SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
MONITORING AND ANALYSIS

Rule 1158 Follow-Up Study #10

Sampling Conducted
May 2004 – June 2004

Program Monitoring Conducted By
RES Environmental, Inc.
865 Via Lata, Colton, CA, 92324

Sample Analysis By
Steven Barbosa, Principal Air Quality Chemist
Sandra Hom, Senior Air Quality Chemist
Roger Bond, Air Quality Chemist
Jorge Diez, Laboratory Technician

Report Prepared By
Jeremy C. O'Kelly, Air Quality Chemist
October 2005

Reviewed By
Henry Hogo
Assistant DEO, Science and Technology Advancement

Report # MA 2005-14

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

EXECUTIVE SUMMARY

Purpose

In June 1999, Rule 1158 affecting storage, handling and shipment of petroleum coke, coal, and sulfur was amended to further reduce particulate emissions from these sources. This study is one of an ongoing series, required under State law, examining targeted compounds contained in the inhalable particulate fraction (PM_{10}) in the greater Long Beach/Wilmington area. This series of studies consists of PM_{10} sampling in the spring/summer and fall/winter, observing trends in ambient PM_{10} concentration and the elemental carbon content of collected samples.

Sampling

Sampling was conducted between May 15, 2004 and July 2, 2004, coincident with the AQMD PM_{10} monitoring network one-in-six day schedule. Sampling locations were identical to those utilized for the previous Rule 1158 follow-up studies. It is intended that these sites be used throughout the entire series of studies. Field operations were conducted by RES Environmental, Inc., while all laboratory operations and data analysis were performed by AQMD staff. Twenty-four samples were collected over eight non-consecutive sampling days.

Key Findings

1. The average ambient PM_{10} measured at the study sites did not differ greatly from the AQMD Long Beach network station, while the average ambient PM_{10} measured at the AQMD Central Los Angeles network station was higher than the measurements at study sites on several sampling days.

2. The current and previous monitoring studies indicate that higher PM_{10} and elemental carbon (EC) concentrations are measured at the Hudson School site than any other study site, and that Hudson School measurements are often higher than many AQMD network sites for PM_{10}. During this study the average EC at Hudson School (2.5 $\mu g/m^3$) was from 1.5 to 2 times higher compared to the other study sites, including the AQMD network sites at Central Los Angeles (1.2 $\mu g/m^3$) and Long Beach (1.0 $\mu g/m^3$) – the two closest AQMD network sites with PM_{10} measurements.

3. Monitoring at Long Beach shows a significant decline in ambient EC since Rule 1158 was amended in July 1999. Results through fall/winter 2000 showed a steady decline in EC, while more recent studies have shown modest fluctuation in EC concentrations. The magnitude of this fluctuation is consistent with seasonal meteorological variation.

4. Monitoring during the spring/summer period shows lower and more consistent PM_{10} levels, whereas fall/winter measurements (which are historically higher throughout the Basin than springtime measurements) have been more illustrative of trends in the area. Examination of all of the monitoring data for spring and fall suggests that the measurable benefits of Rule 1158 have been observed, and other sources of PM_{10} and EC in the area may be greater contributors to PM_{10} than the coke/coal sources.

1.0 INTRODUCTION

Over the course of several years prior to 1997, the AQMD had received complaints of black, oily airborne dust from residents of Long Beach and Wilmington area neighborhoods. Surveys of the area noted that there were numerous coal and petroleum coke production, storage, and shipment facilities. These included open stockpiles of green coke, enclosed "coke barns", refinery kilns producing petroleum coke, and a variety coke and coal carrying trains and trucks. Other industrial processes including sulfur distribution facilities, heavy traffic patterns, and general construction activities were also noted in the area.

In August 1996, AQMD staff attended a public meeting in San Pedro, that focused on public concern over the levels of particulate matter in the region. Subsequently, the AQMD staff coordinated with various public action groups to select several sites for particulate monitoring, including sites located at specific areas of community concern.

Two studies were conducted at these sites, one in May 1997[1] and one in fall/winter 1998[2]. These studies were designed to characterize local micrometeorological parameters, and to microscopically and chemically characterize airborne particulate collected in the area. The most pronounced findings of these studies were the elevated levels of elemental carbon and inhalable particulate matter at some study sites, including a monitoring site adjacent to Elizabeth Hudson Elementary School in Long Beach.

In June 1999, the AQMD amended Rule 1158 affecting storage, handling and shipment practices for petroleum coke, coal, and sulfur. Subsequent state legislation (HSC 40459) requires that the AQMD, in conjunction with the California Air Resources Board (CARB), conduct studies examining the frequency and severity of violations related to AQMD Rule 1158, including impacts on ambient air quality. A summary of these activities are to be submitted to the State Legislature annually. To monitor the efficacy of the Rule and provide supporting data for the Legislative Report, the AQMD initiated a series of *Rule 1158 Follow-up Studies.* These studies are conducted twice annually on an ongoing basis each spring/summer and fall/winter, and address the requirements of HSC 40459 to maintain a particulate monitoring program in the port area assessing prevalent coke particulates and improvements in air quality.

Removal and enclosure of open coke storage piles, and modification to equipment and work practices to comply with Rule 1158 requirements is ongoing. The Rule 1158 compliance schedule mandates implementation of the majority of control measures by August 1999, with full implementation of all measures by June 2004. AQMD Compliance staff have documented a high rate of compliance with the initial rule implementation requirements, including covered transport, truck washing, prompt roadway/spill clean-up and the removal of several large open coke piles that has resulted

[1] South Coast Air Quality Management District. (September 1997) *Micrometeorological and Ambient Air Quality Monitoring Conducted Simultaneously in the Vicinity of the Los Angeles and Long Beach Harbors.* Diamond Bar, CA.

[2] South Coast Air Quality Management District. (March 1999) *Micrometeorological and Ambient Air Quality Monitoring Conducted Simultaneously in the Vicinity of the Los Angeles and Long Beach Harbors.* Diamond Bar, CA.

in the reduction of fugitive coke emissions from storage, handling, and shipping operations. Implementation of Rule 1158 has contributed to a decrease in ambient PM_{10} concentrations in the local area.

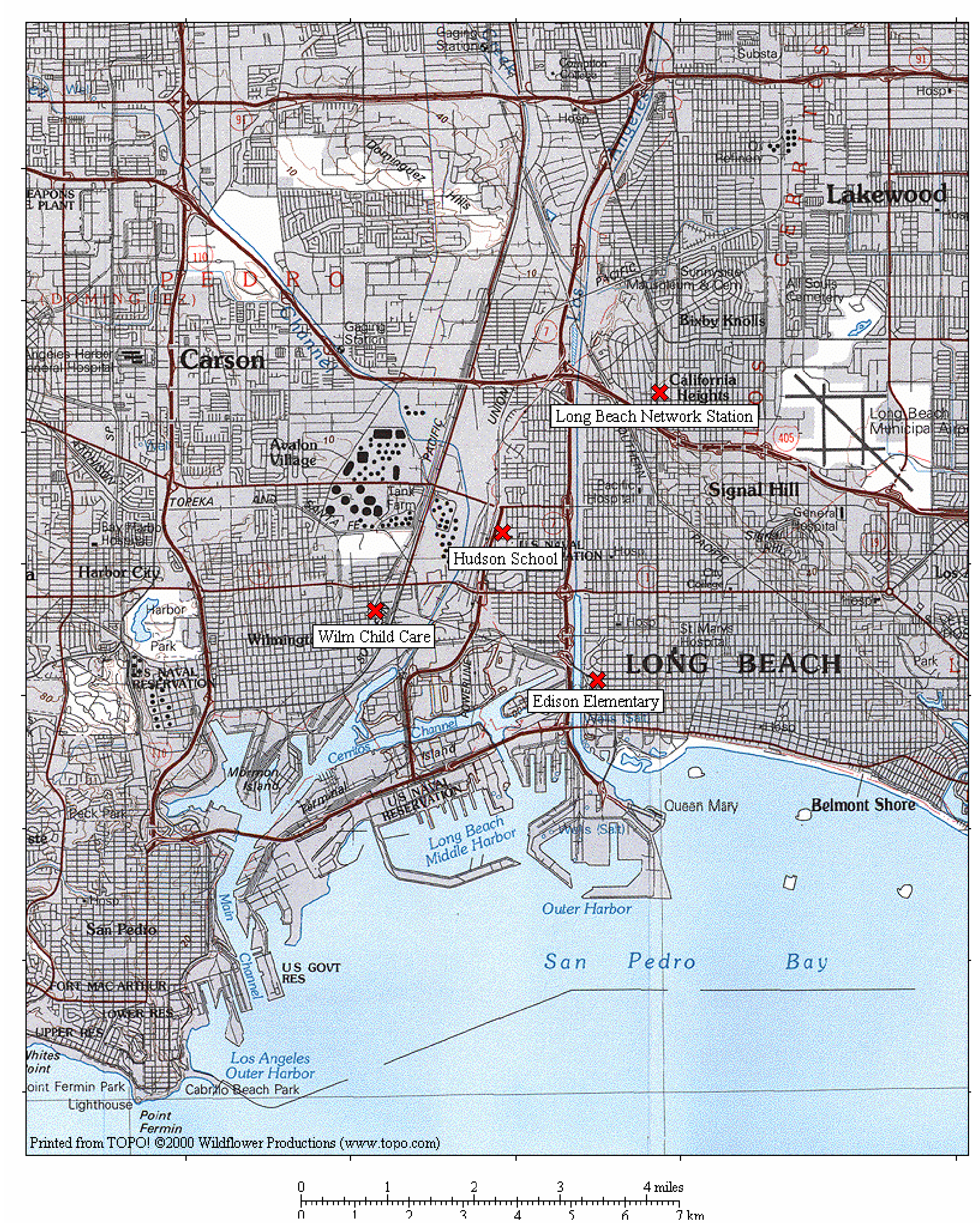


Figure 1 – Study Sampling Sites

2.0 PROJECT DISCUSSION

From May 15, 2003 to June 20, 2003, PM_{10} monitoring was conducted at three locations in the cities of Long Beach (two sites) and Wilmington (one site). This study constituted the tenth in a series of follow-up studies evaluating improvements in local air quality precipitated through implementation of Rule 1158, as amended on June 11, 1999.

This study builds on a base of knowledge established by several previous studies: two prior to Rule amendment and nine follow-up studies. Together they constitute a set of six spring/summer studies[3,4] and five fall/winter studies[5,6]. The primary objectives of the current study are to collect data suitable for the evaluation of:

- Current inhalable particulate (PM_{10}) ambient concentration trends for the study area.
- Speciation of the carbonaceous component of the collected particulate samples for elemental and organic carbon content.
- Comparison of 2004 PM_{10} mass and carbon data with that obtained during the earlier Rule 1158 studies.

The prevailing winds in the study area place portions of the community downwind of coal and coke production and/or storage facilities, and fugitive dust from these activities has been a longstanding community concern. This fugitive dust contributes to increases in the PM_{10} particulate concentration. Mobile sources such as diesel trucks, trains and ships in the area also contribute to the overall ambient particulate matter concentrations.

