SUSITNA
HYDROELECTRIC PROJECT

FEDERAL ENERGY REGULATORY COMMISSION
PROJECT No. 7114

HI-VOLUME AIR MONITORING PROGRAM FINAL MONITORING AND QUALITY ASSURANCE REPORT

FINAL REPORT

MARCH 1985

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HARZA-EBASCO
SUSITNA JOINT VENTURE

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

HI-VOLUME AIR MONITORING PROGRAM
FINAL REPORT

Report by

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Prepared for

Alaska Power Authority

March 1985

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HI-VOLUME AIR MONITORING PROGRAM
FINAL REPORT

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THE ALASKA POWER AUTHORITY

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I. INTRODUCTION

A. PURPOSE

This report presents the final results of the 1984 air quality monitoring program for the Susitna Hydroelectric Project in central Alaska. To define the background ambient suspended particulate matter concentrations in the vicinity of the proposed dam site for the Susitna Hydroelectric Project, the Alaska Power Authority operated three High Volume (Hi-Vol) air samplers from June through September 1984. Background data were requested by the Alaska Department of Environmental Conservation (ADEC) from the Alaska Power Authority (Power Authority) to support air pollution permits for construction of the hydroelectric project. Background data to determine existing ambient conditions are required to assess compliance with Ambient Air Quality Standards and to define the Prevention of Significant Deterioration (PSD) increment available for new source development.

This report is the third and final report for the monitoring program. The first report, Hi-Volume Air Monitoring Program: Initial Monitoring and Quality Assurance Report (June 1984), described the methods to be used and quality assurance procedures to be implemented in the program. The second report, Hi-Volume Air Monitoring Program: Interim Monitoring and Quality Assurance Report (August 1984), summarized results of monitoring for the period May 30, 1984 through August 10, 1984 and the quality assurance audit.

B. COOPERATING AGENCIES AND ORGANIZATIONS

The principal cooperating agency for the monitoring program was the Alaska Department of Environmental Conservation (ADEC). ADEC participated in the selection of Hi-Vol sampler sites prior to implementation of the monitoring program, examined the Quality Assurance manual developed in support of the program, and has been provided previous summaries of the monitoring program.

C. MONITORING PROGRAM DESIGN AND SCHEDULE

The Power Authority designed and operated the Susitna monitoring program based on the procedures and requirements contained in the Ambient Monitoring Guidelines for Prevention of Significant Deterioration (EPA 1980) and in Selecting Sites for Monitoring Total Suspended Particulates (EPA 1977A). Laboratory and quality assurance protocols were derived from the Quality Assurance Handbook for Air Pollution Measurement Systems (EPA 1976). Although requirements for monitoring suspended particulate matter call for sampling at least once every sixth day (EPA 1980), all parties agreed to operation of the samplers at a frequency of once every third day schedule to increase the data capture over the minimum time period. Hi-Vol monitoring was performed only during the summer months, because that is the time most susceptible to wind-blown dust. The region is covered with snow during the winter, therefore windblown dust is negligible during that period. ADEC agreed that the summer program would be sufficient to characterize suspended particulate concentrations.

D. SUMMARY OF MONITORING RESULTS

Based on the data obtained from the three Hi-Vol monitors operated at the proposed site of the Susitna Hydroelectric Project, it can be concluded that the existing ambient air quality is very good. The measured data are discussed in detail in Section V. The data are consistent with those obtained in the most pristine environments and are characteristic of the global background particulate matter concentrations referenced in the Air Quality Criteria for Particulate Matter (EPA-1981). The measured particulate concentrations at the three Hi-Vols ranged from 0.99 to 12.8 micrograms per cubic meter (ug/m^3) for a 24 hour average. The highest geometric mean value for the three Hi-Vols was 4.57 ug/m^3.

E. QUALITY ASSURANCE AND AUDITS

Prior to establishing the ambient monitoring program on-site, a Quality Assurance Plan was established for the program consistent with the Ambient Monitoring Guidelines (EPA 1980). The Plan established the procedures for operating the monitoring program including sampler selection, equipment installation, calibration, maintenance, recording of data, and audits. An audit of the program operation was performed approximately at the mid-point of the four month period and no adverse finding was noted. The quality assurance program is described in detail in Section VI. In accordance with the rules of ADEC (18 Alaska Administrative Code 50.300 (c)(1)), consultation and coordination were obtained prior to siting the samplers. ADEC personnel accompanied project personnel on a site selection visit to the area and approved the Quality Assurance Plan as well as the Hi-Vol monitoring sites in late May 1984.

II. REGULATORY FRAMEWORK

A. U.S. CLEAN AIR ACT AND PREVENTION OF SIGNIFICANT DETERIORATION

The federal Clean Air Act, as amended in 1977, requires preconstruction monitoring of ambient air quality to satisfy the requirements for Prevention of Significant Deterioration (PSD) (Part C of the Act). The purposes of preconstruction monitoring are to determine whether emissions from proposed new sources will result in exceeding either Ambient Air Quality Standards or PSD increments, and to verify the accuracy of modeling estimates. Federal regulations establish minimum standards for preconstruction monitoring programs and provide guidance to states delegated authority to implement PSD (40 CFR 51). Alaska has full authority to implement the program and has several regulations more stringent than federal requirements.

B. ALASKA REGULATIONS

ADEC has been delegated authority to implement the PSD program by EPA (48 FR p. 30623). The regulations concerning the implementation of this program are contained primarily in the state regulations on Permit to Operate (18 AAC 50.300). ADEC has authority to require the collection of ambient and meteorological monitoring data as a permit condition, and to require approval of the monitoring network prior to data collection.

C. GUIDELINES FOR PSD MONITORING

To further define and clarify the requirements for ambient monitoring programs, EPA has published <u>Ambient Monitoring Guidelines for Prevention of Significant Deterioration</u> (EPA 1980). The Guidelines detail siting criteria, data quality control procedures, quality assurance procedures, and data reporting requirements. Generally, the Guidelines specify which procedures are mandatory, which are to be determined on a case-by-case basis, and which are only recommended.

III. EXISTING AND PROPOSED SOURCES OF AIR POLLUTION

A. EXISTING SOURCES

The proposed site for the Susitna Hydroelectric Project is in a remote and undeveloped area of interior Alaska, away from traditional sources of air pollution. Figure III-1 is a map of the area within 150 miles of the site. The nearest major emission source is the coal-fired power plant at Healy, some 75 miles to the northwest. Based on the distance and complex terrain between the power plant and the Watana site, there is no reason to believe that the power plant would significantly affect ambient air quality near the Watana site.

Windblown fugitive dust is known to be a major problem in some regions of Alaska, especially those with fine glacial soils, arid conditions, and strong winds. The ADEC originally suspected that the Susitna area would be subject to windblown dust, so they required the ambient air monitoring described in this report. As shown by the low measured TSP concentrations described in Section V, windblown dust at the Susitna site is not a significant problem.

B. PROPOSED POINT SOURCES

Proposed facilities with point source emissions will include diesel-electric generators, a refuse incinerator, and two concrete batch plants. A number of diesel generators will be used to provide a combined 16 MW of electrical power during the peak construction period. The combined generators will emit more than 250 tons per year of nitrogen oxides. The ADEC has therefore ruled that the Susitna Hydroelectric Project will be subject to PSD review during the air quality permitting by ADEC. The key pollutants that will be subject to review will include total suspended particulates (TSP), carbon monoxide, nitrogen oxides, and sulfur dioxide.

