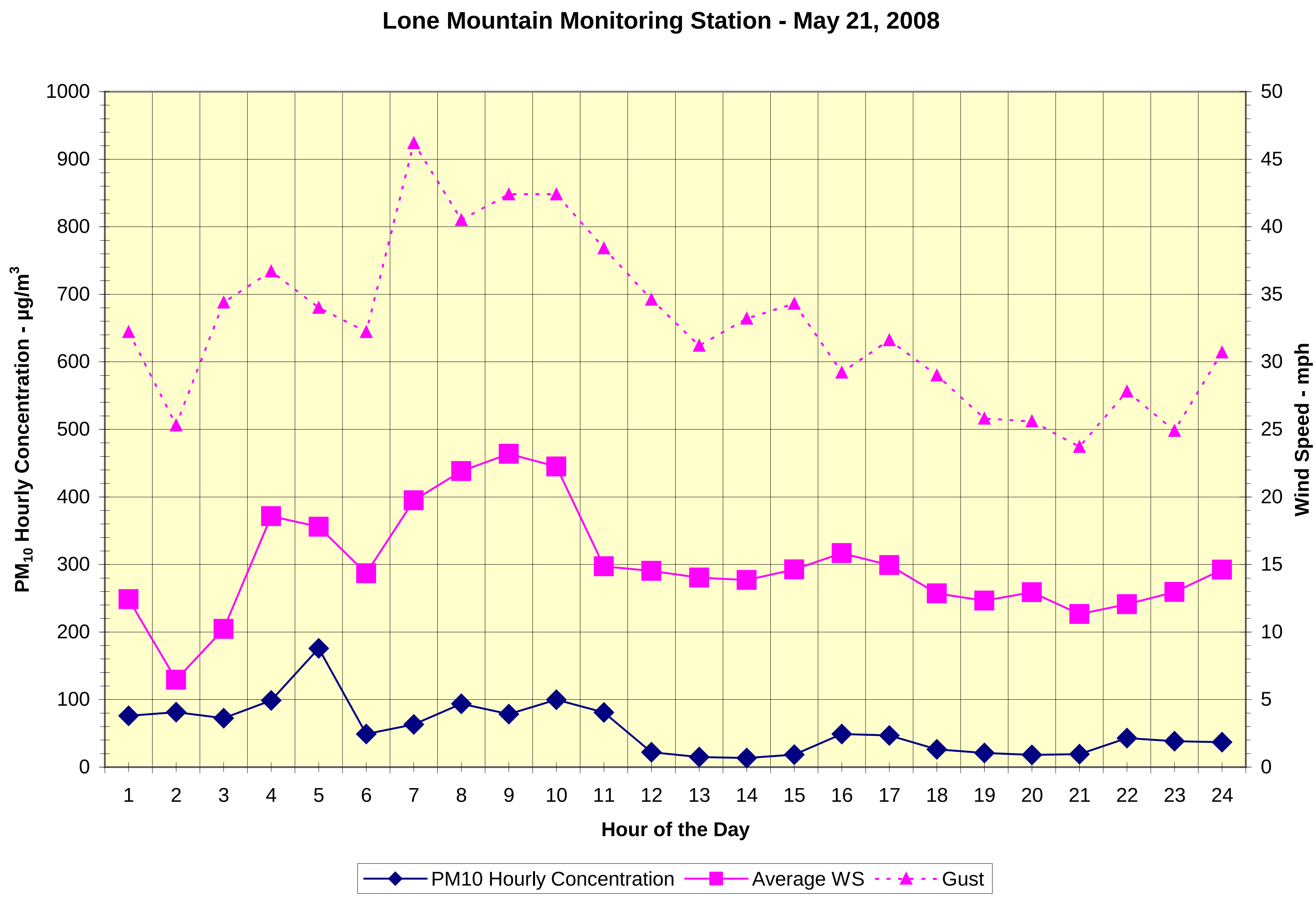


Figure 21. PM_{10} Concentrations and Wind Speed at Lone Mountain Road Monitoring Station.

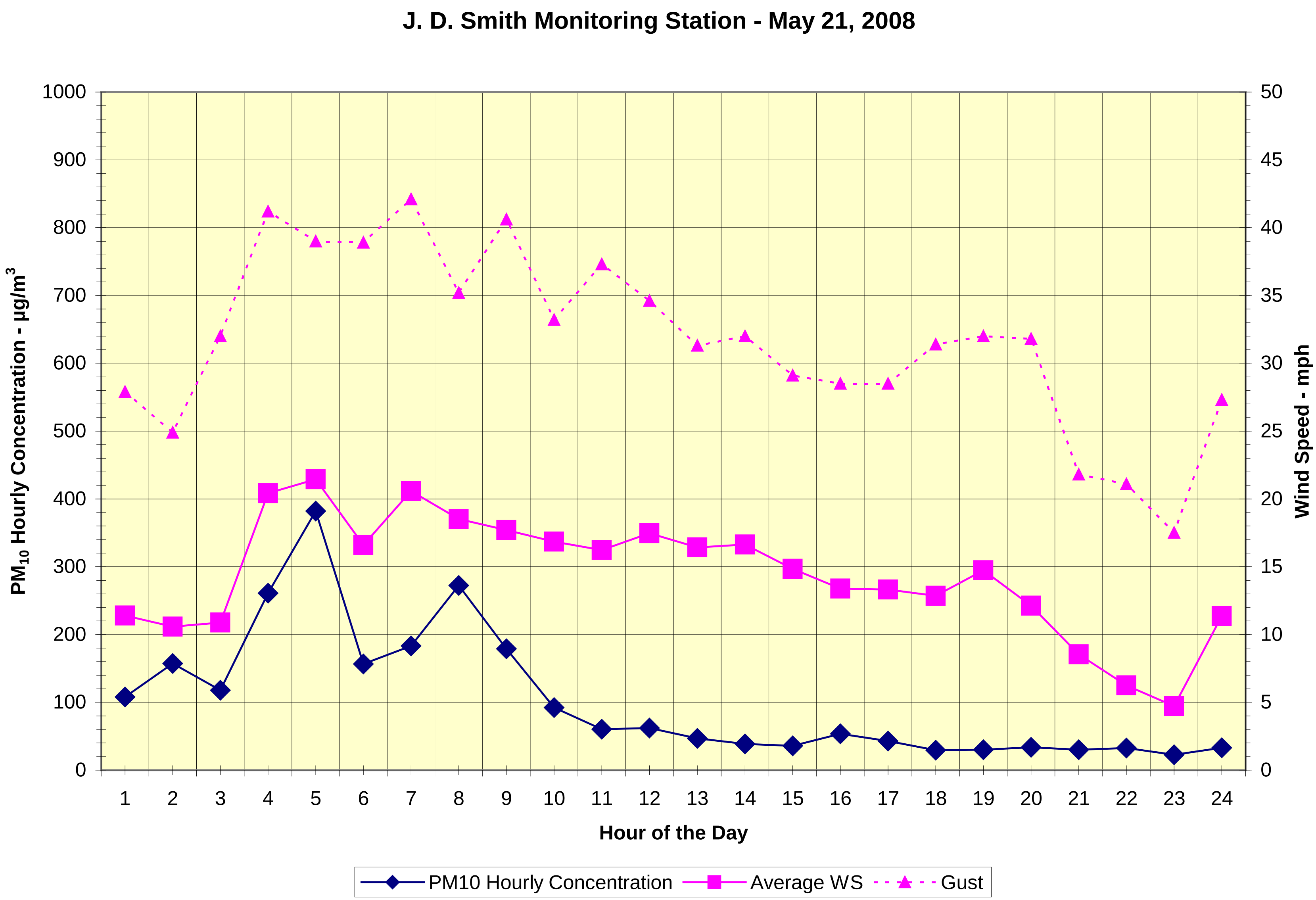


Figure 22. PM_{10} Concentrations and Wind Speed at J.D. Smith Monitoring Station.

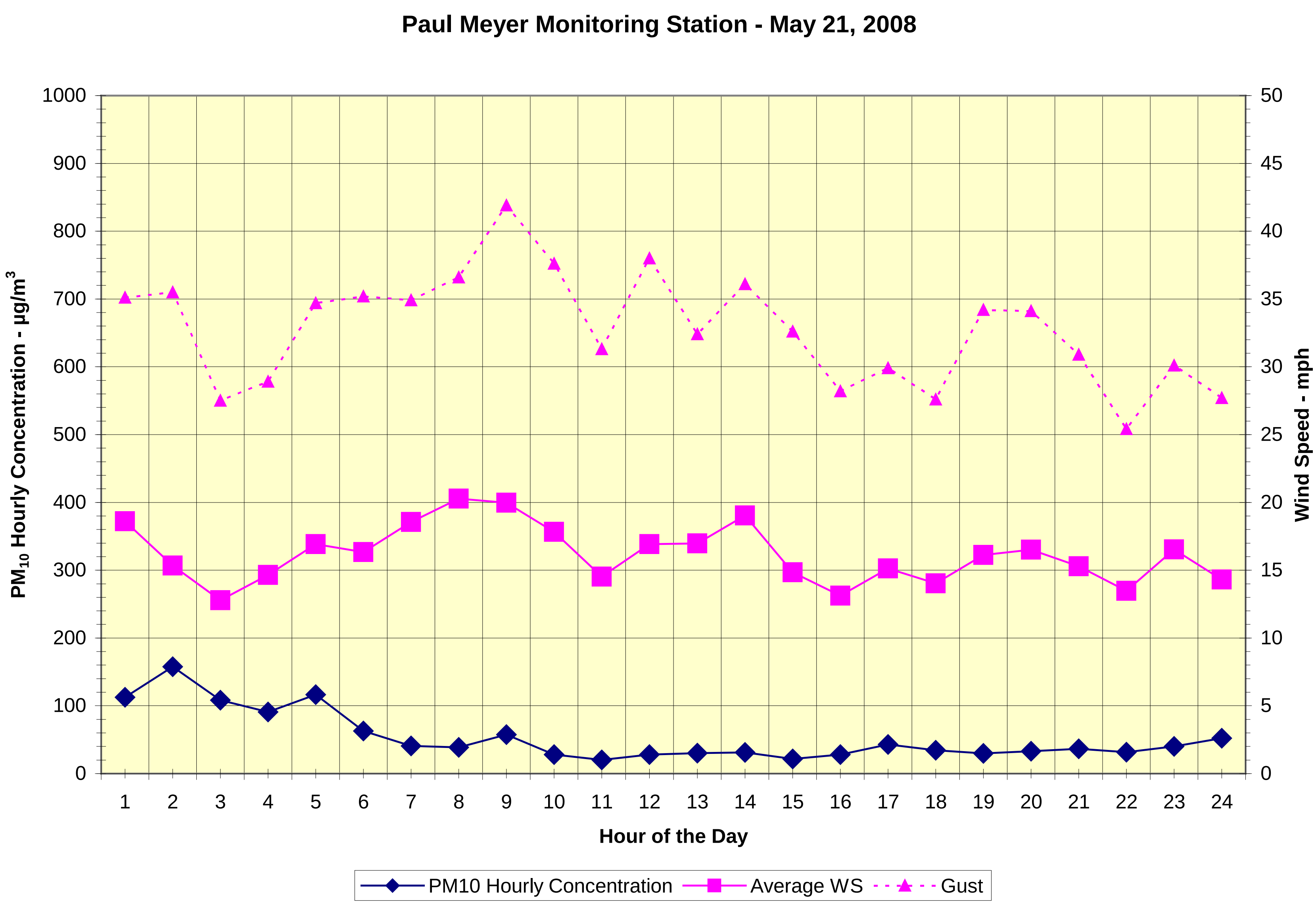


Figure 23. **PM_{10} Concentrations and Wind Speed at Paul Meyer Monitoring Station.**

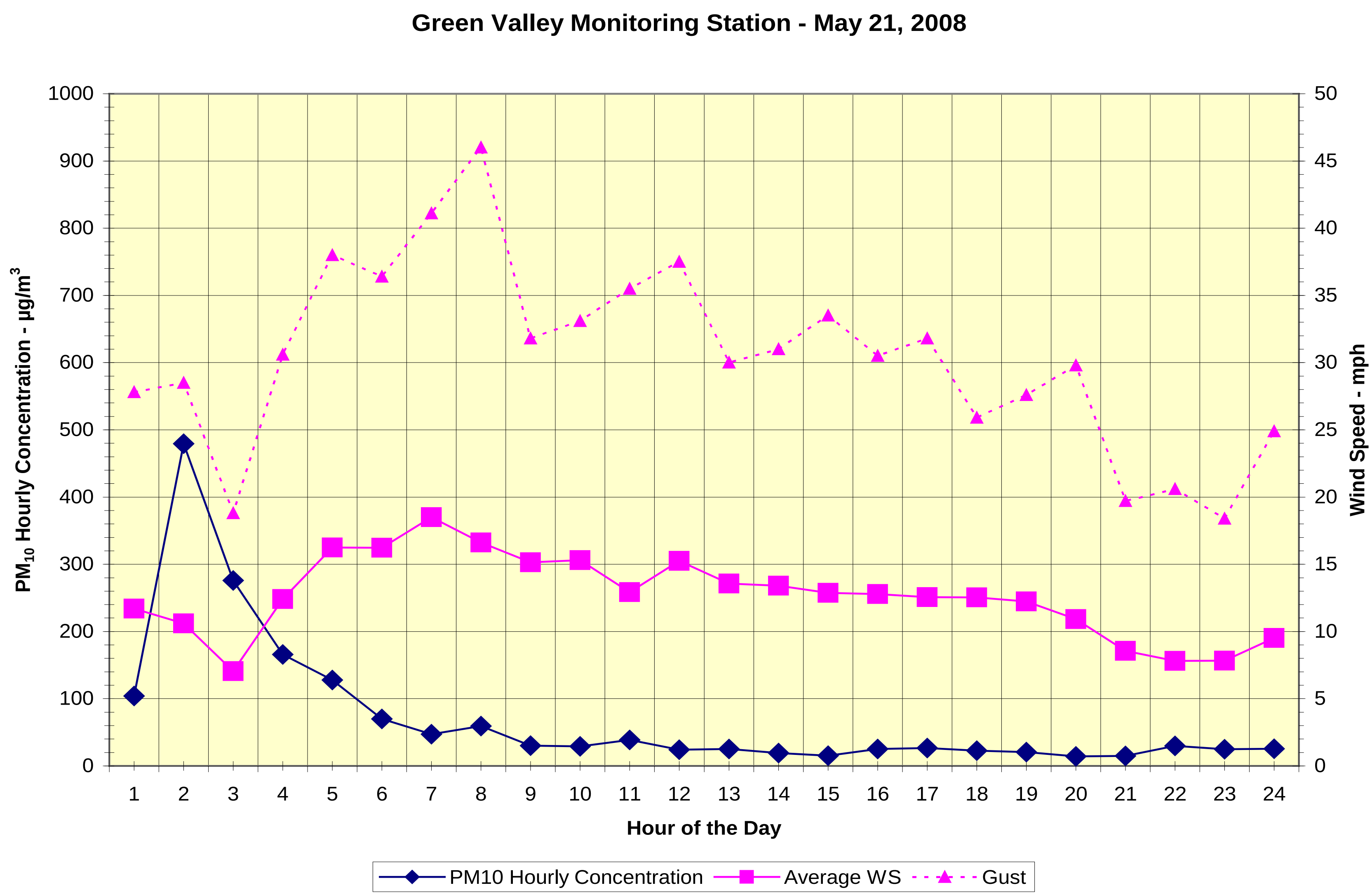


Figure 24. PM_{10} Concentrations and Wind Speed at Green Valley Monitoring Station.