Site selection and the sampling calendar were influenced by several factors. Sampling dates were scheduled to repeat as closely as possible the sampling dates of the previous studies, while coinciding with the U.S. EPA one-in-six monitoring schedule utilized by the AQMD in its PM_{10} monitoring network. Samples were scheduled for collection on May 15, 21, 27, June 2, 8, 14 and 20, 2004, and July 2, 2004, producing a data set consisting of 24 samples.

The three current monitoring sites were chosen from seven sites used in the fall/winter 1998 study, *Micrometeorological and Ambient Air Quality Monitoring Conducted Simultaneously in the Vicinity of the Los Angeles and Long Beach Harbors* (March 1999); the sites have remained constant during the course of the *Rule 1158 Follow-Up* series of studies (Figure 1.) Site selection criteria included site locations relative to coal and coke facilities with respect to the local prevailing wind patterns, and their importance as locations at or near student populations (the sites include two schools and a child care center). Of the seven sites included in the 1998 study, the two school sites exhibited the

---

[3] South Coast Air Quality Management District. (September 1997)

[4] South Coast Air Quality Management District. *Rule 1158 Follow-Up Study #2, #4, #6. #8 and #10,* Diamond Bar, CA.

[5] South Coast Air Quality Management District. (March 1999)

[6] South Coast Air Quality Management District. *Rule 1158 Follow-Up Study #1, #3, #5, #7 and #9.* Diamond Bar, CA

highest levels of ambient PM_{10} and elemental carbon. Detailed site maps can be found in Appendix A-2.

2.1 SITE DESCRIPTIONS

RES Environmental, Inc. (RES), was contracted by the AQMD to perform field operations for the current study at three sampling locations:

Site 1: School Building Services Facilities/Hudson School (HUD)
2401 Webster Avenue
Long Beach, California

The monitoring site is located at the Long Beach School Building Services facility (maintenance yard), adjacent to the Hudson Middle School. The PM_{10} sampler was installed on top of two adjoining steel containers. Potential exposures consist of Henry Ford Freeway, which runs parallel to the monitoring site to the west; and the maintenance yard to the north, east and south of the monitoring site. The maintenance yard consists of repairs and fabrication of materials, including welding. Meteorological monitoring equipment was included at this site.

Site 2: Edison Elementary School (EDI)
625 Maine Avenue
Long Beach, California

This site was located at the Edison Elementary School in Long Beach. The PM_{10} sampler was located on a steel container at the western side of the school and playground. The sampler was also installed on a five-foot platform to clear the school building to the east. Potential exposures consist of a main street artery (16^{th} Street) located to the north, which carries heavy vehicle traffic; and a small bus terminal to the west of the monitoring site.

Site 3: Wilmington Childcare Center (WIL)
1419 Young Street
Wilmington, California

The monitoring equipment was installed on the roof of the Childcare Center. Potential exposures consist of a commercial/industrial development to the east; and a parking area to the west of the monitoring site.

2.2 SAMPLING AND ANALYSIS METHODOLOGY

The AQMD maintains a PM_{10} monitoring network throughout the South Coast Air Basin (Basin). The Federal Reference Method (FRM) selective size inlet (SSI) PM_{10} samplers utilized in the PM_{10} network and analytical procedures are summarized here.

The SSI sampler used in this study is the U.S. EPA's FRM sampler found in the Code of Federal Regulations (40CFR50 Appendix J). It is used to monitor particulate matter 10 microns in diameter and less (PM_{10}). For the purposes of this study, the SSI samplers are used to collect PM_{10} samples, which were also used for the determination of organic carbon (OC), elemental carbon (EC), and total carbon.

The SSI sampler contains a pump controlled by a programmable timer. An elapsed time accumulator, linked in parallel with the pump, records total pump operation time in hours. During operation, a known quantity of air is drawn through a particle size separator, which achieves particle separation, by impaction. The correct flow rate through the inlet is critical to collection of the correct particle size so that after impaction, only particles with a diameter of 10 microns or less remain suspended in the airstream. The flow of air then passes through a quartz filter medium, upon which the particles are collected. A programmable timer automatically turns the pump off at the end of the 24-hour sampling period.

Once a sample has been collected it is returned to the laboratory, following chain-of-custody protocols, where both PM_{10} mass and carbon content are determined. Ambient PM_{10} mass is determined by subtracting the weight of the clean unsampled filter (measured in the laboratory prior to sampling) from the weight of the sampled filter containing the collected PM_{10}, to yield the mass of the PM_{10} collected on the filter. This mass is then divided by the amount of air drawn through the filter to give the ambient concentration, expressed as mass per cubic meter ($\mu g/m^3$).

Ambient carbon levels are determined by taking a small portion of the PM_{10} filter and putting it into a carbon analyzer. The analyzer consists of a computer-controlled programmable oven, computer controlled gas flows, a laser, and a flame ionization detector (FID). The sample is first heated in the oven in increasing amounts of oxygen. As the temperature rises, organic carbon followed by elemental carbon are evolved from the filter. The laser beam passes through the filter, and the transmitted intensity increases at the detector as the light-absorbing carbon leaves the filter, causing the filter to become less black. The evolved carbon is swept from the oven by gas flow, and is transported to the FID where it is detected (in the form of methane) throughout the heating process. The computer that controls these processes collects data on the oven temperature profile, laser light absorption, and FID response to determine the OC and EC content of the filter. This information, combined with the volume of air sampled, provides the OC and EC concentration in the ambient air.

3.0 DATA ANALYSIS

Data collected from the current study are compared with data collected from the previous Long Beach/Wilmington area studies. The following sections discuss the results of the analysis.

3.1 PM_{10} AMBIENT CONCENTRATION ANALYSIS

PM_{10} ambient concentrations observed during the study are shown in Table 1. Complete data tabulations can be found in Appendix A-1. Long Beach values are provided for comparison. The Central Los Angeles data reflect conditions within the urban core, where particulate levels are typically higher in carbonaceous compounds, resulting from a higher contribution from vehicle emissions.

Table 1: Spring/Summer 2004 PM_{10} Concentrations ($\mu g/m^3$) at Sampling Sites

	Date							
Location	**5/15/04**	**5/21/04**	**5/27/04**	**6/2/04**	**6/8/04**	**6/14/04**	**6/20/04**	**7/2/04**
HUD	37	28	32	36	38	32	37	32
EDI	37	20	33	31	34	21	39	23
WIL	34	23	25	33	31	29	30	23
Long Beach	34	20	31	33	30	30	34	24
Los Angeles	37	20	31	44	29	41	35	25

Twenty-four hour ambient PM_{10} concentrations during the study period ranged from a maximum of 39 $\mu g/m^3$ at EDI on June 20th, to a minimum of 20 $\mu g/m^3$ obtained at the EDI site on May 21st. The average PM_{10} concentration for the three study sites was 31 $\mu g/m^3$.

None of the 24 school samples collected during the course of the study exceeded the State 24 hour PM_{10} standard of 50 $\mu g/m^3$. The Federal PM_{10} 24-hour standard of 150 $\mu g/m^3$ was also not exceeded in the current study. The highest site average (34 $\mu g/m^3$) over the course of the study occurred at the Hudson School site. As observed in previous studies, the Hudson School site ranked highest for PM_{10}.

For all studies except the fall/winter 2000 study, the HUD site exhibited the highest PM_{10} average. It should also be noted that on several occasions in the previous studies, the HUD site PM_{10} concentrations are significantly higher than those observed at EDI and WIL. Taken together, these trends suggest that HUD consistently experiences higher PM_{10} concentrations than elsewhere in the study area. Such elevated samples may be the result of local sources or meteorological conditions influencing the immediate area adjacent to the sampler, and underscore the complexity and variety of particulate sources that contribute to ambient PM_{10}.

3.2 PM$_{10}$ TREND ANALYSIS

Figure 2 summarizes the ambient PM$_{10}$ concentrations observed over the course of the six spring/summer studies. The black line represents the three-site study average for each study. The data show a seasonal PM$_{10}$ average centered on 35 μg/m^3, with a standard deviation of approximately ±11 μg/m^3 (or about 31%.)

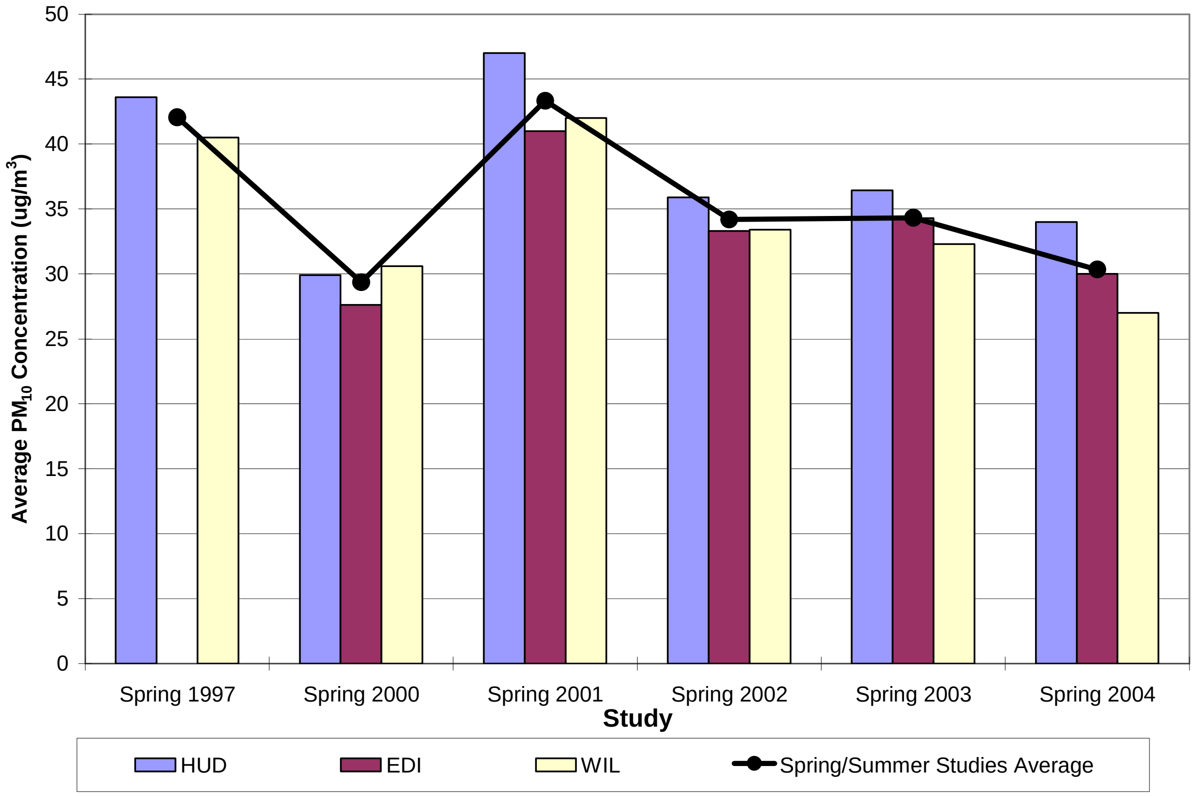


Figure 2: Ambient PM10 Concentrations by Site and Year

3.3 ELEMENTAL CARBON ANALYSIS

Elemental carbon (EC) is of particular interest in this study, as it arises in part from coke and coal storage as well as from transportation including diesel emissions from trucks, trains and ships. During the 2004 study, EC analysis was performed on samples collected at the Long Beach and Central Los Angeles network stations in addition to the samples collected at the study sites. A summary of the EC data is provided in Table 2.

