APPENDIX 5.1B

Modeling Analysis

APPENDIX 5.1B

Modeling Analysis

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Table 5.1B-2 Emissions and Stack Parameters for Screening Modeling

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LEC Meteorological Data: Stockton, 2000-2004, Wind Frequency Distributions

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Figure 5.1B-9 24-Hour Average PM_{10} Impacts

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Table 5.1B-1
Lodi Energy Center
Building Dimensions Used for Modeling

Dimensions	(meters)		
Structure Heigh	**t**	**Length**	**Width**
New Structures			
Combustion Turbines	10.7	13	11
HRSGs (New), Tier 1	9.1	57	9
HRSGs (New), Tier 2	32.0	30	9
CTG Inlet	21.3	14	9
Main Aux transformer	3.9	10	9
Auxilary Boiler	4.5	8	4
Boiler Enclosure	5.6	1	1
Water Treatment	12.2	49	20
Steam Transformer	3.9	12	9
Steam Turbine	10.7	43	14
Cooling Tower	9.8	103	13
Tank 18	12.2	15	
Tank 09	12.2	9	
Existing Structures			
Gas Turbines Skid	5.0	17	4
Gas Turbines Inlet	11.3	11	9
HRSGs, Tier 1	10.7	34	8
HRSGs, Tier 2	21.2	19	8
STIG Cooling Tower	6.0	9	7
Control Room	6.2	17	15
Old Office	3.8	12	9
Warehouse	5.7	21	18
Tank 1	9.1	12	
Tank 2	9.1	12	
Tank 3	9.1	12	
Tank 4	9.1	12	
Tank 5	9.1	12	
Tank 6	4.6	8	

Table 5.1B-2
NCPA Lodi Energy Center
Emissions and Stack Parameters for Screening Modeling

Turbine Case		Ambient		Stack	Stack Ht	Exhaust Temp	Exhaust Velocity	NOx, g/s	SO2, g/s	CO, g/s	PM10, g/s
Number	Condition	Temp	Load	Diam (m)	(m)	(deg K)	(m/s)	per turbine	per turbine	per turbine	per turbine
1	Cold Base	23.7	100%	5.78	45.720	356.889	18.752	1.719	6.764E-01	1.570	1.134
2	Cold Low	23.7	50%	5.78	45.720	343.000	11.847	1.112	4.377E-01	1.016	1.134
3	Cold Peak	23.7	100%	5.78	45.720	350.778	18.793	1.921	7.560E-01	1.755	1.386
4	Avg. Base	61.2	100%	5.78	45.720	359.111	17.838	1.621	6.377E-01	1.480	1.134
5	Avg. Low	61.2	50%	5.78	45.720	348.000	11.756	1.055	4.153E-01	0.964	1.134
6	Avg. Peak	61.2	100%	5.78	45.720	354.111	17.945	1.813	7.133E-01	1.656	1.386
7	Hot Base	107.7	100%	5.78	45.720	360.778	17.466	1.540	6.059E-01	1.406	1.134
8	Hot Low	107.7	50%	5.78	45.720	351.333	12.127	1.000	3.934E-01	0.913	1.134
9	Hot Peak	107.7	100%	5.78	45.720	355.778	17.586	1.742	6.856E-01	1.591	1.386

Table 5.1B-3
NCPA Lodi Energy Center
Results of the CTG Screening Analysis

Case	Condition	Max. Impact, ug/m3 per 1.0 g/s					Max. Impact, ug/m3 per 1.0 g/s				
		1-hr	3-hr	8-hr	24-hr	annual	1-hr	3-hr	8-hr	24-hr	annual
		2000 Met Data					2003 Met Data				
1	Cold Base	1.765	1.420	1.204	0.662	0.111	1.504	1.170	0.968	0.418	0.116
2	Cold Low	2.770	2.165	2.085	1.169	--	2.440	1.857	1.542	0.800	--
3	Cold Peak	1.830	1.447	1.248	0.688	--	1.569	1.231	1.014	0.446	--
4	Avg. Base	1.843	1.457	1.247	0.693	0.114	1.552	1.202	0.995	0.426	0.119
5	Avg. Low	2.703	2.117	2.029	1.145	--	2.375	1.813	1.493	0.772	--
6	Avg. Peak	1.885	1.474	1.276	0.709	--	1.596	1.246	1.029	0.440	--
7	Hot Base	1.868	1.470	1.260	0.702	0.115	1.565	1.208	1.002	0.428	0.120
8	Hot Low	2.604	2.009	1.925	1.097	--	2.252	1.735	1.427	0.725	--
9	Hot Peak	1.907	1.485	1.288	0.718	--	1.607	1.251	1.034	0.441	--
		2001 Met Data					2004 Met Data				
1	Cold Base	1.800	1.348	0.959	0.476	0.114	1.491	1.170	0.959	0.535	0.119
2	Cold Low	2.394	2.082	1.512	0.855	--	2.569	2.030	1.488	1.010	--
3	Cold Peak	1.830	1.374	1.000	0.492	--	1.566	1.216	0.999	0.560	--
4	Avg. Base	1.846	1.383	0.979	0.498	0.117	1.558	1.210	0.984	0.558	0.122
5	Avg. Low	2.352	2.035	1.464	0.834	--	2.497	1.971	1.443	0.978	--
6	Avg. Peak	1.865	1.408	1.012	0.509	--	1.608	1.237	1.013	0.576	--
7	Hot Base	1.862	1.401	0.984	0.506	0.118	1.577	1.227	0.989	0.568	0.123
8	Hot Low	2.268	1.962	1.392	0.791	--	2.373	1.865	1.381	0.926	--
9	Hot Peak	1.880	1.424	1.016	0.516	--	1.624	1.252	1.017	0.585	--
		2002 Met Data					Max, All Years				
1	Cold Base	1.766	1.351	1.077	0.695	0.121	*1.800*	1.420	1.204	0.695	0.121
2	Cold Low	2.679	2.280	1.881	1.223	--	2.770	2.280	2.085	1.223	--
3	Cold Peak	1.807	1.406	1.112	0.723	--	*1.830*	1.447	1.248	0.723	--
4	Avg. Base	1.821	1.409	1.118	0.726	0.124	1.846	1.457	1.247	0.726	0.124
5	Avg. Low	2.644	2.228	1.829	1.192	--	2.703	2.228	2.029	1.192	--
6	Avg. Peak	1.847	1.446	1.149	0.744	--	1.885	1.474	1.276	0.744	--
7	Hot Base	1.839	1.427	1.135	0.736	0.125	1.868	1.470	1.260	0.736	0.125
8	Hot Low	2.565	2.129	1.731	1.130	--	2.604	2.129	1.925	1.130	--
9	Hot Peak	1.863	1.461	1.164	0.753	--	1.907	1.485	1.288	0.753	--

Table 5.1B-3 (cont'd)

Emission Rates for Screening Modeling (lb/hr)											
Turbine		NOx		SO2				CO		PM10	
Case		1-hr	annual avg	1-hr	3-hr	24-hr	annual avg	1-hr	8-hr	24-hr	annual avg
1	Cold Base	13.64	16.29	5.368	5.368	5.368	5.55	12.46	12.46	9.0	9.57
2	Cold Low	8.83	16.29	3.474	3.474	3.474	5.55	8.06	8.06	9.0	9.57
3	Cold Peak	15.25	16.29	6.000	6.000	5.684	5.55	13.93	13.93	10.0	9.57
4	Avg. Base	12.86	16.29	5.061	5.061	5.061	5.55	11.75	11.75	9.0	9.57
5	Avg. Low	8.38	16.29	3.296	3.296	3.296	5.55	7.65	7.65	9.0	9.57
6	Avg. Peak	14.39	16.29	5.661	5.661	5.361	5.55	13.14	13.14	10.0	9.57
7	Hot Base	12.22	16.29	4.809	4.809	4.809	5.55	11.16	11.16	9.0	9.57
8	Hot Low	7.94	16.29	3.122	3.122	3.122	5.55	7.25	7.25	9.0	9.57
9	Hot Peak	13.83	16.29	5.441	5.441	5.125	5.55	12.63	12.63	10.0	9.57

Turbine Emission Rates for Screening Modeling (g/s)											
Turbine		NOx		SO2				CO		PM10	
Case	Condition	1-hr	annual avg	1-hr	3-hr	24-hr	annual avg	1-hr	8-hr	24-hr	annual avg
1	Cold Base	1.719	2.052	0.676	0.676	0.676	0.699	1.570	1.570	1.134	1.206
2	Cold Low	1.112	2.052	0.438	0.438	0.438	0.699	1.016	1.016	1.134	1.206
3	Cold Peak	1.921	2.052	0.756	0.756	0.716	0.699	1.755	1.755	1.260	1.206
4	Avg. Base	1.621	2.052	0.638	0.638	0.638	0.699	1.480	1.480	1.134	1.206
5	Avg. Low	1.055	2.052	0.415	0.415	0.415	0.699	0.964	0.964	1.134	1.206
6	Avg. Peak	1.813	2.052	0.713	0.713	0.676	0.699	1.656	1.656	1.260	1.206
7	Hot Base	1.540	2.052	0.606	0.606	0.606	0.699	1.406	1.406	1.134	1.206
8	Hot Low	1.000	2.052	0.393	0.393	0.393	0.699	0.913	0.913	1.134	1.206
9	Hot Peak	1.742	2.052	0.686	0.686	0.646	0.699	1.591	1.591	1.260	1.206

		Modeled Impacts, ug/m3, by Pollutant and Averaging Period									
Turbine		NOx		SO2				CO		PM10	
Case	Condition	1-hr	Annual	1-hr	3-hr	24-hr	Annual	1-hr	8-hr	24-hr	Annual
1	Cold Base	3.095	0.248	1.2176	0.960	0.4704	0.0846	2.826	1.890	0.79	0.146
2	Cold Low	3.082	--	1.2125	0.998	**0.5352**	--	2.815	2.118	**1.39**	--
3	Cold Peak	**3.517**	--	**1.3839**	**1.094**	0.5176	--	**3.212**	**2.190**	0.91	--
4	Avg. Base	2.993	0.255	1.1774	0.929	0.4628	0.0869	2.733	1.845	0.82	0.150
5	Avg. Low	2.853	--	1.1225	0.925	0.4948	--	2.605	1.956	1.35	--
6	Avg. Peak	3.417	--	1.3444	1.052	0.5025	--	3.121	2.113	0.94	--
7	Hot Base	2.876	**0.257**	1.1316	0.890	0.4459	**0.0874**	2.627	1.773	0.83	**0.151**
8	Hot Low	2.603	--	1.0243	0.837	0.4445	--	2.378	1.757	1.28	--
9	Hot Peak	3.322	--	1.3071	1.018	0.4862	--	3.034	2.050	0.95	--

Table 5.1B-4
NCPA Lodi Energy Center
Emission Rates and Stack Parameters for Refined Modeling

	Stack Diam, m	Release Height m	Temp, deg K	Exhaust Flow, m3/s	Exhaust Velocity, m/s	Emission Rates, g/s			
						NOx	SO2	CO	PM10
Averaging Period: One hour									
Gas Turbine (Case 3)	5.779	45.720	350.78	492.950	18.793	1.9215	0.7560	1.755	n/a
Aux Boiler	0.914	12.192	463.56	9.848	14.997	0.0688	2.332E-02	0.299	n/a
Averaging Period: Three hours									
Gas Turbine (Case 3)	5.779	45.720	350.78	492.950	18.793	n/a	0.7560	n/a	n/a
Aux Boiler	0.914	12.192	463.56	9.848	14.997	n/a	2.332E-02	n/a	n/a
Averaging Period: Eight hours									
Gas Turbine (Case 3)	5.779	45.720	350.78	492.950	18.793	n/a	n/a	85.4887	n/a
Aux Boiler	0.914	12.192	463.56	9.848	14.997	n/a	n/a	2.991E-01	n/a
Averaging Period: 24-hours									
Gas Turbine (Case 2)	5.779	45.720	343.00	310.758	11.847	n/a	0.4377	n/a	1.1340
Aux Boiler	0.914	12.192	463.56	9.848	14.997	n/a	1.166E-02	n/a	2.961E-02
Cooling Tower (per cell, 7 cells)	4.267	13.960	303.39	87.445	6.114	n/a	n/a	n/a	8.097E-03
Averaging Period: Annual									
Gas Turbine (Case 7)	5.779	45.720	360.78	458.119	17.466	2.0520	0.6991	n/a	1.2059
Aux Boiler	0.914	12.192	463.56	9.848	14.997	3.674E-03	1.246E-03	n/a	3.164E-03
Cooling Tower (per cell, 7 cells)	4.267	13.960	303.39	87.445	6.114	n/a	n/a	n/a	8.097E-03

Table 5.1B-5
NCPA Lodi Energy Center
Emission Rates and Stack Parameters for Modeling Startup Impacts

	Stack Diam, m	Stack Height, m	Exh Temp, Deg K	Exhaust Flow, m3/s	Exhaust Velocity, m/s	Em Rates, g/s	
						NOx	CO
Gas Turbine/HRSG	5.779	45.720	343.000	310.758	11.847	20.16	113.40
Auxiliary Boiler	0.914	12.192	463.556	9.848	14.997	6.88E-02	0.30

Table 5.1B-6
NCPA Lodi Energy Center
Calculation of Inversion Fumigation Impacts

CTG Emission Rates, g/s

Case	NOx	SO2	CO	PM10
1	1.719	0.676	1.570	1.134
2	1.112	0.438	1.016	1.134
3	1.921	0.756	1.755	1.386
4	1.621	0.638	1.480	1.134
5	1.055	0.415	0.964	1.134
6	1.813	0.713	1.656	1.386
7	1.540	0.606	1.406	1.134
8	1.000	0.393	0.913	1.134
9	1.742	0.686	1.591	1.386

Inversion Breakup Modeling Results from SCREEN3

Case	Unit Impacts, ug/m3 per g/s	Maximum One-Hour Avg Impacts, ug/m3				Distance to Maximum (m)
		NOx	SO2	CO	PM10	
1	1.077	1.8515	0.7285	1.6909	1.2213	17,857
2	1.562	1.7377	0.6837	1.5870	1.7713	13,574
3	1.113	2.1386	0.8414	1.9532	1.5426	17,431
4	1.234	2.0000	0.7869	1.8265	1.3994	16,156
5	1.76	1.8576	0.7309	1.6965	1.9958	12,427
6	1.276	2.3134	0.9102	2.1128	1.7685	15,763
7	1.555	2.3947	0.9422	2.1870	1.7634	13,619
8	2.228	2.2277	0.8765	2.0345	2.5266	10,437
9	1.654	2.8819	1.1339	2.6320	2.2924	13,015

Flat Terrain Modeling Results from SCREEN3

Case	Unit Impacts, ug/m3 per g/s	Maximum One-Hour Avg Impacts, ug/m3				Distance to Maximum (m)
		NOx	SO2	CO	PM10	
1	0.9341	1.6058	0.6318	1.4666	1.0593	1,091
2	1.336	1.4863	0.5848	1.3574	1.5150	1,083
3	0.978	1.8792	0.7394	1.7162	1.3555	1,076
4	1.012	1.6402	0.6453	1.4979	1.1476	1,200
5	1.691	1.7847	0.7022	1.6300	1.9176	1,008
6	1.067	1.9345	0.7611	1.7667	1.4789	1,161
7	1.535	2.3639	0.9301	2.1589	1.7407	1,038
8	2.112	2.1118	0.8309	1.9286	2.3950	945
9	1.672	2.9133	1.1463	2.6606	2.3174	1,011

Adjust unit impacts for longer averaging periods to account for 90-minute duration of fumigation

Case	1-hr unit	3-hr unit	8-hr unit	24-hr unit
1	1.077	1.006	0.961	0.943
2	1.562	1.449	1.378	1.350
3	1.113	1.046	1.003	0.986
4	1.234	1.123	1.054	1.026
5	1.760	1.726	1.704	1.695
6	1.276	1.172	1.106	1.080
7	1.555	1.545	1.539	1.536
8	2.228	2.170	2.134	2.119
9	1.672	1.672	1.672	1.672

Table 5.1B-6 (cont'd)

Case/Avg Period	NOx	SO2	CO	PM10
One-Hour				
1	1.8515	0.7285	1.6909	-
2	1.7377	0.6837	1.5870	-
3	2.1386	0.8414	1.9532	-
4	2.0000	0.7869	1.8265	-
5	1.8576	0.7309	1.6965	-
6	2.3134	0.9102	2.1128	-
7	2.3947	0.9422	2.1870	-
8	2.2277	0.8765	2.0345	-
9	**2.9133**	**1.1463**	**2.6606**	-
3 Hours				
1	-	0.6121	-	-
2	-	0.5708	-	-
3	-	0.7114	-	-
4	-	0.6445	-	-
5	-	0.6449	-	-
6	-	0.7521	-	-
7	-	0.8425	-	-
8	-	0.7683	-	-
9	-	**1.0316**	-	-
8 Hours				
1	-	-	1.0560	-
2	-	-	0.9803	-
3	-	-	1.2325	-
4	-	-	1.0917	-
5	-	-	1.1497	-
6	-	-	1.2821	-
7	-	-	1.5149	-
8	-	-	1.3639	-
9	-	-	**1.8625**	-
24 Hours				
1	-	0.2551	-	0.4278
2	-	0.2364	-	0.6124
3	-	0.2983	-	0.5469
4	-	0.2617	-	0.4653
5	-	0.2816	-	0.7690
6	-	0.3082	-	0.5988
7	-	0.3723	-	0.6968
8	-	0.3335	-	**0.9613**
9	-	**0.4585**	-	0.9270

NOTES TO TABLE 5.1B-6

INVERSION BREAKUP FUMIGATION ANALYSIS

Inversion breakup fumigation is generally a short-term phenomenon and was evaluated here as persisting for up to 90 minutes. SCREEN3 was used to model 1-hour unit impacts from the CTG/HRSG under 2.5 m/s winds and F stability (for fumigation impacts) and under all meteorological conditions (shown in the table as "Inversion Breakup Modeling Results from SCREEN3").