3.1.7 Trajectory Modeling Results

To investigate the exceptional event on May 21, 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. Tracing the trajectory paths provides insight into the sources of air that affected DAQEM monitoring sites.

The numbers shown along the trajectory paths in Figures 25-27 are the heights above ground level (agl) in meters of the centerline of the plume at hourly intervals. Closely spaced plume heights indicate lower wind speeds 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 PM_{10} values are not available in the AIRNow-Tech system.

HYSPLIT trajectory plots were created for three time periods at four-hour intervals, with the time of the frontal passage in the middle. Figures 25-27 show the trajectory results for air parcels ending at 10 meters agl at the East Craig Road monitoring station at 0000, 0400, and 0800 PDT on May 21, 2008.

Figure 25 shows trajectory paths during the prefrontal southwesterly airflow. The path ending at the East Craig Road station apparently was aloft while in southeastern California and crossed over the mountains southwest of Las Vegas.

Figure 26 shows trajectory paths near the time of the frontal passage, approximately 0400 PDT—the hour with maximum wind speeds and PM_{10} concentrations. The path affecting the East Craig Road station originated northwest of Las Vegas. Recall the hour with maximum wind speeds and PM_{10} concentration values at East Craig Road began at 0400 PDT.

Figure 27 shows trajectory paths at 0800, a few hours after the frontal passage, about the time PM_{10} concentrations began to drop quickly in the Las Vegas Valley. Both trajectory paths show the air originating aloft well northwest of Las Vegas.

In summary, the trajectory paths generally follow anticipated routes based on the winds observed during the frontal passage. The regional winds came from the southwest direction early on, and from the northwest after the front passed.

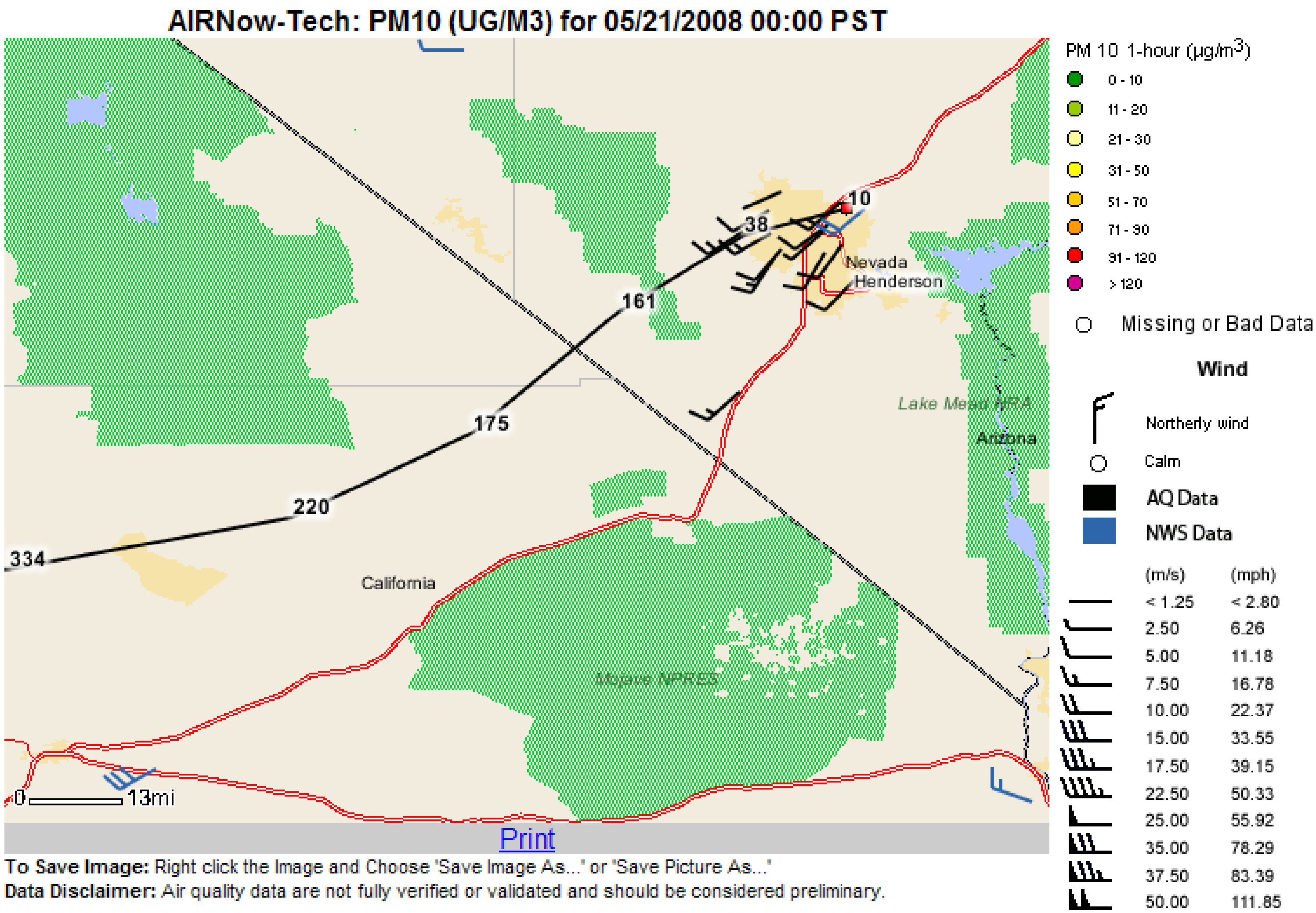


Figure 25. HYSPLIT Trajectories for 10 m agl Ending May 21, 2008, at 0000 PDT.

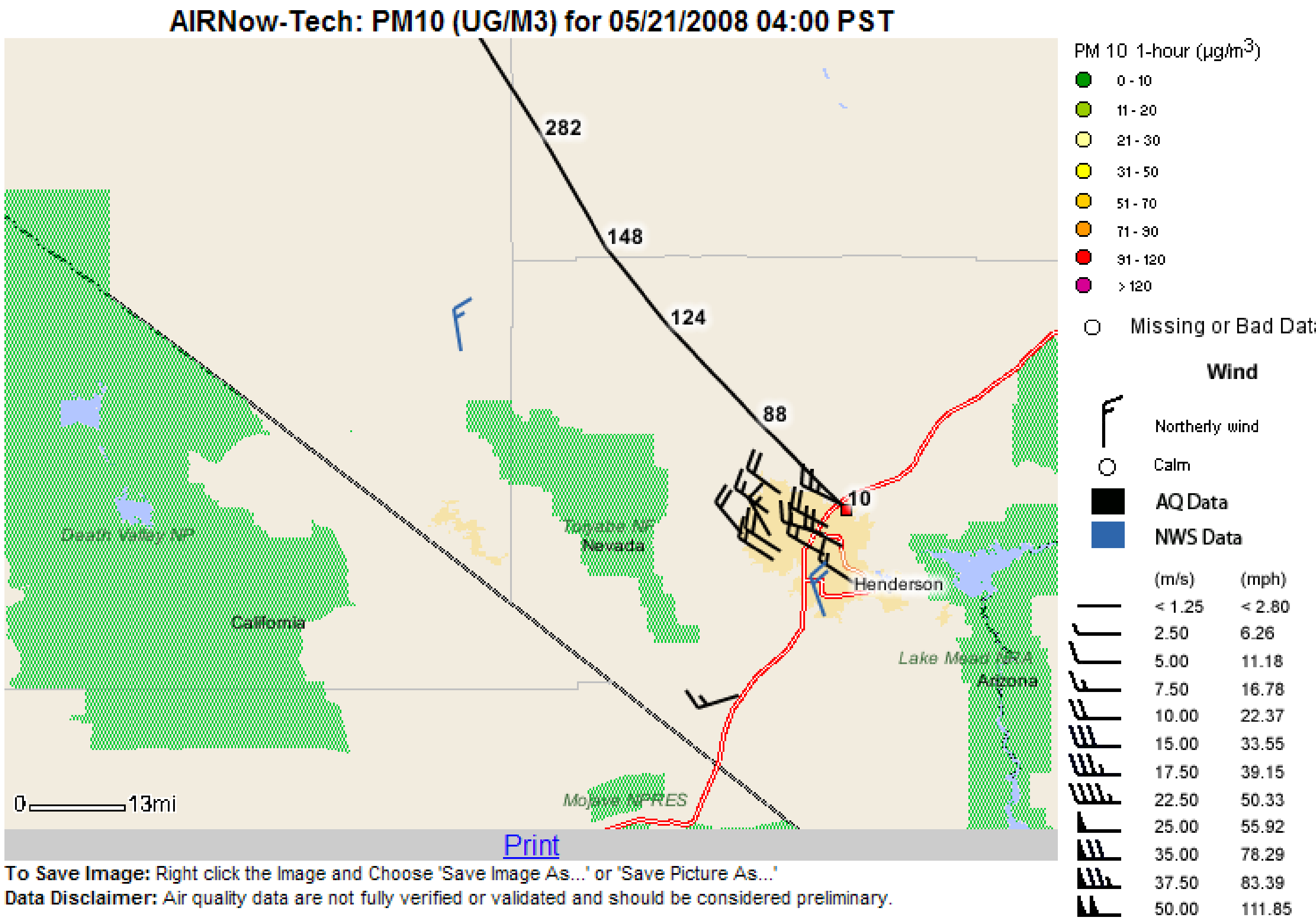


Figure 26. HYSPLIT Trajectories for 10 m agl Ending May 21, 2008, at 0400 PDT.

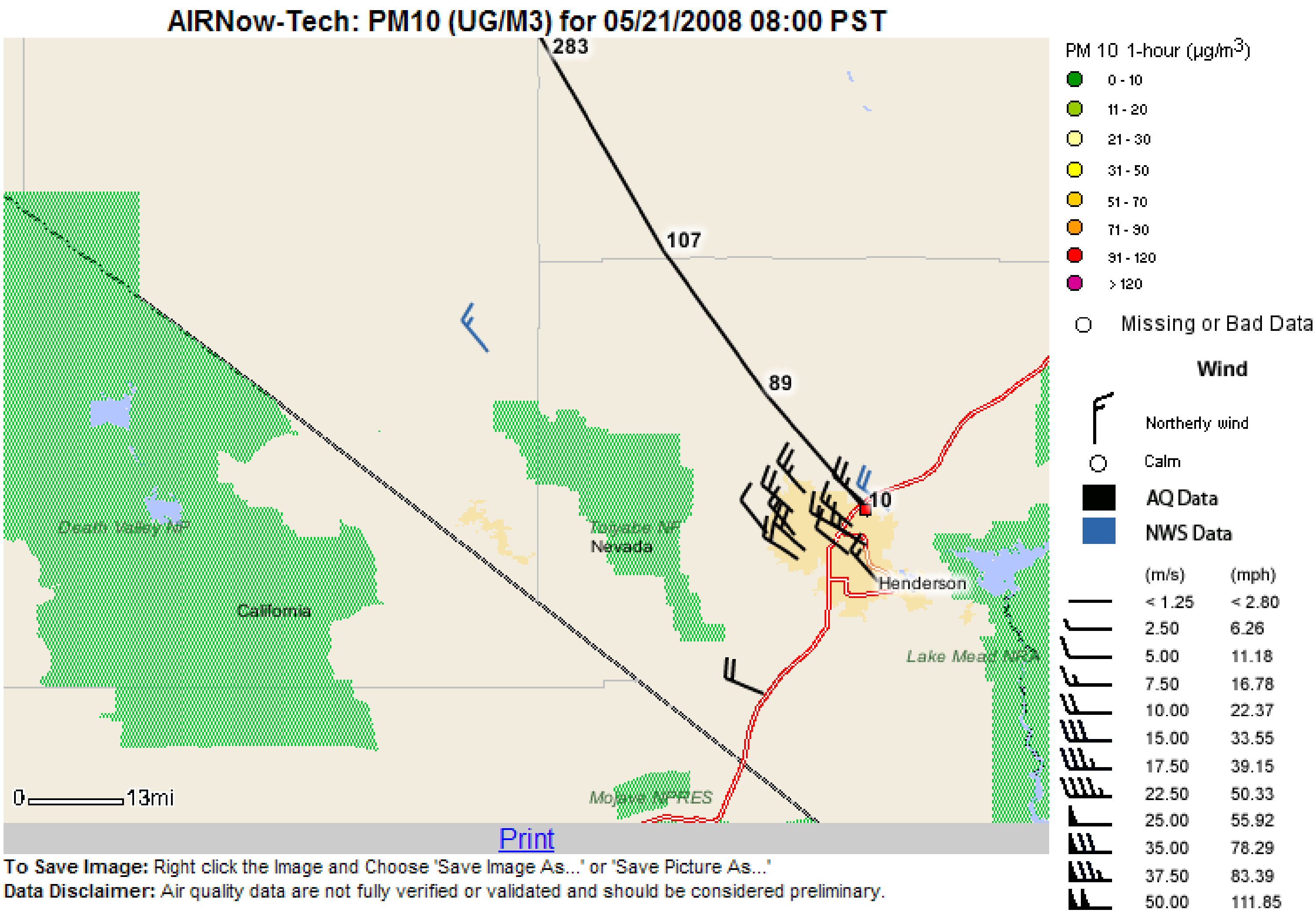


Figure 27. HYSPLIT Trajectories for 10 m agl Ending 5/21/2008 at 08:00 PDT.