Table 2: Spring/Summer 2004 EC Concentrations (μg/m³) at Sampling Sites

Location	5/15/04	5/21/04	5/27/04	6/2/04	6/8/04	6/14/04	6/20/04	7/2/04
	Date							
HUD	2.1	2.5	2.2	2.1	2.8	2.3	2.2	3.5
EDI	2.0	1.4	2.4	1.9	2.1	1.4	2.6	2.3
WIL	1.7	1.0	1.4	1.7	1.2	1.5	0.7	2.0
Long Beach	0.8	1.0	1.2	0.8	0.9	0.9	1.0	1.2
Los Angeles	2.1	0.7	1.3	1.5	1.1	1.2	0.8	0.9

The highest average ambient EC concentration of 7.5 μg/m³ was measured at the Hudson School site (HUD). During the 2003 spring/summer study, it was noted that EC measurements were higher on days that were characterized by winds primarily from the northwesterly direction. Onshore winds dominated the sampling days during the current study, and HUD continued to exhibit the highest EC levels. In 2003, the study average EC differed by 1 μg/m³ for HUD (2.6 μg/m³) and EDI (1.6 μg/m³). During the 2004 study, the difference between the averages at HUD (2.5 μg/m³) and EDI (2.0 μg/m³) was 0.5 μg/m³.

Elemental carbon concentrations were averaged for the three sites over the duration of each study, and the results are represented in Figure 3. Complete data tabulations can be found in Appendix A-1. The results obtained in the current study do not differ significantly from other spring/summer follow-up studies, and show no clear trend for average ambient EC. This may be due largely to varying weather conditions.

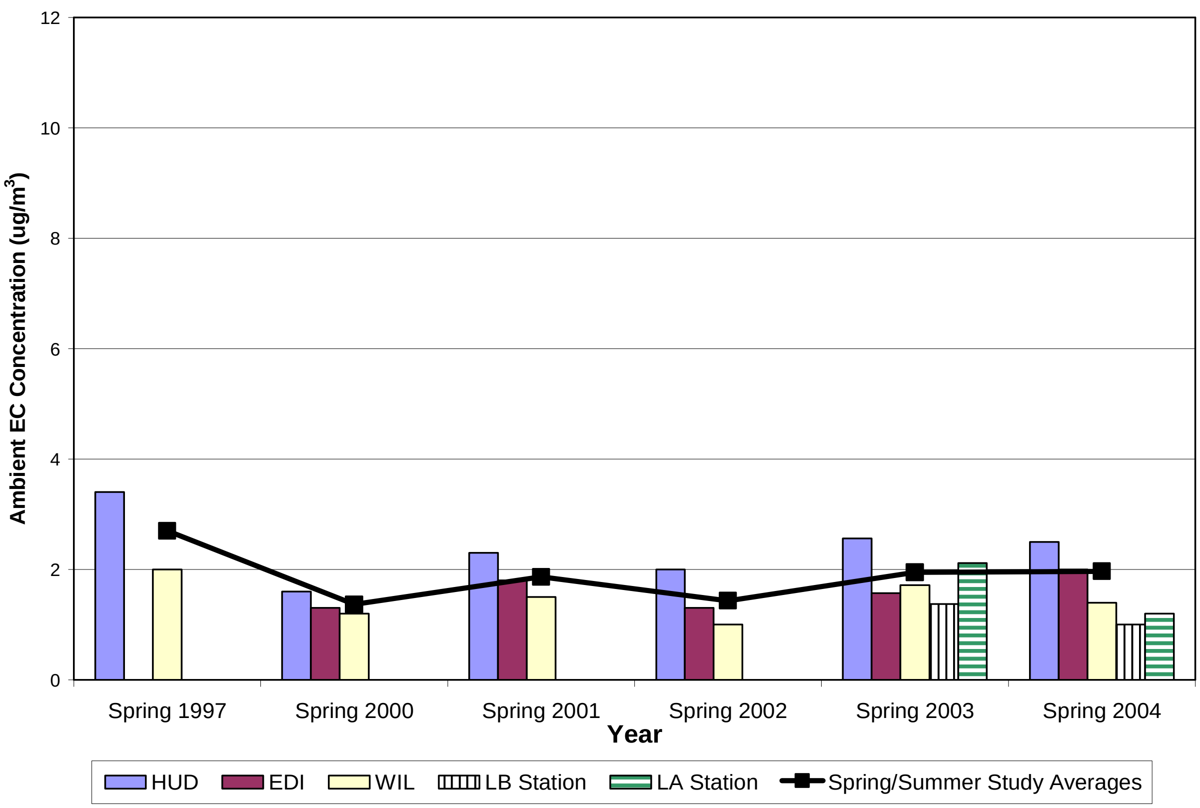


Figure 3: Spring/Summer Average EC by Site and Year

As the changes in EC concentration become smaller from year to year (illustrated particularly in the 2000-2004 spring studies) it has become difficult to differentiate between changes due to seasonal variation, experimental error, and changes due to rule compliance. PM_{10} and EC concentrations are typically much higher during fall and winter, facilitating trend observations during those seasons as is shown in Figure 4. The fall/winter data shown in Figure 4 shows the ambient EC downward trend from 1998 through implementation of Rule 1158 revisions in 2000. Subsequently, average EC concentrations rise slightly and appear to level off.

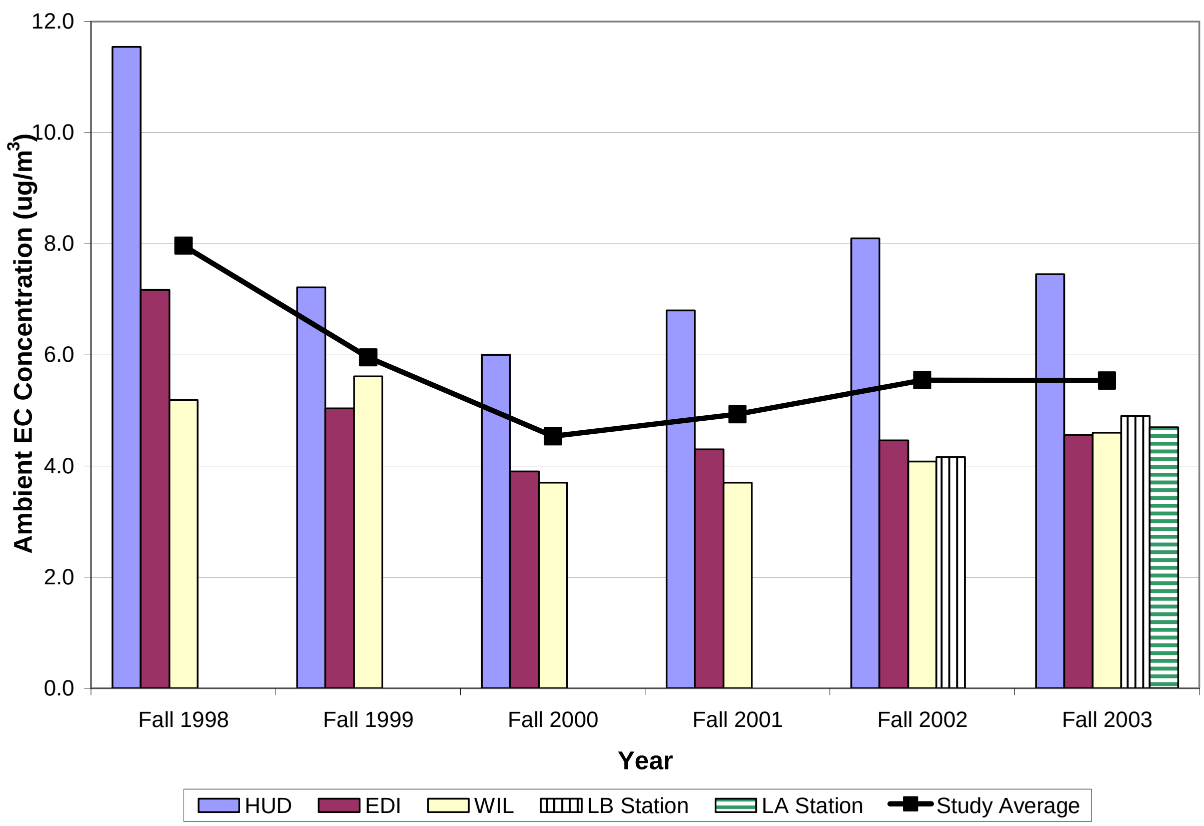


Figure 4: Fall/Winter Average EC by Site and Year

4.0 CONCLUSIONS

Average PM_{10} values show seasonal variation, with low PM_{10} and EC in the spring, and higher PM_{10} and EC in the fall. For the duration of the 2003 study, ambient PM_{10} measurements were higher than the Long Beach network station, and were higher than the Central Los Angeles network station on dates where the wind was predominantly from the west and northwest. In 2004, there were no significant offshore winds during the sampling periods, and the study PM_{10} measurements track closely with the Long Beach network station.

The current and previous monitoring studies indicate that PM_{10} and EC concentrations measured at the Hudson School site are often higher than the other study sites, and higher than many AQMD network sites for PM_{10}. This indicates that localized sources or meteorological conditions may disproportionately impact the Hudson site. Hudson School is located in close proximity to BP-Arco, a large oil refining facility, which is located to the northwest, and is adjacent to the Terminal Island Freeway and a significant rail spur (see map, Appendix A-3).

Ambient EC remains well below concentrations observed in studies prior to Rule 1158 amendment (June 1999). From 1998 – 2000, ambient elemental carbon concentrations had decreased steadily over the series of fall/winter studies, and then assumed a seasonal variation pattern during subsequent fall/winter and spring/summer studies from 2000-2004. The studies indicate more PM_{10} and EC at the Hudson school site than at other study sites, and that monitoring at Hudson school often results in higher measurements than many of the AQMD PM_{10} network sites.

In summary, the spring/summer series of studies does not show discernable impacts of Rule 1158 compared to the fall/winter measurements. The longer trend shown in the data for the spring and fall studies suggests that the measurable benefits of Rule 1158 revision have been observed, and other sources of PM_{10} and EC in the area are now more dominant than the coke/coal contribution.