For longer-term averaging periods, impacts were calculated using the highest modeled impact from SCREEN3 for the corresponding averaging period. A sample calculation for 24-hour average PM_{10} for Case 1 is as follows:

- For Case 1, 1-hour average unit impact under inversion breakup conditions = 1.077 µg/m^3 per g/s.
- For Case 1, max. 1-hour average unit impact from SCREEN3 = 0.9341 µg/m^3 per g/s.
- The appropriate unit impact for the 24-hour averaging period is calculated as 1.5 hours of inversion breakup fumigation plus 22.5 hours of operation under typical conditions (from SCREEN3): [(1.5 * 1.077 µg/m^3 per g/s) + (22.5 * 0.9341 µg/m^3 per g/s)] ÷ 24 hrs = 0.943 µg/m^3 per g/s.
- For an emission rate of 1.314 g/s, the total 24-hour average PM_{10} impact under inversion breakup fumigation conditions is: 0.943 µg/m^3 per g/s * 1.314 g/s * 0.4 [persistence factor for converting 1-hour average screening impact into 24-hour average concentration] = 0.427 µg/m^3.

Table 5.1B-7
NCPA Lodi Energy Center
Emission Rates and Stack Parameters for Modeling Commissioning Impacts

	Stack Diam, m	Stack Height, m	Exh Temp, Deg K	Exhaust Flow, m3/s	Exhaust Velocity, m/s	Em Rates, g/s	
						NOx	CO
Gas Turbine/HRSG	5.779	45.720	343.000	310.758	11.847	25.20	252.00
Auxiliary Boiler	0.914	12.192	463.556	9.848	14.997	6.88E-02	0.30

Max. Modeled Impact During Commissioning of Two CTGs

	Max Modeled Conc, ug/m3	Background, ug/m3	Total Impact, ug/m3	State Standard, ug/m3	Federal Standard, ug/m3
NO2, 1 hr ozone lmtd	36.4	163.6	200	338	--
CO, 1 hr	718	5,500	6,218	23,000	40,000
CO, 8 hr	535	3,178	3,713	10,000	10,000