3.2 MEDIA COVERAGE OF WIND EVENT

The *Las Vegas Sun* ran an article on May 21 about the possibility of health hazards associated with high wind events (Appendix B). Although Las Vegas did have sustained winds of more than 25 mph and gusts in the 40-mph range that day, the wind event occurred between 1100 PDT May 20 and 0600 PDT May 21, 2008. Compared to the wind event in February of that year, nothing newsworthy happened during the high-wind event, such as property damage, injuries, or fatalities. The Clark County media is diligent about informing the public at large of air quality forecasts, helping DAQEM advise residents without direct access to the Internet.

Appendix B also includes a news release sent out by the Clark County Public Information Office prior to the high-wind event. The *Las Vegas Review-Journal* and the *Las Vegas Sun* ran similar articles on wind-related events in their daily editions, along with updates to earlier stories on a wind-driven wildfire in the Las Vegas area.

4.0 EMISSIONS SOURCES AND ACTIVITY

4.1 EAST CRAIG ROAD

The East Craig Road monitoring site (CAMS-20, EPA 32-003-0020) (Figure 28) sits in the northeast portion of the Las Vegas Valley (Figure 7), in a predominantly industrial area. Figures 29–32 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 traveled mostly 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 even though 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 changes from southwest to northwest. Attachments 13 and 14 in Appendix A contain the wind roses 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) in the Las Vegas Valley.

Figure 28. East Craig Road Monitoring Station.

Figure 29. East Craig Road Monitoring Site, Aerial View #1.

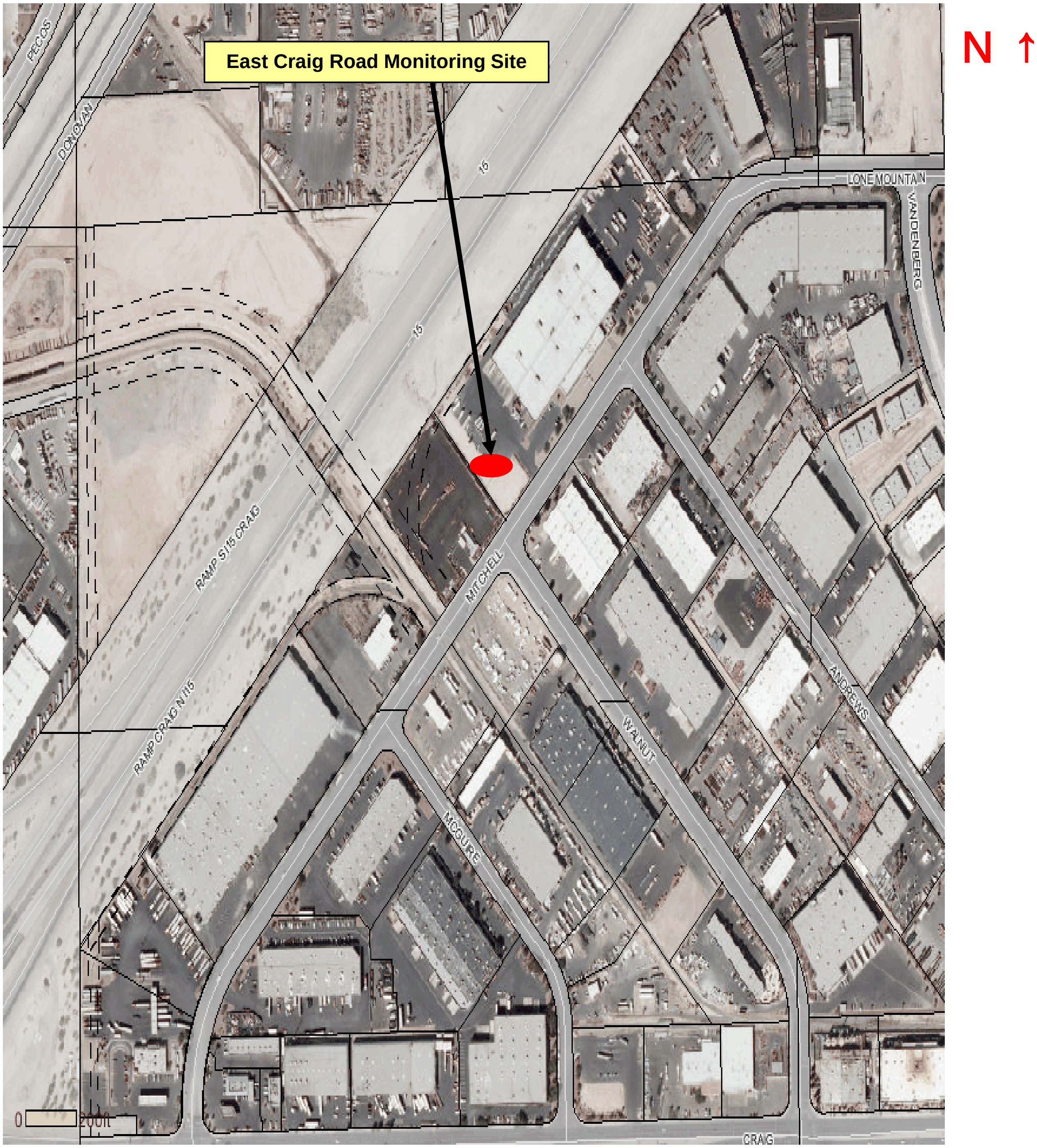


Figure 30. East Craig Road Monitoring Site, Aerial View #2.

Figure 31. East Craig Road Monitoring Site, Aerial View #3.

Figure 32. East Craig Road Monitoring Site, Aerial View #4.

4.2 JOE NEAL

The Joe Neal monitoring site (CAMS-75, EPA 32-003-0075) (Figure 33) sits in the northwest part of the Las Vegas Valley, in a predominantly residential area. Figures 34–37 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 southwest. Occasional high concentrations occur when wind direction changes drastically, as it did during the high-wind event. However, the site had no measured PM_{10} exceedances on that day.

Figure 33. Joe Neal Monitoring Station.

Figure 34. Joe Neal Monitoring Site, Aerial View #1.

Figure 35. Joe Neal Monitoring Site, Aerial View #2.

Figure 36. Joe Neal Monitoring Site, Aerial View #3.

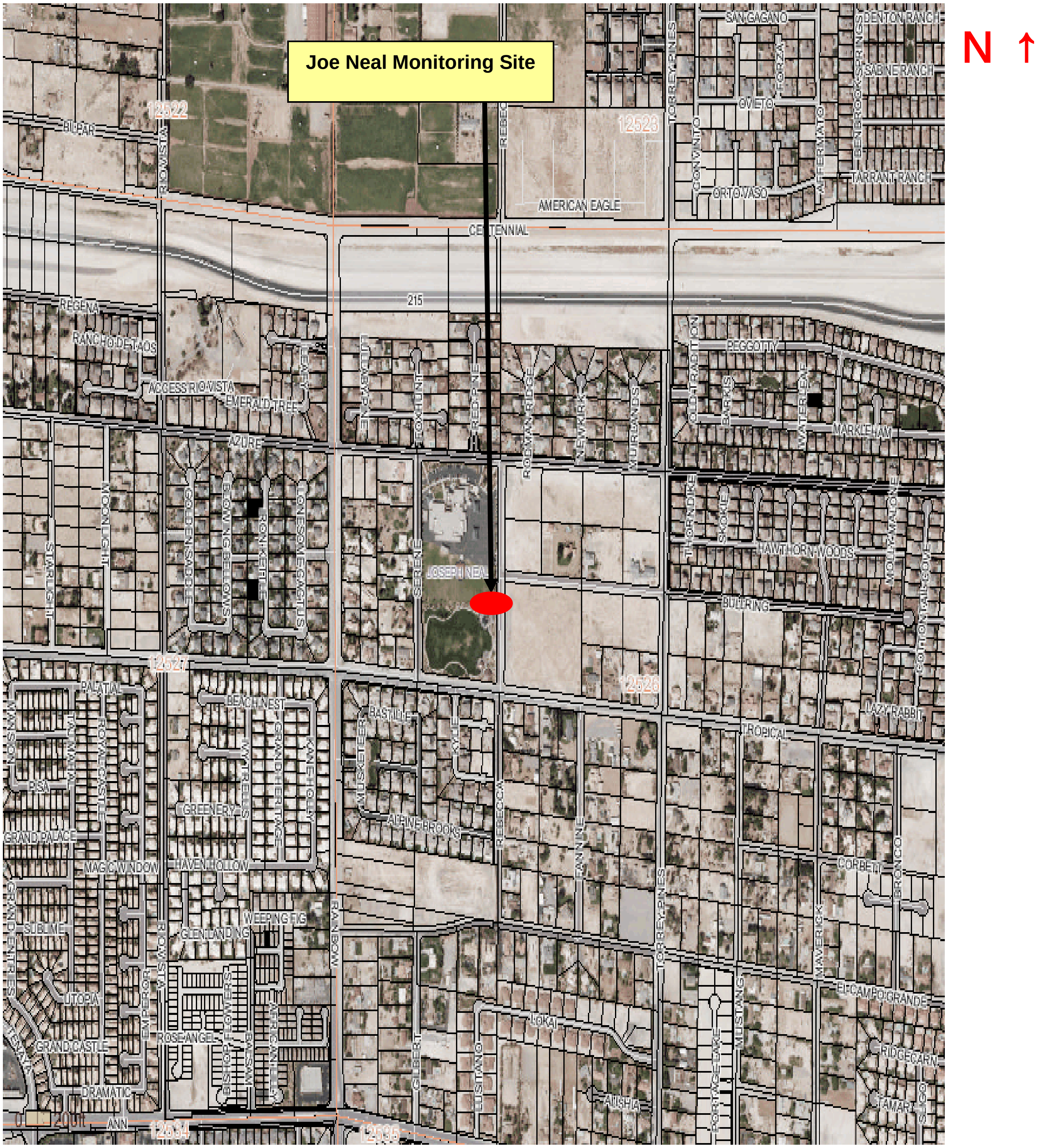


Figure 37. Joe Neal Monitoring Site, Aerial View #4.

4.3 LONE MOUNTAIN

The Lone Mountain monitoring site (CAMS-72, EPA 32-003-0072) (Figure 38) sits in the northwest part of the Las Vegas Valley (Figure 7), in a predominantly residential area with light commercial amenities and three schools. Figures 39–42 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 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 sits inside a fenced compound owned by the Southern Nevada Water District; the adjacent parking area is gravel, which meets AQR requirements. The predominant wind direction is southwest. Occasional high concentrations occur when wind direction changes drastically, as it did during the high-wind event. However, the site had no measured PM_{10} exceedances on that day.

Figure 38. Lone Mountain Monitoring Station.

Figure 39. Lone Mountain Monitoring Site, Aerial View #1.

Figure 40. Lone Mountain Monitoring Site, Aerial View #2.