APPENDIX A-1 LONG BEACH PM_{10} MONITORING DATA

2004 Spring/Summer PM_{10} Ambient Concentration Results

Location	5/15/04	5/21/04	5/27/04	6/2/04	6/8/04	6/14/04	6/20/04	7/2/04	Average
HUD	37	28	32	36	38	32	37	32	34
EDI	37	20	33	31	34	21	39	23	30
WIL	34	23	25	33	31	29	30	23	27
LB Station	34	20	31	33	30	30	34	24	30
LA Station	37	20	31	44	29	41	35	25	33

2004 Spring/Summer Organic Carbon Ambient Concentration Results

Location	5/15/04	5/21/04	5/27/04	6/2/04	6/8/04	6/14/04	6/20/04	7/2/04	Average
HUD	3.6	3.4	3.7	3.3	4.3	3.1	4.0	6.8	4.0
EDI	3.9	2.8	5.0	3.3	4.0	2.9	3.6	4.0	3.7
WIL	3.7	2.4	3.1	3.9	3.3	2.4	3.1	3.9	3.2
LB Station	3.5	3.2	3.6	3.8	3.8	2.6	3.7	3.5	3.5
LA Station	4.5	3.0	3.6	4.5	4.3	4.1	3.5	3.6	3.9

2004 Spring/Summer Elemental Carbon Ambient Concentration Results

Location	5/15/04	5/21/04	5/27/04	6/2/04	6/8/04	6/14/04	6/20/04	7/2/04	Average
HUD	2.1	2.5	2.2	2.1	2.8	2.3	2.2	3.5	2.5
EDI	2.0	1.4	2.4	1.9	2.1	1.4	2.6	2.3	2.0
WIL	1.7	1.0	1.4	1.7	1.2	1.5	0.7	2.0	1.4
LB Station	0.8	1.0	1.2	0.8	0.9	0.9	1.0	1.2	1.0
LA Station	2.1	0.7	1.3	1.5	1.1	1.2	0.8	0.9	1.2

2004 Spring/Summer Total Carbon Ambient Concentration Results

Location	5/15/04	5/21/04	5/27/04	6/2/04	6/8/04	6/14/04	6/20/04	7/2/04	Average
HUD	5.7	5.9	5.9	5.4	7.1	5.4	6.2	10.3	6.5
EDI	5.9	4.2	7.4	5.2	6.1	4.3	5.2	6.3	5.6
WIL	5.4	3.4	4.5	5.6	4.5	3.9	3.8	5.9	4.6
LB Station	4.3	4.2	4.8	4.6	4.7	3.5	4.7	4.7	4.4
LA Station	6.6	3.7	4.9	6.0	5.4	5.3	4.3	4.5	5.1

2003 Spring/Summer PM_{10} Ambient Concentration Results

Location	5/15/03	5/21/03	5/27/03	6/2/03	6/8/03	6/14/03	6/20/03	Average
HUD	29	53	44	31	20	41	37	36
EDI	28	50	48	26	9	48	31	34
WIL	29	48	38	32	19	33	27	32
LB Station	26	38	49	22	18	31	24	30
LA Station	35	46	53	58	35	41	28	42

2003 Spring/Summer Organic Carbon Ambient Concentration Results

Location	5/15/03	5/21/03	5/27/03	6/2/03	6/8/03	6/14/03	6/20/03	Average
HUD	4.0	8.7	5.5	2.9	2.9	5.3	3.2	4.6
EDI	3.2	6.9	6.0	2.7	2.8	5.0	2.8	4.2
WIL	3.4	6.6	4.2	2.9	2.7	4.2	2.6	3.8
LB Station	3.2	4.7	3.7	2.9	2.8	4.1	3.0	3.5
LA Station	4.7	7.6	6.9	6.1	4.1	3.4	3.0	5.1

2003 Spring/Summer Elemental Carbon Ambient Concentration Results

Location	5/15/03	5/21/03	5/27/03	6/2/03	6/8/03	6/14/03	6/20/03	Average
HUD	1.5	3.9	1.7	1.4	1.6	3.3	4.5	2.6
EDI	1.1	3.4	0.9	0.9	0.6	2.4	1.7	1.6
WIL	1.1	4.7	1.4	1.0	1.0	1.7	1.1	1.7
LB Station	1.1	2.3	2.4	0.5	0.9	1.1	1.3	1.4
LA Station	2.1	3.7	3.4	0.9	0.4	3.2	1.1	2.1

2003 Spring/Summer Total Carbon Ambient Concentration Results

Location	5/15/03	5/21/03	5/27/03	6/2/03	6/8/03	6/14/03	6/20/03	Average
HUD	5.5	12.6	7.2	4.3	4.5	8.6	7.7	7.2
EDI	4.3	10.3	6.9	3.6	3.4	7.4	4.5	5.8
WIL	4.5	11.3	5.6	3.9	3.7	5.9	3.7	5.5
LB Station	4.3	7.0	6.1	3.4	3.7	5.2	4.3	4.9
LA Station	6.8	11.3	10.3	7.0	4.5	6.6	4.1	7.2

2002 Spring/Summer PM_{10} Ambient Concentration Results

Location	5/8/02	5/14/02	5/20/02	5/26/02	6/1/02	6/7/02	6/13/02	6/19/02	Average
HUD	50	58	22	22	28	20	55	32	36
EDI	40	56	18	21	31	18	50	32	33
WIL	37	54	47	19	21	17	41	31	33
LB Station	NS	NS	16	27	24	21	34	30	25

2001 Spring/Summer Organic Carbon Ambient Concentration Results

Location	5/8/02	5/14/02	5/20/02	5/26/02	6/1/02	6/7/02	6/13/02	6/19/02	Average
HUD	5.4	4.8	3.3	2.1	1.8	2.4	5.0	2.4	3.4
EDI	3.4	4.5	3.1	2.3	2.6	2.0	3.5	2.8	3.0
WIL	2.8	4.5	2.2	1.9	2.0	2.4	3.2	2.6	2.7

2001 Spring/Summer Elemental Carbon Ambient Concentration Results

Location	5/8/02	5/14/02	5/20/02	5/26/02	6/1/02	6/7/02	6/13/02	6/19/02	Average
HUD	3.5	2.2	2.6	0.9	1.0	1.2	3.5	1.0	2.0
EDI	1.5	2.0	1.7	1.1	0.8	0.9	1.7	0.9	1.3
WIL	1.1	1.8	0.7	0.8	0.5	1.1	1.3	1.1	1.0

2001 Spring/Summer Total Carbon Ambient Concentration Results

Location	5/8/02	5/14/02	5/20/02	5/26/02	6/1/02	6/7/02	6/13/02	6/19/02	Average
HUD	8.9	7.1	5.9	3.1	2.8	3.6	8.5	3.4	5.4
EDI	4.9	6.5	4.9	3.4	3.4	3.0	5.2	3.7	4.4
WIL	3.8	6.3	2.9	2.7	2.5	3.5	4.5	3.7	3.7

2001 Spring/Summer PM_{10} Ambient Concentration Results

Location	5/25/01	5/31/01	6/6/01	6/12/01	6/18/01	6/24/01	6/30/01	Average
HUD	39	70	47	34	63	36	38	47
EDI	31	67	41	32	49	36	33	41
WIL	39	56	43	36	47	35	35	42
LB Station	30	48	45	29	43	32	37	38

2001 Spring/Summer Organic Carbon Ambient Concentration Results

Location	5/25/01	5/31/01	6/6/01	6/12/01	6/18/01	6/24/01	6/30/01	Average
HUD	3.6	6.6	4.6	3.1	6.1	3.2	3.4	4.4
EDI	3.4	5.1	4.9	2.5	4.9	3.4	3.3	3.9
WIL	4.1	3.7	4.0	3.2	4.8	3.1	3.1	3.7

2001 Spring/Summer Elemental Carbon Ambient Concentration Results

Location	5/25/01	5/31/01	6/6/01	6/12/01	6/18/01	6/24/01	6/30/01	Average
HUD	1.7	3.9	2.0	1.1	3.5	1.3	2.2	2.3
EDI	1.0	2.9	1.6	1.1	3.0	1.2	1.5	1.8
WIL	2.3	1.2	1.8	1.1	2.1	1.1	0.9	1.5

2001 Spring/Summer Total Carbon Ambient Concentration Results

Location	5/25/01	5/31/01	6/6/01	6/12/01	6/18/01	6/24/01	6/30/01	Average
HUD	5.3	10.5	6.6	4.2	9.6	4.6	5.6	6.6
EDI	4.4	8.0	6.5	3.6	7.9	4.7	4.8	5.7
WIL	6.4	4.9	5.8	4.3	6.9	4.2	4.0	5.2

APPENDIX A-1 LONG BEACH PM_{10} MONITORING DATA (CONTINUED)

2000 Spring/Summer PM_{10} Ambient Concentration Results

Location	5/24/00	5/30/00	6/5/00	6/11/00	6/17/00	6/23/00	6/29/01	Average
HUD	27	31	40	32	18	19	42	30
EDI	20	28	37	31	25	17	35	28
WIL	22	38	41	33	19	24	37	31
LB Station	*	*	32	30	17	19	34	26

* No Sample

2000 Spring/Summer Organic Carbon Ambient Concentration Results

Location	5/24/00	5/30/00	6/5/00	6/11/00	6/17/00	6/23/00	6/29/01	Average
HUD	2.9	2.6	3.8	3.0	2.3	2.0	3.7	2.9
EDI	2.5	2.6	3.6	2.8	2.6	2.1	3.1	2.8
WIL	2.5	2.9	3.7	3.0	2.4	2.9	3.3	3.0

2000 Spring/Summer Elemental Carbon Ambient Concentration Results

Location	5/24/00	5/30/00	6/5/00	6/11/00	6/17/00	6/23/00	6/29/01	Average
HUD	1.7	1.2	2.6	1.4	0.7	0.8	2.5	1.6
EDI	1.2	1.2	1.7	1.4	0.8	0.6	1.3	1.3
WIL	1.3	1.2	1.8	1.1	0.9	1.0	1.6	1.2

2000 Spring/Summer Total Carbon Ambient Concentration Results

Location	5/24/00	5/30/00	6/5/00	6/11/00	6/17/00	6/23/00	6/29/01	Average
HUD	4.6	3.7	6.4	4.4	3	2.8	6.2	4.4
EDI	3.7	3.8	5.3	4.2	3.4	2.7	4.4	3.9
WIL	3.8	4.1	5.5	4.1	3.3	3.9	4.9	4.2

1997 Spring/Summer PM_{10} Ambient Concentration Results

Location	5/4/97	5/8/97	5/12/97	5/14/97	5/20/97	5/22/97	5/27/97	Average
HUD	48	50	36	*	32	39	58	44
EDI	*	*	*	*	*	*	*	*
WIL	43	50	35	42	30	36	48	41
LB Station								

* No Sample

1997 Spring/Summer Organic Carbon Ambient Concentration Results

Location	5/20/97	5/22/97	5/27/97	Average
HUD	3.6	4.3	6.9	4.9
EDI	*	*	*	*
WIL	4.1	4.2	5.8	4.7