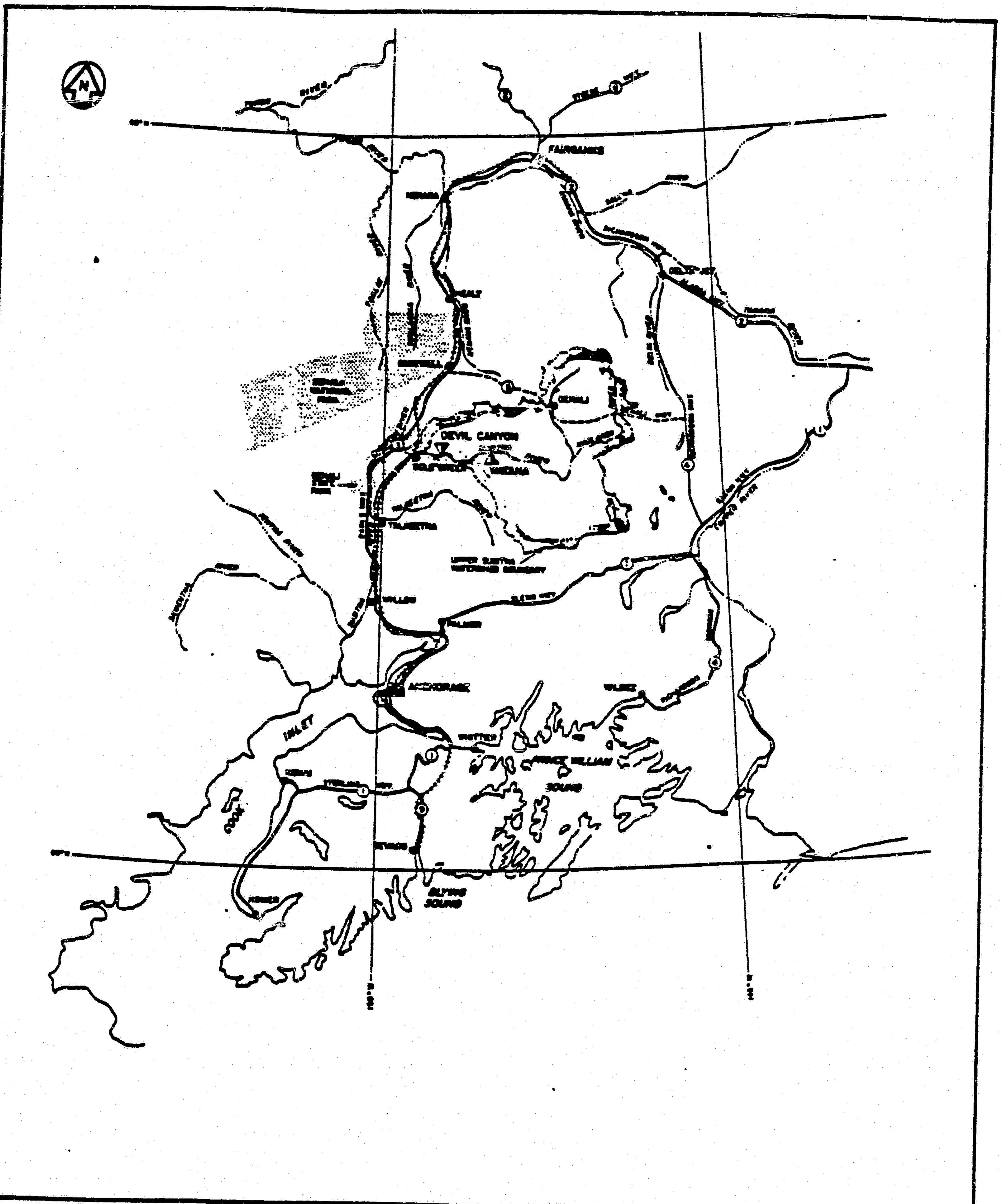

Figure III-1

VICINITY MAP FOR THE SUSITNA
HYDROELECTRIC PROJECT

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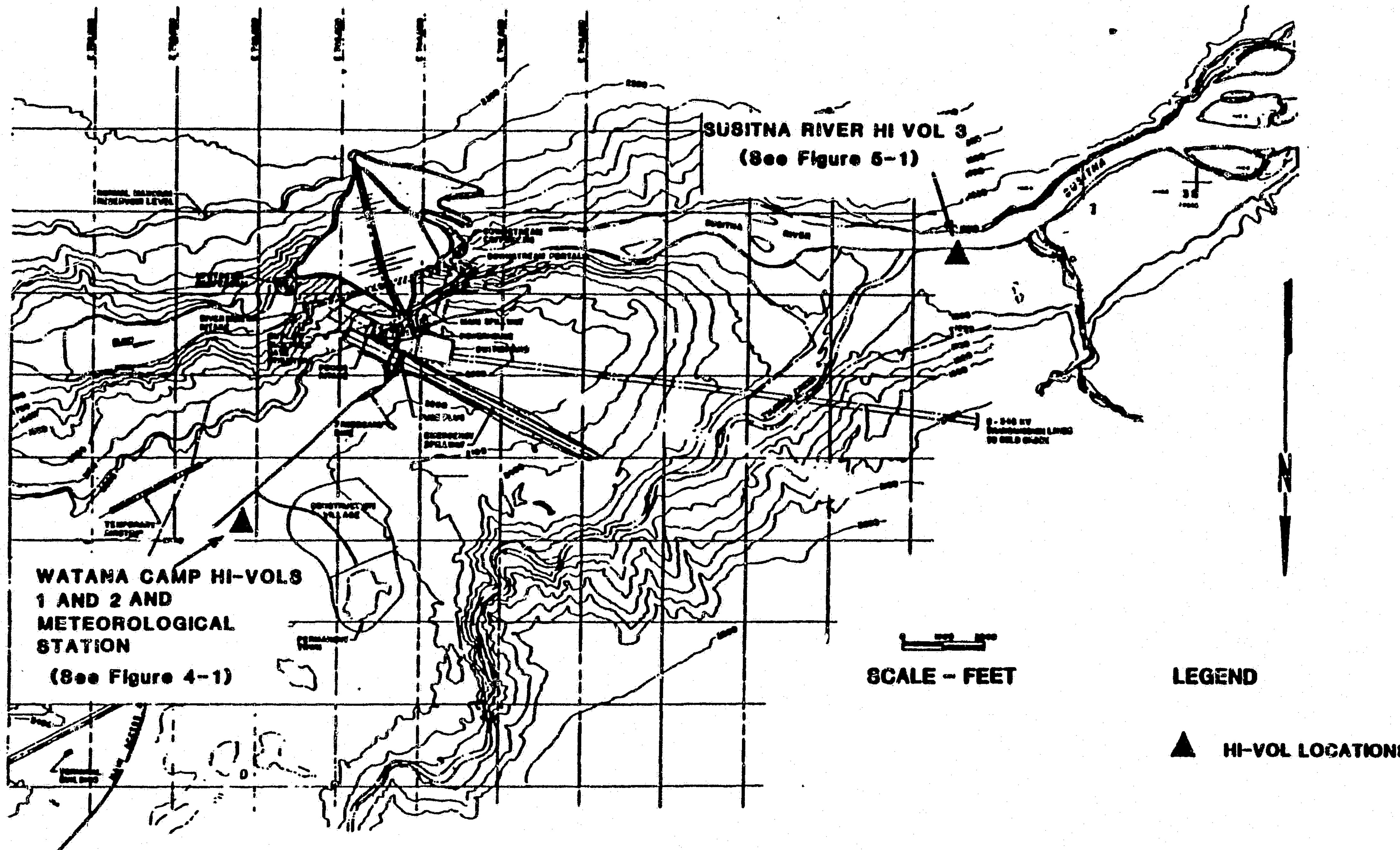
C. POTENTIAL FUGITIVE EMISSIONS SOURCES

Fugitive dust potential is typically characterized by the Thornthwaite Precipitation Evaporation (P-E) index which is a measure of the net precipitation minus evaporation. Table III-1 lists the P-E values using data from the Watana site. High values indicate a high potential for windblown dust. The index when calculated for the Watana site shows the highest potential for wind-blown dust during spring and early summer, with a secondary peak potential in August. For that reason, it was decided that suspended particulate monitoring should only be performed in the summer months as the representative worst-case period.

Construction of the dam is assumed to require several unit operations which may be sources of fugitive dust emissions. These unit operations include: quarry operations, such as overburden removal, drilling and blasting, rock removal, and rock conveying; borrow area operation, including overburden removal, soil loading into trucks, and soil hauling and conveying; gravel processing, including conveyor dumping, and gravel screening; and dam site operations, including fill placement and compaction. Several of the construction areas are shown in Figure III-2.



HI-VOL SAMPLER LOCATION MAP

Figure III-2

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Wizard," manufactured by MRI, operated and maintained by R&M Consultants, Inc. for the Power Authority.

The location of the meteorological station is shown in Figure III-1 and in Figure III-2. The station is located at an elevation of approximately 2,200 feet MSL and is at approximate UTM coordinates N 3,232,600 and E 748,950 in Alaska State Plane, Zone 4. The station is located about 100 yards from the Watana camp in an open, gradually sloping area on the north side of the Susitna River. The wind sensors are approximately three meters above the ground.

2. Measured Meteorological Data

Summer weather patterns at the Watana site for the period 1980-1984 are shown in Table IV-1. The wind regime at the Watana campsite is affected by local topography and seasonal influences. Early in the summer season, the winds are predominantly from the west. Later in the season, the winds rotate, having first a more northerly component, then an easterly component. Wind speed patterns at Watana are fairly uniform throughout the summer, with average speeds at about 2.5 mps. The maximum wind gust occurred in May of 1980, when a peak speed of 16.5 mps was recorded. Precipitation at the Watana site also shows a seasonal pattern. Precipitation is low during May, then reaches a maximum in July or August. Liquid precipitation amounts decrease in the late summer season as the temperatures fall and snowfall begins to occur.

Figure IV-2 shows more detail of wind conditions for the summer of 1984. These wind roses give the percent frequency of occurrence of wind speed and wind direction categories by month. Prevailing wind directions were west and north-northeast in May 1984, and strongly from the west in June and July. In August 1984, a secondary wind direction maximum developed in the northeast quadrant and by September a distinct easterly prevailing wind occurred. A similar pattern occurred during 1983, as shown in Figure IV-3.