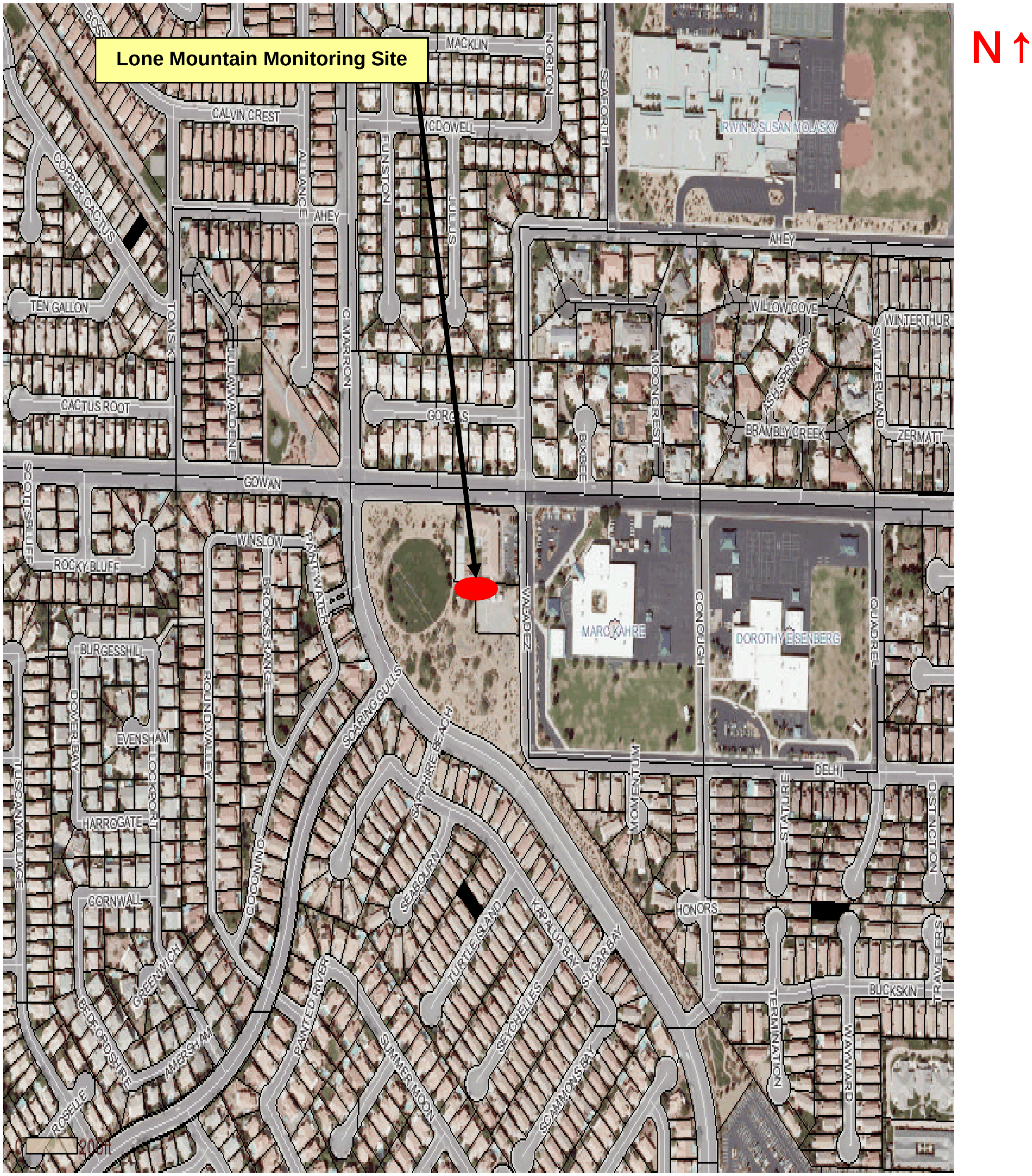


Figure 41. Lone Mountain, Monitoring Site Aerial View #3.

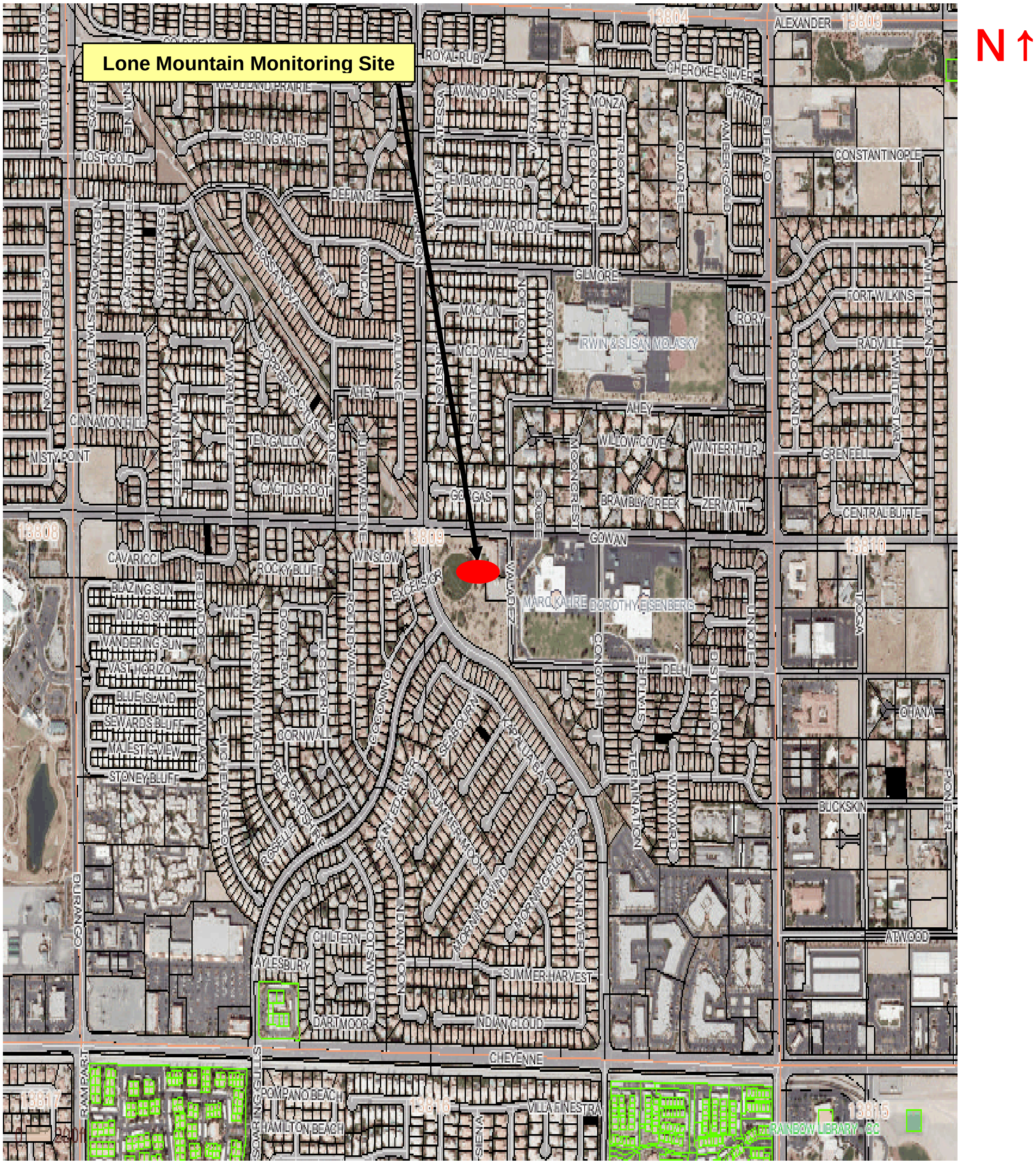


Figure 42. Lone Mountain Monitoring Site, Aerial View #4.

4.4 PAUL MEYER

The Paul Meyer monitoring site (CAMS-43, EPA 32-003-0043) (Figure 43) sits in the western part of the Las Vegas Valley (Figure 7), in a predominantly residential area with commercial amenities, a sports/city park, a community center, and a school. Figures 44–47 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 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 sports 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 park community center, and the adjacent parking area is paved. The predominant wind direction is southwest. Occasional elevated concentrations occur when wind direction changes drastically, as it did during the high-wind event. However, the site had no measured PM_{10} exceedances on that day.

Figure 43. Paul Meyer Monitoring Station.

Figure 44. Paul Meyer Monitoring Site, Aerial View #1.

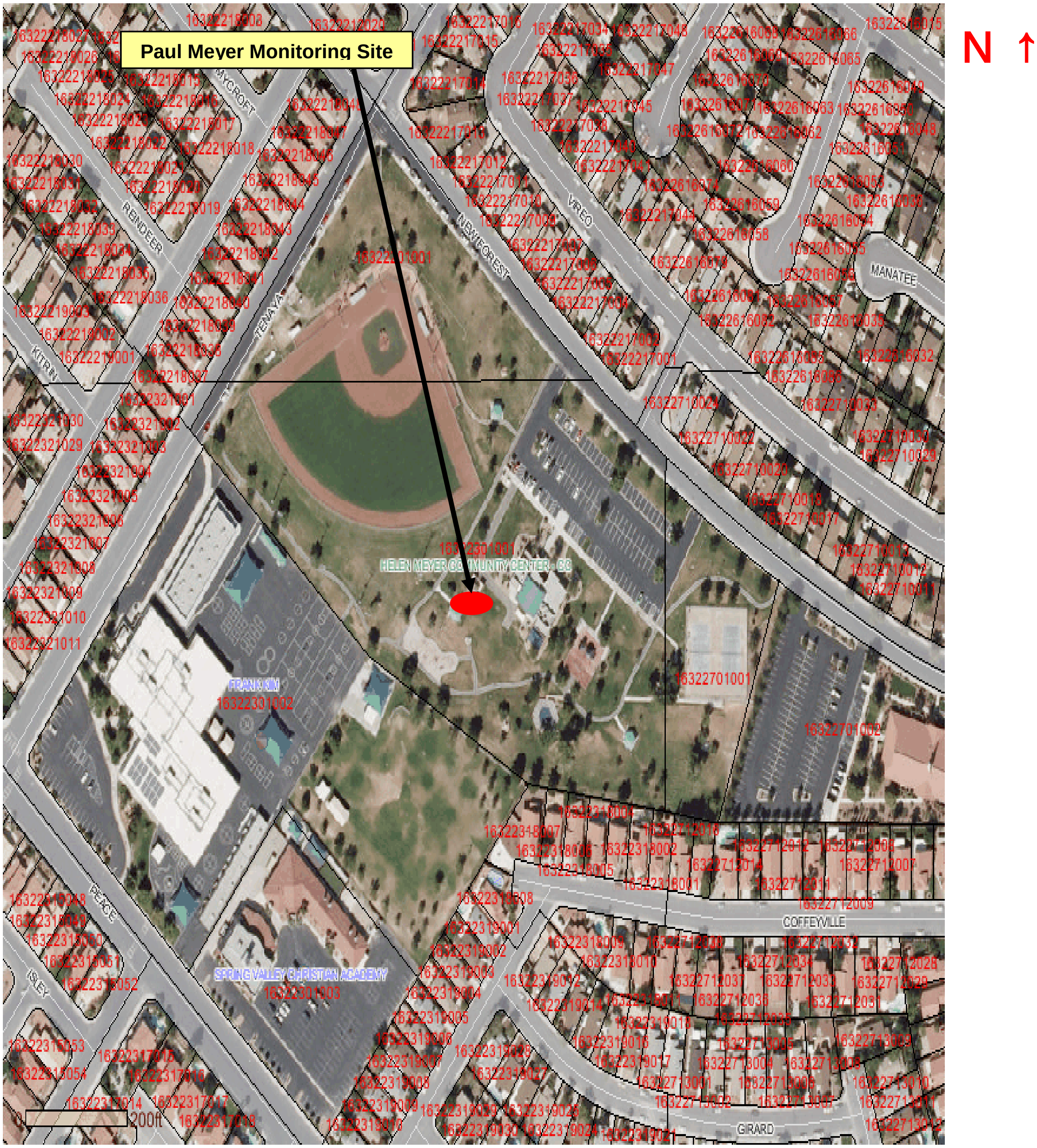


Figure 45. Paul Meyer Monitoring Site, Aerial View #2.

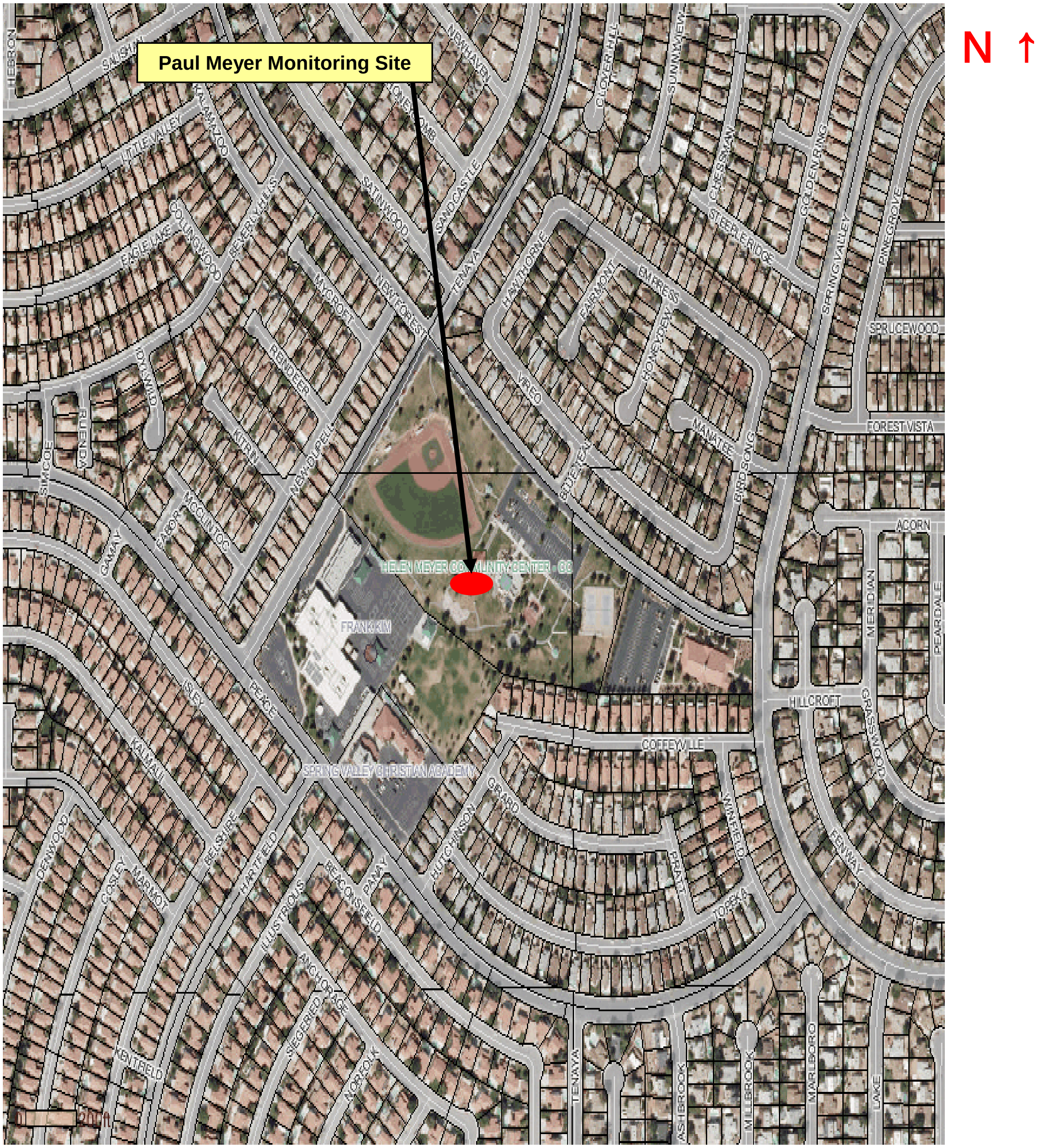


Figure 46. Paul Meyer Monitoring Site, Aerial View #3.