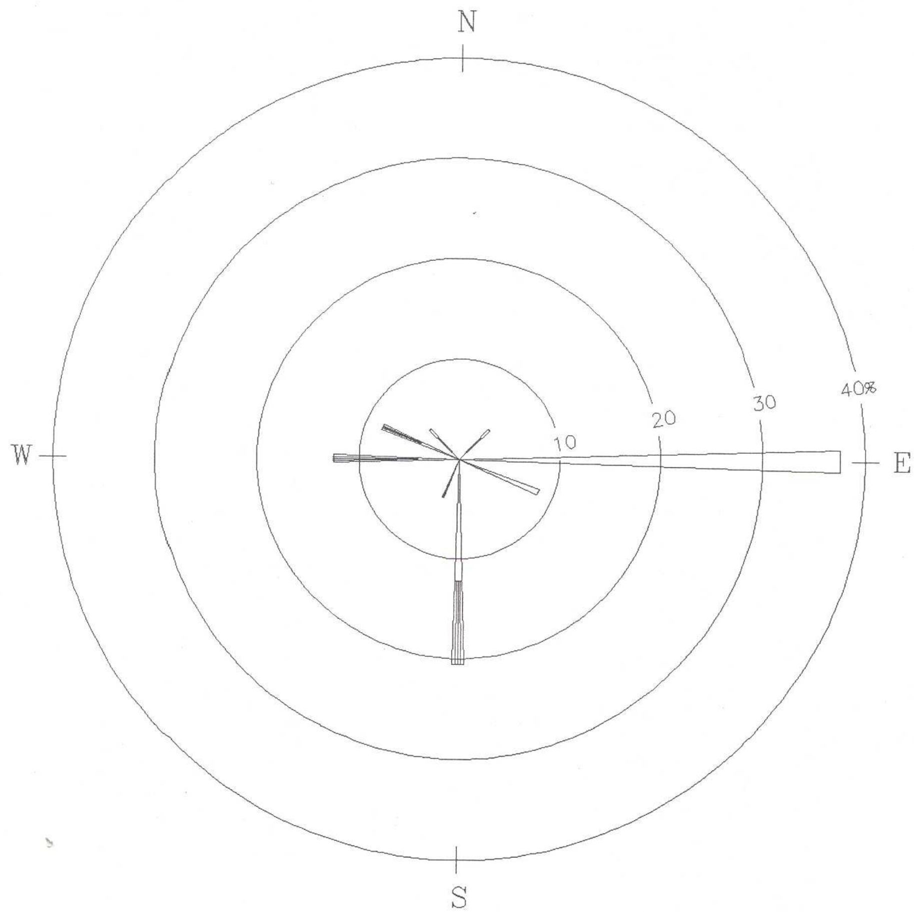
1997 Spring/Summer Elemental Carbon Ambient Concentration Results

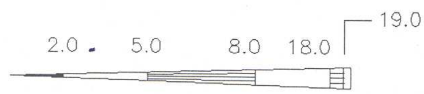
Location	5/20/97	5/22/97	5/27/97	Average
HUD	2.3	2.4	5.4	3.4
EDI	*	*	*	
WIL	1.2	1.6	3.3	2.0

1997 Spring/Summer Total Carbon Ambient Concentration Results

Location	5/20/97	5/22/97	5/27/97	Average
HUD	5.9	6.7	12.3	8.3
EDI	*	*	*	
WIL	5.3	5.8	9.1	6.7

APPENDIX A-2 STUDY WIND DATA





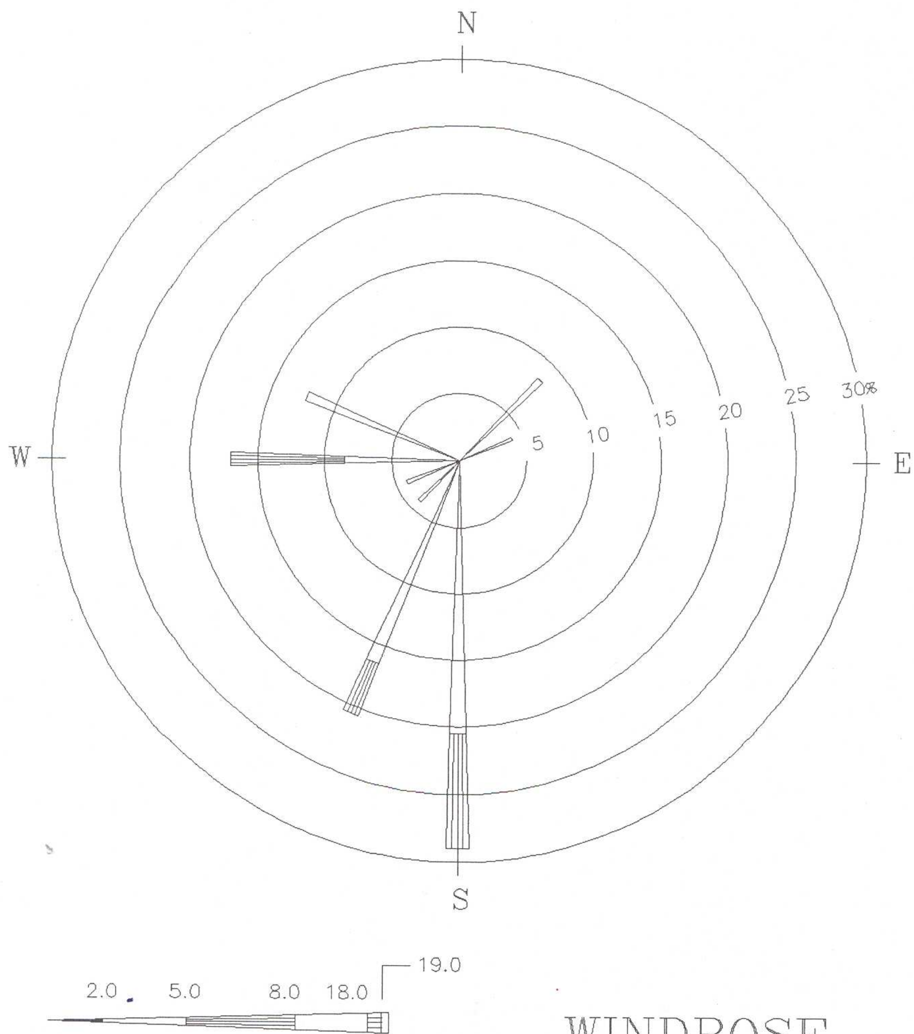
WIND SPEED CLASS BOUNDARIES
(MILES/HOUR)

NOTES:
DIAGRAM OF THE FREQUENCY OF OCCURRENCE FOR EACH WIND DIRECTION. WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING. EXAMPLE – WIND IS BLOWING FROM THE NORTH .0 PERCENT OF THE TIME.

WINDROSE

AQMD
PERIOD: 5/15/04

APPENDIX A-2 STUDY WIND DATA



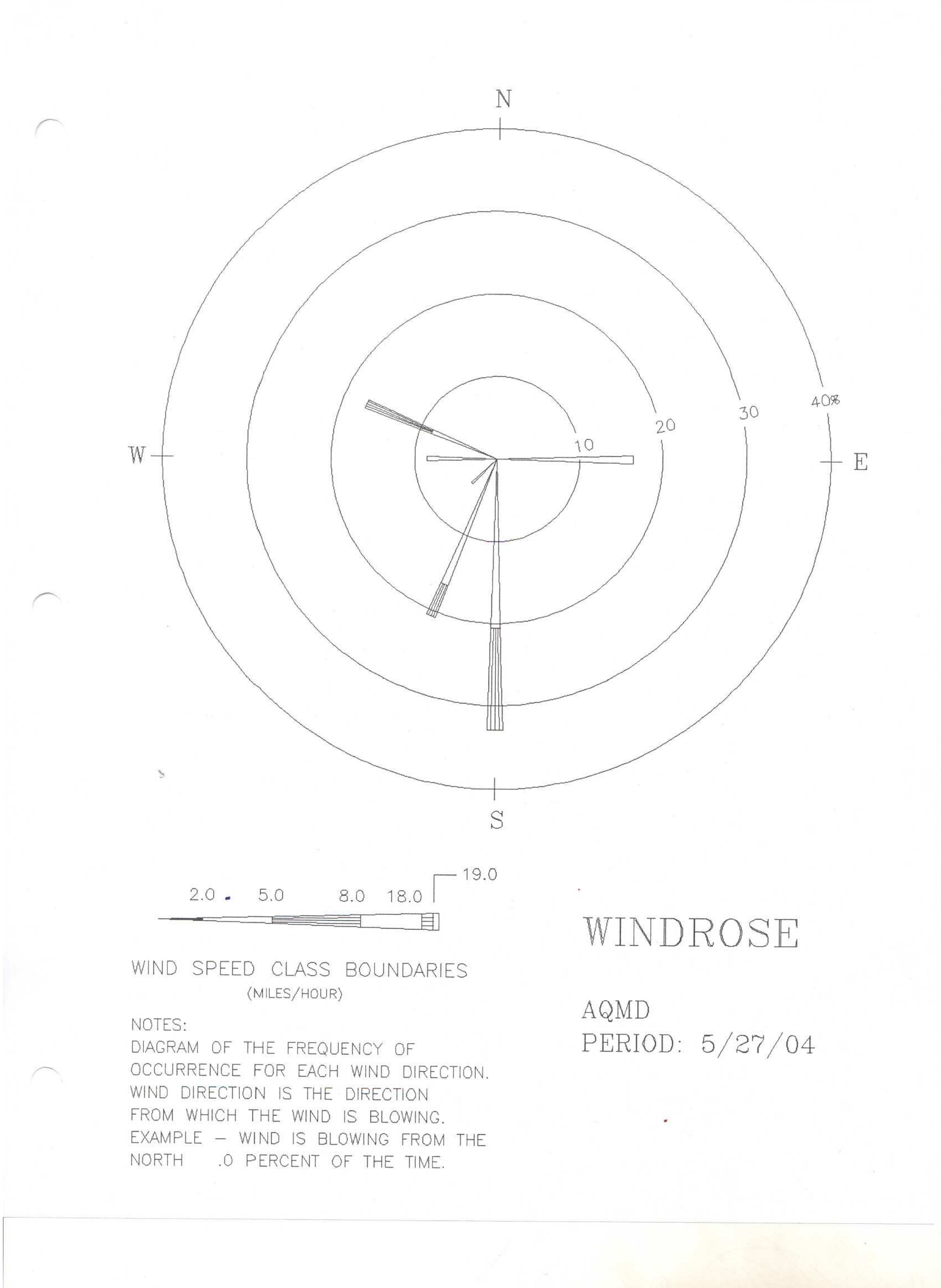
WIND SPEED CLASS BOUNDARIES
(METERS/SECOND)

NOTES:
DIAGRAM OF THE FREQUENCY OF OCCURRENCE FOR EACH WIND DIRECTION. WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING. EXAMPLE – WIND IS BLOWING FROM THE NORTH .0 PERCENT OF THE TIME.