The frequency of occurrence of measurable precipitation is also a key aspect of characterizing suspended particulate air quality conditions.

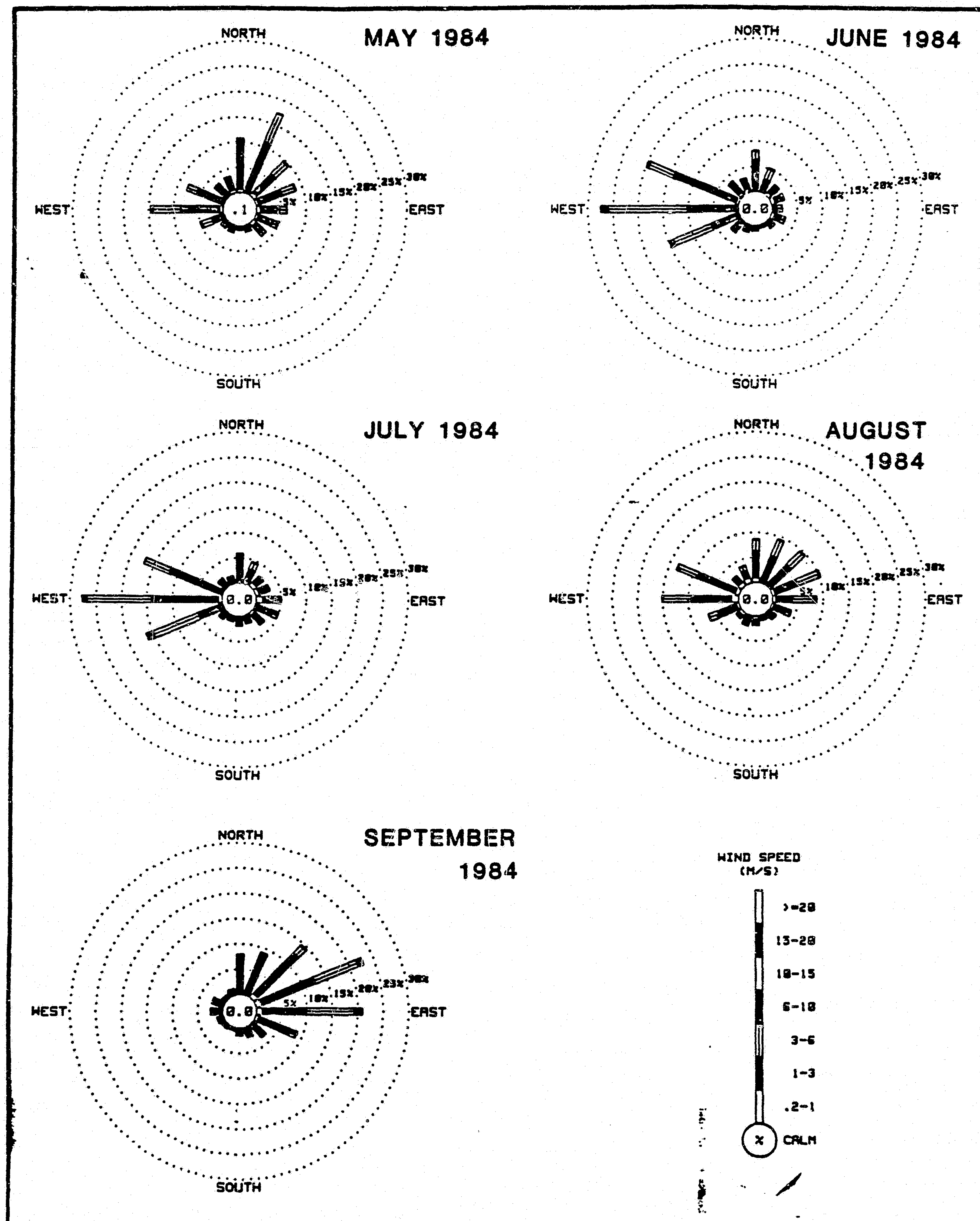

Figure IV-2

WATANA CAMPSITE MONTHLY WIND ROSES (1984)

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SUSITNA JOINT VENTURE

Table IV-2 presents a summary of the number of days, by month, when the daily total precipitation exceeded 0.01 inches. The frequency for July 1984 appears to be low, but a missing data period for that month may be responsible for this factor. A corrected July 1984 frequency would be 15 days.

Meteorological conditions recorded for days when the TSP samplers were operating are shown in Table IV-3. Temperatures and wind speeds during the TSP monitoring period were similar to historical values. Prevailing wind directions also show the general east-west prevalence of wind directions on site.

V. RESULTS OF THE 1984 TSP MONITORING PROGRAM

Background TSP concentrations were collected near the Watana damsite from May 30, 1984 to September 22, 1984. A set of two collocated Hi-Vol samplers was installed at the Watana field campsite, and one sampler was installed at the Susitna River. The two sampling locations were depicted in Figure III-2. This section of the report describes the samplers and the site locations. It discusses the results of the monitoring program and compares these to the concurrent meteorological data. Finally, a discussion of the results in terms of applicable standards is provided.

A. WATANA CAMPSITE SAMPLERS

The two collocated Hi-Vols were established near the Watana campsite on May 29, 1984. These samplers measured baseline TSP concentrations in the main plateau regions above the river. The location of the campsite Hi-Vols is shown in Figure III-2 and in Figure IV-1. The samplers were located at coordinates Alaska State Plane, Zone 4, N 3,232,764 and E 748,863, and at an elevation of 2,270 feet MSL. They were situated approximately 300 feet north of the existing Watana field camp, and 30 feet east of the existing water supply and electrical line that runs northward from the camp.

The Hi-Vols were well-situated in a location that provided a representative background TSP sample with a minimal chance of sample contamination caused by campsite emissions. The terrain near the samplers slopes upward very gently to the north. The ground cover around the samplers consisted of typical low tundra vegetation, and the nearest sparse trees were situated approximately 150 feet from the Hi-Vols. The emission sources at the field camp included a diesel electric generator and a refuse incinerator. However, those emission sources were located approximately 300 feet south of the samplers, and the onsite meteorological data indicate that the summer winds seldom blow from the south.

TABLE III-1

COMPARISON OF MEASURED MONTHLY WINDBLOWN DUST FACTORS AT WATANA SITE

Date	Total Precipitation P (inches)	Total Evaporation E (inches)	Average Wind Speed V (mph)	P/E Ratio	Monthly Dust Factor "C" 1/
1981					
May	1.73	4.24	5.05	.4080	184.9
June	5.12	5.15	6.49	.9942	66.1
July	6.73	2.44	5.59	2.7582	5.5
August	6.53	1.83	6.04	3.5683	4.1
September	3.04	1.16	5.14	2.6207	4.7
1982					
May	1.02	--	5.36	--	--
June	3.44	5.12	6.04	.6719	116.7
July	4.29	4.30	5.36	.9977	37.0
August	2.29	3.81	4.47	.6010	59.1
September	3.97	2.06	5.36	1.9272	9.9
1983					
May	--	--	5.81	--	--
June	1.55	4.82	6.04	.3216	509.3
July	4.45	4.36	4.70	1.0206	23.8
August	4.65	2.55	4.47	1.8235	6.4
September	--	--	--	--	--

1/ Monthly "C" = $(0.239)(V^3)/(P/E)^2$. Based on Jutze 1978.

IV. SUMMARY OF METEOROLOGICAL DATA

The Susitna Project is located in the Susitna River Basin. The area is bordered on the north and west by the Alaskan Range, to the east by the Copper River Lowlands and to the south by the Talkeetna Mountains. It is expected that topography significantly influences local wind patterns.

A. OFF-SITE REPORTING STATION

The closest station from which long-term meteorological records are available is Talkeetna, located about 50 air miles to the southwest of the Watana site. Long-term climatic records for Talkeetna indicate that the climate of the region varies between continental and modified maritime climate (NOAA 1983). Precipitation at Talkeetna is characteristic of a modified marine climate and is approximately 28 inches per year. Temperatures at Talkeetna are continental in nature, with a maximum annual range of -48°F to 91°F. The warmest period, with readings generally in the upper 60s and low 70s, is from June through mid-July. Cooler weather after mid-July usually results from increased cloudiness and precipitation during late summer.

Surface winds in steep valleys are greatly influenced by local topography. At Talkeetna, the prevailing winds are northerly, parallel to the local valley orientation. The wind direction pattern at Talkeetna is not expected to be representative of the winds at Watana, where the Susitna valley is oriented east-west.