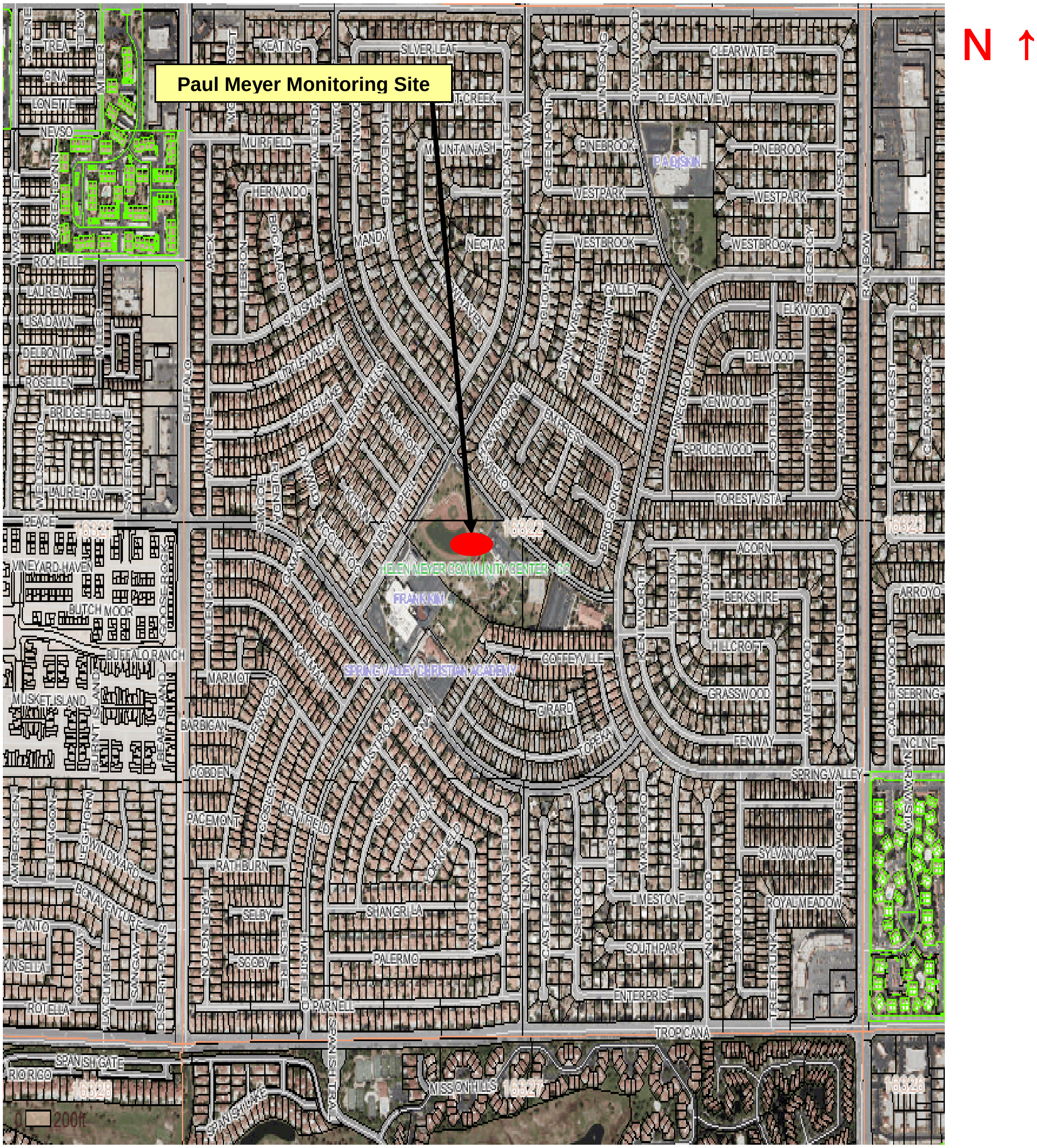


Figure 47. Paul Meyer Monitoring Site, Aerial View #4.

4.5 GREEN VALLEY

The Green Valley monitoring site (CAMS-0298, EPA 32-003-0298) (Figure 48) sits in the southern part of the Las Vegas Valley (Figure 7), in a predominantly residential area with commercial amenities and a large sports complex/city park. Figures 49–52 provide aerial views of the site, whose purpose is to monitor middle-scale spatial emissions of PM_{10} from individual sources in the area. A large sports complex/city park and 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 PM 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 elevated concentrations occur when wind direction changes drastically, as it did during the high-wind event. However, the site had no measured PM_{10} exceedances on that day.

Figure 48. Green Valley Monitoring Station.

Figure 49. Green Valley Monitoring Site, Aerial View #1.

Figure 50. Green Valley Monitoring Site, Aerial View #2.

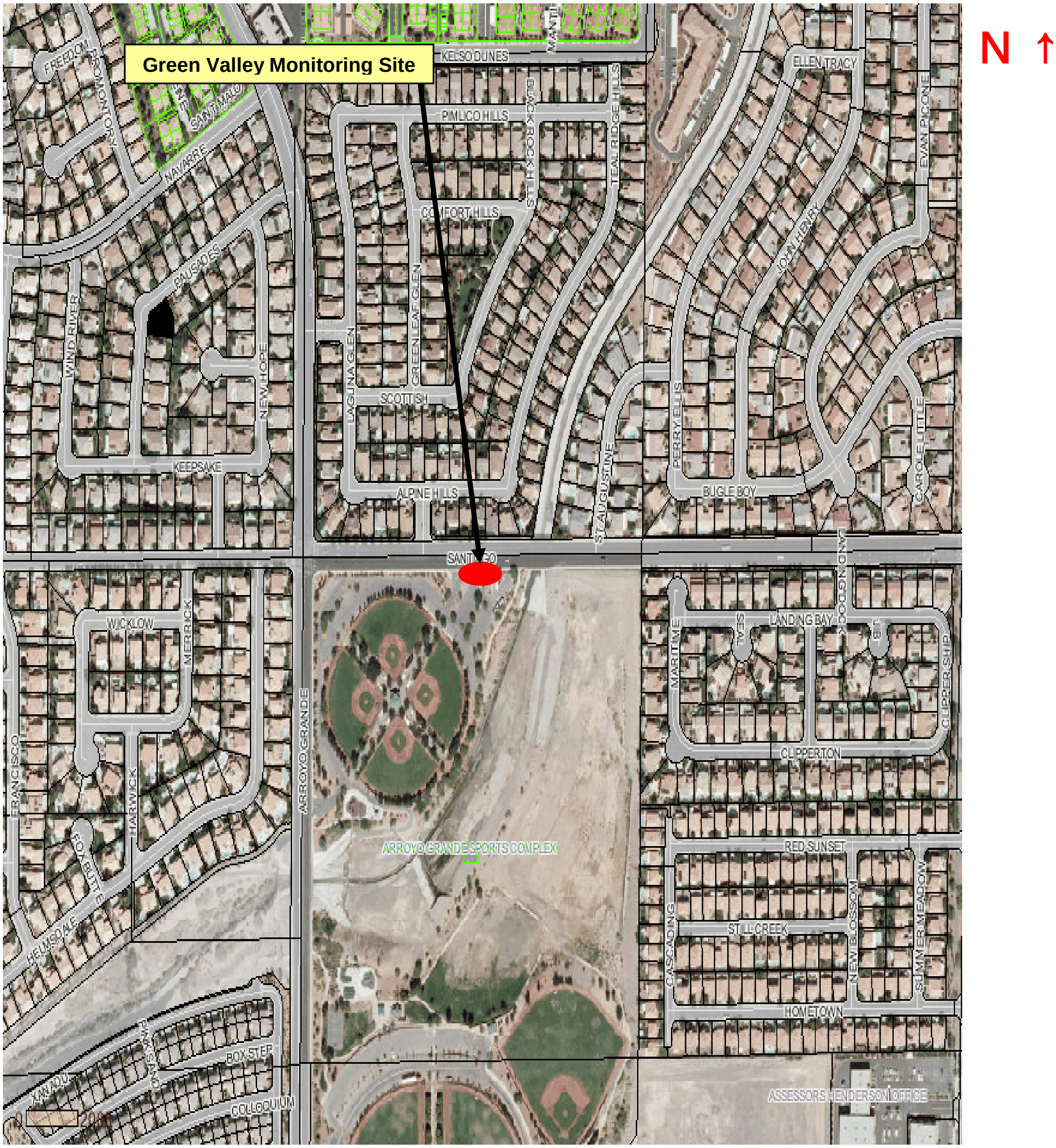


Figure 51. Green Valley Monitoring Site, Aerial View #3.

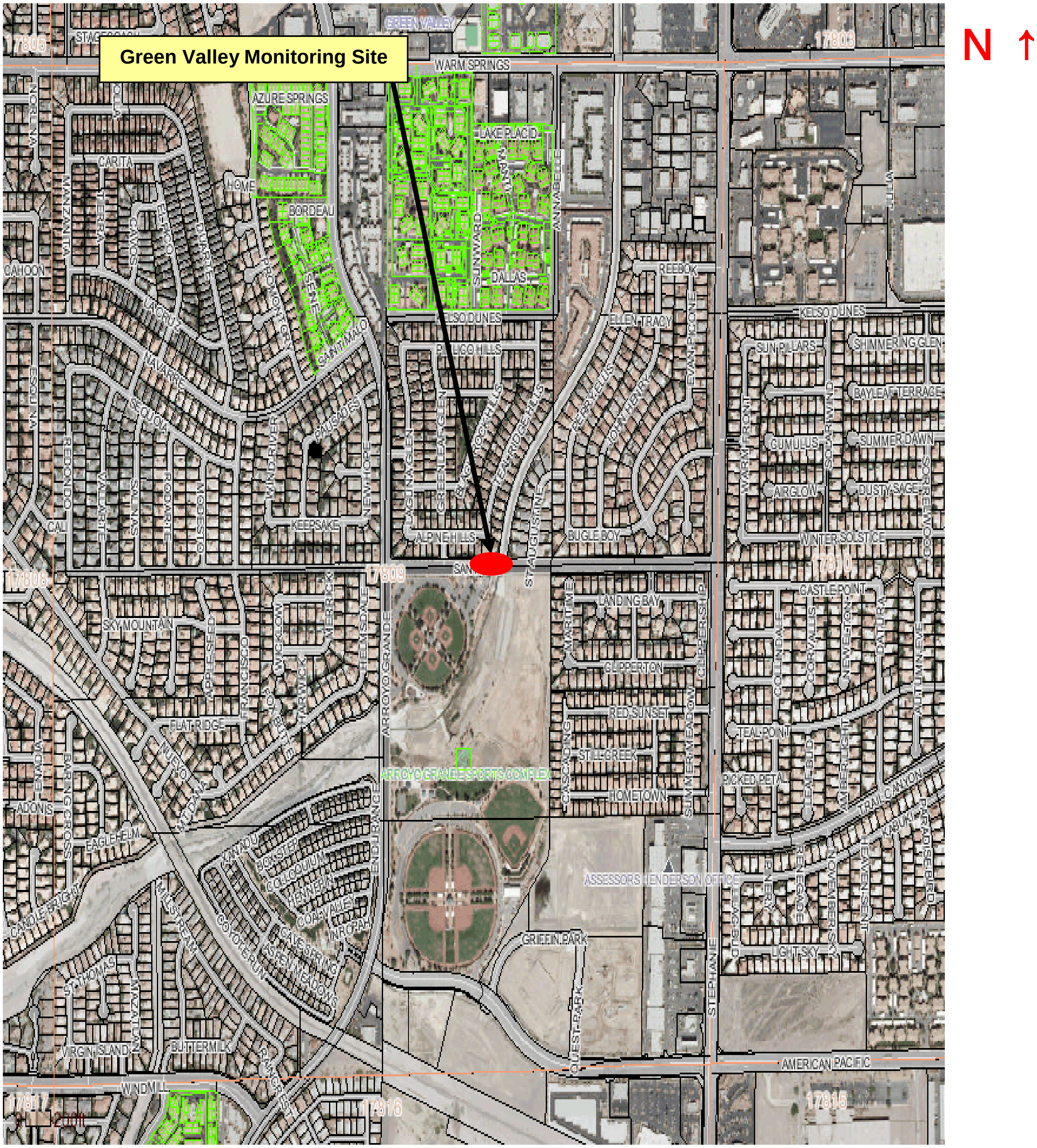


Figure 52. **Green Valley Monitoring Site, Aerial View #4.**

4.6 J.D. SMITH

The J.D. Smith monitoring site (CAMS-2002, EPA 32-003-2002) (Figure 53) sits in the northeast part of the Las Vegas Valley (Figure 7), in a predominantly residential area. Figures 51–54 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 nearest cross streets are Tonopah and Bruce, which get their traffic influences primarily from personal vehicles and small trucks delivering to the three schools 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 “population exposure.” Land development has decreased the intensity of PM emissions in the area; DAQEM has checked nearby sources to ensure they are fenced and stabilized. Some sources and land uses to the north, east, southeast, and west, even though well stabilized, may cause elevated dust conditions when high wind thresholds occur. Occasional elevated concentrations occur when wind direction changes drastically, as it did during the high-wind event. However, the site had no measured PM_{10} exceedances on that day.