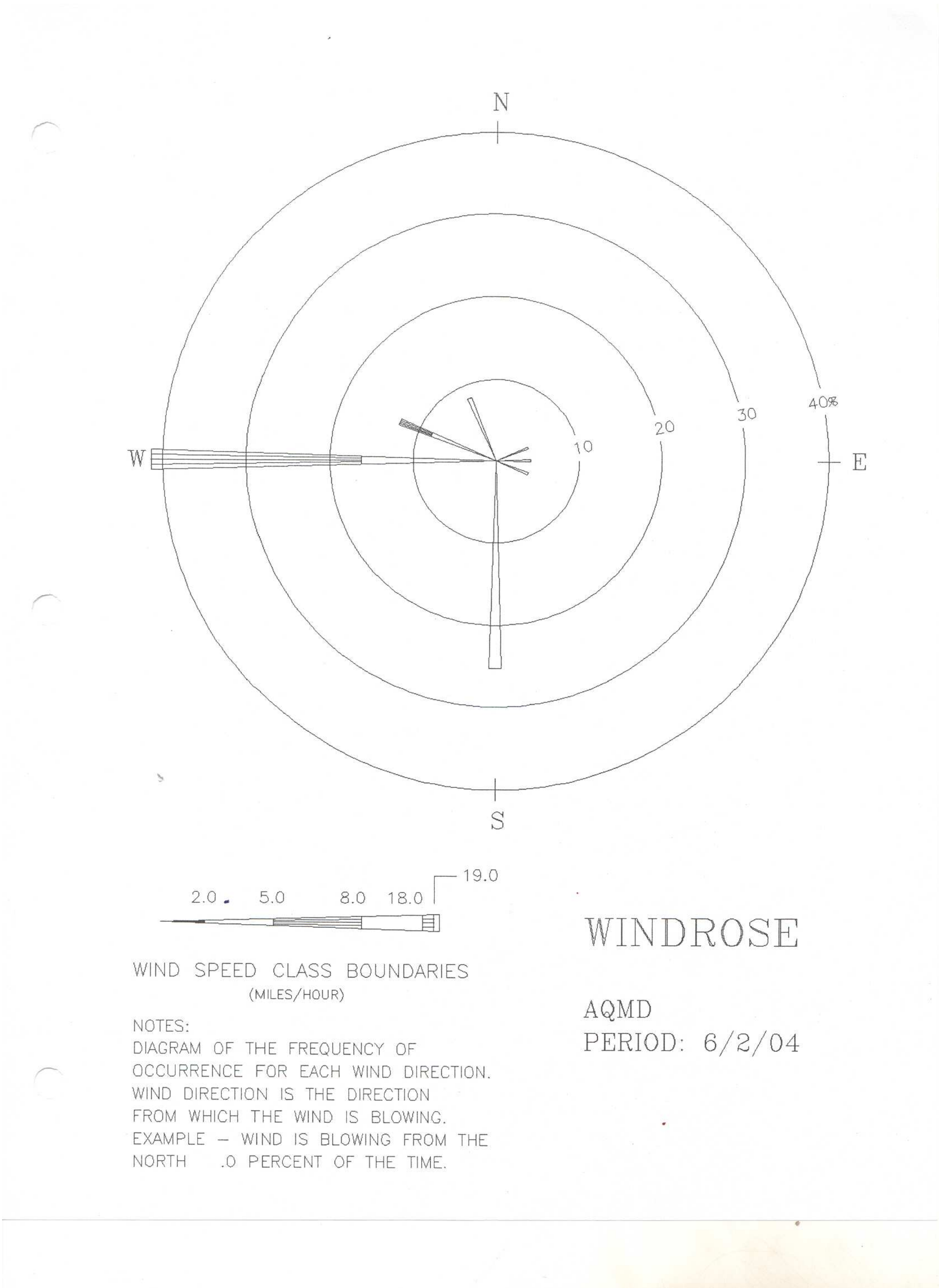
WINDROSE

AQMD
PERIOD: 5/21/04

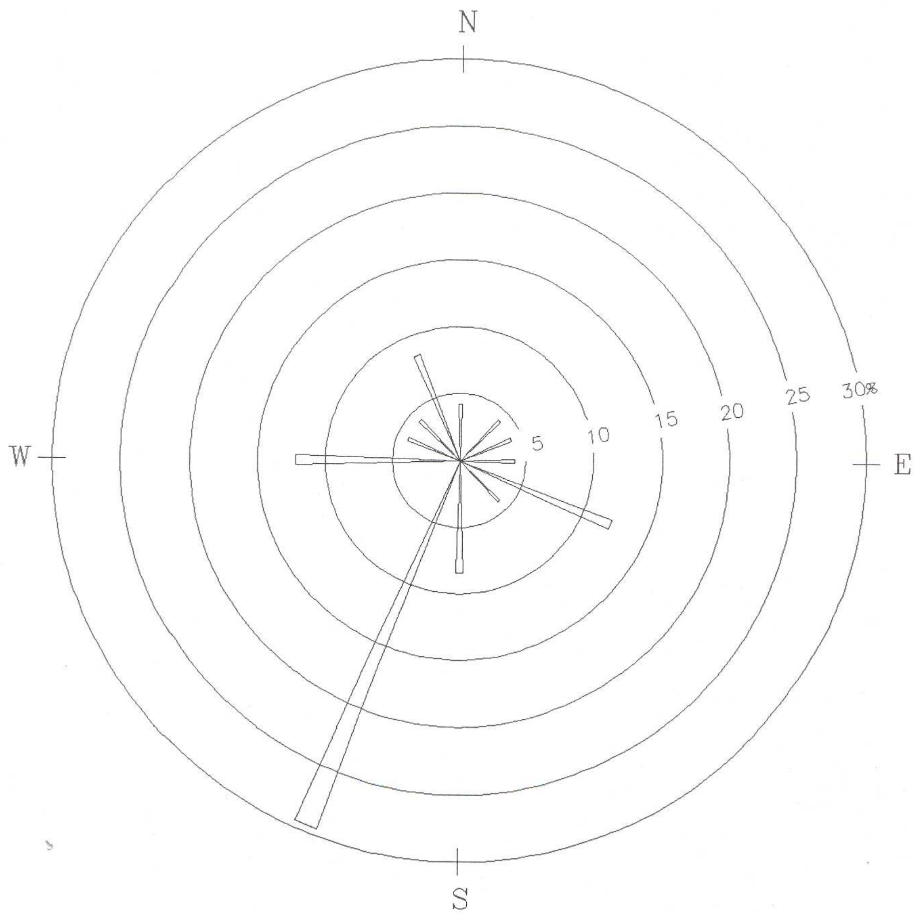
APPENDIX A-2 STUDY WIND DATA

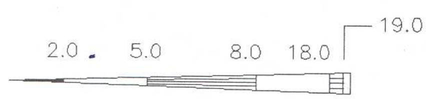


APPENDIX A-2 STUDY WIND DATA



APPENDIX A-2 STUDY WIND DATA





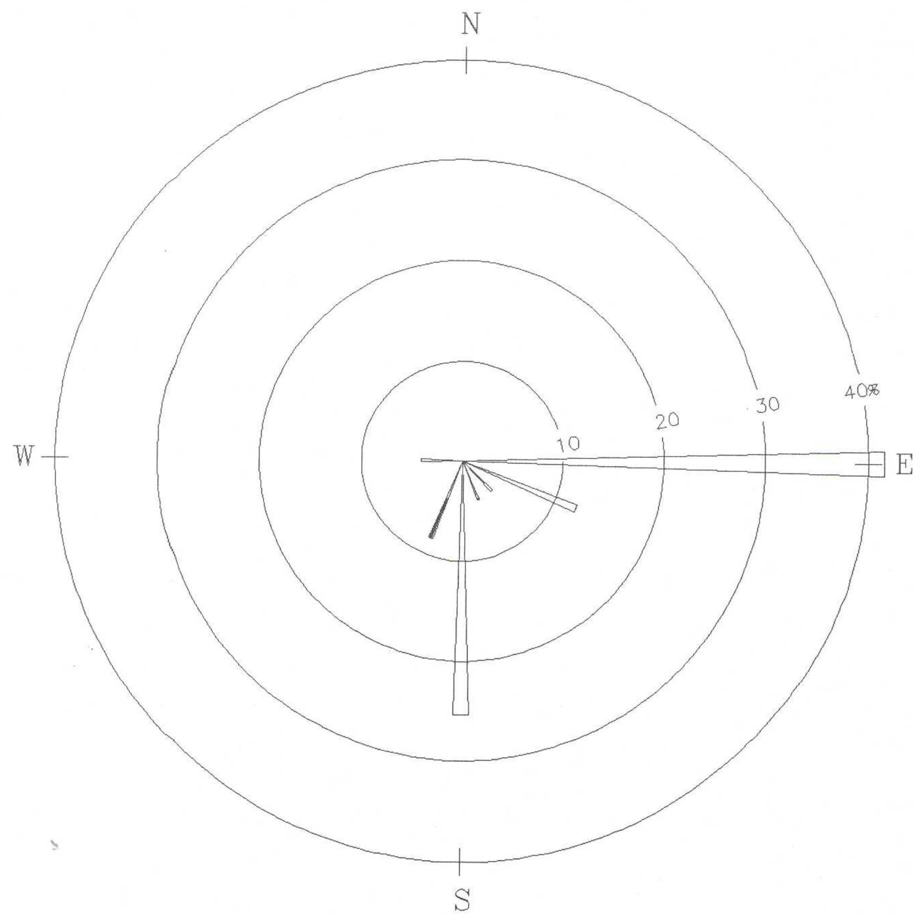
WIND SPEED CLASS BOUNDARIES
(MILES/HOUR)

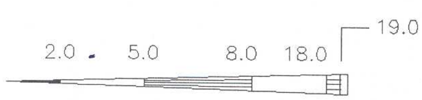
NOTES:
DIAGRAM OF THE FREQUENCY OF OCCURRENCE FOR EACH WIND DIRECTION. WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING. EXAMPLE – WIND IS BLOWING FROM THE NORTH 4.2 PERCENT OF THE TIME.