B. ON-SITE METEOROLOGICAL DATA

1. Description of Meteorological Monitoring Station

Meteorological data has been collected at the Watana campsite since April, 1980 (Alaska Power Authority 1984). The station consists of a "Weather

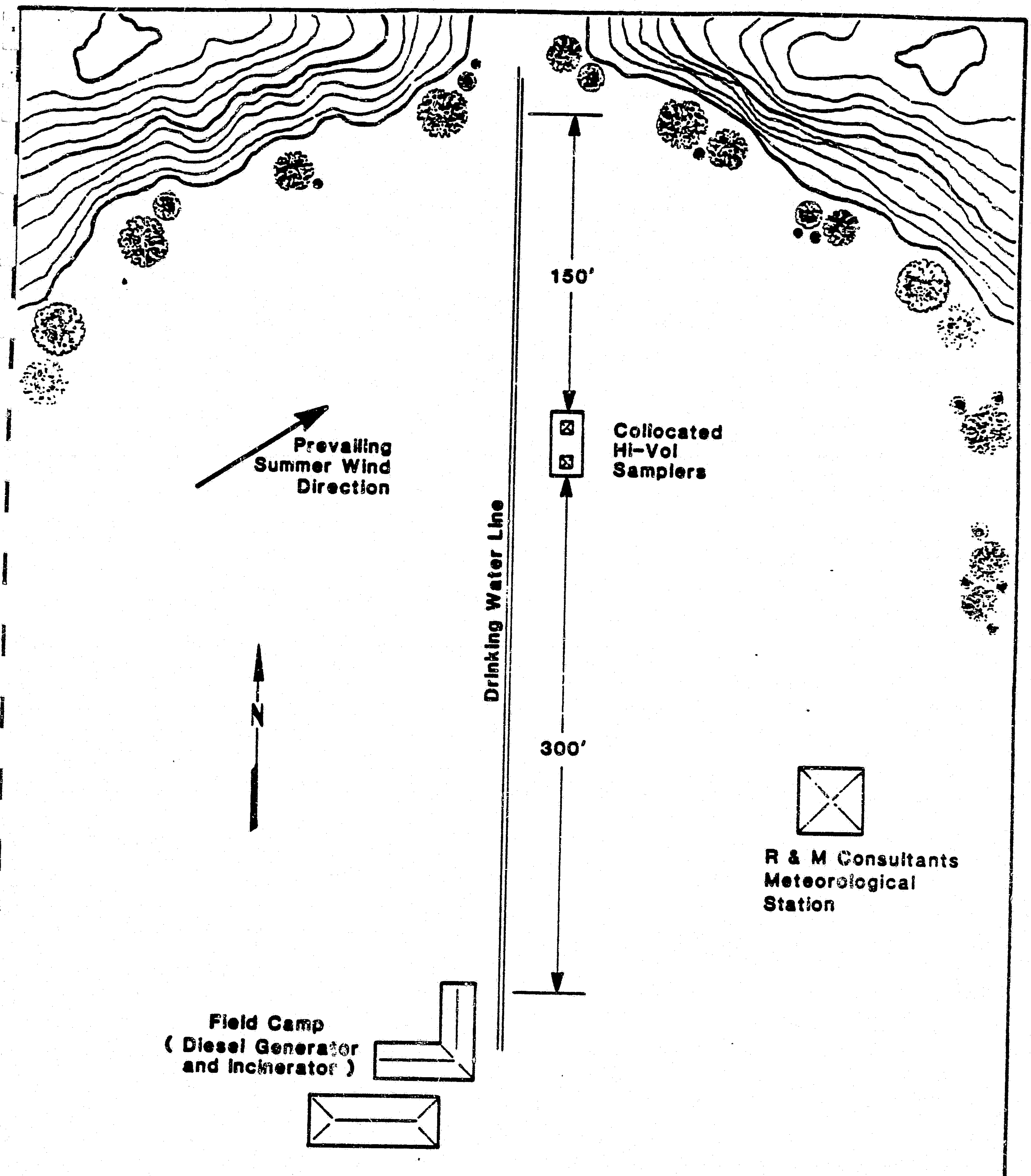

Figure IV-1

WATANA CAMP HI-VOL STATION

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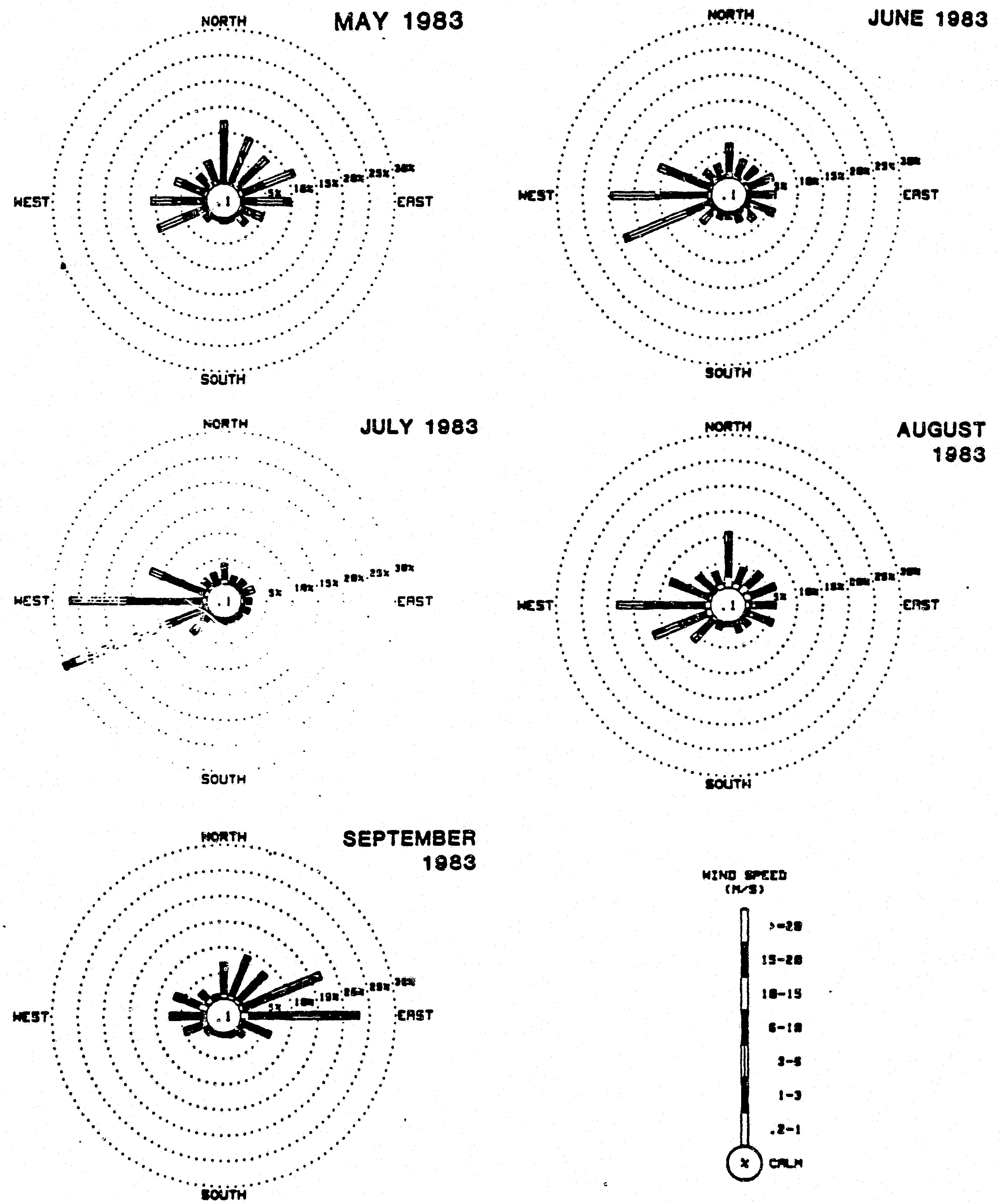
METEOROLOGICAL STATION LOCATOR MAP

TABLE IV-1

WATANA MONTHLY SUMMER METEOROLOGICAL SUMMARY

Year	Month	Temperature Maximum (°C)	Temperature Minimum (°C)	Temperature Mean (°C)	Wind Prevailing Direction (Sector)	Wind Average Speed (mps)	Precipitation Monthly Total (mm)
1980[1]	May	16.0	-5.0	4.6	WSW	3.1	14.6
	June						
	July	23.9	4.5	11.9	WSW	2.6	107.6
	August						
	September						
1981[2]	May	22.1	-2.2	7.6	WSW	2.6	44.0
	June	22.7	-0.1	9.3	WSW	2.9	129.8
	July	17.0	1.2	10.3	WSW	2.5	170.6
	August				N	2.7	165.6
	September	14.5	-13.3	4.4	ENE	2.3	77.2
1982[3]	May	15.6	-27.2	2.3	WSW	2.4	25.8
	June						87.4
	July	26.4	0.7	10.8	W	2.4	109.2
	August	20.1	1.8	10.0	W	2.0	58.2
	September	14.5	-5.6	5.0	E	2.4	100.8
1983[4]	May	20.1	-3.6	5.3	N	2.6	15.2
	June	26.1	2.1	10.5	W	2.7	39.4
	July						113.4
	August						117.8
	September						
1984[5]	May	16.2	-7.4	4.0	ENE	2.5	8.0
	June	21.6	0.6	10.2	W	2.9	62.4
	July	21.2	3.1	11.5	W	2.7	42.4
	August	21.5	-4.2	9.4	W	2.5	100.0
	September	15.5	-3.0	6.4	ENE	2.5	33.6

1/ Alaska Power Authority 1981
2/ Alaska Power Authority 1982
3/ Alaska Power Authority 1983
4/ Alaska Power Authority 1984
5/ R&M Consultants 1984



R & M Consultants, Inc., 1984

Figure IV-3

WATANA CAMPSITE MONTHLY WIND ROSES (1983)

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TABLE IV-2

NUMBER OF DAYS WITH PRECIPITATION

GREATER THAN 0.01 INCH

Month	Year 1983[1]	1984[2]
May	7	6
June	14	14
July	18	9
August	11	11
September	No data	10

[1] Alaska Power Authority 1984.