Figure 53. J.D. Smith Monitoring Station.

Figure 54. J.D. Smith Monitoring Site, Aerial View #1.

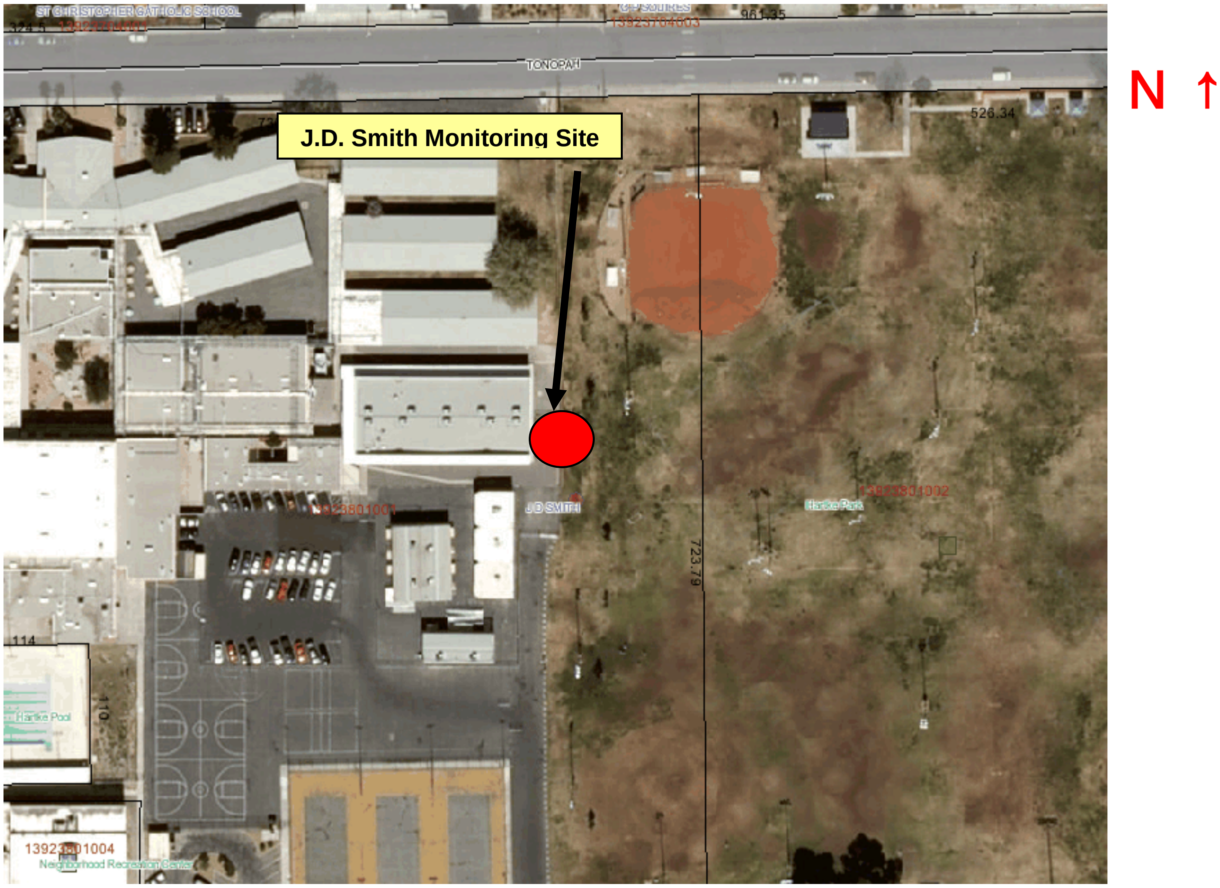


Figure 55. J.D. Smith Monitoring Site, Aerial View #2.

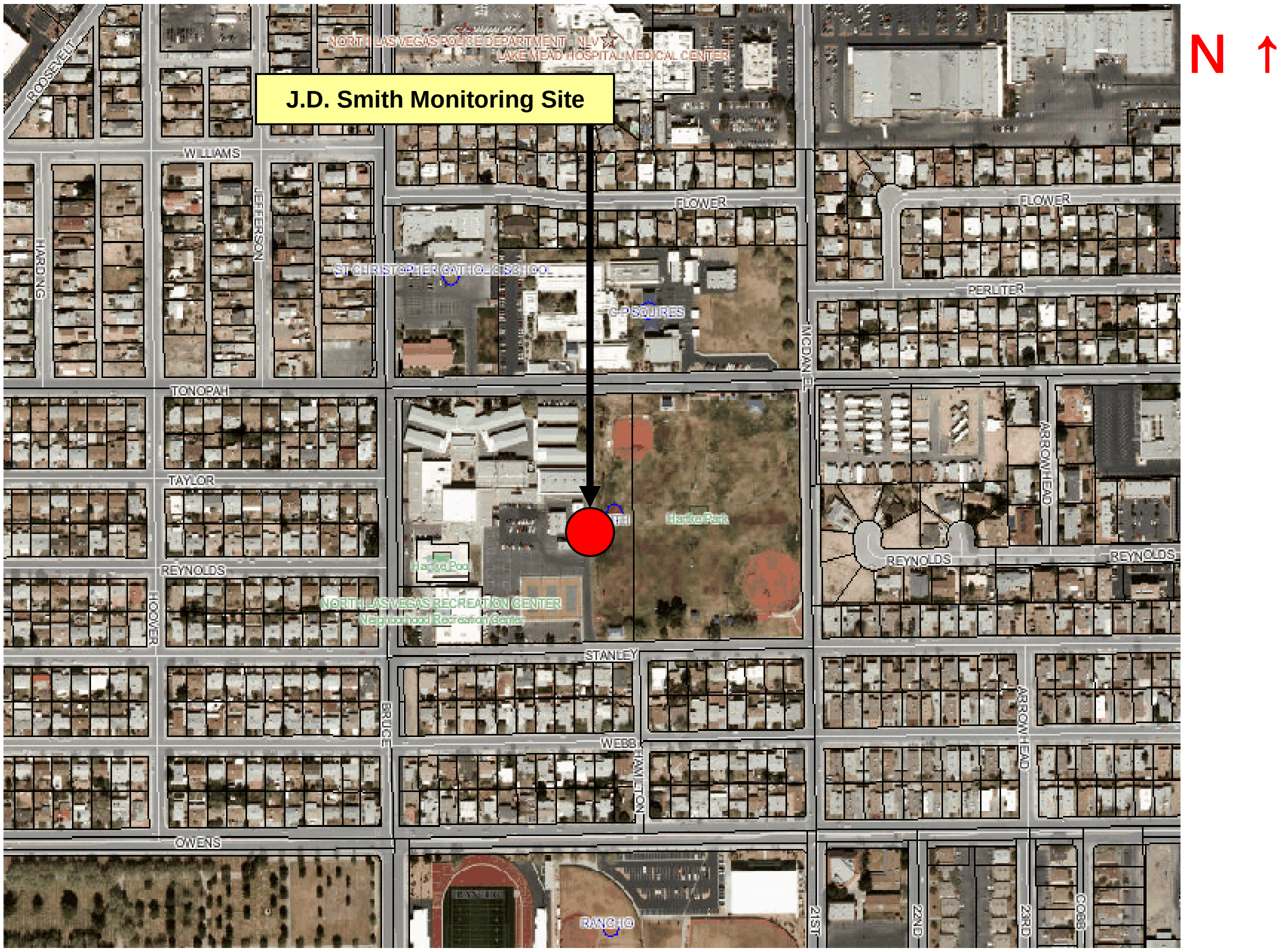


Figure 56. J.D. Smith Monitoring Site, Aerial View #3.

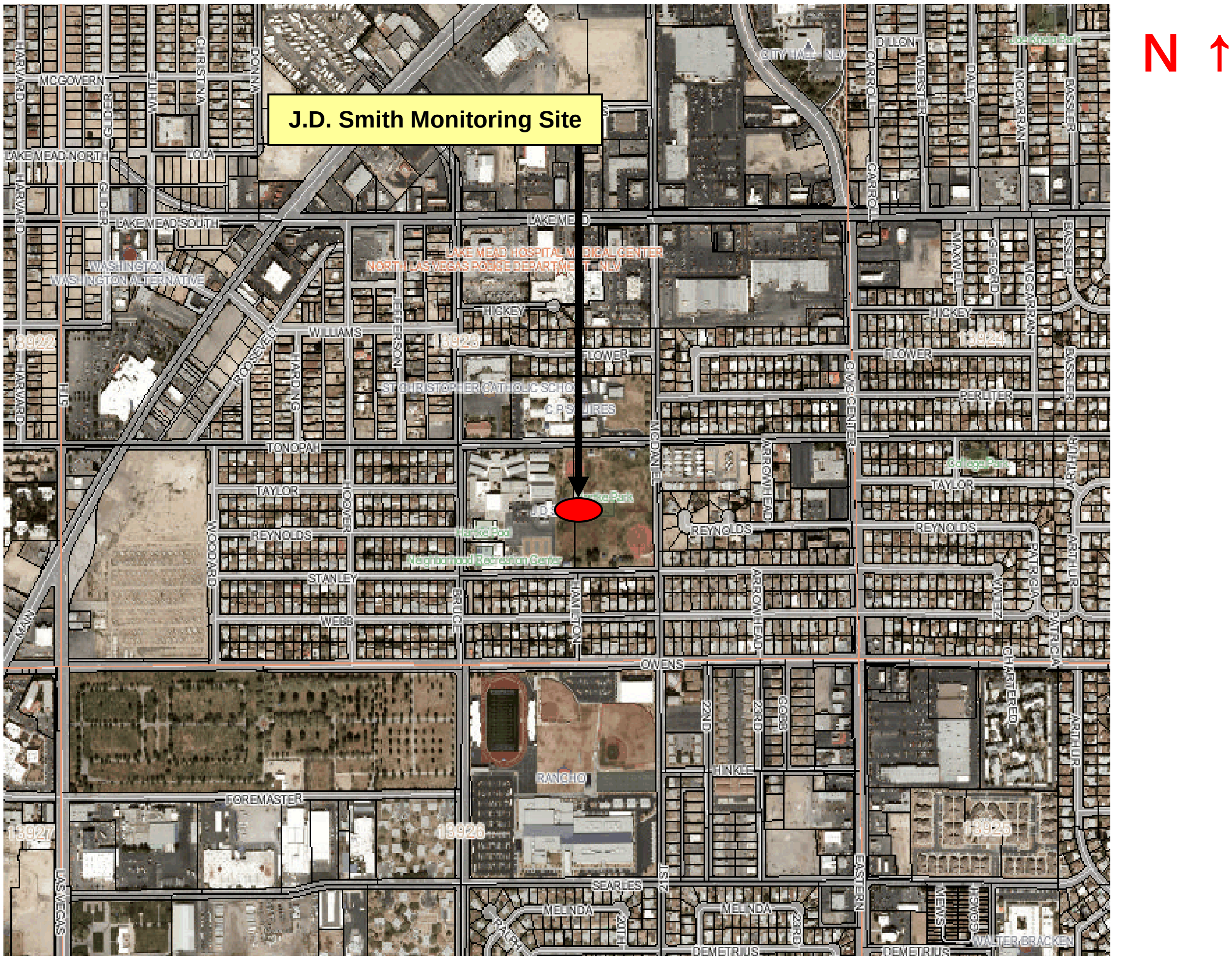


Figure 57. J.D. Smith Monitoring Site, Aerial View #4.

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.

DAQEM follows a proven standard procedure for handling potential high-wind events, detailed in its NEAP. This procedure requires maximum enforcement activity a day before the potential high-wind event, with a major focus on areas where dust violations have previously occurred. The department also faxes a “Construction Advisory” to permitted construction firms and selected stationary sources 12–24 hours before the expected arrival of high-wind conditions that could raise dust (Appendix D, Attachment 1).

On May 20, 2008, the day before the event, 16 enforcement officers were active in the field, 14 on 10-hour shifts and two on nine-hour shifts. Four management and administrative staff were supporting field enforcement efforts. All 16 officers continued enforcement activities until approximately 1800 PDT, depending on their location. Inspectors contacted 54 permitted construction sites that day, and by 1730 PDT, few were still active. One standby officer was on duty from 1700 to 2200 PDT; three dust complaints were called in, and American Asphalt received a verbal warning for not following Best Management Practices (BMP). Attachment 2 in Appendix C provides a full list of permitted construction site inspections, along with Corrective Action Orders (CAOs) and Notices of Violation (NOVs) issued that day.

Many permitted construction sites had prepared for the high winds forecast for May 21 based on the 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 11 CAOs for failure to employ BACM and fugitive dust violations, three of which were for fugitive dust violations on privately held vacant land. Problems observed included trackout; dust control permits that were missing, expired, or not on site; improper stockpiles on-site; and material loading without adequate mitigation. Compliance staff conducted follow-up inspections to assure compliance at sites that received a CAO. Enforcement officers did not issue NOVs at any of the sites because all the contractors corrected all the CAO issues.