FIGURE 5.1B-1A JANUARY PREDOMINANT MEAN CIRCULATION OF THE SURFACE WINDS

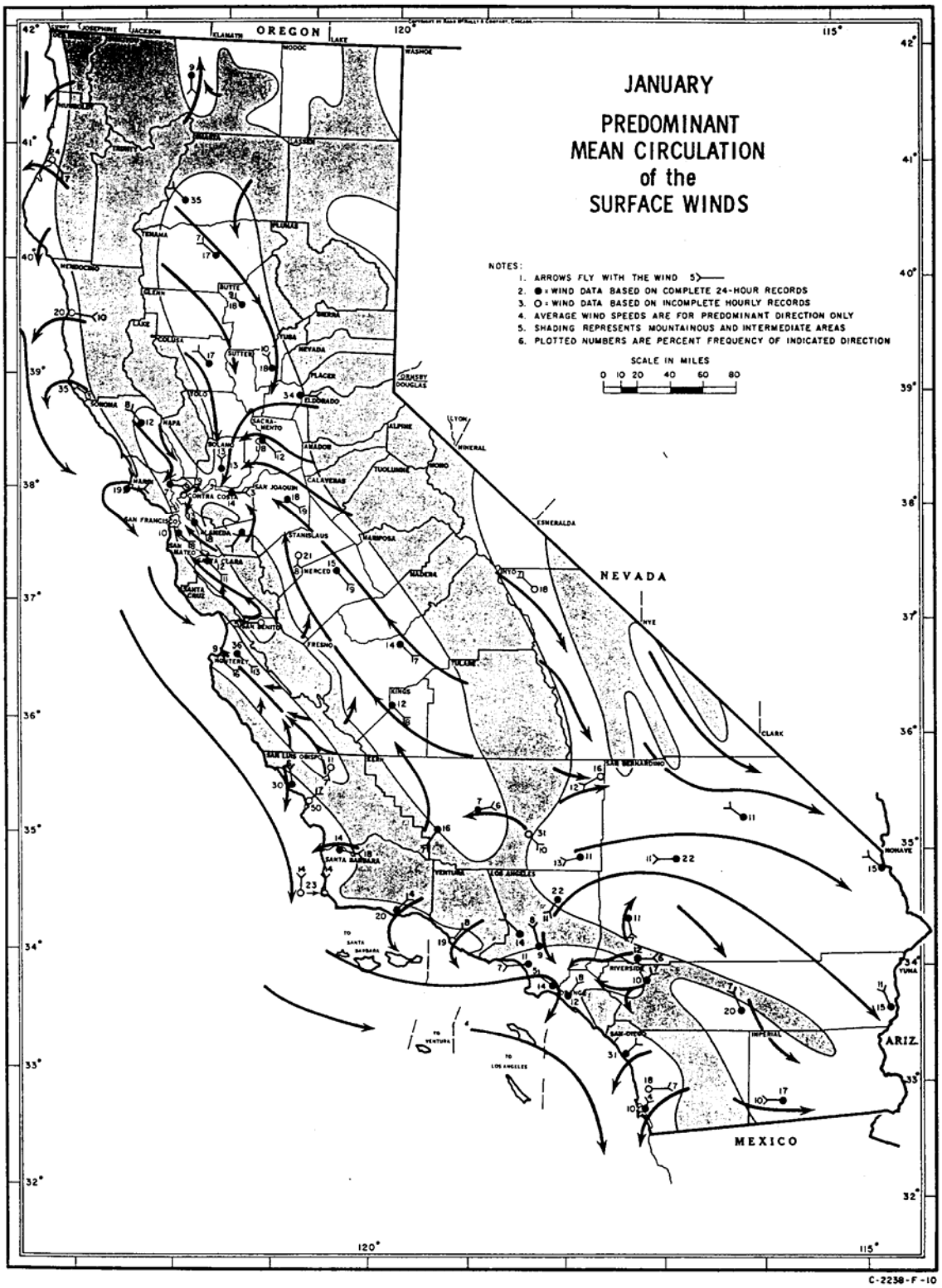


FIGURE 5.1B-1B APRIL PREDOMINANT MEAN CIRCULATION OF THE SURFACE WINDS

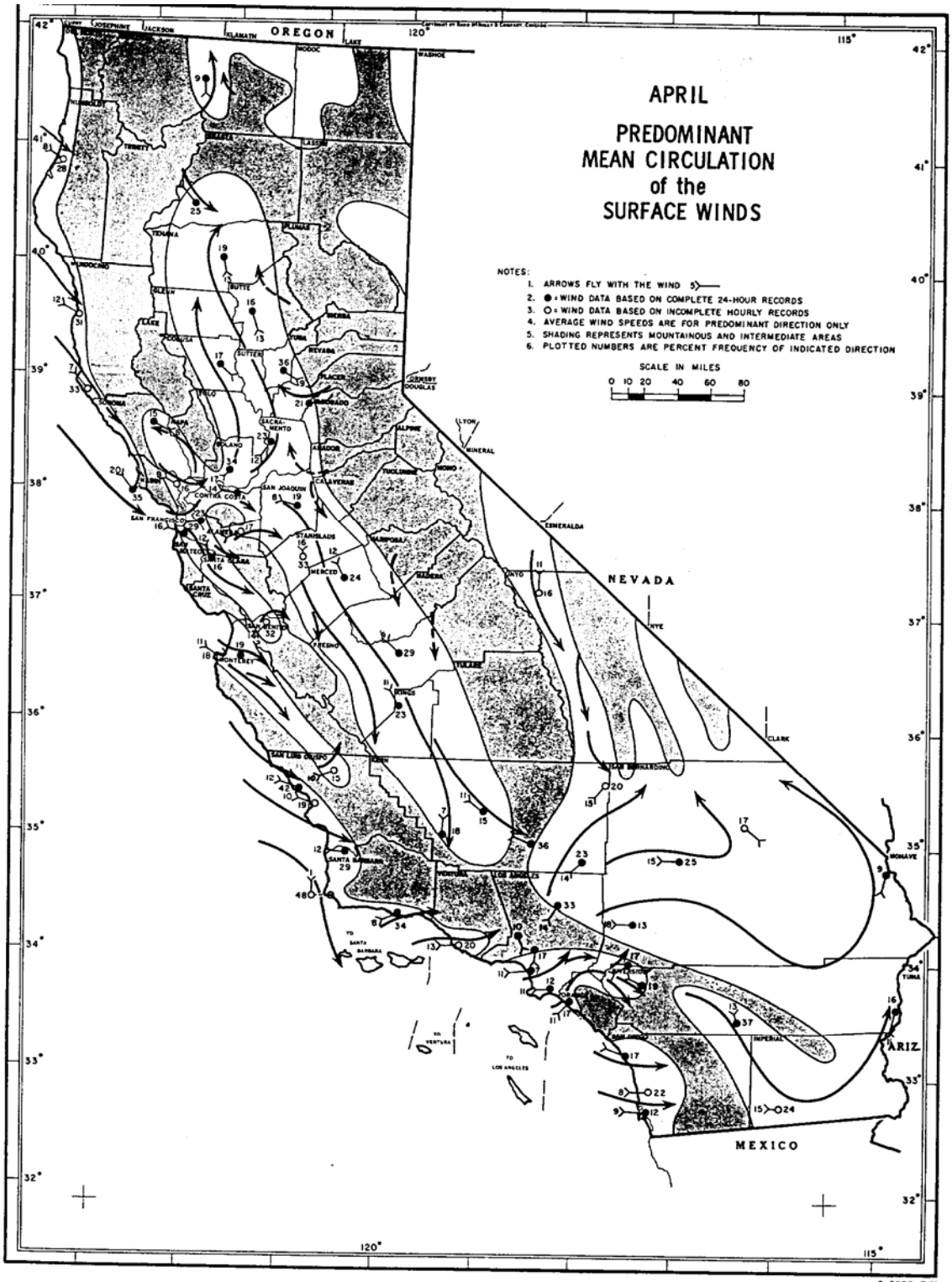


FIGURE 5.1B-1C JULY PREDOMINANT CIRCULATION OF THE SURFACE WINDS

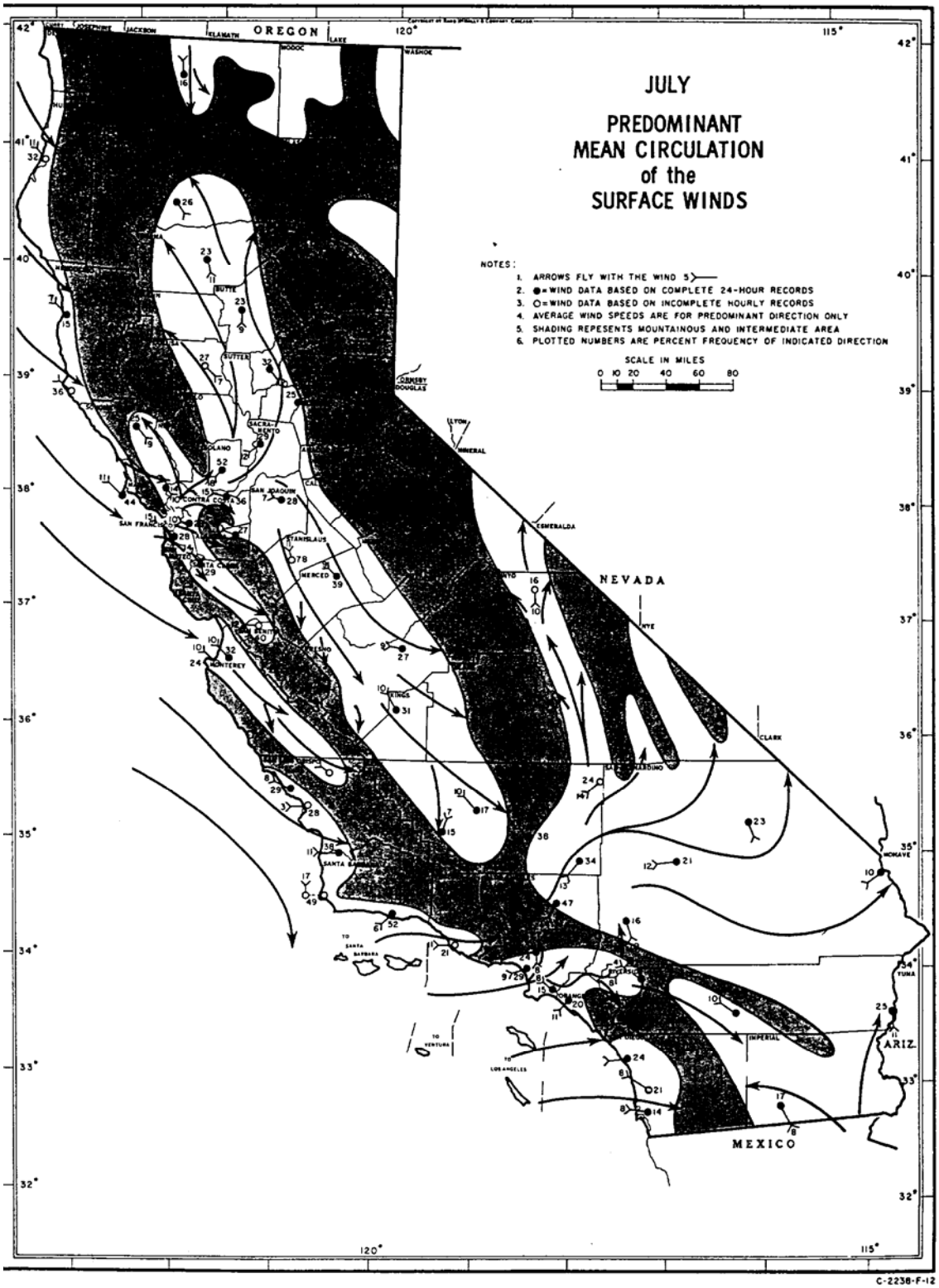


FIGURE 5.1B-1D OCTOBER PREDOMINANT MEAN CIRCULATION OF THE SURFACE WINDS

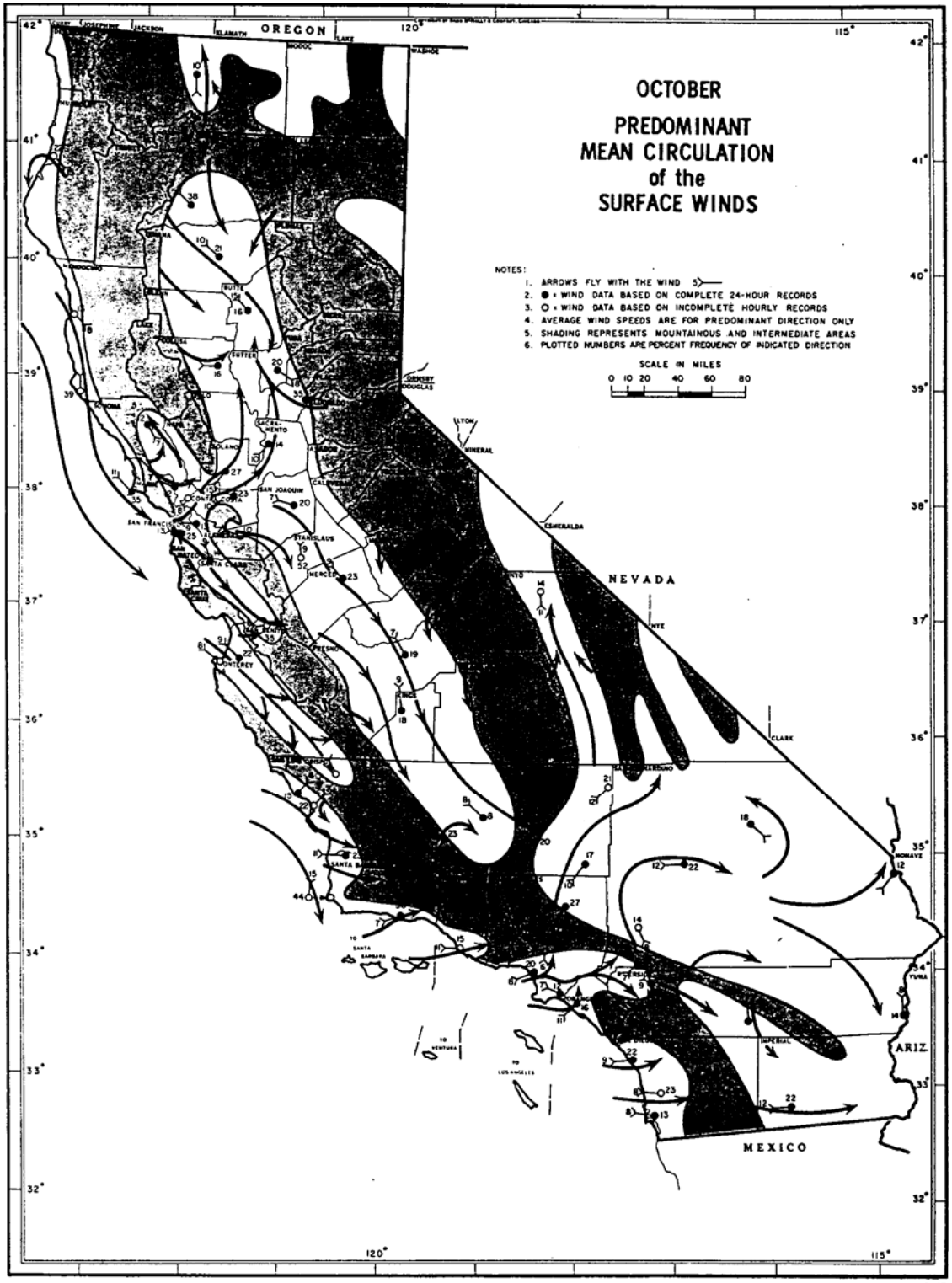


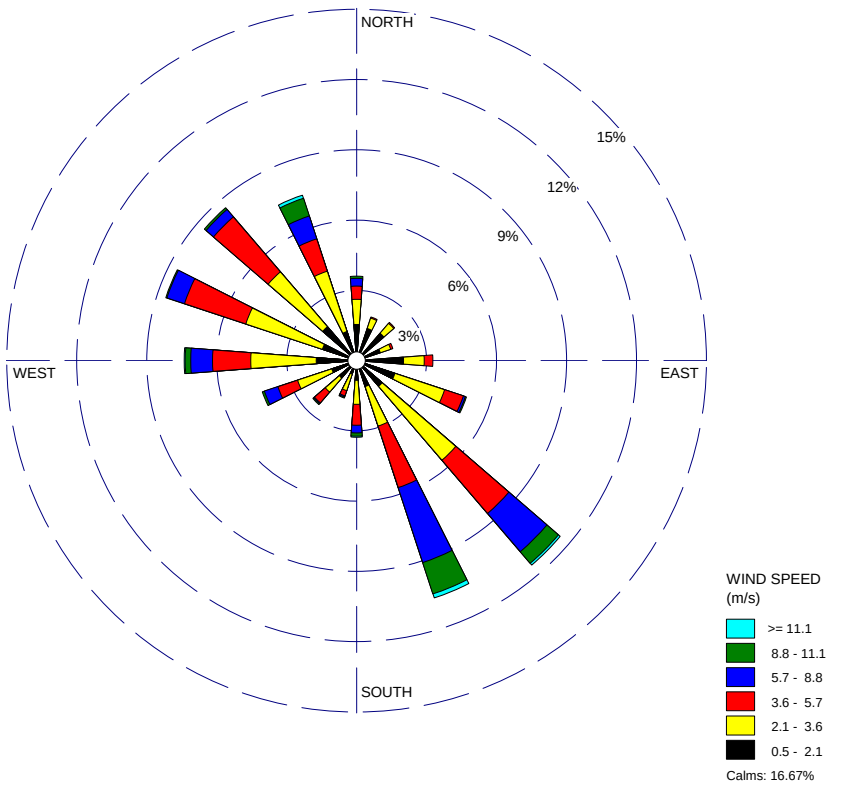
Figure 5.1B-2A 2000 1st Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - First Quarter, 2000
January 1, 2000 through March 31, 2000

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000 **Jan 1 - Mar 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **16.67%**	TOTAL COUNT: **2142 hrs.**	
	AVG. WIND SPEED: **3.29 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

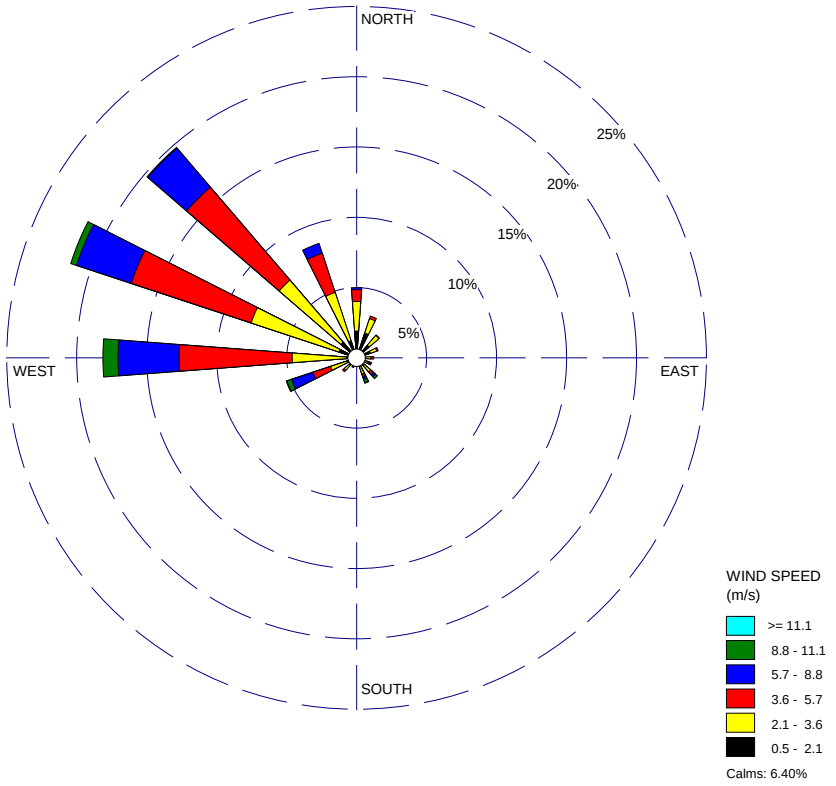
Figure 5.1B-2B 2000 2nd Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Second Quarter, 2000
April 1, 2000 through June 30, 2000

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000 **Apr 1 - Jun 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **6.40%**	TOTAL COUNT: **2046 hrs.**	
	AVG. WIND SPEED: **4.00 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

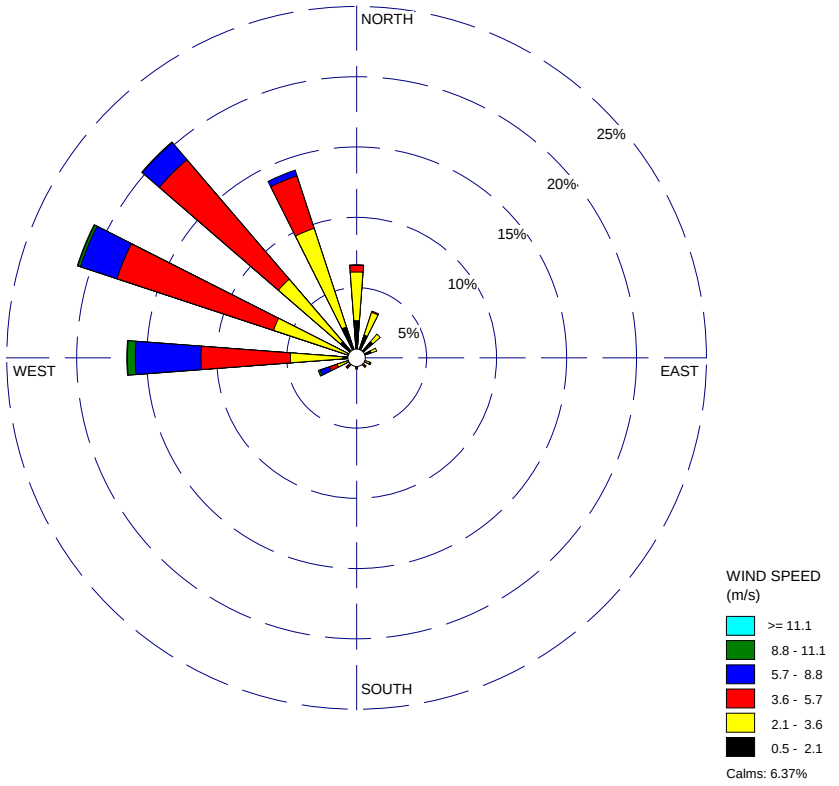
Figure 5.1B-2C 2000 3rd Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Third Quarter, 2000
July 1, 2000 through September 30, 2000

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000 **Jul 1 - Sep 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **6.37%**	TOTAL COUNT: **2118 hrs.**	
	AVG. WIND SPEED: **3.72 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

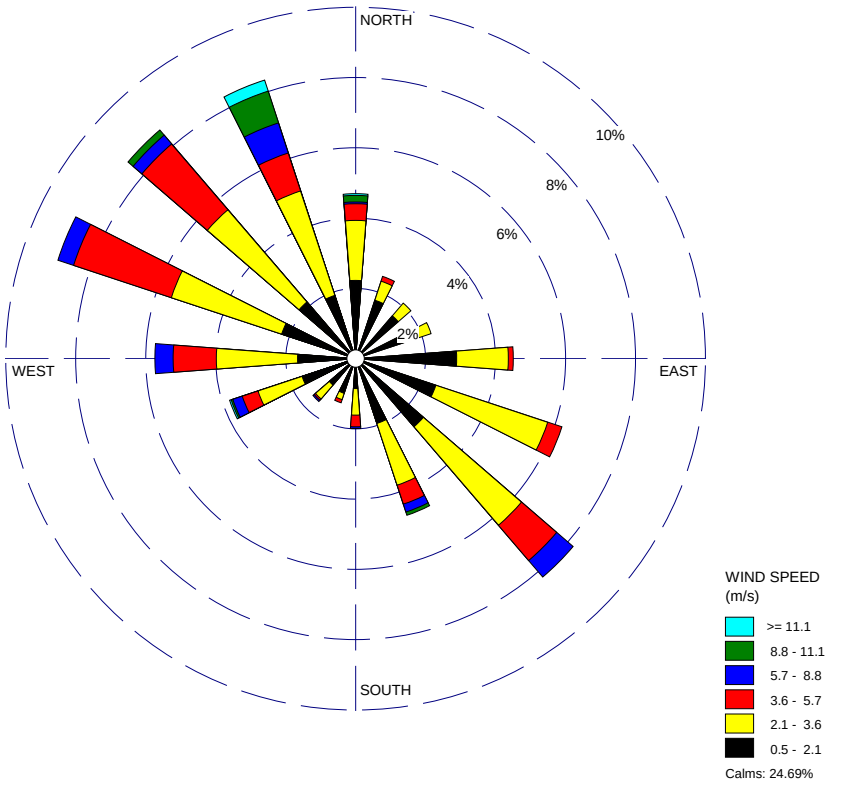
Figure 5.1B-2D 2000 4th Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Fourth Quarter, 2000
October 1, 2000 through December 31, 2000

DISPLAY:

Wind Speed
Direction (blowing from)



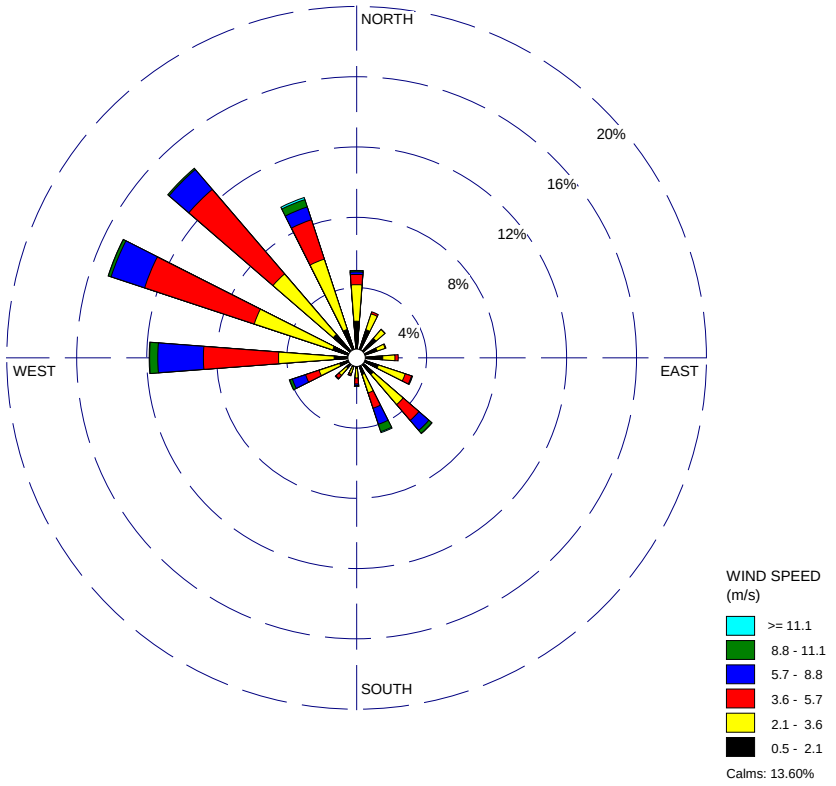
COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000 **Oct 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **24.69%**	TOTAL COUNT: **2114 hrs.**	
	AVG. WIND SPEED: **2.36 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Figure 5.1B-2E 2000 Annual Wind Rose, Stockton, CA

WIND ROSE PLOT:
Stockton, CA - 2000
January 1, 2000 through December 31, 2000

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2000 **Jan 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **13.60%**	TOTAL COUNT: **8420 hrs.**	
	AVG. WIND SPEED: **3.34 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