[2] R&M Consultants 1984.

TABLE IV-3

WATANA METEOROLOGY CORRESPONDING TO TSP SAMPLING SCHEDULE

Date	Temperature Maximum (°C)	Temperature Minimum (°C)	Temperature Mean (°C)	Mean Relative Humidity (Percent)	Wind Prevailing Direction (Sector)	Wind Average Speed (mps)	Precipitation Daily Total
May 30, 1984	9.8	0.0	4.9	64	E	3.2	0.8
June 2, 1984	16.7	0.6	8.7	28	N	2.2	0.0
June 5	18.5	1.9	10.2	25	ENE	2.4	0.0
June 8	15.3	3.9	9.6	64	WNW	3.6	1.8
June 11	18.1	4.3	11.2	46	WSW	3.1	0.0
June 14	15.8	2.1	9.0	61	W	2.8	1.0
June 17	14.7	5.1	9.9	62	W	2.4	0.4
June 20	18.5	7.0	12.8	50	WNW	2.0	2.0
June 23	14.6	6.0	10.3	56	W	2.8	2.0
June 26	15.2	6.9	11.1	71	W	2.8	10.8
June 29	15.3	9.3	12.3	60	WSW	2.4	0.0
July 2, 1984	11.9	6.6	9.3	73	W	3.6	0.0
July 5	19.6	8.8	14.2	63	W	2.2	7.4
July 8	14.3	6.2	10.3	45	NNE	2.5	0.0
July 11	14.2	6.4	10.3	49	WSW	2.3	0.2
July 14	11.2	6.8	9.0	74	WNW	3.2	0.0
July 17							
July 20							
July 23	21.2	7.1	14.2	51	N	1.9	0.0
July 26	8.7	7.2	8.0	87	W	3.1	5.0
July 29							
August 1, 1984	20.4	9.2	14.8	71	N	1.4	0.0
August 4							
August 7	21.1	9.4	15.3	44	W	2.5	0.0
August 10	14.7	6.1	10.4	54	W	2.3	1.6
August 13	18.3	3.6	11.0	28	ESE	2.6	0.0
August 16	17.6	6.0	11.8	51	WNW	2.3	0.0
August 19	14.8	8.4	11.6	62	E	3.8	5.0
August 22	13.2	6.3	9.8	68	W	1.4	2.6
August 25	7.7	2.4	5.1	82	W	1.8	22.4
August 28	8.9	-4.2	2.4	43	E	3.4	0.0
August 31	9.6	1.6	5.6	50	NE	2.2	0.0
September 3	12.8	-1.6	5.6	47	NE	2.4	0.0
September 6	11.9	4.5	8.2	72	ESE	1.7	3.4
September 9	15.5	-0.1	7.7	53	N	1.6	0.6
September 12	12.5	0.8	6.7	65	E	1.7	0.2
September 15	13.2	5.3	9.3	59	E	4.1	0.0
September 18	7.7	1.9	4.8	89	E	1.4	6.2

B. SUSITNA RIVER SAMPLER

The third Hi-Vol sampler and its diesel electric generator were installed near the bank of the Susitna River on June 7, 1984. The location of this sampler relative to the proposed damsite is shown in Figure III-2 and Figure V-1. The Susitna River Hi-Vol was requested by ADEC to determine whether windblown dust concentrations near the gravel bars are higher than the dust concentrations in the plateau regions near the campsite. The sampler was located at coordinates Alaska State Plane, Zone 4, N 3,226,900 and E 729,500, in a clearing north of the river at elevation 1,435 feet MSL. The diesel generator and its fuel tank were situated 76 feet northwest of the Hi-Vols, in a location that minimized the influence of the generator exhaust on the TSP measurements (see Figure V-1). The Hi-Vols had excellent exposure downstream and toward the river, with reasonably good exposure upstream and away from the river.

C. MONITORING EQUIPMENT SPECIFICATIONS

1. Hi-Vol Descriptions

The three Hi-Vols were identical General Metal Works Model 2000 units. All three units were equipped with electromechanical seven-day time switches and elapsed time indicators. The two collocated Hi-Vols (Units 1 and 2) at the Watana field camp were operated on continuous line power from the main camp generator. Unit 3 at the Susitna River was powered by a 5 kW Lamborghini diesel generator, with a 55-gal fuel tank.

The Hi-Vols were mounted on sampling platforms, as shown in Figure V-II. The filters on all three Hi-Vols were situated 8.5 feet above ground level.

Site Location:

N 3,226,900
E 729,500
Alaska Plane Coord.
Zone 4
Elev. 1435 Ft. MSL

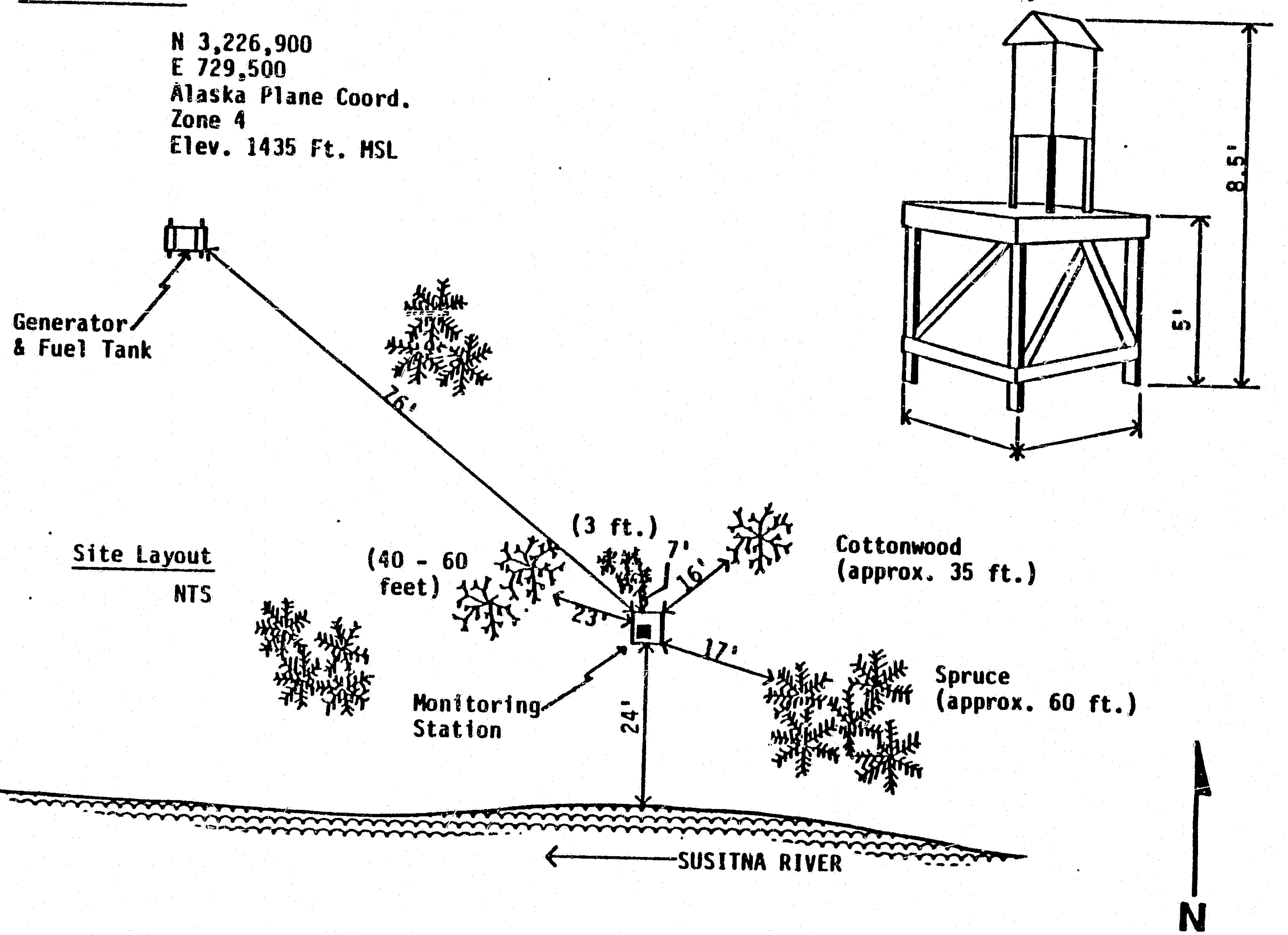

Figure V-1

CONFIGURATION OF SUSITNA RIVER HI-VOL

V-3

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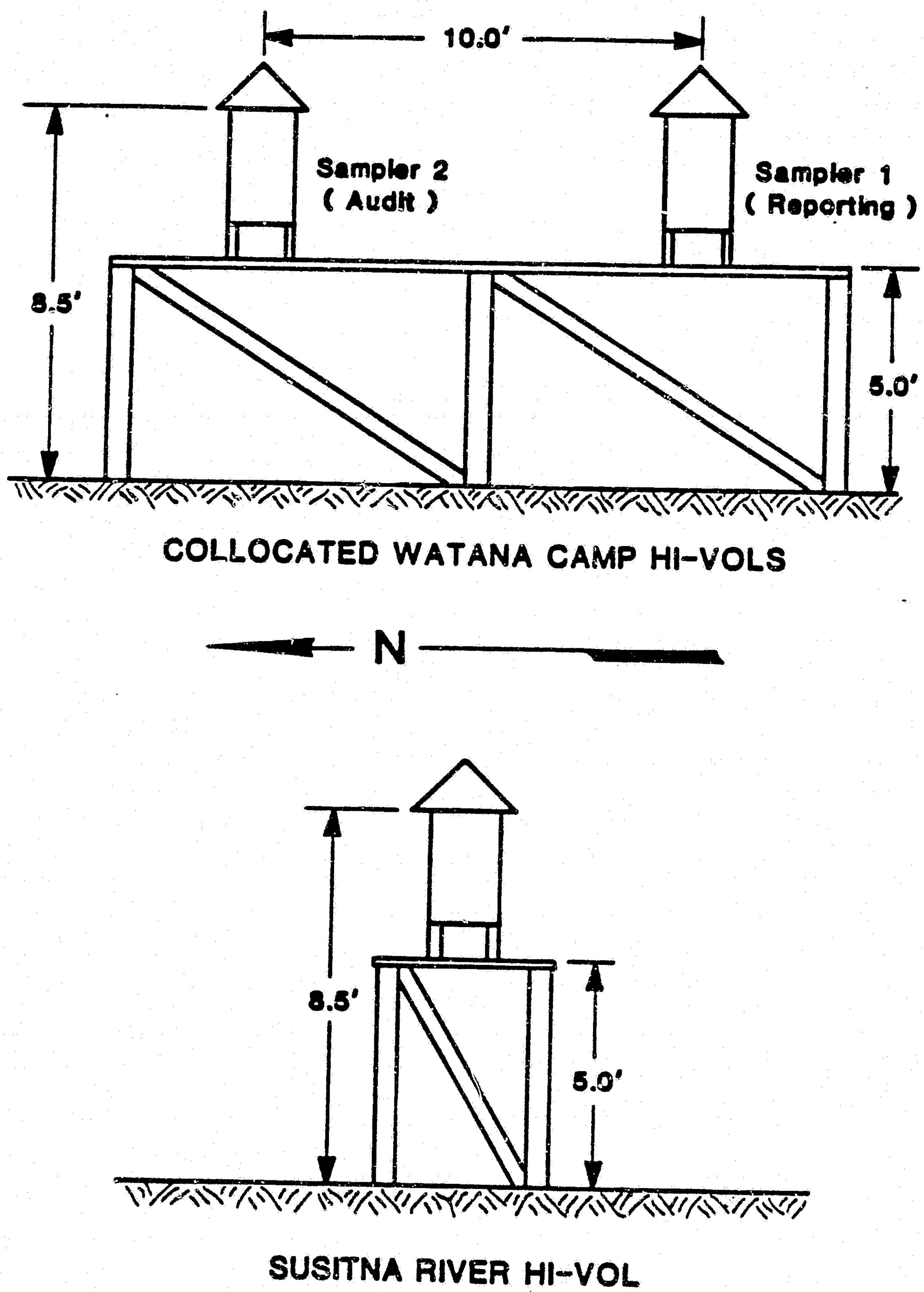

Figure V-2

SUSITNA HI-VOL SAMPLING PROGRAM
SAMPLING PLATFORM CONFIGURATIONS

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2. Flowrate Calibration Equipment

The Hi-Vol flowrates were measured before and after the 24-hr sampling period using a Kurz Model 341 calibration unit. This unit is an electronic, hot-wire anemometer mass flowmeter that directly indicates the sampler flowrate in standard cubic feet per minute (SCFM, 25C, 1 atm).

The electronic flowmeter was factory calibrated at the midpoint of the sampling program. As an additional spot check to ensure accurate flowrate measurements, the electronic flowmeter was checked biweekly against a standard critical orifice ("top hat") calibrator.

3. Sampling Schedule

ADEC specified that the three Hi-Vols should be run on a three-day sampling frequency. All three units were operated on a three-day schedule beginning in late May or early June through September 1984. The collocated units 1 and 2 were operated from midnight to midnight on the specified sampling days. Unit 3 on the Susitna River was accessible only by helicopter and was powered by a diesel generator, and consequently the unit was operated from 10:00 am on the designated sampling day to 10:00 am the following day.

D. TSP MONITORING RESULTS

Results of the monitoring program are shown in Table V-1. The observation date and concentrations measured at each of the sampling locations are given. The geometric mean values for each of the samplers are also provided in Table V-1. A measurement of negative filter weights was noted for a total of ten of the observations. This was determined to be the result of not completely removing loose filter lint from the filters prior to installation in the samples. Negative results and missing data were excluded from the subsequent analyses.

TABLE V-1
MEASURED TSP CONCENTRATIONS (ug/m^3)

Date	Watana Campsite Samplers Unit 1	Watana Campsite Samplers Unit 2	Watana Campsite Samplers Percent Difference	Susitna River Unit 3
05/30/84	Negative	Negative	-	-
06/02/84	Neg	0.33*	-	-
06/05/84	Neg	Neg	-	-
06/08/84	2.45*	Neg	-	2.10*
06/11/84	4.29*	2.9*	32.6	7.39*
06/14/84	1.09*	0.05*	95.4	3.63*
06/17/84	Neg	Neg	-	1.34*
06/20/84	4.34	3.35	22.8	3.57
06/23/84	3.06	2.22	27.5	4.14
06/26/84	1.76	2.27	-29.0	5.08
06/29/84	6.87	6.83	0.58	6.43
07/02/84	2.57	3.04	-18.3	0.99
07/05/84	6.83	6.53	4.4	5.98
07/08/84	3.65	3.79	-3.8	4.03
07/11/84	2.90	2.93	-1.0	4.51
07/14/84	2.95	3.19	-8.1	5.32
07/17/84	3.12	4.62	-48.1	6.11
07/20/84	3.06	3.06	0	3.33
07/23/84	5.62	5.81	-3.4	7.99
07/26/84	1.29	2.16	-67.4	5.15
07/29/84	3.34	2.51	24.8	3.01
08/01/84	2.81	1.55	44.8	6.92
08/04/84	5.12	5.99	-17.0	5.33
08/07/84	2.77	5.02	-61.0	6.45
08/10/84	Neg	1.86	-	4.75
08/13/84	4.46	3.82	14.3	
08/16/84	9.82	9.54	2.9	5.02
08/19/84	3.34	2.18	34.7	4.19
08/22/84	3.99	2.54	36.3	5.19
08/25/84	1.04	1.12	-7.7	4.28
08/28/84	1.57	1.35	14.0	2.66
08/31/84	4.11	9.08	-120.9	3.32
09/03/84	3.89	3.82	1.8	5.03
09/06/84	4.30	3.50	18.6	3.90
09/09/84	3.96	3.54	10.6	4.43
09/12/84	4.96	4.55	8.3	4.64
09/15/84	6.51	8.03	-23.3	6.86
09/18/84	Neg	12.8	-	3.16
Geometric mean	3.48	3.47	-	4.57

*Because of identified problems with processing of the filters, these concentrations have not been included in the geometric mean value.

The measured 24 hour TSP concentrations ranged from 0.99 to 12.8 ug/m^3. Concentrations at the Susitna River (Unit 3) were consistently higher than those at the Watana Camp (Units 1 and 2). The geometric mean values for Samplers 1, 2, and 3 were 3.48, 3.47, and 4.57 ug/m^3, respectively.