A total of 1,417 construction notices were sent out for this high-wind event: 1,056 were sent via fax, 134 were sent via e-mail, and 227 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 this is unsuccessful, staff call the company’s landline and, at a minimum, read the dust advisory aloud over the phone.

On May 21, 2008, the day of the event, 23 enforcement officers were active in the field, 19 on 10-hour shifts and four on nine-hour shifts. Five management and administrative staff were supporting field enforcement efforts. All 23 officers continued enforcement activities until approximately 1800 PDT, depending on their location. Inspectors contacted 26 construction sites that day, and by 1730, few were still active. One standby officer was on duty from 1700 to 2200 PDT, but no dust complaints were called in. 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 May 21, based on the faxed upgrade from “Construction Advisory” to “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 10 CAOs for failure to employ BACM and fugitive dust violations, three of which were for fugitive dust violations on privately held vacant land. Problems observed included trackout; dust control permits that were missing, expired, or not on site; failure to post dust control permit sign on site in public view; failure to employ BACM; not having a dust control permit; and material loading without adequate mitigation. Compliance staff conducted follow-up inspections to assure compliance at sites that received a CAO. Enforcement officers issued NOVs to American Asphalt & Grading, North Corridor Constructors, and Palm Mortuary and Cemeteries, Inc. for failure to employ BACM and for fugitive dust crossing over the property line. Precision Construction received an NOV for failure to employ BACM, fugitive dust issues, not having a dust control permit onsite, and not having a dust control permit sign posted on-site in public view. All these NOVs went to the Air Pollution Control (APC) Hearing Officer on September 24, 2008. 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.

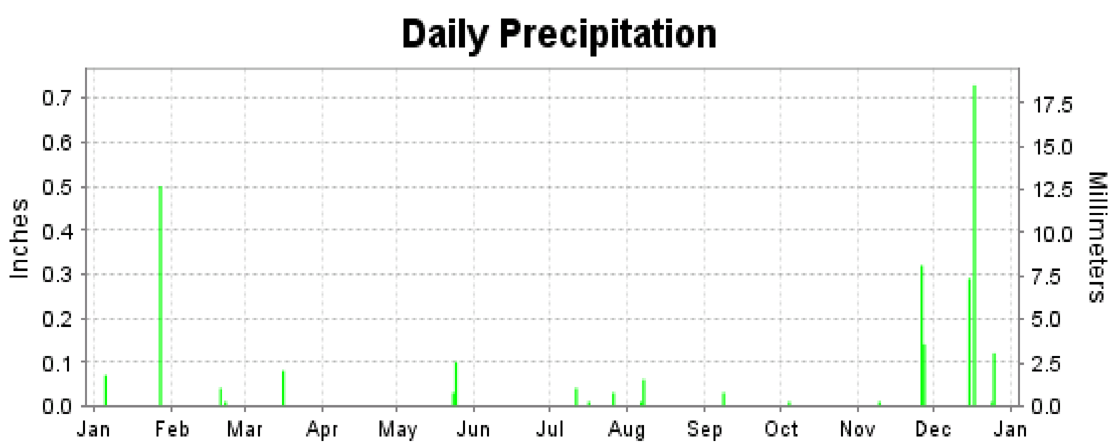
On May 22, 2008, the day after the event, DAQEM enforcement officers conducted their daily site inspections. Sixteen enforcement officers were active in the field, 12 on 10-hour shifts and four on nine-hour shifts. Five management and administrative staff were supporting field enforcement efforts. All 16 officers continued enforcement activities until approximately 1800 PDT, depending on their location. Inspectors contacted 31 permitted construction sites that day. One standby officer was on duty from 1700 to 2200 PDT, but no dust complaints were called in. Enforcement officers issued two CAOs, which resulted in one NOV issued to Meldrum Family Trust for improper acreage on the dust control permit. Meldrum Family Trust did not contest the NOV and paid the fines assessed. 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 high-wind event. This enhanced enforcement activity reduced the potential for multiple exceedances of the 24-hour PM_{10} NAAQS in the Las Vegas Valley. The event took place from the late evening of May 20 through the early morning May 21, 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. The surrounding environment consists of industrial warehouses, batch plants, and similar activities. None of these were operating when the highest winds, and resulting excessive PM_{10} concentrations, were measured at the site on May 21.

5.2 PRECIPITATION IN POTENTIAL FUGITIVE DUST SOURCE REGION

Figure 58 illustrates the small amount of rain Las Vegas had received by the end of May 2008. According to National Weather Service records, the Las Vegas Valley had received only 0.83 inch of measurable precipitation as of May 21, 2008 (Table 14). On May 24-25, 2008 (Figures 59-60), the Las Vegas Valley and surrounding areas received approximately 0.7 inch of additional precipitation; that brought the state total to 1.53 inches of precipitation through the end of May. This absence of precipitation increased the amount of fugitive dust generated from native desert soil during the high-wind event on May 21.

Moisture content of soils is a significant factor for a high-wind event. Figures 61 and 62 show Clark County's departure from normal precipitation levels during 2007 and 2008. Table 14, which provides precipitation data, demonstrates that the period preceding the high-wind event was not damp enough to limit blowing dust: the last rain event before May 21 was in March, where 0.1 inch was recorded. Figure 63 shows that no measurable precipitation occurred on May 21, the exceedance day. The predominant soils in the area around the East Craig Road monitoring site were classified as "Moderate Low" in moisture content during a 2003 survey conducted to develop a particulate emission potential map (Figure 64). 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).



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

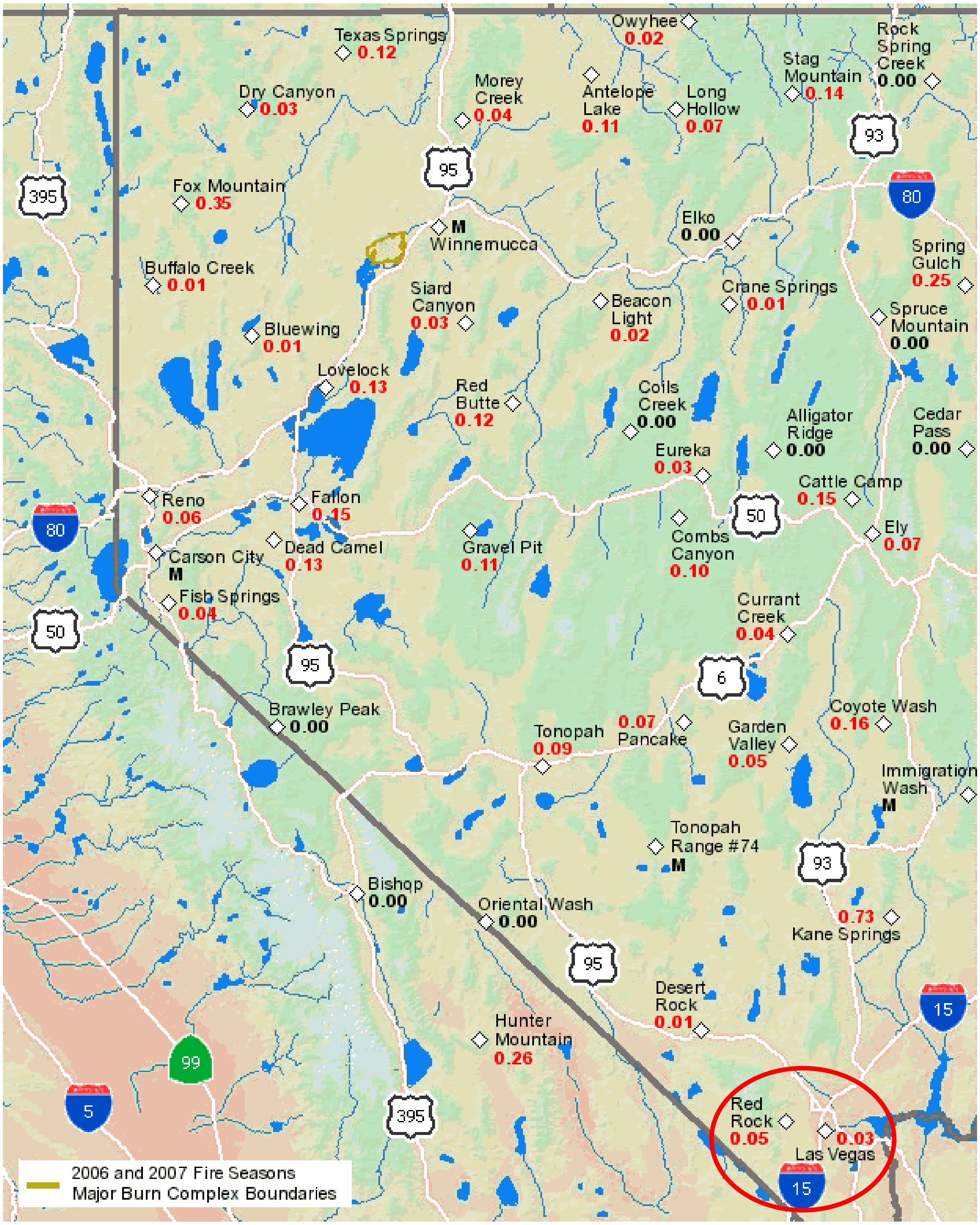
Figure 58. Daily Precipitation in Las Vegas Valley, 2008.

Table 14. October 2007–September 2008 Precipitation Summary 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 NTL WILDLIFE REF	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 PH	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 REF	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 PA	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 FO FIRE SP	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		

National Weather Service
California-Nevada River Forecast Center
3310 El Camino Avenue, Room 227

Sacramento, CA 95821-6373



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

Figure 59. Precipitation Measured in Las Vegas Area on May 24, 2008.