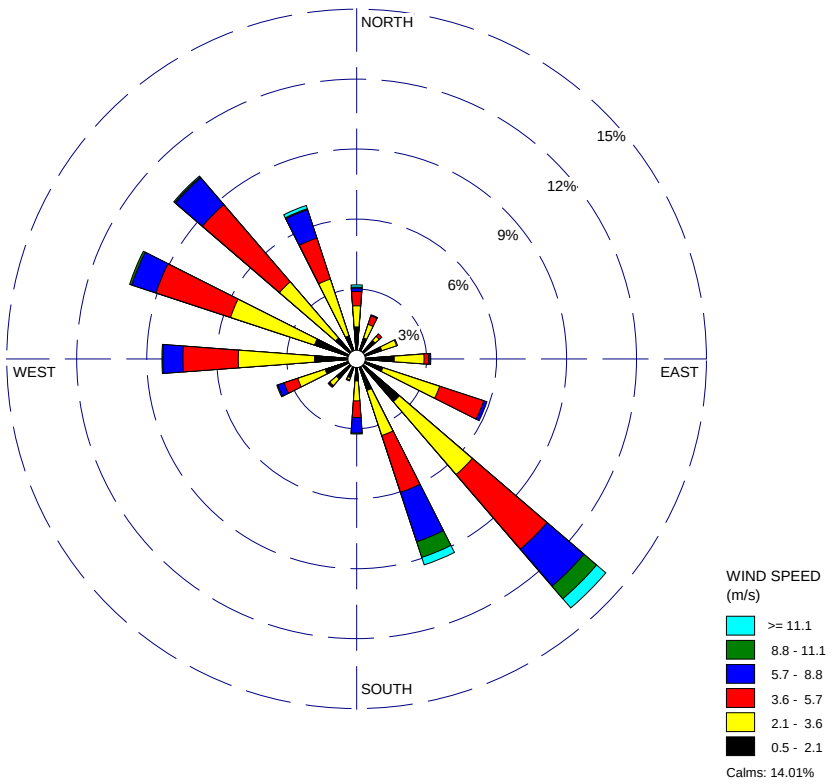
Figure 5.1B-3A 2001 1st Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - First Quarter, 2001
January 1, 2001 through March 31, 2001

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2001 **Jan 1 - Mar 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **14.01%**	TOTAL COUNT: **2113 hrs.**	
	AVG. WIND SPEED: **3.40 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

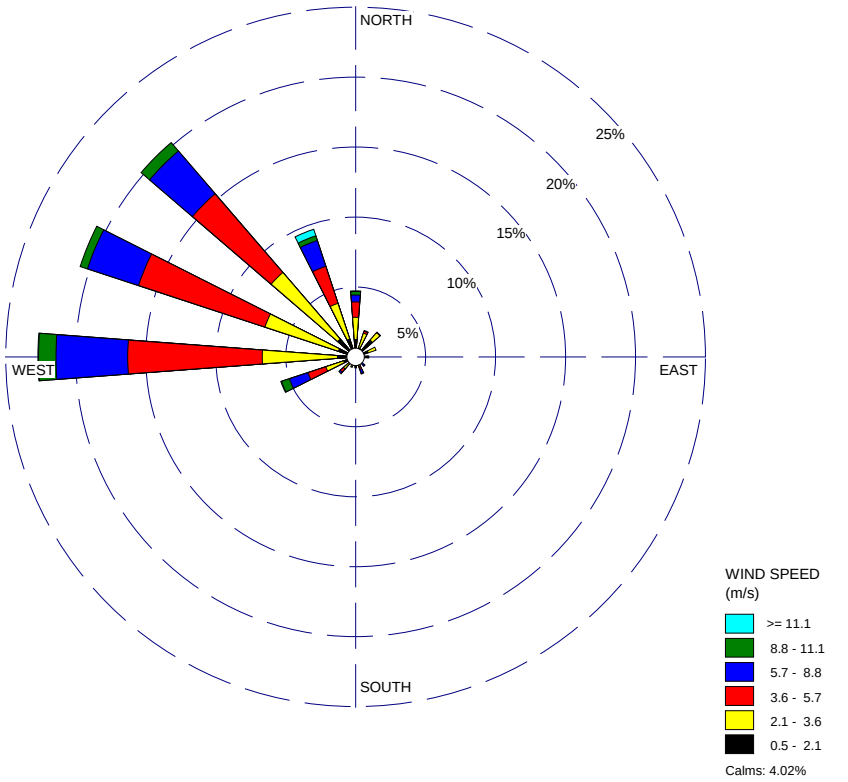
Figure 5.1B-3B 2001 2nd Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Second Quarter, 2001
April 1, 2001 through June 30, 2001

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2001 **Apr 1 - Jun 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **4.02%**	TOTAL COUNT: **2013 hrs.**	
	AVG. WIND SPEED: **4.34 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

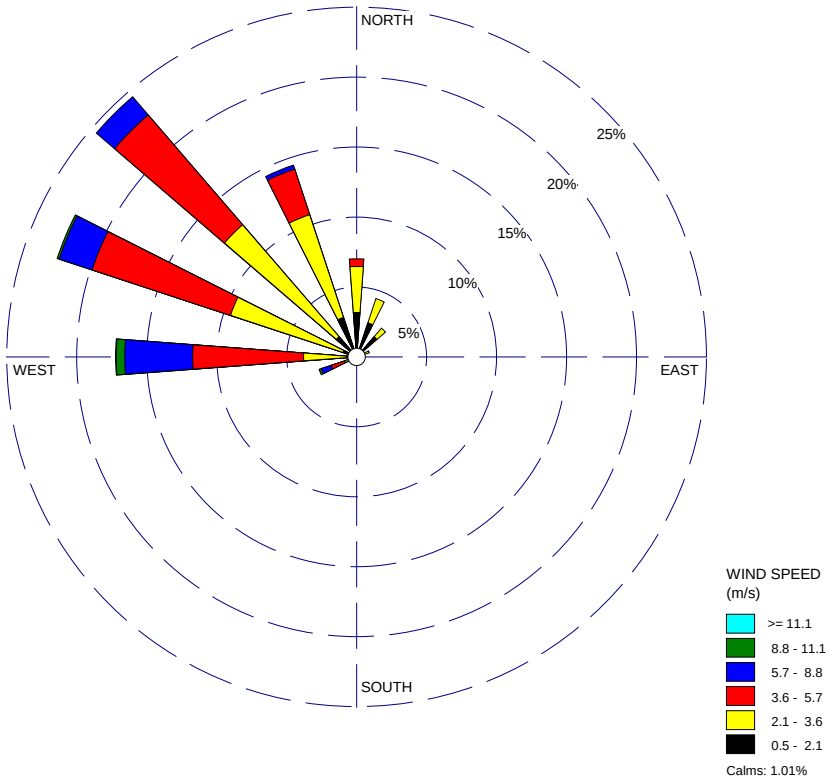
Figure 5.1B-3C 2001 3rd Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Third Quarter, 2001
July 1, 2001 through September 30, 2001

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2001 **Jul 1 - Sep 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **1.01%**	TOTAL COUNT: **1985 hrs.**	
	AVG. WIND SPEED: **3.85 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

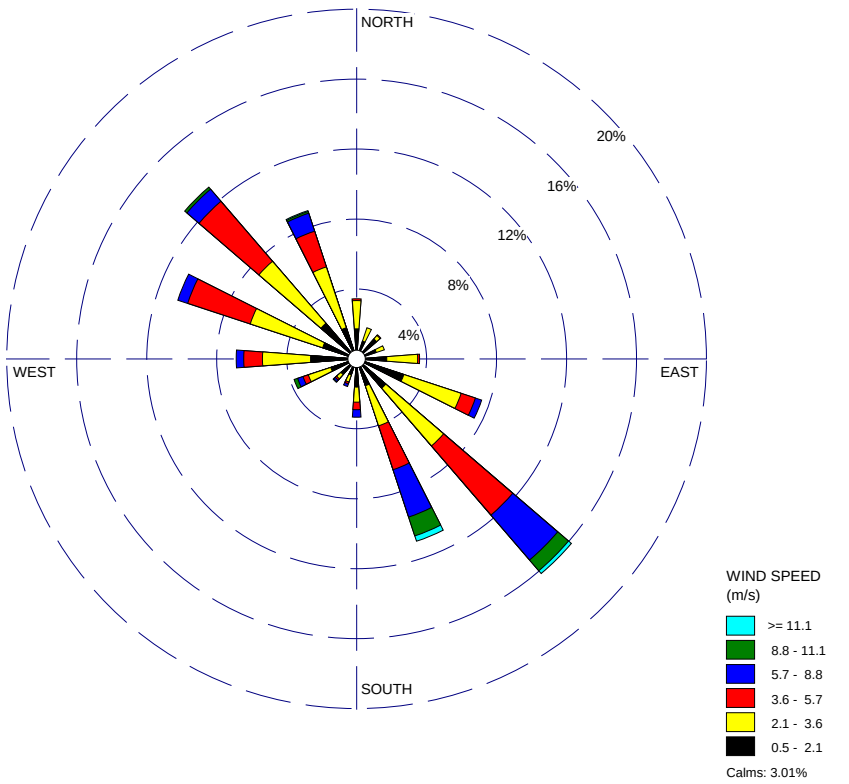
Figure 5.1B-3D 2001 4th Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Fourth Quarter, 2001
October 1, 2001 through December 31, 2001

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2001 **Oct 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **3.01%**	TOTAL COUNT: **1863 hrs.**	
	AVG. WIND SPEED: **3.60 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

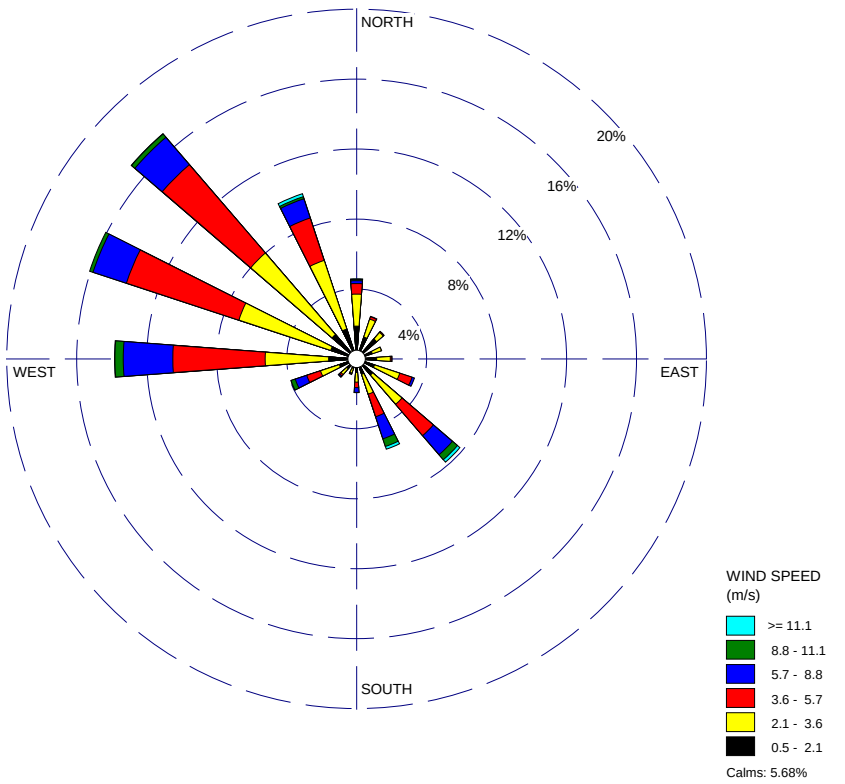
Figure 5.1B-3E 2001 Annual Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - 2001
January 1, 2001 through December 31, 2001

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2001 **Jan 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **5.68%**	TOTAL COUNT: **7974 hrs.**	
	AVG. WIND SPEED: **3.80 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

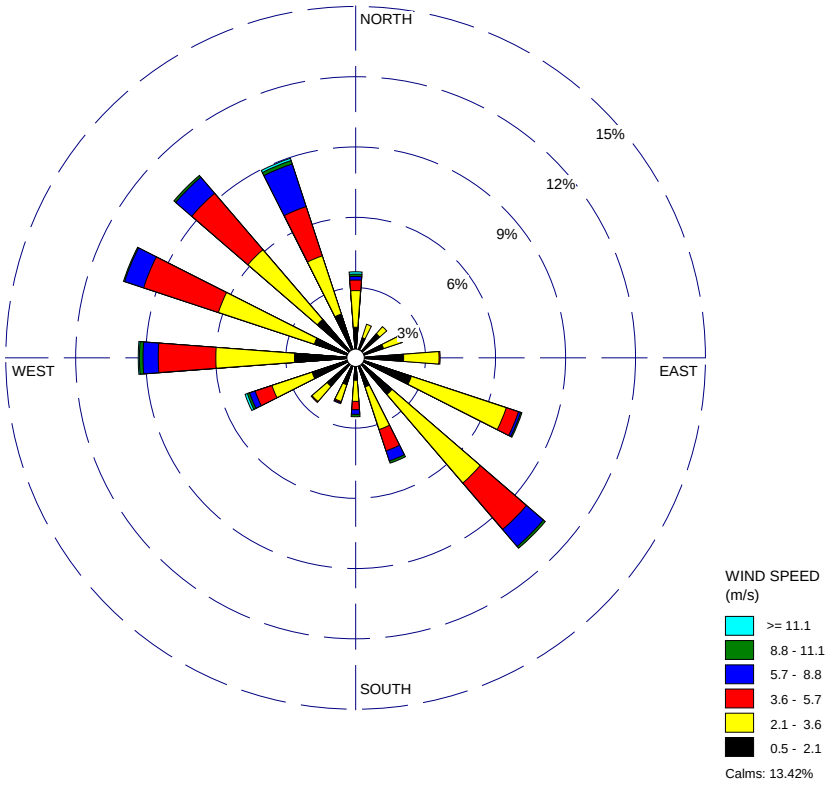
Figure 5.1B-4A 2002 1st Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - First Quarter, 2002
January 1, 2002 through March 31, 2002

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2002 **Jan 1 - Mar 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **13.42%**	TOTAL COUNT: **1990 hrs.**	
	AVG. WIND SPEED: **2.93 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

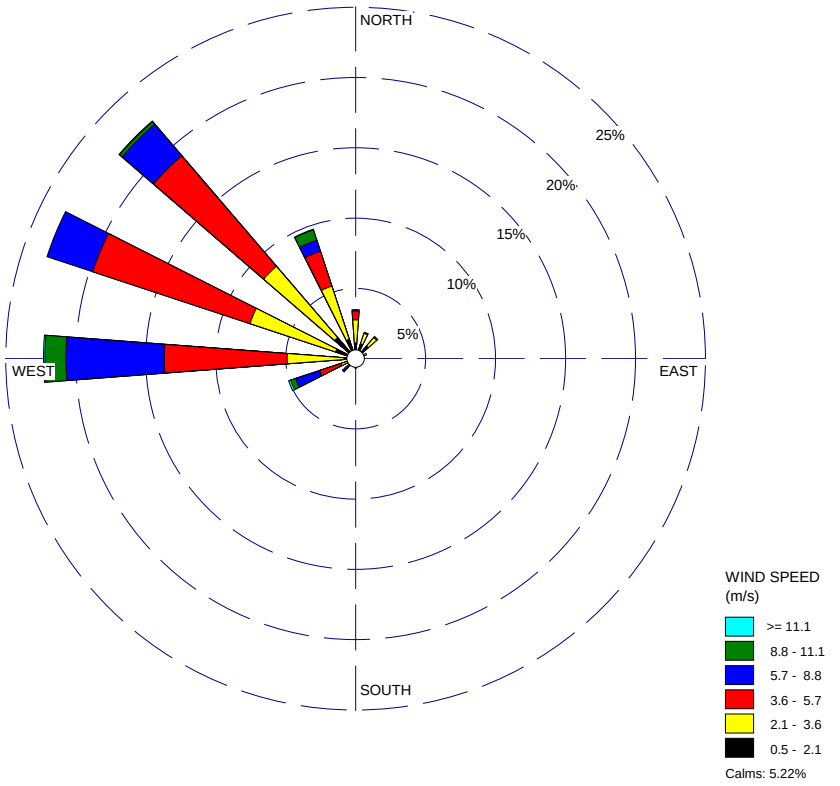
Figure 5.1B-4B 2002 2nd Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Second Quarter, 2002
April 1, 2002 through June 30, 2002

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2002 **Apr 1 - Jun 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **5.22%**	TOTAL COUNT: **2068 hrs.**	
	AVG. WIND SPEED: **4.27 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