A linear correlation coefficient for TSP measurements between the three units was calculated from these data. For Units 1 and 2, the linear correlation coefficient is 0.8261; between Units 1 and 3 the correlation is 0.5174; and between Units 2 and 3 the correlation is 0.2614.

Another important aspect of air quality data relates to long-term changes in pollutant levels. Figure V-3 depicts the measured levels of TSP for each three-day interval in the observation period. Although the concentrations of TSP may be slightly higher during the late summer than during the early summer, the data indicate no strong trend during this period.

E. DISCUSSION OF AIR QUALITY AND METEOROLOGICAL DATA

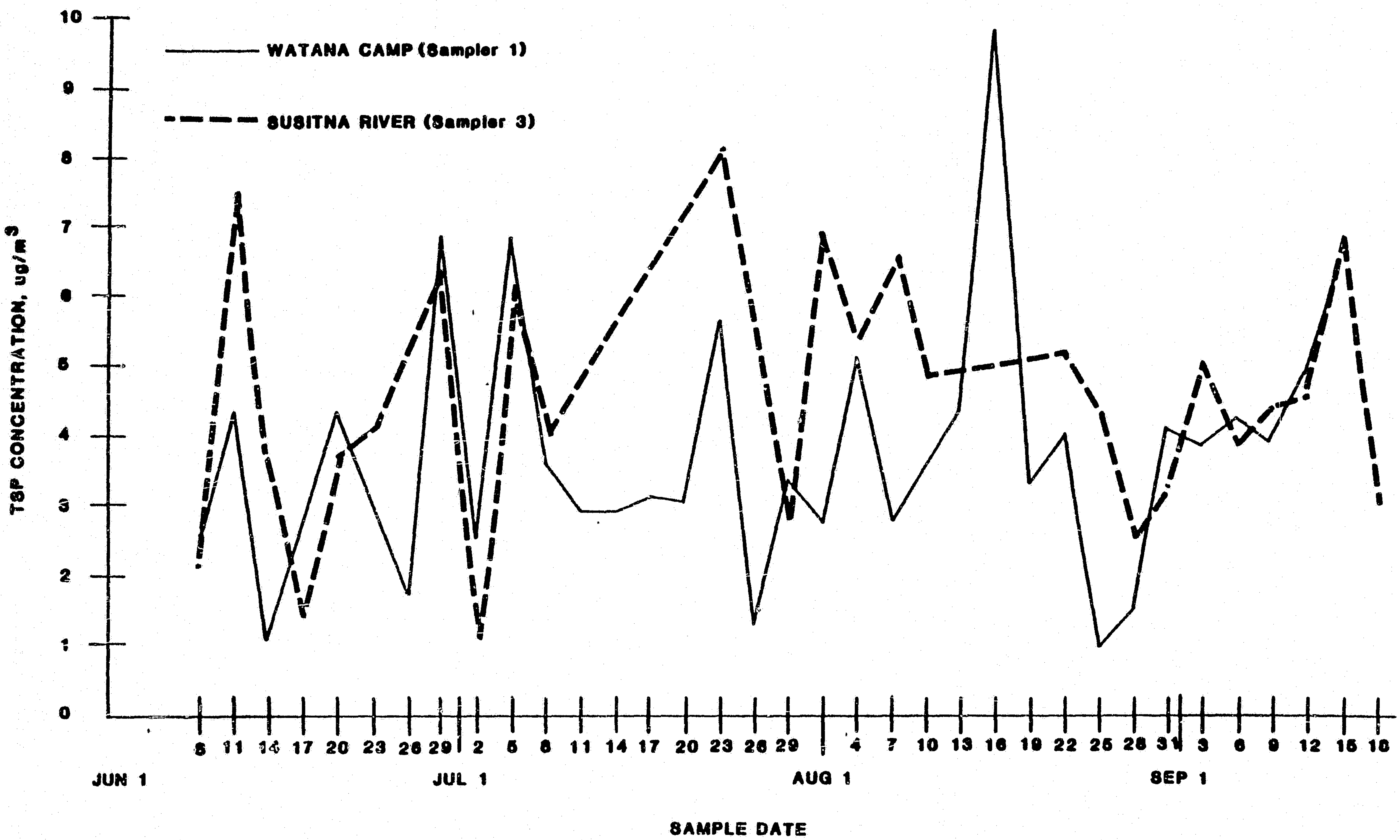
It is important to describe the effects of local meteorological conditions on the observed background ambient air quality. The effects of wind speed, wind direction, and precipitation are all of importance.

Figure V-4a and V-4b show the relationship between prevailing wind direction and measured TSP concentration at Units 1 and 3. There is no apparent correlation between wind direction and background TSP concentration. These figures also demonstrate that prevailing winds blew either upriver or downriver during the summer 1984 sampling period.

Figures V-5a and V-5b show the relationships between background TSP concentration, wind speed, and precipitation. There was no correlation between TSP and average wind speed. The most recent emission factors for windblown dust predict that wind erosion should be proportional to wind speed. If background TSP was caused by local wind erosion, then the regression line for TSP versus wind speed would have a positive slope.

As shown in Figures V-5a and V-5b, there was no strong positive regression slope measured at either the Watana Camp or at the Susitna River. It can, therefore, be concluded that the background TSP concentrations are not caused by local wind erosion.

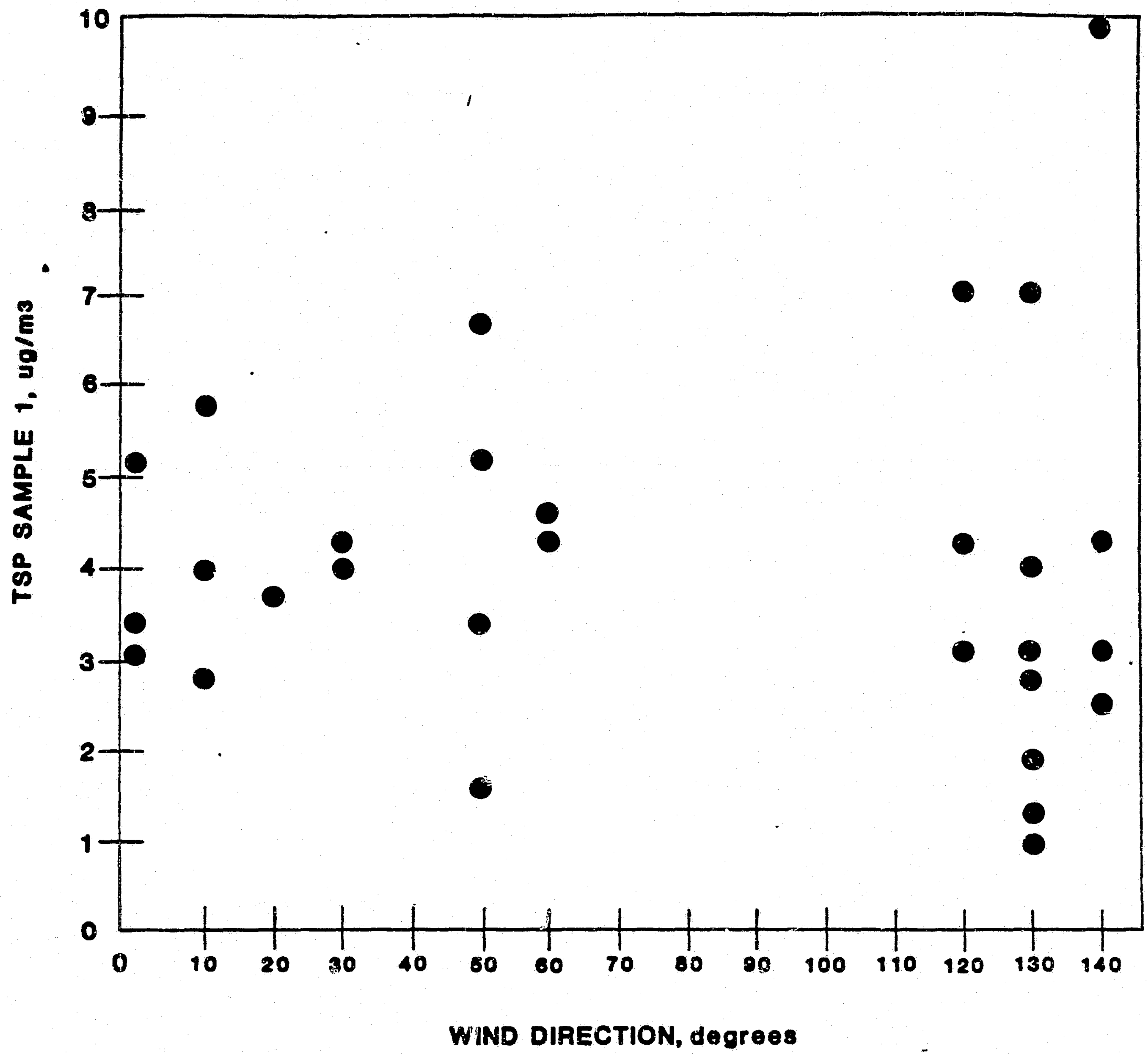
Figures V-5a and V-5b also show that there was little relationship between background TSP and daily precipitation. The emission factors for windblown dust predict that wind erosion should occur only on those days with no precipitation. However, there was no difference in background TSP at the Watana Camp on "precipitation days" versus "no precipitation days". At the Susitna River, background TSP was slightly higher on days with no rain. It can, therefore, be concluded that TSP concentrations at the Susitna site will be slightly decreased by precipitation.