WINDROSE

AQMD
PERIOD: 6/8/04

APPENDIX A-2 STUDY WIND DATA





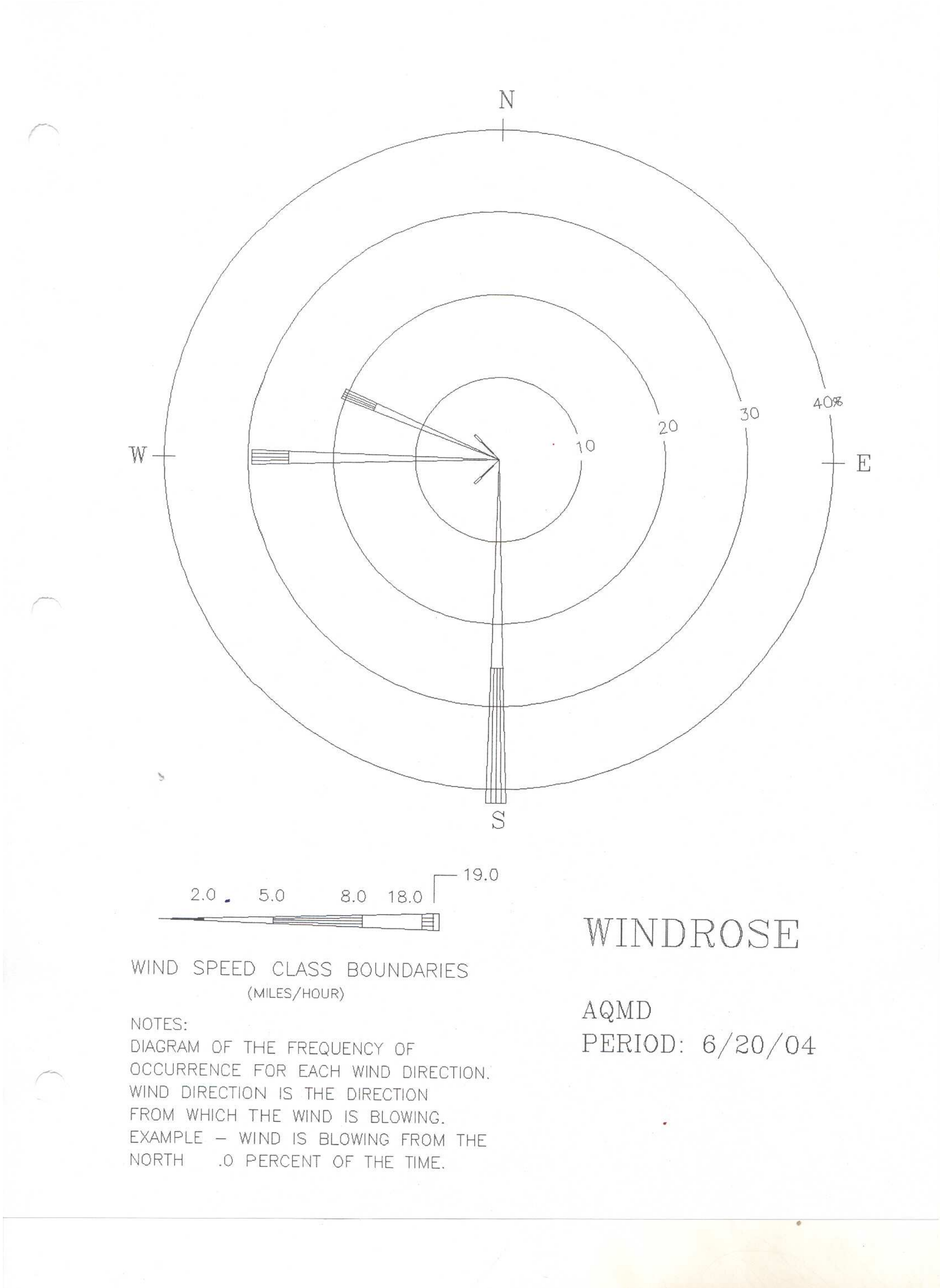
WIND SPEED CLASS BOUNDARIES
(MILES/HOUR)

NOTES:
DIAGRAM OF THE FREQUENCY OF OCCURRENCE FOR EACH WIND DIRECTION. WIND DIRECTION IS THE DIRECTION FROM WHICH THE WIND IS BLOWING. EXAMPLE – WIND IS BLOWING FROM THE NORTH .0 PERCENT OF THE TIME.