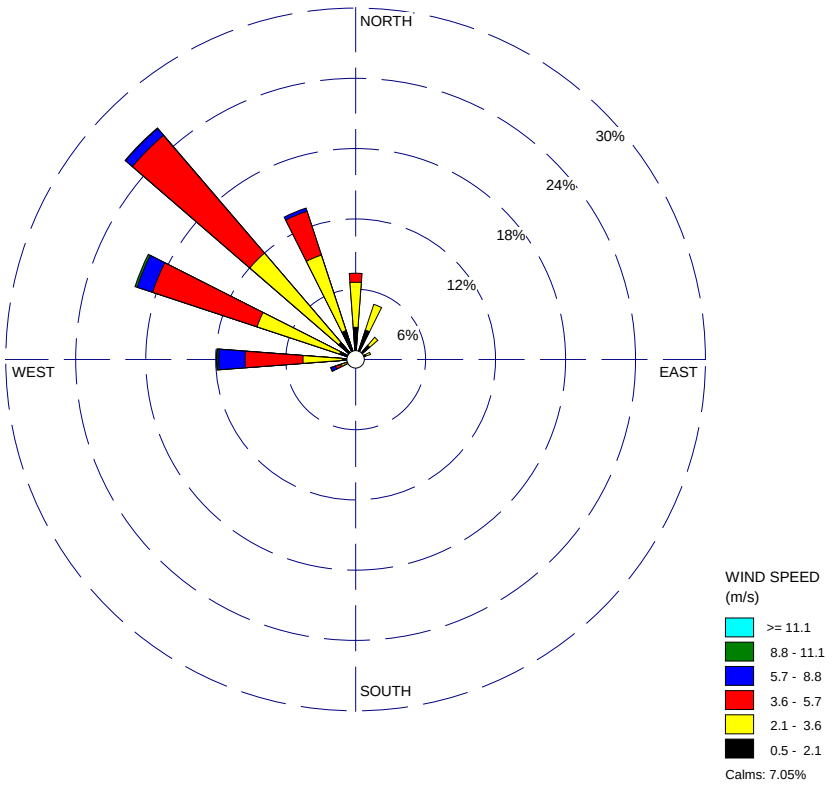
Figure 5.1B-4C 2002 3rd Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Third Quarter, 2002
July 1, 2002 through September 30, 2002

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2002 **Jul 1 - Sep 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **7.05%**	TOTAL COUNT: **2084 hrs.**	
	AVG. WIND SPEED: **3.40 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

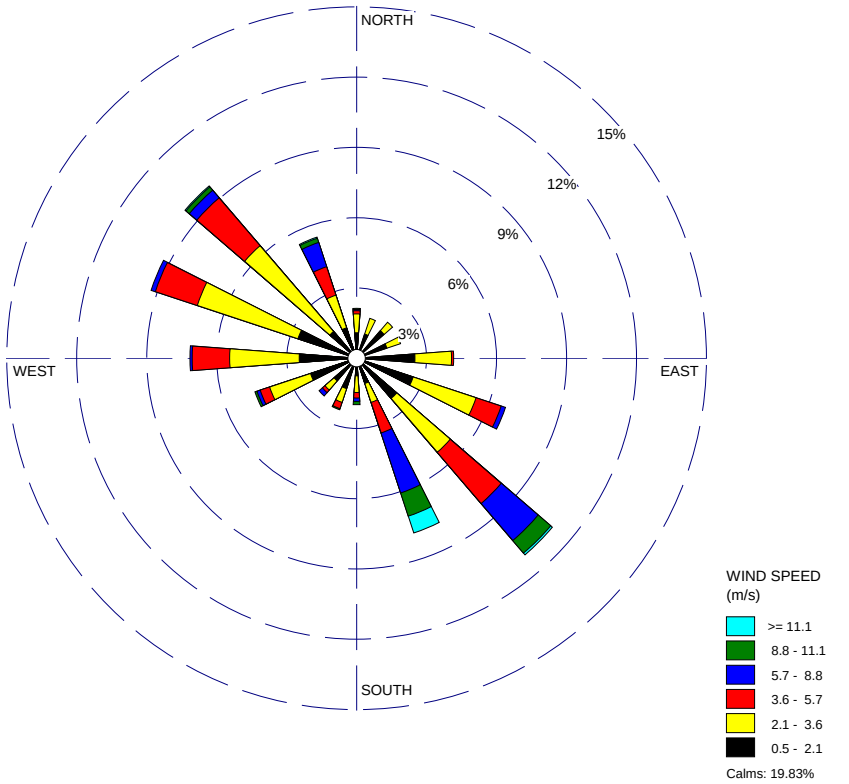
Figure 5.1B-4D 2002 4th Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Fourth Quarter, 2002
October 1, 2002 through December 31, 2002

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2002 **Oct 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **19.83%**	TOTAL COUNT: **2118 hrs.**	
	AVG. WIND SPEED: **2.88 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

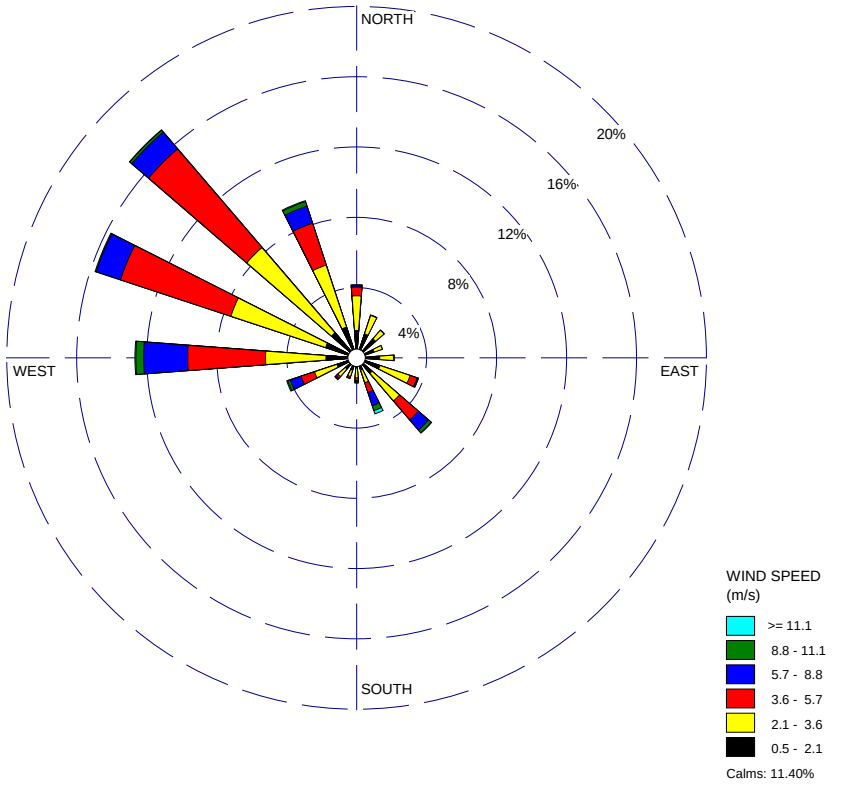
Figure 5.1B-4E 2002 Annual Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - 2002
January 1, 2002 through December 31, 2002

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2002 **Jan 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **11.40%**	TOTAL COUNT: **8260 hrs.**	
	AVG. WIND SPEED: **3.37 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

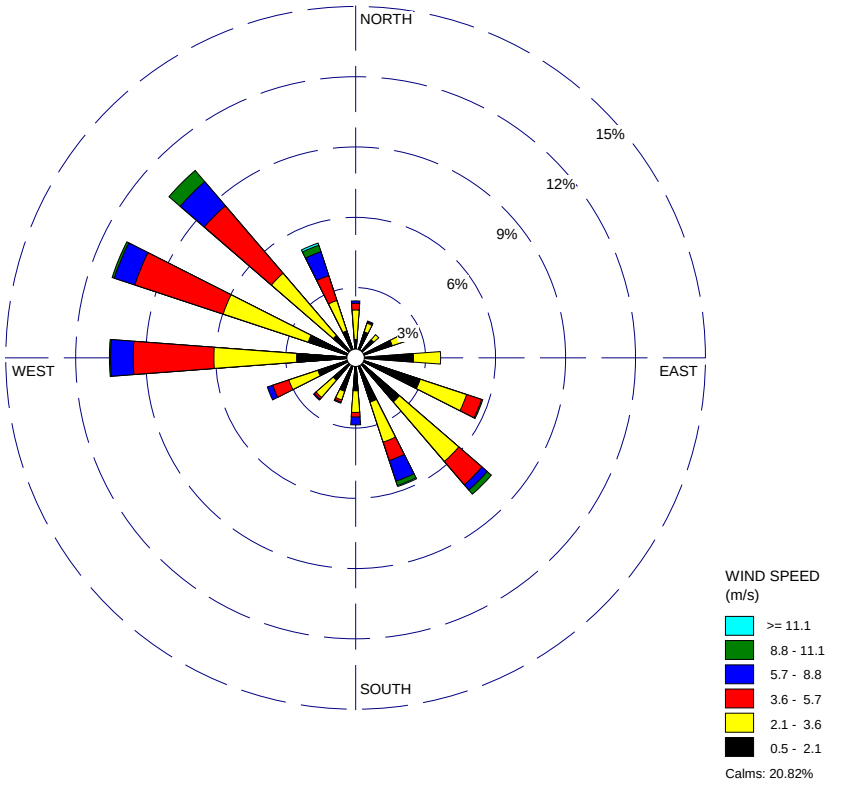
Figure 5.1B-5A 2003 1st Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - First Quarter, 2003
January 1, 2003 through March 31, 2003

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2003 **Jan 1 - Mar 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **20.82%**	TOTAL COUNT: **2061 hrs.**	
	AVG. WIND SPEED: **2.70 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

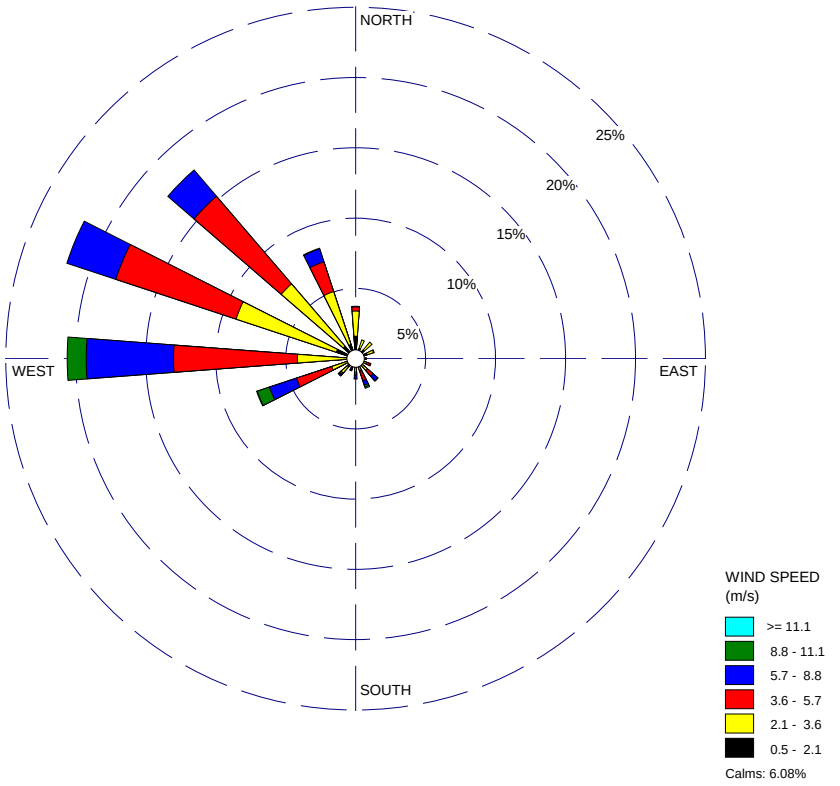
Figure 5.1B-5B 2003 2nd Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Second Quarter, 2003
April 1, 2003 through June 30, 2003

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2003 **Apr 1 - Jun 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **6.08%**	TOTAL COUNT: **2072 hrs.**	
	AVG. WIND SPEED: **4.15 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

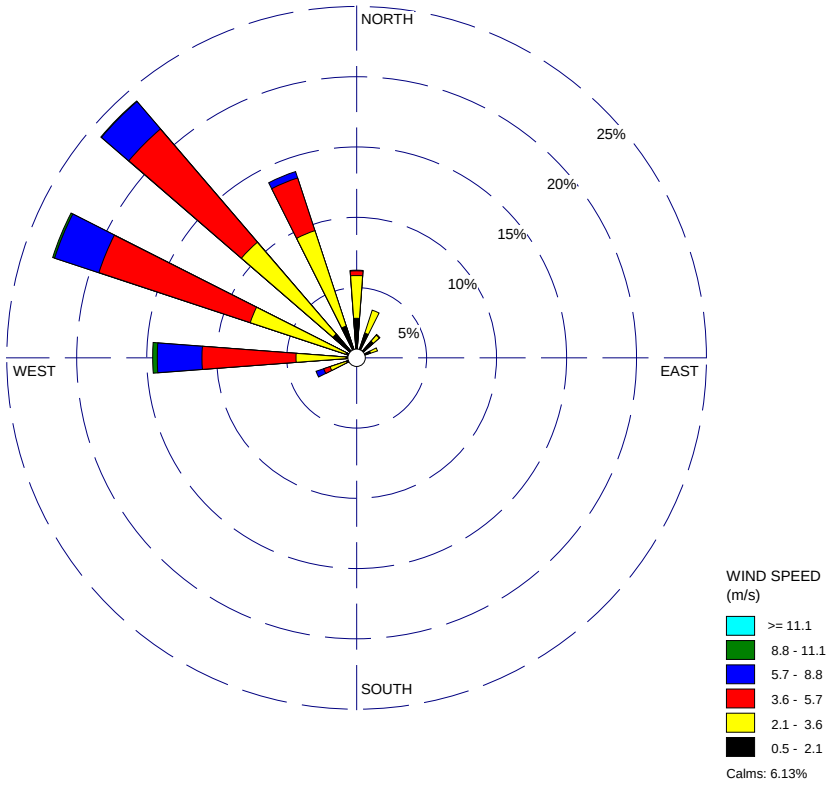
Figure 5.1B-5C 2003 3rd Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Third Quarter, 2003
July 1, 2003 through September 30, 2003

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2003 **Jul 1 - Sep 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **6.13%**	TOTAL COUNT: **2104 hrs.**	
	AVG. WIND SPEED: **3.68 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

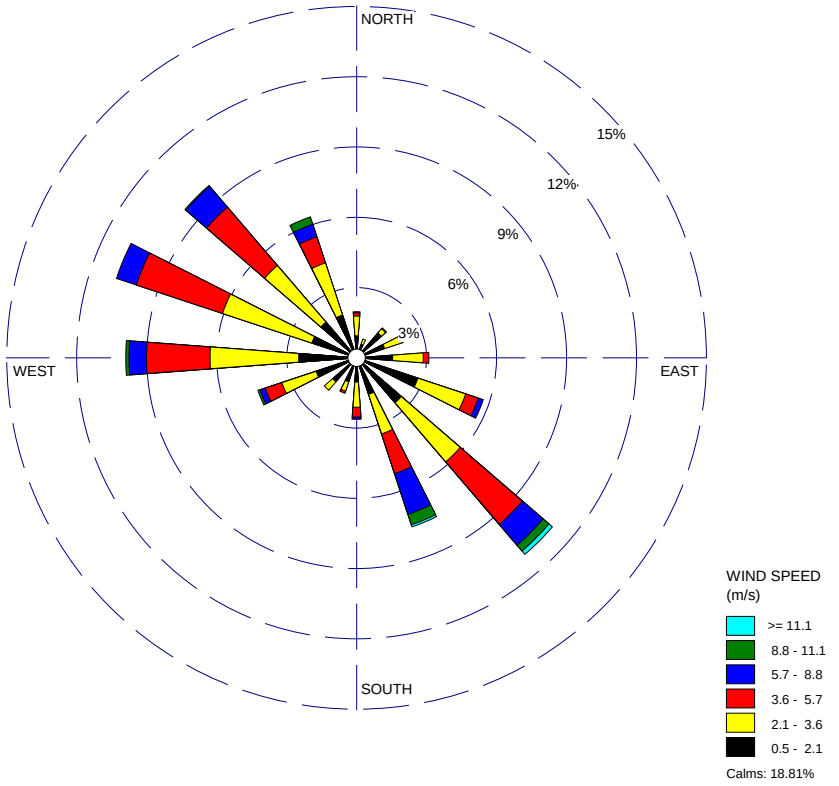
Figure 5.1B-5D 2003 4th Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Fourth Quarter, 2003
October 1, 2003 through December 31, 2003