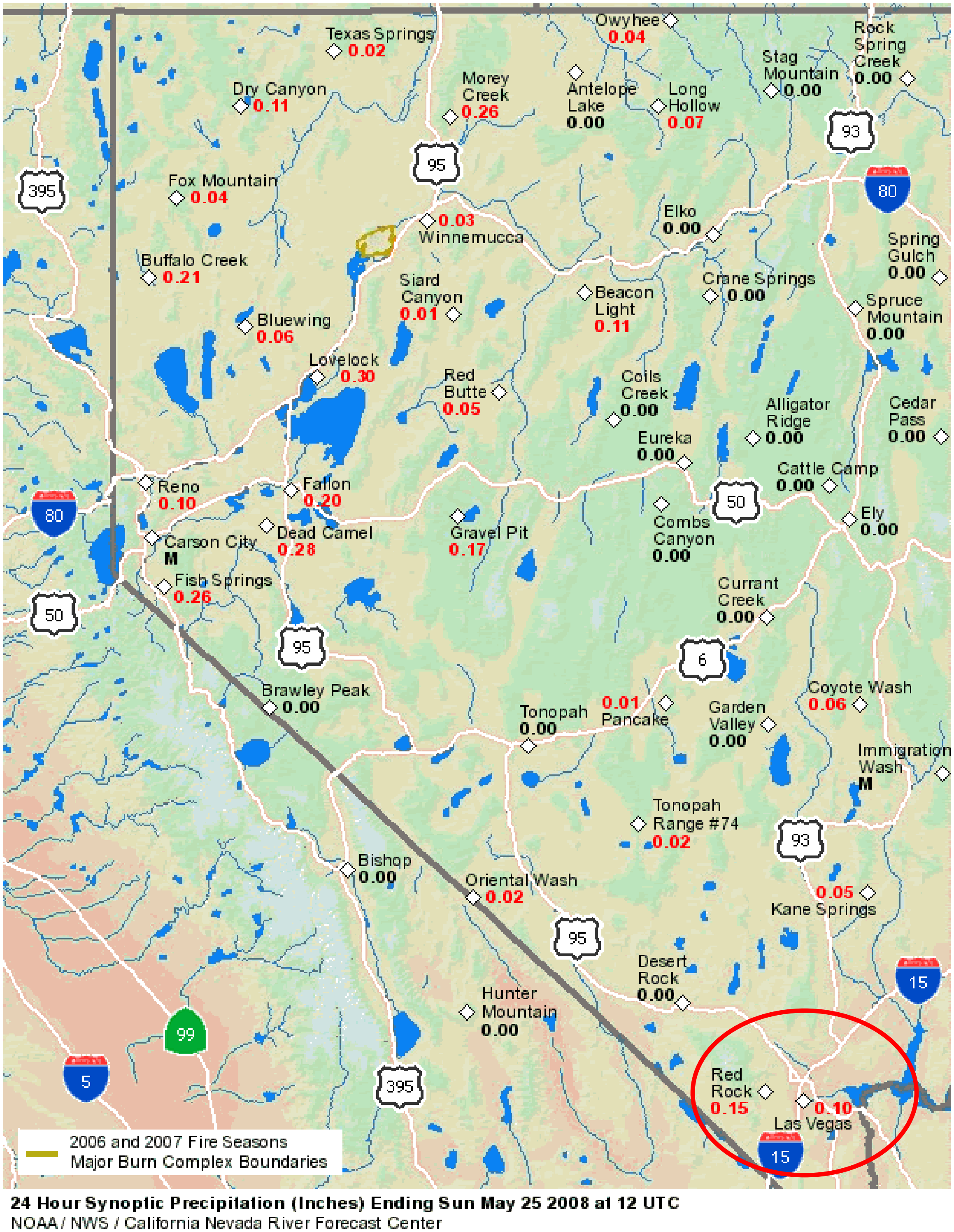
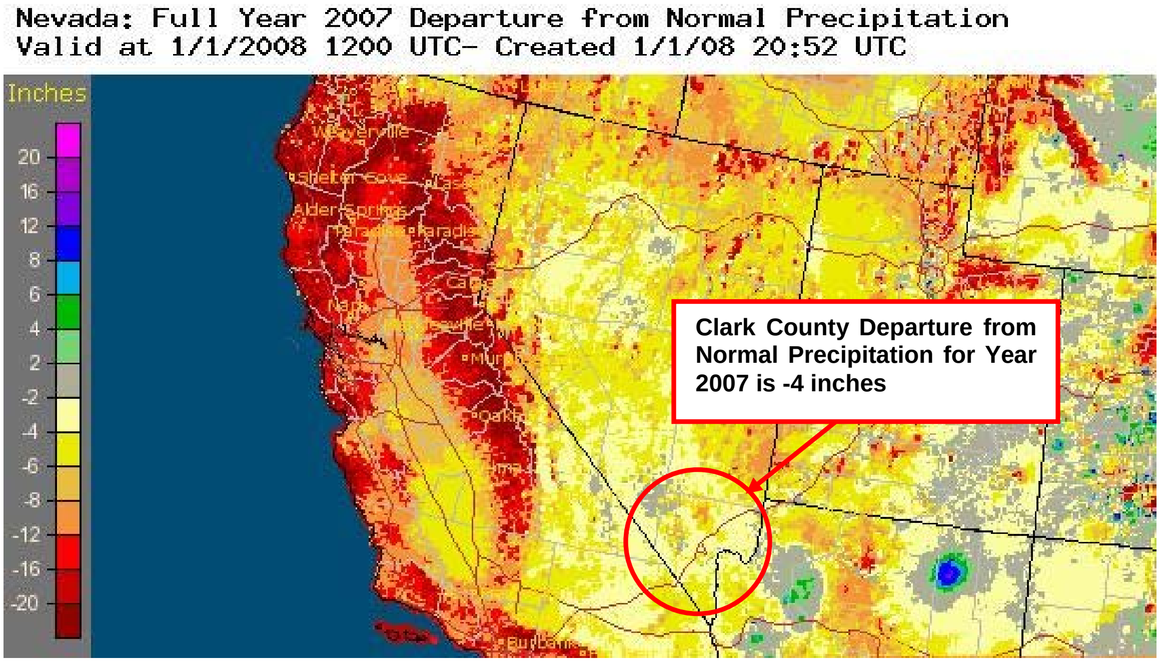
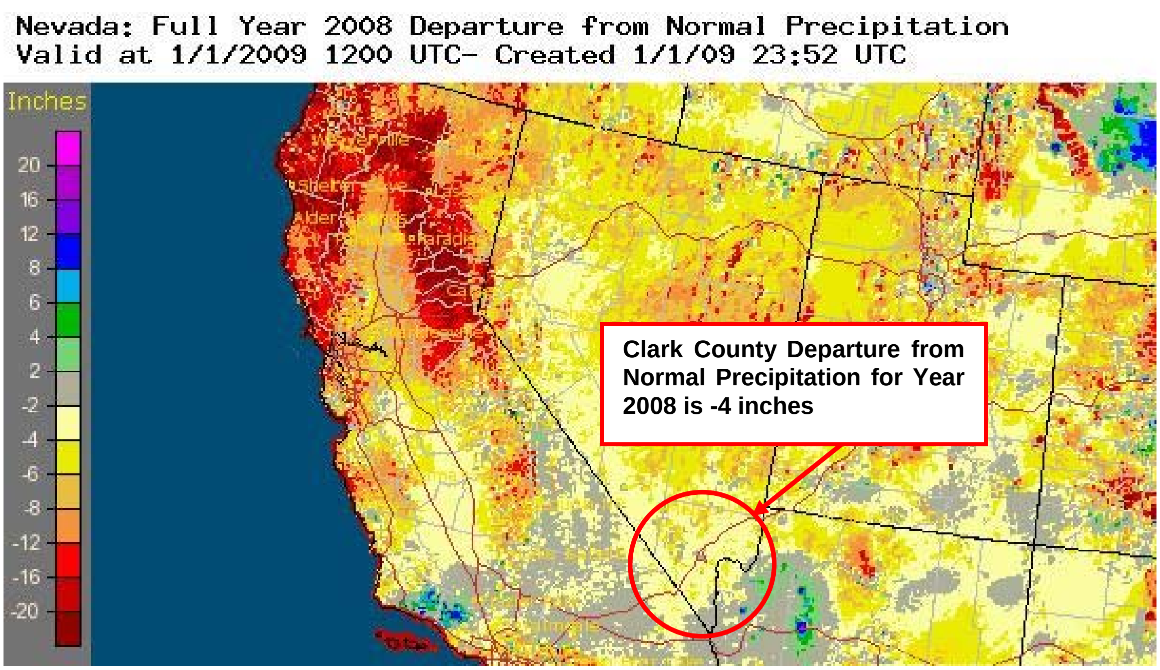


Figure 60. Precipitation Measured in Las Vegas Area on May 25, 2008.



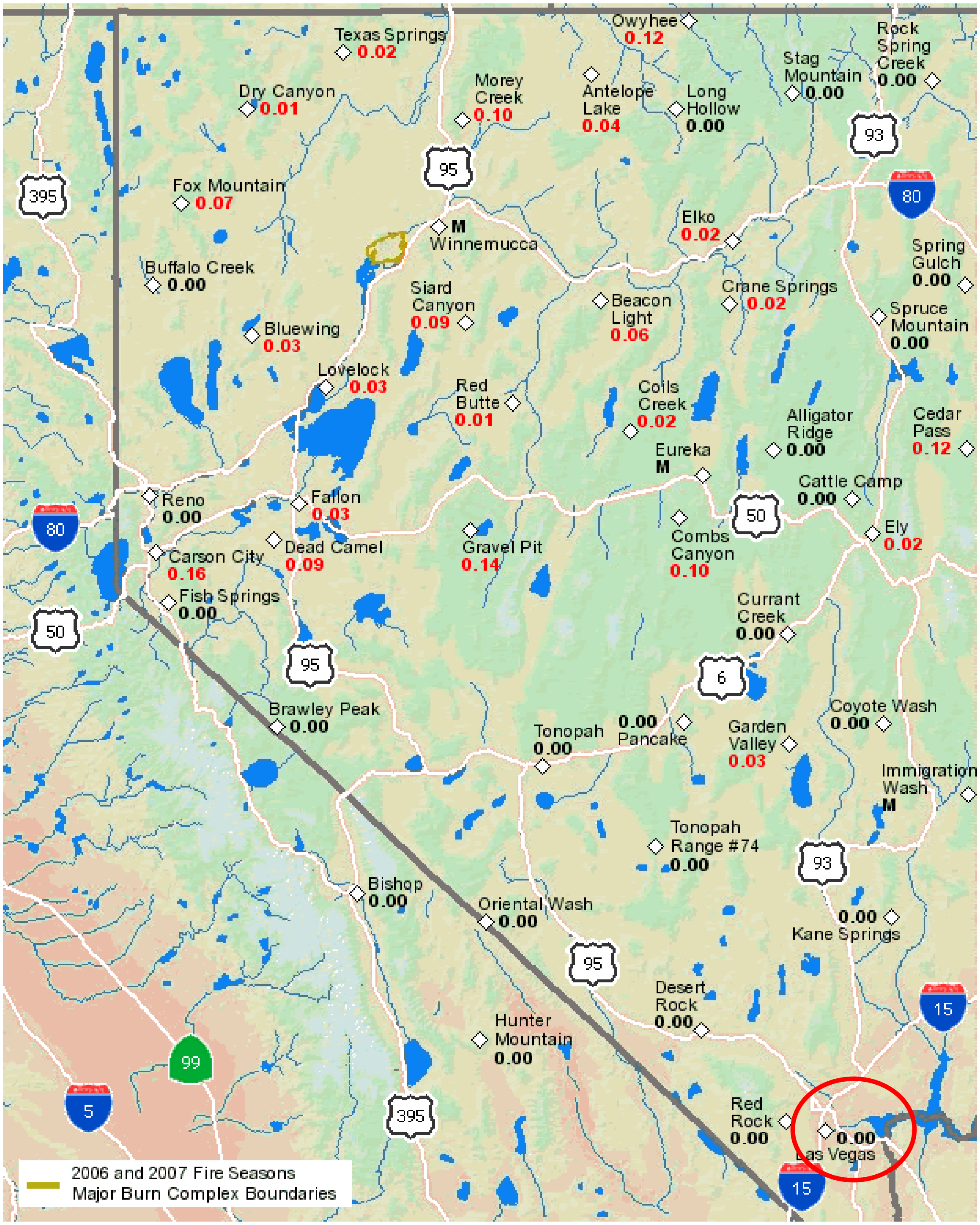
Source: National Weather Service
California-Nevada River Forecast Center

Figure 61. Nevada Departure from Normal Precipitation, 2007.



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

Figure 62. Nevada Departure from Normal Precipitation, 2008.



24 Hour Synoptic Precipitation (Inches) Ending Wed May 21 2008 at 12 UTC
NOAA / NWS / California Nevada River Forecast Center

Figure 63. Precipitation at McCarran International Airport on May 21, 2008.

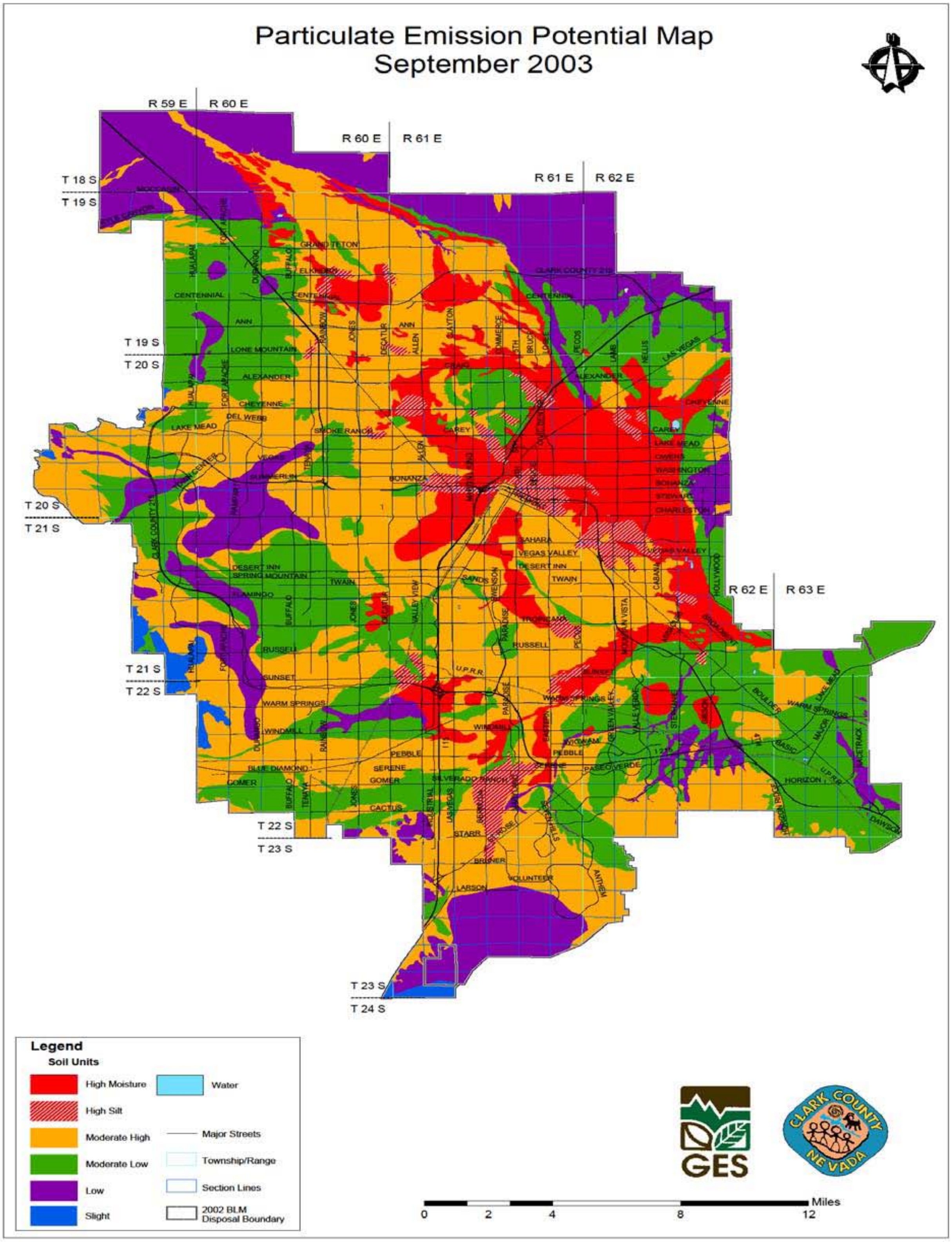


Figure 64. Particulate Emissions Potential Map of Las Vegas Valley), September 2003.

5.3 ESTABLISHING WIND THRESHOLDS FOR CLARK COUNTY

A key element in the Clark County 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 to establish emission factors 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 in Clark County. Appendix C 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, Clark County through its DAQEM committed to additional studies to refine these emission factors. Appendix C contains the final report on these studies.

Site selection for the refined emission factors study was based on the U.S. National Resources Conservation Service's major Wind Erodibility Group classifications. Seven of the eight classifications were available for testing and analysis in the BLM disposal area and the Southern Nevada Public Lands Management Act area. Out of 53 sites selected for visits, UNLV found 32 that could be physically sampled by the wind tunnel crew.

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 determine 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 mph or greater, overwhelm the native desert environment and stabilized vacant land areas. Because of the unusual threshold-qualifying winds on May 20–21, 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 event and found that PM_{10} emissions for BACM-controlled sources were well controlled. DAQEM therefore concludes that the PM_{10} exceedance would not have occurred without the high winds that reentrained 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 May 21, 2008, in the AQS.