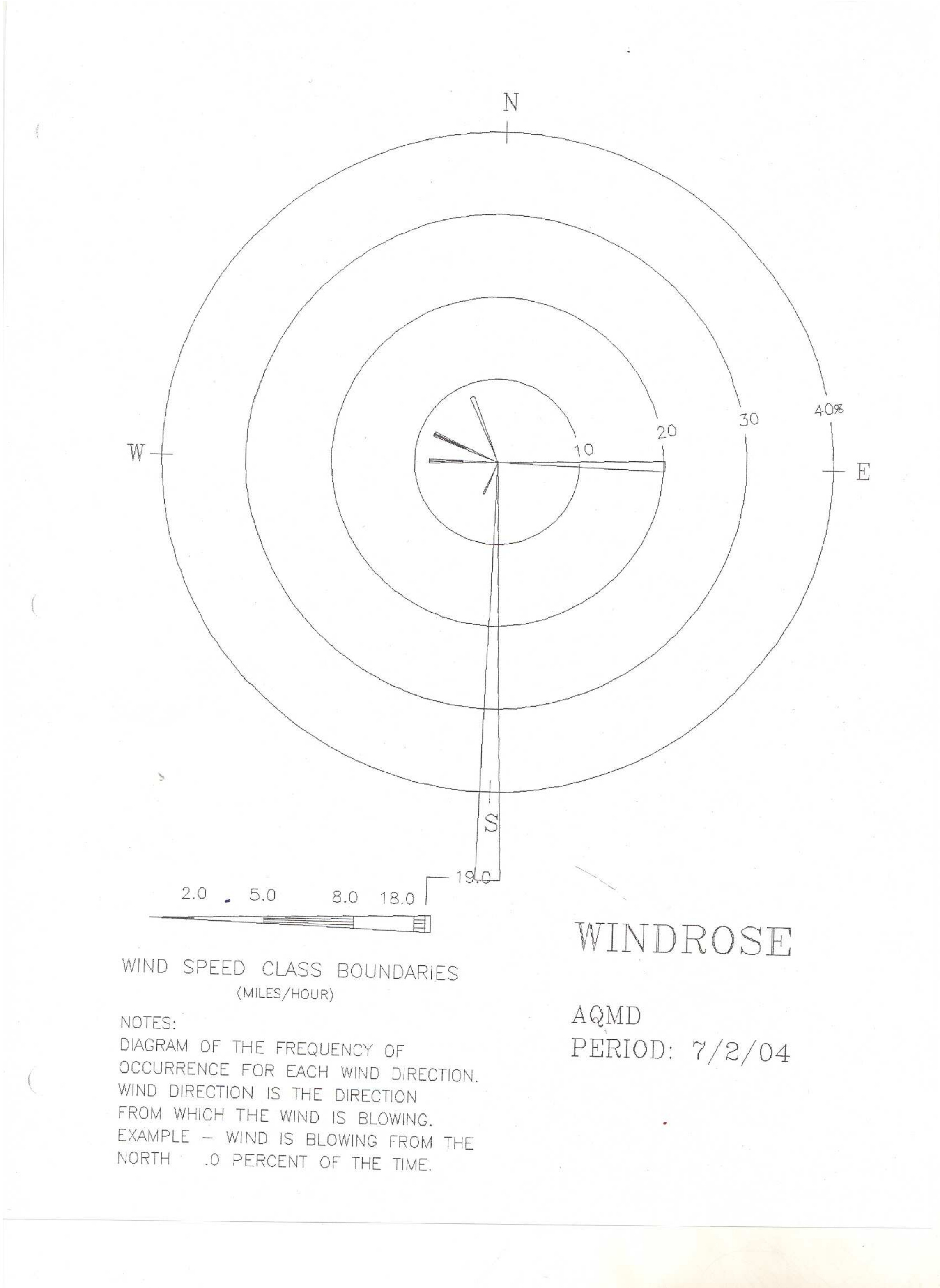
WINDROSE

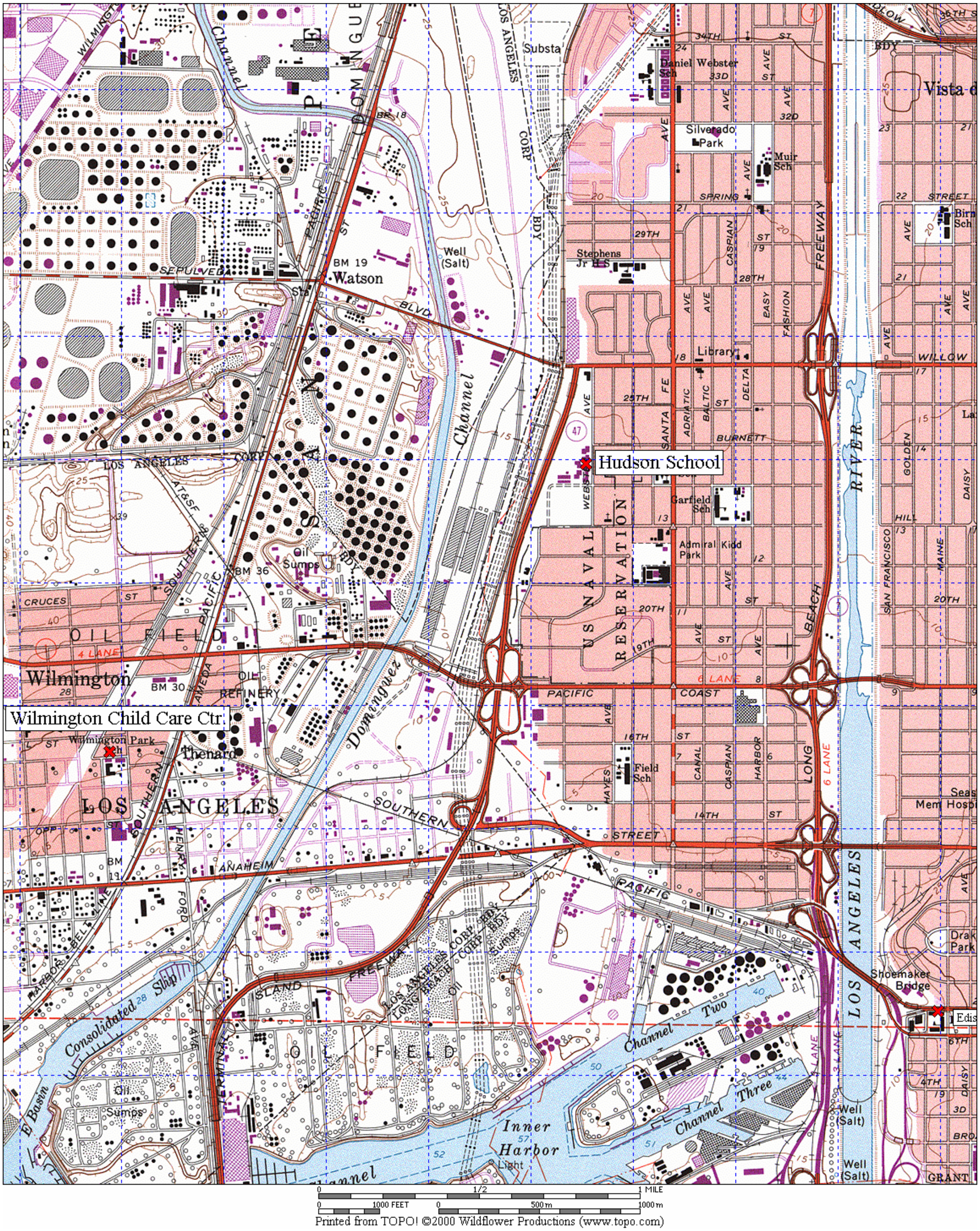
AQMD
PERIOD: 6/14/04

APPENDIX A-2 STUDY WIND DATA

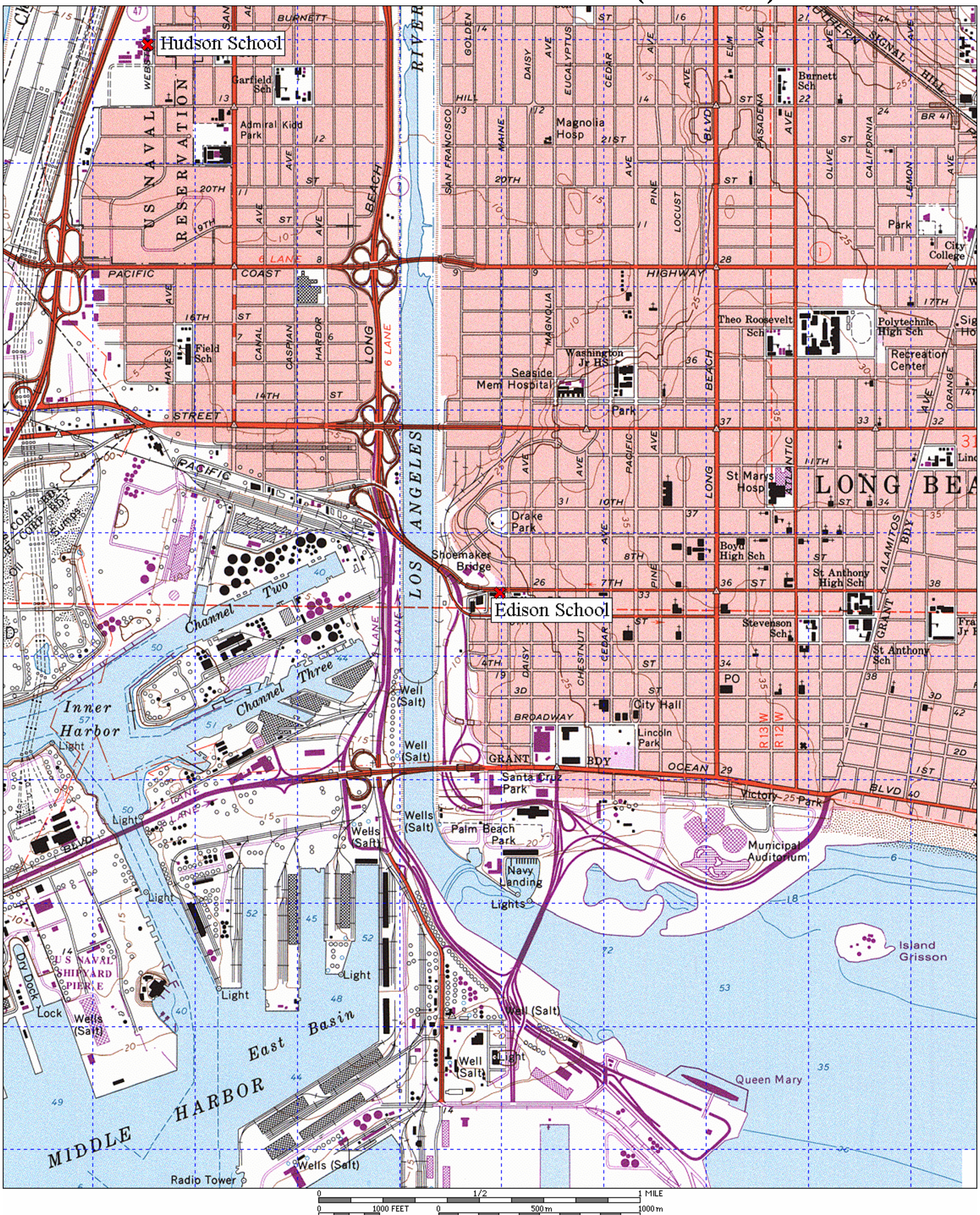


APPENDIX A-2 STUDY WIND DATA



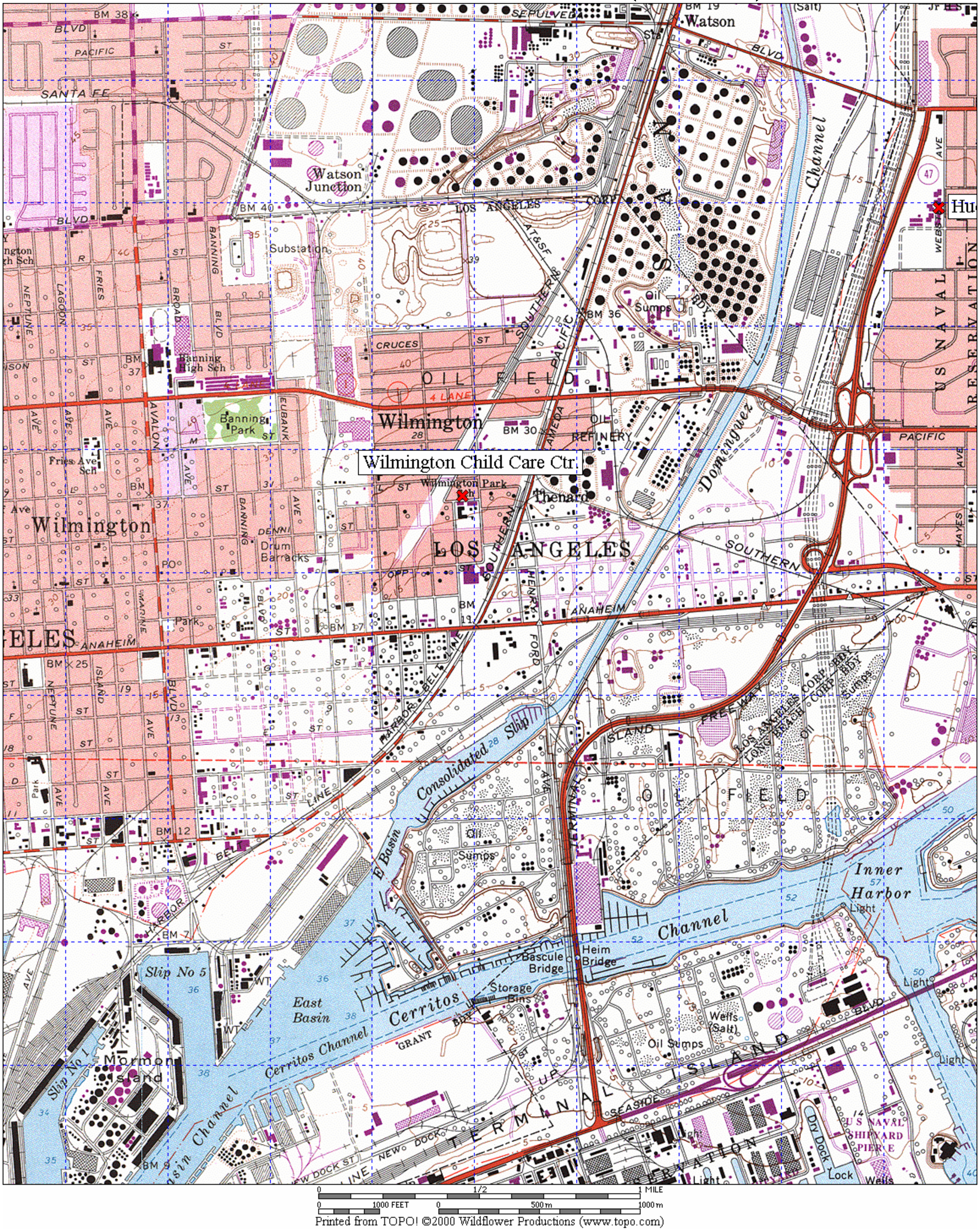


Hudson School and Surrounding Area

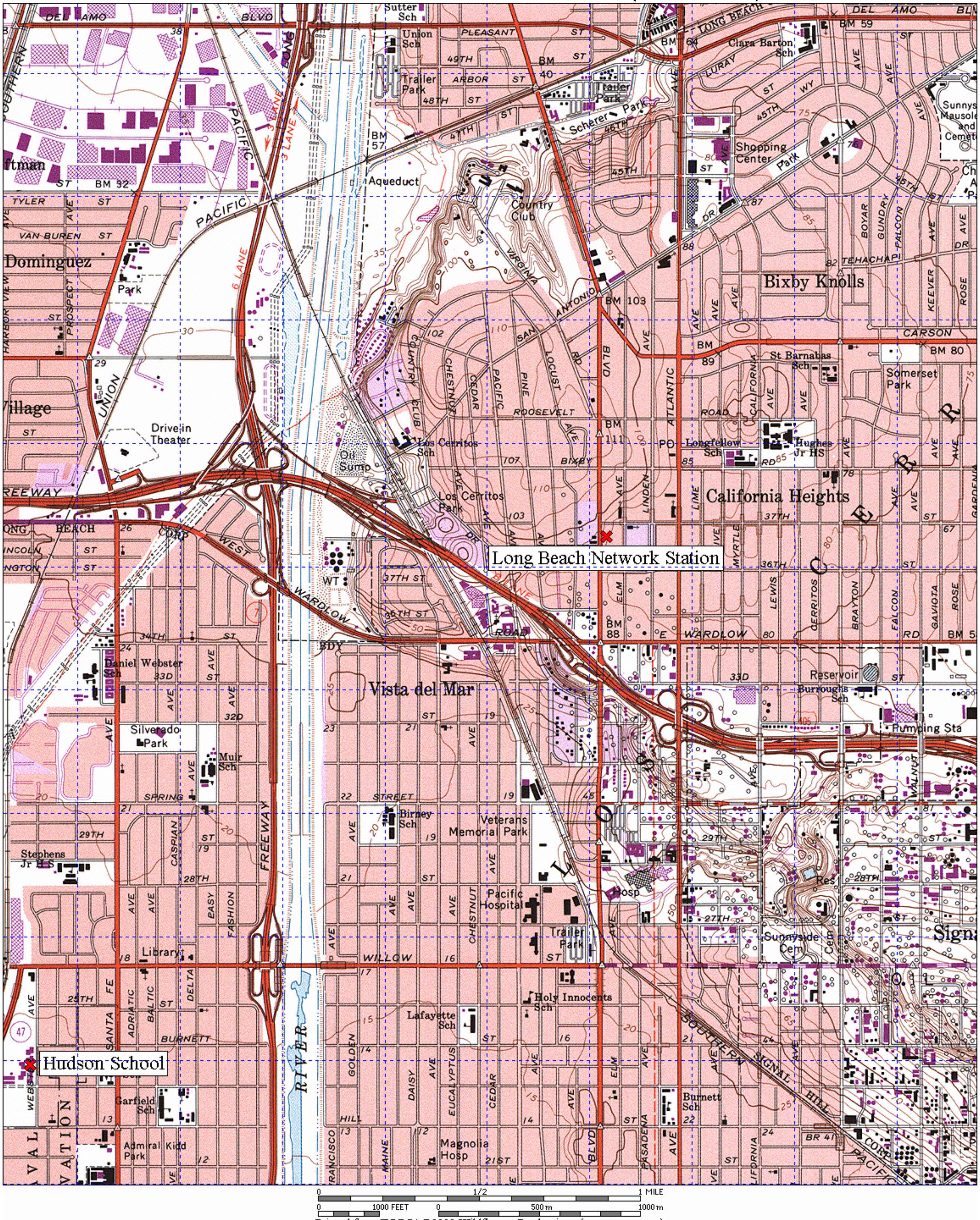


Printed from TOPO! ©2000 Wildflower Productions (www.topo.com)

Edison School and Surrounding Area



Wilmington Childcare Center and Surrounding Area



Printed from TOPO! ©2000 Wildflower Productions (www.topo.com)

Long Beach Station and Surrounding Area