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2003 **Oct 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **18.81%**	TOTAL COUNT: **2137 hrs.**	
	AVG. WIND SPEED: **2.86 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

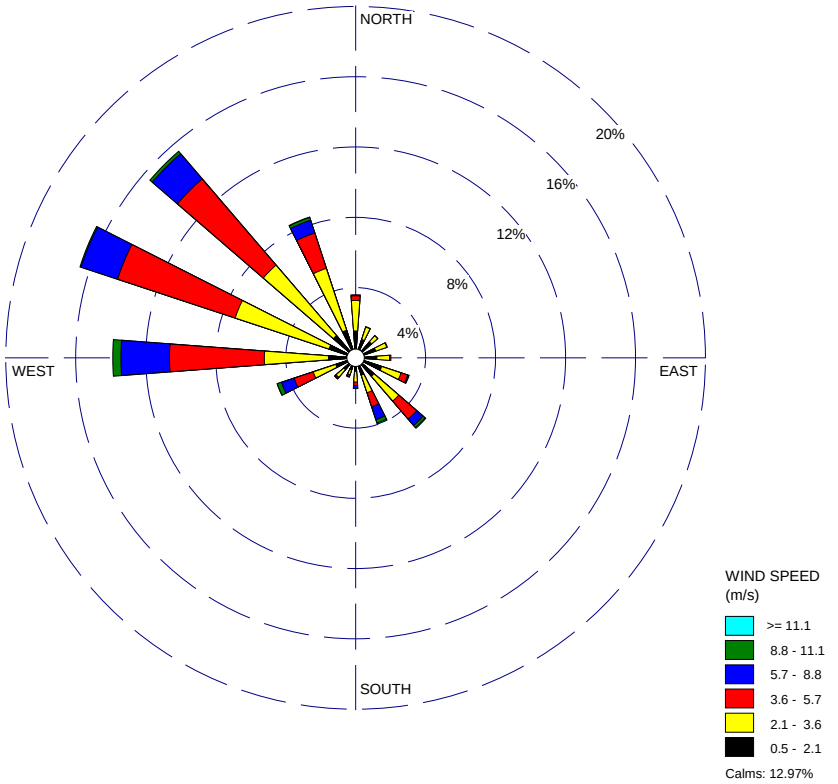
Figure 5.1B-5E 2003 Annual Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - 2003
January 1, 2003 through December 31, 2003

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2003 **Jan 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **12.97%**	TOTAL COUNT: **8374 hrs.**	
	AVG. WIND SPEED: **3.35 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

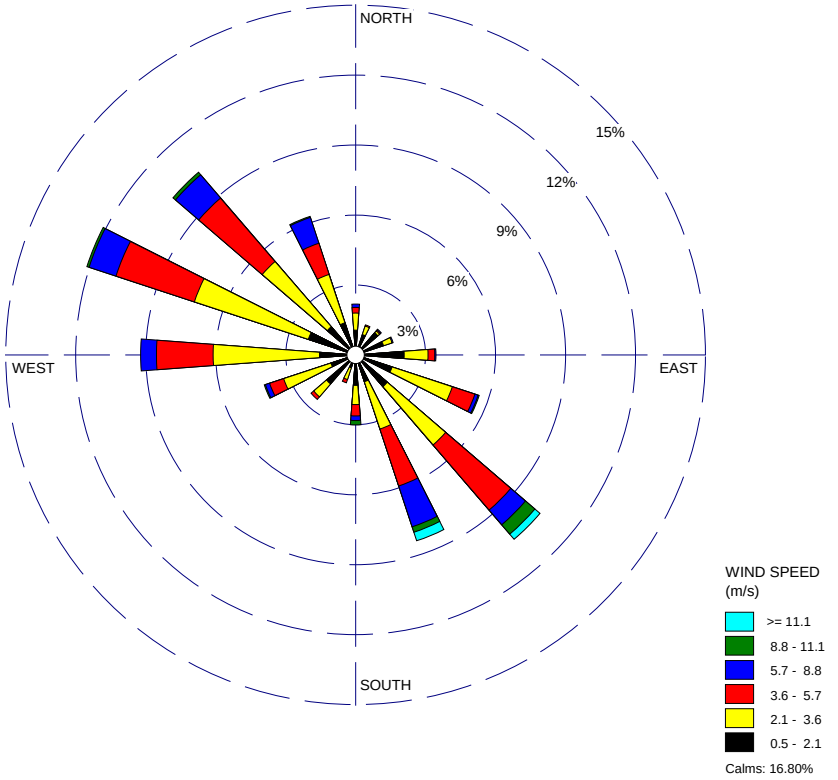
Figure 5.1B-6A 2004 1st Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - First Quarter, 2004
January 1, 2004 through March 31, 2004

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2004 **Jan 1 - Mar 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **16.80%**	TOTAL COUNT: **2066 hrs.**	
	AVG. WIND SPEED: **3.04 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

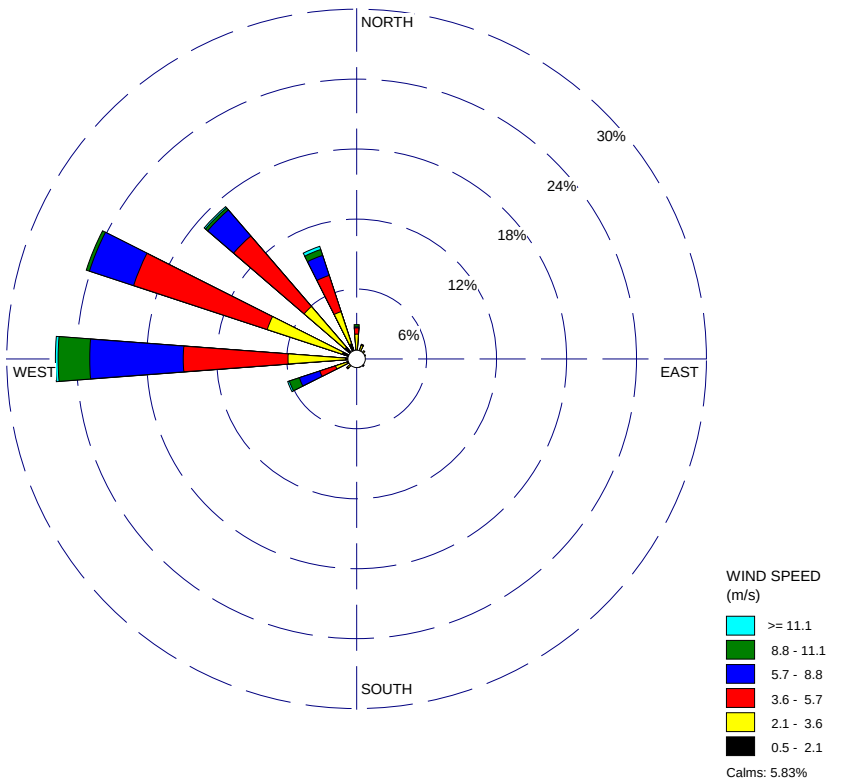
Figure 5.1B-6B 2004 2nd Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Second Quarter, 2004
April 1, 2004 through June 30, 2004

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2004 **Apr 1 - Jun 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **5.83%**	TOTAL COUNT: **2111 hrs.**	
	AVG. WIND SPEED: **4.51 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

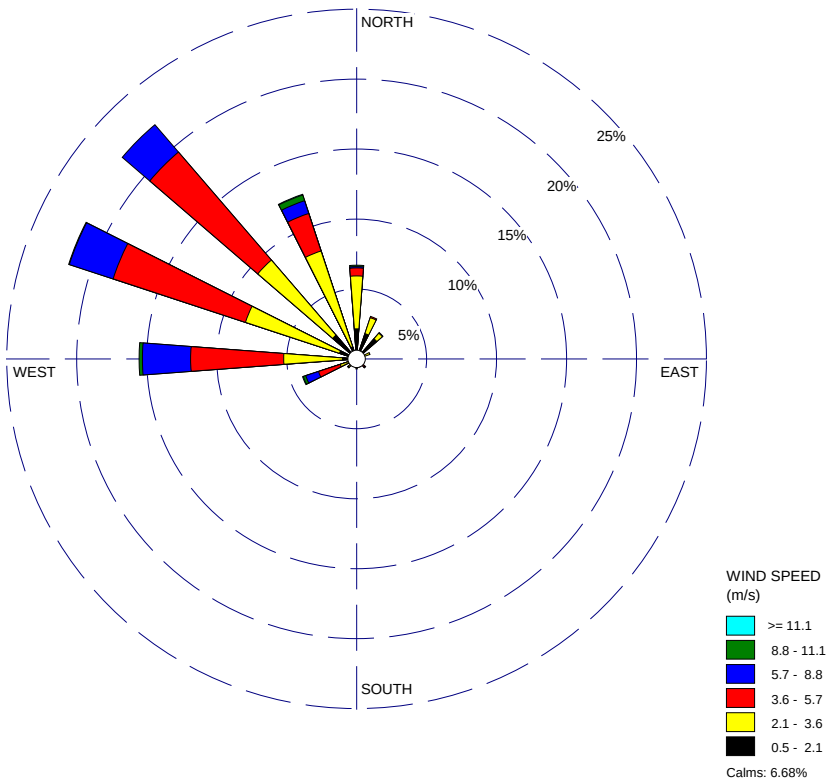
Figure 5.1B-6C 2004 3rd Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Third Quarter, 2004
July 1, 2004 through September 30, 2004

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2004 **Jul 1 - Sep 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **6.68%**	TOTAL COUNT: **2096 hrs.**	
	AVG. WIND SPEED: **3.77 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

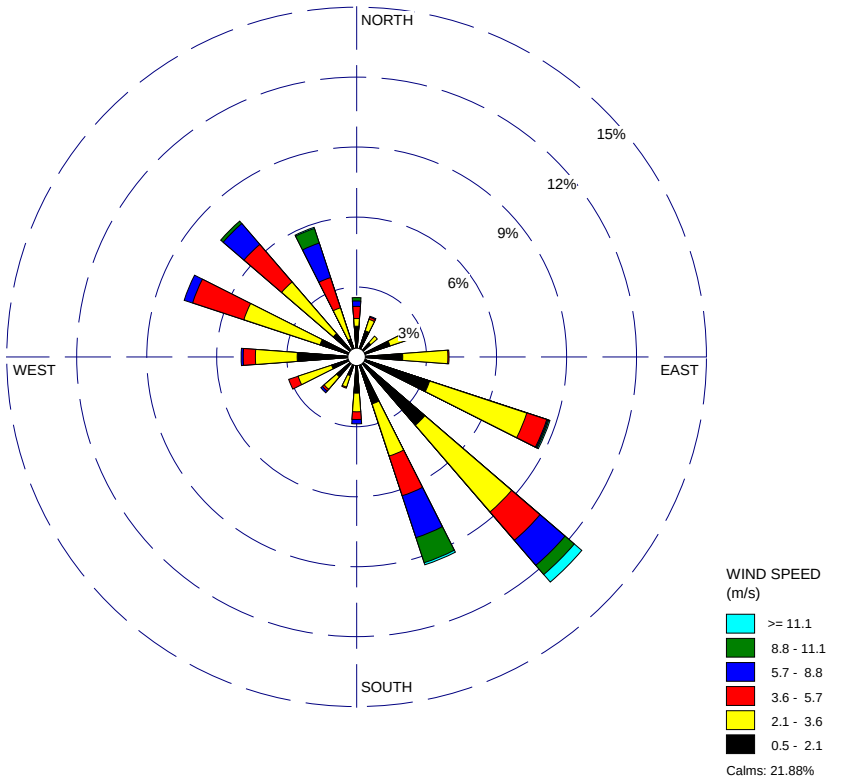
Figure 5.1B-6D 2004 4th Quarter Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - Fourth Quarter, 2004
October 1, 2004 through December 31, 2004

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2004 **Oct 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **21.88%**	TOTAL COUNT: **2125 hrs.**	
	AVG. WIND SPEED: **2.74 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

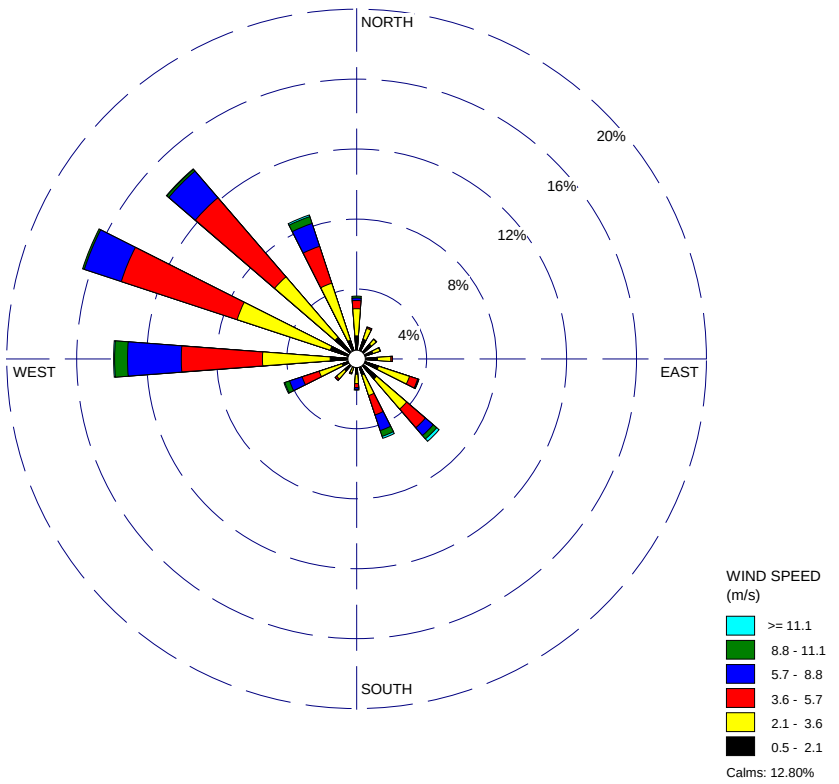
Figure 5.1B-6E 2004 Annual Wind Rose, Stockton, CA

WIND ROSE PLOT:

Stockton, CA - 2004
January 1, 2004 through December 31, 2004

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2004 **Jan 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **12.80%**	TOTAL COUNT: **8398 hrs.**	
	AVG. WIND SPEED: **3.52 m/s**	DATE: **5/1/2008**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

2000: ANNUAL
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	1146	81	179	89	35	14	7	3		9	1563
NNE	1	63	134	24	9	1	0	0		0	232
NE	1	68	93	17	2	0	0	0		0	181
ENE	1	50	83	10	3	1	0	0		0	148
E	4	68	82	31	11	4	0	0		0	200
ESE	0	52	124	70	23	9	2	1		2	283
SE	0	58	115	122	60	40	26	23		34	478
SSE	0	43	76	58	38	39	36	37		50	377
S	0	25	42	30	16	12	5	2		5	137
SSW	0	24	39	17	9	0	0	0		2	91
SW	0	33	60	18	14	6	3	0		1	135
WSW	0	29	101	60	37	31	29	23		30	340
W	0	47	152	176	204	157	108	85		67	996
WNW	0	50	167	301	335	219	117	40		27	1256
NW	0	47	202	281	335	198	80	38		15	1196
NNW	0	53	208	236	141	57	43	17		52	807
Sub-Total:	1153	791	1857	1540	1272	788	456	269		294	8420

Average Wind Speed: 3.34m/s

2000: FIRST QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	357	19	22	15	7	5	4	2		3	434
NNE	1	14	20	6	0	1	0	0		0	42
NE	1	18	22	4	1	0	0	0		0	46
ENE	0	10	18	5	1	1	0	0		0	35
E	3	14	33	12	7	1	0	0		0	70
ESE	0	19	40	26	14	4	1	1		1	106
SE	0	11	50	59	33	31	17	18		27	246
SSE	0	13	24	26	24	35	31	34		41	228
S	0	7	17	16	12	7	4	2		5	70
SSW	0	6	15	8	5	0	0	0		2	36
SW	0	12	20	6	10	3	1	0		1	53
WSW	0	7	32	18	12	7	7	4		4	91
W	0	11	55	31	16	19	7	9		10	158
WNW	0	19	36	52	44	15	12	3		3	184
NW	0	13	49	45	44	22	4	3		4	184
NNW	0	12	41	33	25	6	14	6		22	159
Sub-Total:	362	205	494	362	255	157	102	82		123	2142

Average Wind Speed: 3.29m/s

2000: SECOND QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	131	14	45	23	13	4	2	1		0	233
NNE	0	13	40	7	4	0	0	0		0	64
NE	0	12	24	7	1	0	0	0		0	44
ENE	1	10	19	1	2	0	0	0		0	33
E	0	8	10	3	2	2	0	0		0	25
ESE	0	2	11	5	2	1	1	0		1	23
SE	0	8	9	10	3	2	2	1		5	40
SSE	0	8	10	7	3	1	2	2		6	39
S	0	5	0	3	0	0	0	0		0	8
SSW	0	5	6	3	1	0	0	0		0	15
SW	0	4	17	3	1	2	0	0		0	27
WSW	0	4	17	19	13	14	13	11		17	108
W	0	6	30	58	91	74	52	25		34	370
WNW	0	9	42	111	98	86	59	20		14	439
NW	0	4	50	95	99	79	49	22		5	403
NNW	0	6	41	53	34	26	11	4		0	175
Sub-Total:	132	118	371	408	367	291	191	86		82	2046

Average Wind Speed: 4.00m/s

2000: THIRD QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	135	25	66	38	6	4	1	0		0	275
NNE	0	14	51	7	2	0	0	0		0	74
NE	0	16	28	3	0	0	0	0		0	47
ENE	0	13	16	3	0	0	0	0		0	32
E	0	4	6	0	0	0	0	0		0	10
ESE	0	6	15	0	1	1	0	0		0	23
SE	0	5	6	5	1	2	0	0		0	19
SSE	0	4	5	0	2	0	0	0		0	11
S	0	5	6	4	1	1	0	0		0	17
SSW	0	1	7	3	1	0	0	0		0	12
SW	0	2	11	4	2	1	1	0		0	21
WSW	0	5	18	8	7	5	6	6		6	61
W	0	8	37	55	79	56	44	45		23	347
WNW	0	4	36	92	150	99	37	16		10	444
NW	0	13	48	95	155	82	25	8		2	428
NNW	0	19	86	100	64	19	8	1		0	297
Sub-Total:	135	144	442	417	471	270	122	76		41	2118

Average Wind Speed: 3.72m/s

2000: FOURTH QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8			>=8	Total
N	523	23	46	13	9	1	0	0	6	621
NNE	0	22	23	4	3	0	0	0	0	52
NE	0	22	19	3	0	0	0	0	0	44
ENE	0	17	30	1	0	0	0	0	0	48
E	1	42	33	16	2	1	0	0	0	95
ESE	0	25	58	39	6	3	0	0	0	131
SE	0	34	50	48	23	5	7	4	2	173
SSE	0	18	37	25	9	3	3	1	3	99
S	0	8	19	7	3	4	1	0	0	42
SSW	0	12	11	3	2	0	0	0	0	28
SW	0	15	12	5	1	0	1	0	0	34
WSW	0	13	34	15	5	5	3	2	3	80
W	0	22	30	32	18	8	5	6	0	121
WNW	0	18	53	46	43	19	9	1	0	189
NW	0	17	55	46	37	15	2	5	4	181
NNW	0	16	40	50	18	6	10	6	30	176
Sub-Total:	524	324	550	353	179	70	41	25	48	2114

Average Wind Speed: 2.36m/s

2001: ANNUAL
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	>=8	Total
N	453	62	149	84	35	13	7	4	11	818
NNE	0	43	117	31	7	4	2	0	0	204
NE	1	57	90	12	3	1	1	0	0	165
ENE	2	39	66	12	0	1	0	0	0	120
E	0	53	66	35	5	1	2	0	0	162
ESE	0	39	93	75	40	19	5	5	1	277
SE	0	41	122	110	105	83	51	46	62	620
SSE	0	33	72	64	60	48	41	43	72	433
S	0	32	53	21	14	11	11	6	6	154
SSW	0	21	40	8	3	0	2	1	0	75
SW	0	31	47	16	4	5	4	2	1	110
WSW	0	32	98	43	32	34	19	32	25	315
W	0	56	153	207	232	188	114	94	57	1101
WNW	0	49	187	328	346	192	93	53	30	1278
NW	0	57	224	355	317	213	106	47	32	1351
NNW	0	53	211	208	120	83	50	32	34	791
Sub-Total:	456	698	1788	1609	1323	896	508	365	331	7974

Average Wind Speed: 3.8 m/s

2001: FIRST QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	>=8	Total
N	296	13	23	12	7	6	2	1	3	363
NNE	0	9	19	5	6	2	1	0	0	42
NE	1	11	14	1	2	1	0	0	0	30
ENE	1	12	21	4	0	1	0	0	0	39
E	0	21	25	15	3	1	2	0	0	67
ESE	0	12	34	33	32	10	1	1	1	124
SE	0	22	62	54	49	40	20	19	31	297
SSE	0	10	33	30	26	28	16	21	32	196
S	0	7	22	9	7	8	8	3	4	68
SSW	0	9	11	0	1	0	0	0	0	21
SW	0	11	16	5	0	1	1	0	0	34
WSW	0	13	32	11	8	5	2	3	2	76
W	0	12	49	46	28	22	7	9	3	176
WNW	0	17	51	52	50	21	11	10	4	216
NW	0	13	34	45	61	31	11	17	6	218
NNW	0	8	30	38	23	16	14	10	7	146
Sub-Total:	298	200	476	360	303	193	96	94	93	2113

Average Wind Speed: 3.4 m/s

2001: SECOND QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	81	14	23	20	18	4	5	3	8		176
NNE	0	5	23	8	1	2	1	0	0		40
NE	0	15	25	6	0	0	1	0	0		47
ENE	1	11	15	4	0	0	0	0	0		31
E	0	11	7	1	0	0	0	0	0		19
ESE	0	1	6	0	0	0	0	1	0		8
SE	0	2	2	6	1	0	2	5	0		18
SSE	0	4	7	4	0	4	3	3	1		26
S	0	5	8	2	1	0	0	0	0		16
SSW	0	5	7	4	0	0	0	0	0		16
SW	0	5	10	8	3	3	3	0	0		32
WSW	0	3	26	16	13	14	9	17	15		113
W	0	9	44	81	100	93	52	41	36		456
WNW	0	10	42	85	120	71	46	23	19		416
NW	0	10	57	93	82	67	49	25	23		406
NNW	0	12	31	38	28	28	19	15	22		193
Sub-Total:	82	122	333	376	367	286	190	133	124		2013

Average Wind Speed: 4.3 m/s

2001: THIRD QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	20	19	75	34	9	2	0	0	0		159
NNE	0	21	53	13	0	0	0	0	0		87
NE	0	14	36	4	0	0	0	0	0		54
ENE	0	6	11	2	0	0	0	0	0		19
E	0	6	3	0	0	0	0	0	0		9
ESE	0	0	4	0	1	0	0	0	0		5
SE	0	0	3	0	1	0	0	0	0		4
SSE	0	1	4	1	1	0	0	0	0		7
S	0	2	3	2	1	0	0	0	0		8
SSW	0	0	6	1	0	0	0	0	0		7
SW	0	2	7	2	0	0	0	0	0		11
WSW	0	2	10	6	7	13	5	9	4		56
W	0	7	19	49	90	67	49	42	18		341
WNW	0	6	53	129	127	79	29	17	6		446
NW	0	14	75	158	124	81	32	2	0		486
NNW	0	20	100	92	41	27	6	0	0		286
Sub-Total:	20	120	462	493	402	269	121	70	28		1985

Average Wind Speed: 3.85 m/s

2001: FOURTH QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	56	16	28	18	1	1	0	0	0		120
NNE	0	8	22	5	0	0	0	0	0		35
NE	0	17	15	1	1	0	0	0	0		34
ENE	0	10	19	2	0	0	0	0	0		31
E	0	15	31	19	2	0	0	0	0		67
ESE	0	26	49	42	7	9	4	3	0		140
SE	0	17	55	50	54	43	29	22	31		301
SSE	0	18	28	29	33	16	22	19	39		204
S	0	18	20	8	5	3	3	3	2		62
SSW	0	7	16	3	2	0	2	1	0		31
SW	0	13	14	1	1	1	0	2	1		33
WSW	0	14	30	10	4	2	3	3	4		70
W	0	28	41	31	14	6	6	2	0		128
WNW	0	16	41	62	49	21	7	3	1		200
NW	0	20	58	59	50	34	14	3	3		241
NNW	0	13	50	40	28	12	11	7	5		166
Sub-Total:	56	256	517	380	251	148	101	68	86		1863

Average Wind Speed: 3.6 m/s

2002: ANNUAL
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	942	58	148	85	34	7	2	2		7	1285
NNE	1	53	119	37	1	0	0	0		1	212
NE	1	61	92	17	2	0	0	0		0	173
ENE	0	44	72	12	1	0	0	0		0	129
E	0	62	80	32	4	0	0	0		0	178
ESE	0	45	131	89	25	10	5	0		2	307
SE	0	38	134	95	52	65	37	22		23	466
SSE	0	31	59	33	19	29	37	18		51	277
S	0	24	42	28	7	6	1	3		8	119
SSW	0	23	52	18	7	1	1	0		1	103
SW	0	44	47	26	7	3	5	3		1	136
WSW	0	40	105	64	39	28	24	25		22	347
W	0	63	172	194	198	169	104	79		65	1044
WNW	0	75	198	351	349	198	87	28		11	1297
NW	0	56	253	374	392	218	75	24		19	1411
NNW	0	55	194	209	123	84	44	31		36	776
Sub-Total:	944	772	1898	1664	1260	818	422	235		247	8260

Average Wind Speed: 3.37 m/s

2002: FIRST QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	267	16	29	12	8	1	1	1		5	340
NNE	0	8	17	5	0	0	0	0		0	30
NE	0	17	18	0	0	0	0	0		0	35
ENE	0	12	25	4	1	0	0	0		0	42
E	0	19	38	14	1	0	0	0		0	72
ESE	0	16	64	55	9	2	2	0		1	149
SE	0	12	72	56	27	25	11	5		5	213
SSE	0	13	33	18	11	8	6	2		3	94
S	0	10	16	11	4	3	1	2		3	50
SSW	0	7	22	10	1	0	1	0		0	41
SW	0	21	21	7	1	0	0	0		0	50
WSW	0	14	37	24	11	4	2	3		4	99
W	0	19	64	36	31	18	6	6		5	185
WNW	0	17	44	62	46	21	12	5		1	208
NW	0	12	59	50	46	17	13	4		3	204
NNW	0	17	40	34	23	21	22	14		7	178
Sub-Total:	267	230	599	398	220	120	77	42		37	1990

Average Wind Speed: 2.93 m/s

2002: SECOND QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	>=8	Total
N	108	8	33	16	8	5	1	0	1	180
NNE	0	8	27	4	1	0	0	0	1	41
NE	0	11	25	5	2	0	0	0	0	43
ENE	0	7	9	1	0	0	0	0	0	17
E	0	5	3	0	1	0	0	0	0	9
ESE	0	3	3	1	0	0	0	0	0	7
SE	0	3	3	2	1	2	0	0	0	11
SSE	0	2	4	4	0	0	0	0	0	10
S	0	3	5	5	1	0	0	0	0	14
SSW	0	1	5	0	1	0	0	0	0	7
SW	0	2	6	8	3	2	3	2	0	26
WSW	0	2	8	13	18	15	18	16	14	104
W	0	5	25	71	84	97	66	60	52	460
WNW	0	14	43	107	153	91	51	17	3	479
NW	0	14	62	103	114	100	46	14	7	460
NNW	0	8	46	58	31	23	7	9	18	200
Sub-Total:	108	96	307	398	418	335	192	118	96	2068

Average Wind Speed: 4.27 m/s

2002: THIRD QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	>=8	Total
N	147	24	67	46	15	1	0	0	0	300
NNE	0	26	55	22	0	0	0	0	0	103
NE	0	13	32	7	0	0	0	0	0	52
ENE	0	10	15	3	0	0	0	0	0	28
E	0	6	3	0	0	0	0	0	0	9
ESE	0	4	4	1	0	0	0	0	0	9
SE	0	2	3	2	1	0	0	0	0	8
SSE	0	3	2	2	0	0	0	0	0	7
S	0	3	9	1	0	0	0	0	0	13
SSW	0	3	3	0	0	0	0	0	0	6
SW	0	4	6	4	0	1	0	0	0	15
WSW	0	2	16	10	5	5	2	5	2	47
W	0	13	31	50	62	41	31	12	8	248
WNW	0	14	49	122	121	75	22	4	7	414
NW	0	15	80	154	184	92	14	1	2	542
NNW	0	19	80	96	50	32	5	1	0	283
Sub-Total:	147	161	455	520	438	247	74	23	19	2084

Average Wind Speed: 3.4 m/s

2002: FOURTH QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	420	10	19	11	3	0	0	1	1		465
NNE	1	11	20	6	0	0	0	0	0		38
NE	1	20	17	5	0	0	0	0	0		43
ENE	0	15	23	4	0	0	0	0	0		42
E	0	32	36	18	2	0	0	0	0		88
ESE	0	22	60	32	16	8	3	0	1		142
SE	0	21	56	35	23	38	26	17	18		234
SSE	0	13	20	9	8	21	31	16	48		166
S	0	8	12	11	2	3	0	1	5		42
SSW	0	12	22	8	5	1	0	0	1		49
SW	0	17	14	7	3	0	2	1	1		45
WSW	0	22	44	17	5	4	2	1	2		97
W	0	26	52	37	21	13	1	1	0		151
WNW	0	30	62	60	29	11	2	2	0		196
NW	0	15	52	67	48	9	2	5	7		205
NNW	0	11	28	21	19	8	10	7	11		115
Sub-Total:	422	285	537	348	184	116	79	52	95		2118

Average Wind Speed: 2.88 m/s

2003: ANNUAL
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	1086	60	138	75	18	4	2	3		0	1386
NNE	0	29	104	21	1	0	1	0		0	156
NE	3	53	66	17	2	0	0	0		0	141
ENE	0	54	79	24	3	0	0	0		0	160
E	0	48	77	38	4	2	0	0		0	169
ESE	0	61	108	60	22	11	5	1		1	269
SE	0	55	112	105	72	41	21	16		20	442
SSE	0	39	96	40	36	34	39	21		27	332
S	0	39	51	25	14	3	5	3		7	147
SSW	0	34	41	10	6	3	1	1		1	97
SW	0	38	57	28	5	1	0	2		2	133
WSW	0	43	104	66	55	41	26	25		35	395
W	0	61	156	219	234	219	123	88		60	1160
WNW	0	51	189	366	377	214	134	41		14	1386
NW	0	53	211	318	298	243	96	50		27	1296
NNW	0	53	182	213	111	66	32	19		29	705
Sub-Total:	1089	771	1771	1625	1258	882	485	270		223	8374

Average Wind Speed: 3.35 m/s

2003: FIRST QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	429	10	21	11	5	1	1	1		0	479
NNE	0	6	23	3	1	0	1	0		0	34
NE	2	13	8	4	0	0	0	0		0	27
ENE	0	18	27	7	1	0	0	0		0	53
E	0	26	36	13	0	0	0	0		0	75
ESE	0	32	46	25	13	1	0	0		1	118
SE	0	23	50	47	20	7	4	2		5	158
SSE	0	17	52	9	10	7	13	5		6	119
S	0	18	20	10	4	0	2	1		4	59
SSW	0	15	22	2	1	1	1	0		0	42
SW	0	12	23	11	2	0	0	1		0	49
WSW	0	13	35	14	12	3	3	2		0	82
W	0	24	54	47	42	29	12	7		2	217
WNW	0	14	56	53	59	23	12	6		3	226
NW	0	12	42	44	47	31	14	12		15	217
NNW	0	14	19	20	10	13	10	6		14	106
Sub-Total:	431	267	534	320	227	116	73	43		50	2061

Average Wind Speed: 2.7 m/s

2003: SECOND QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	126	15	34	21	5	1	0	1		0	203
NNE	0	3	24	2	0	0	0	0		0	29
NE	0	9	17	6	0	0	0	0		0	32
ENE	0	10	15	3	1	0	0	0		0	29
E	0	5	6	4	0	1	0	0		0	16
ESE	0	5	6	6	3	3	1	0		0	24
SE	0	5	6	12	5	6	4	5		1	44
SSE	0	2	10	7	10	5	5	2		5	46
S	0	8	8	4	2	2	3	1		2	30
SSW	0	6	1	5	3	2	0	1		1	19
SW	0	8	11	9	2	1	0	1		2	34
WSW	0	5	13	19	26	29	12	21		29	154
W	0	6	25	55	87	96	74	46		37	426
WNW	0	7	48	131	106	81	55	19		2	449
NW	0	7	47	91	89	81	29	14		8	366
NNW	0	10	40	54	30	16	8	9		4	171
Sub-Total:	126	111	311	429	369	324	191	120		91	2072

Average Wind Speed: 4.15 m/s

2003: THIRD QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	129	26	61	36	6	1	1	0		0	260
NNE	0	13	47	15	0	0	0	0		0	75
NE	0	18	22	5	1	0	0	0		0	46
ENE	0	9	20	4	0	0	0	0		0	33
E	0	3	8	1	0	0	0	0		0	12
ESE	0	2	2	0	0	1	0	0		0	5
SE	0	2	2	0	0	0	0	0		0	4
SSE	0	2	3	0	0	0	0	0		0	5
S	0	1	1	0	0	0	0	0		0	2
SSW	0	1	1	0	0	0	0	0		0	2
SW	0	2	4	4	1	0	0	0		0	11
WSW	0	7	20	15	5	5	8	2		2	64
W	0	3	33	55	74	67	28	31		15	306
WNW	0	6	38	124	160	79	53	13		7	480
NW	0	13	77	138	129	94	38	15		2	506
NNW	0	10	85	105	55	28	9	1		0	293
Sub-Total:	129	118	424	502	431	275	137	62		26	2104

Average Wind Speed: 3.68 m/s

2003: FOURTH QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	402	9	22	7	2	1	0	1	0		444
NNE	0	7	10	1	0	0	0	0	0		18
NE	1	13	19	2	1	0	0	0	0		36
ENE	0	17	17	10	1	0	0	0	0		45
E	0	14	27	20	4	1	0	0	0		66
ESE	0	22	54	29	6	6	4	1	0		122
SE	0	25	54	46	47	28	13	9	14		236
SSE	0	18	31	24	16	22	21	14	16		162
S	0	12	22	11	8	1	0	1	1		56
SSW	0	12	17	3	2	0	0	0	0		34
SW	0	16	19	4	0	0	0	0	0		39
WSW	0	18	36	18	12	4	3	0	4		95
W	0	28	44	62	31	27	9	4	6		211
WNW	0	24	47	58	52	31	14	3	2		231
NW	0	21	45	45	33	37	15	9	2		207
NNW	0	19	38	34	16	9	5	3	11		135
Sub-Total:	403	275	502	374	231	167	84	45	56		2137

Average Wind Speed: 2.86m/s

2004: ANNUAL
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	1075	42	119	80	25	14	9	3		9	1376
NNE	0	44	88	22	5	1	2	0		0	162
NE	0	52	63	9	1	0	1	1		0	127
ENE	1	54	55	8	2	0	1	0		0	121
E	1	49	90	24	7	0	0	1		0	172
ESE	0	59	116	92	28	13	3	1		3	315
SE	0	63	132	122	78	40	20	25		41	521
SSE	0	38	78	69	56	42	33	27		58	401
S	0	38	59	22	11	8	4	4		4	150
SSW	0	28	30	12	4	2	1	0		0	77
SW	0	41	59	27	5	3	2	0		0	137
WSW	0	35	86	68	48	38	26	24		41	366
W	0	59	170	222	207	182	128	84		112	1164
WNW	0	57	211	335	328	256	125	52		18	1382
NW	0	47	200	272	271	229	111	45		26	1201
NNW	0	32	154	196	117	69	56	43		59	726
Sub-Total:	1077	738	1710	1580	1193	897	522	310		371	8398

Average Wind Speed: 3.52 m/s

2004: FIRST QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	347	11	17	9	3	2	2	1		0	392
NNE	0	9	15	3	1	0	0	0		0	28
NE	0	15	12	1	1	0	0	1		0	30
ENE	1	18	14	1	0	0	1	0		0	35
E	0	23	33	8	6	0	0	1		0	71
ESE	0	16	43	31	13	8	2	1		1	115
SE	0	22	41	42	53	23	10	6		18	215
SSE	0	10	31	28	33	20	18	11		22	173
S	0	13	22	9	7	3	2	2		4	62
SSW	0	10	10	3	2	1	0	0		0	26
SW	0	20	20	9	2	1	0	0		0	52
WSW	0	11	33	23	13	0	2	1		2	85
W	0	10	53	63	27	23	10	3		1	190
WNW	0	19	56	75	47	26	17	6		4	250
NW	0	12	48	49	43	31	15	10		5	213
NNW	0	11	37	27	22	7	10	10		5	129
Sub-Total:	348	230	485	381	273	145	89	53		62	2066

Average Wind Speed: 3.04 m/s

2004: SECOND QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	123	6	20	19	7	4	2	0		4	185
NNE	0	5	15	6	1	0	1	0		0	28
NE	0	9	8	3	0	0	0	0		0	20
ENE	0	9	8	0	0	0	0	0		0	17
E	0	4	3	1	0	0	0	0		0	8
ESE	0	0	5	3	0	0	0	0		0	8
SE	0	4	4	5	2	2	0	1		0	18
SSE	0	5	1	4	3	2	0	1		0	16
S	0	5	5	0	2	0	0	0		0	12
SSW	0	4	3	2	0	0	0	0		0	9
SW	0	6	8	8	1	1	0	0		0	24
WSW	0	3	20	17	15	15	15	17		29	131
W	0	7	42	75	94	95	79	57		95	544
WNW	0	12	47	111	136	118	58	23		9	514
NW	0	7	48	70	79	89	42	17		11	363
NNW	0	9	38	43	34	35	21	13		21	214
Sub-Total:	123	95	275	367	374	361	218	129		169	2111

Average Wind Speed: 4.51 m/s

2004: THIRD QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	140	16	61	47	8	4	2	0		2	280
NNE	0	14	43	8	2	0	0	0		0	67
NE	0	18	30	3	0	0	1	0		0	52
ENE	0	4	15	2	0	0	0	0		0	21
E	0	4	5	0	0	0	0	0		0	9
ESE	0	1	4	1	1	0	0	0		0	7
SE	0	1	4	8	3	1	1	0		0	18
SSE	0	4	3	4	2	0	0	0		0	13
S	0	2	8	5	0	0	0	0		0	15
SSW	0	2	4	3	1	1	1	0		0	12
SW	0	3	9	5	1	0	0	0		0	18
WSW	0	6	6	14	14	20	9	6		10	85
W	0	11	31	67	77	62	39	23		15	325
WNW	0	6	62	107	118	90	44	22		4	453
NW	0	12	66	117	120	93	41	10		3	462
NNW	0	5	53	112	39	20	11	6		13	259
Sub-Total:	140	109	404	503	386	291	149	67		47	2096

Average Wind Speed: 3.77 m/s

2004: FOURTH QUARTER
WIND SPEEDS AT 10 METER HEIGHT (m/s)

SECTOR	0-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8		>=8	Total
N	465	9	21	5	7	4	3	2	3		519
NNE	0	16	15	5	1	1	1	0	0		39
NE	0	10	13	2	0	0	0	0	0		25
ENE	0	23	18	5	2	0	0	0	0		48
E	1	18	49	15	1	0	0	0	0		84
ESE	0	42	64	57	14	5	1	0	2		185
SE	0	36	83	67	20	14	9	18	23		270
SSE	0	19	43	33	18	20	15	15	36		199
S	0	18	24	8	2	5	2	2	0		61
SSW	0	12	13	4	1	0	0	0	0		30
SW	0	12	22	5	1	1	2	0	0		43
WSW	0	15	27	14	6	3	0	0	0		65
W	0	31	44	17	9	2	0	1	1		105
WNW	0	20	46	42	27	22	6	1	1		165
NW	0	16	38	36	29	16	13	8	7		163
NNW	0	7	26	14	22	7	14	14	20		124
Sub-Total:	466	304	546	329	160	100	66	61	93		2125

Average Wind Speed: 2.74 m/s

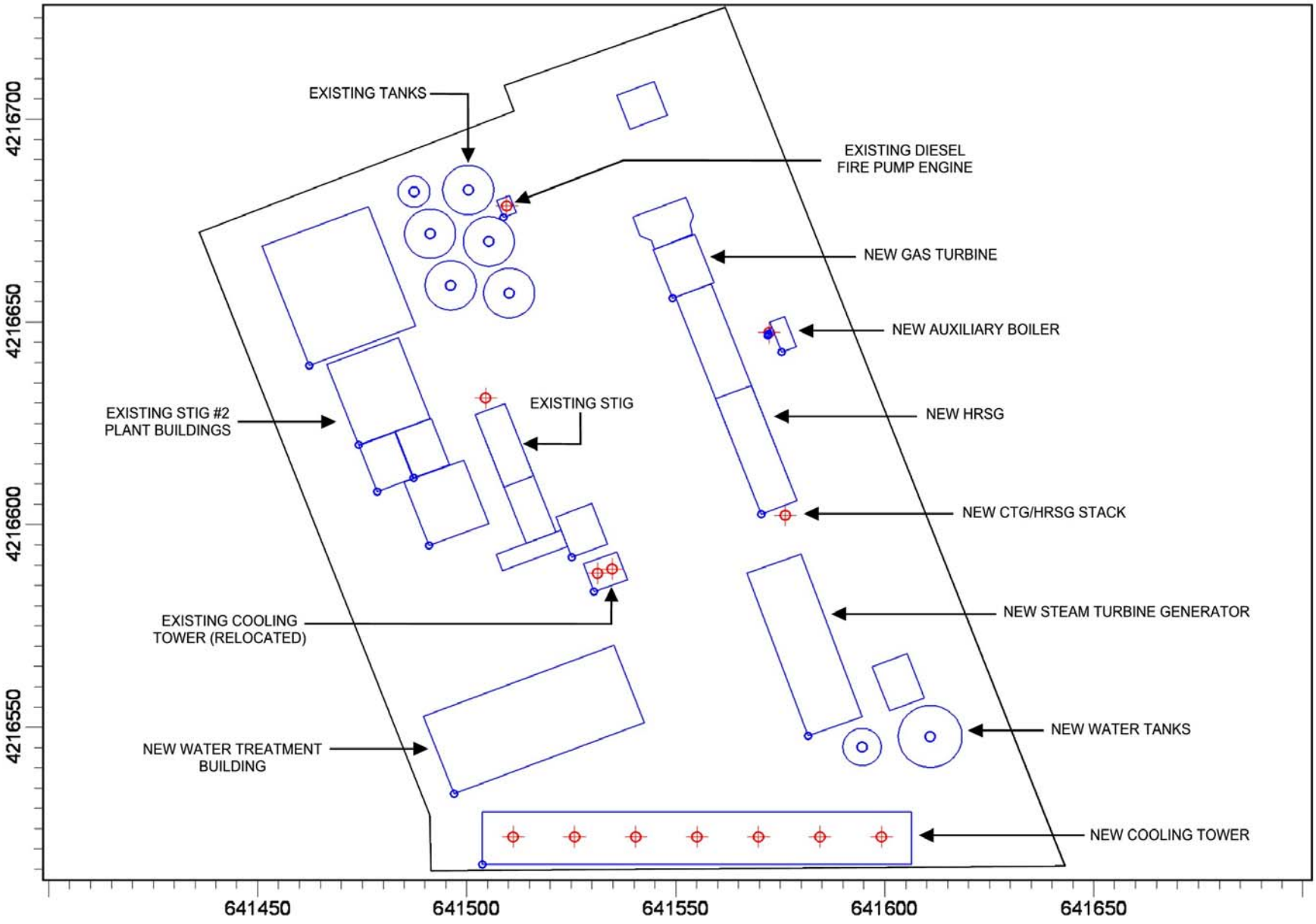


FIGURE 5.1B-7
Building Layout for GEP Analysis

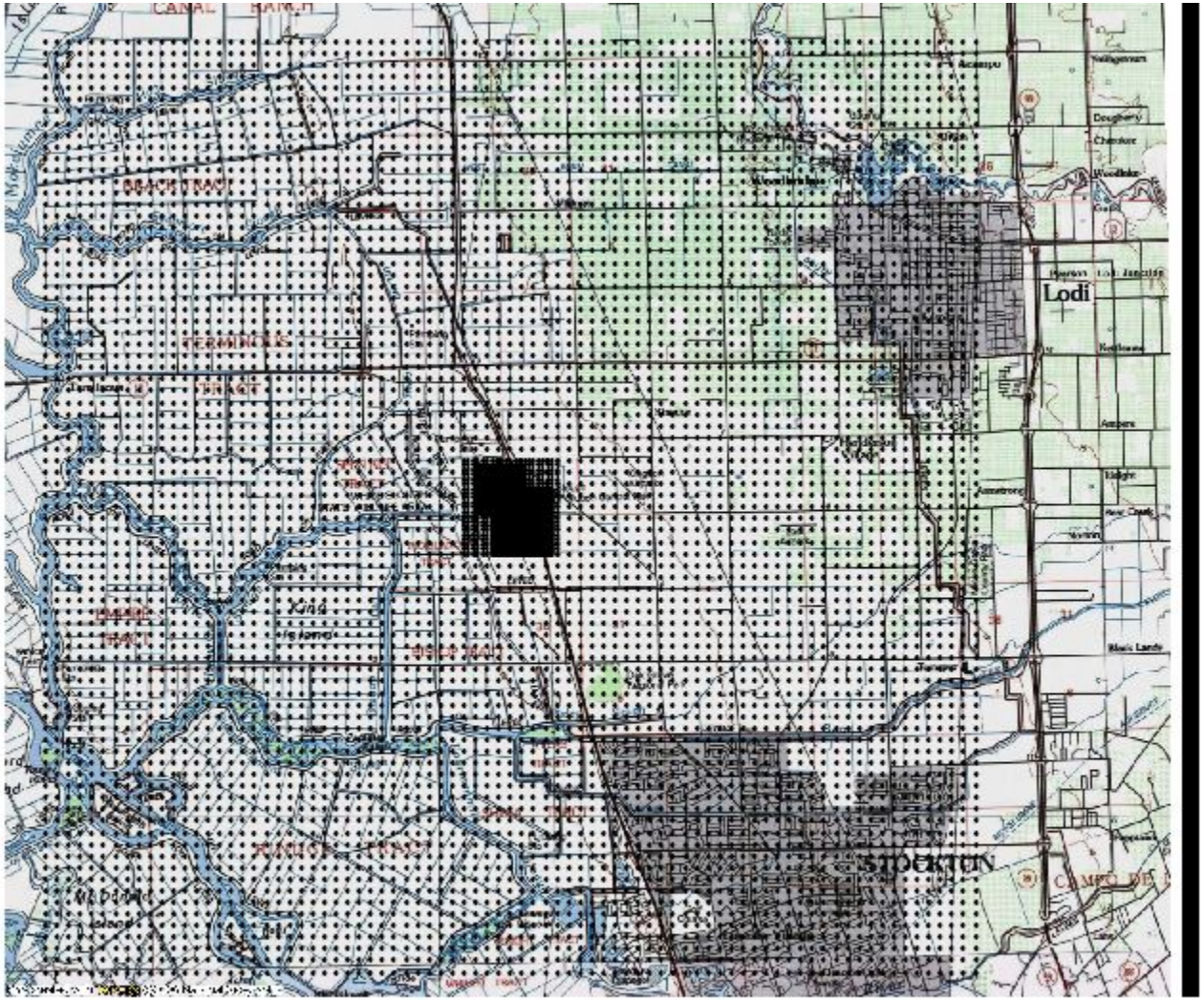


FIGURE 5.1B-8
Layout of the Receptor Grids