HARZA-EBASCO
SUSITNA JOINT VENTURE

TSP CONCENTRATIONS VS. SAMPLE DATE

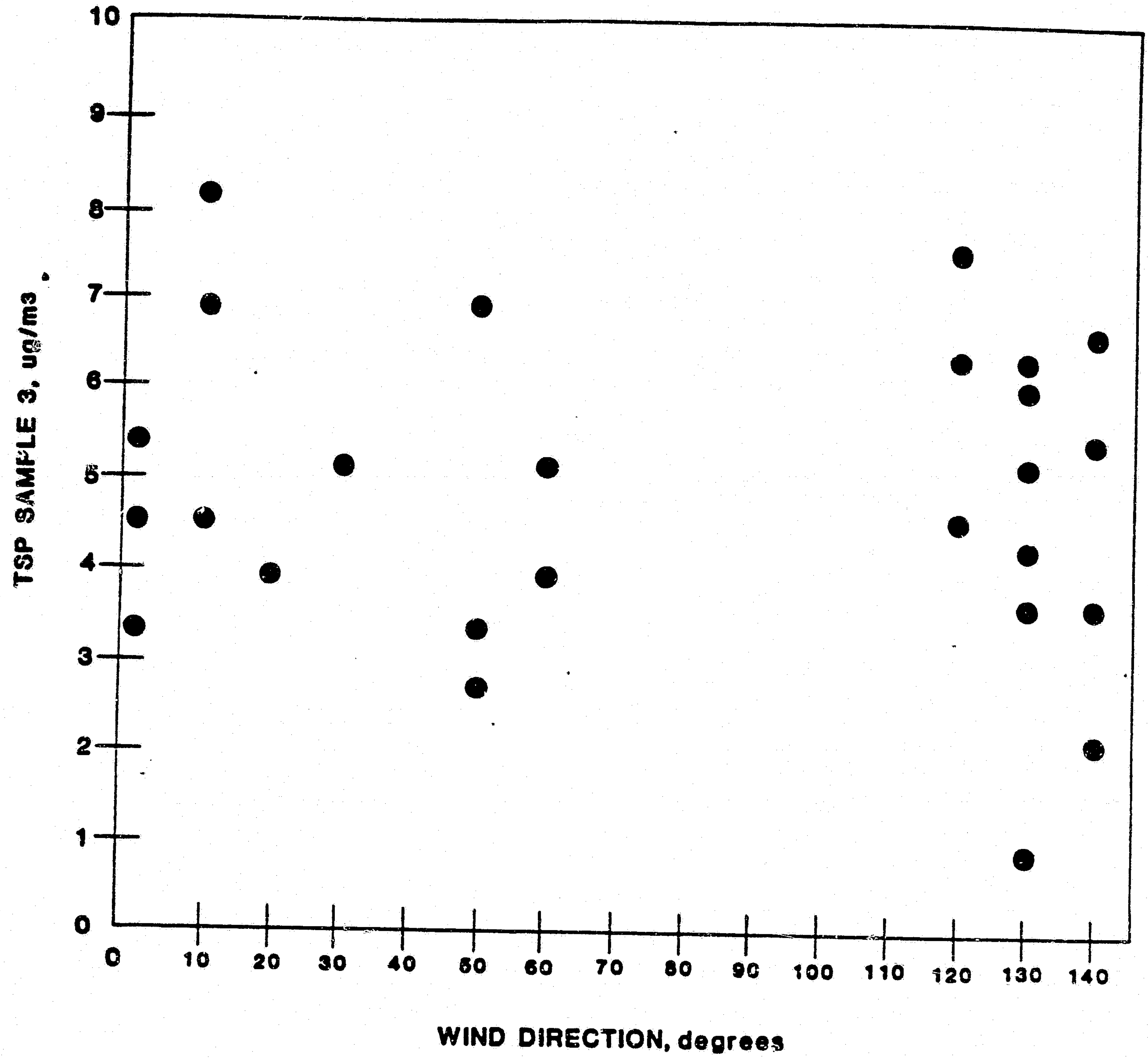
Figure V-3



HARZA-EBASCO
SUSITNA JOINT VENTURE

TSP CONCENTRATION VS. WIND DIRECTION FOR SAMPLER 1 (CAMPSITE)

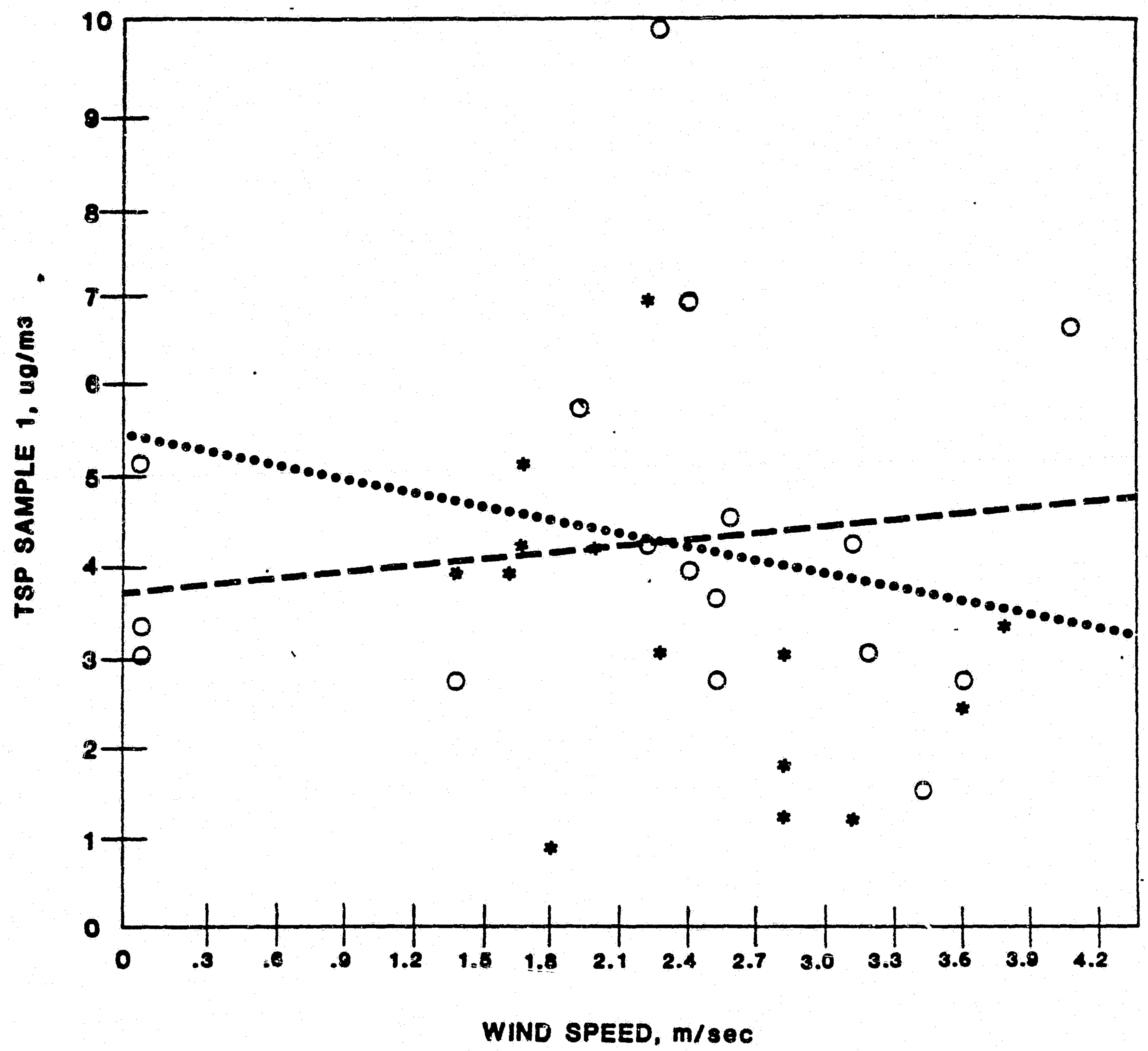
Figure V-4a



HARZA-EBASCO
SUSITNA JOINT VENTURE

TSP CONCENTRATION VS. WIND DIRECTION FOR SAMPLER 3 (SUSITNA RIVER)

Figure V-4b



KEY

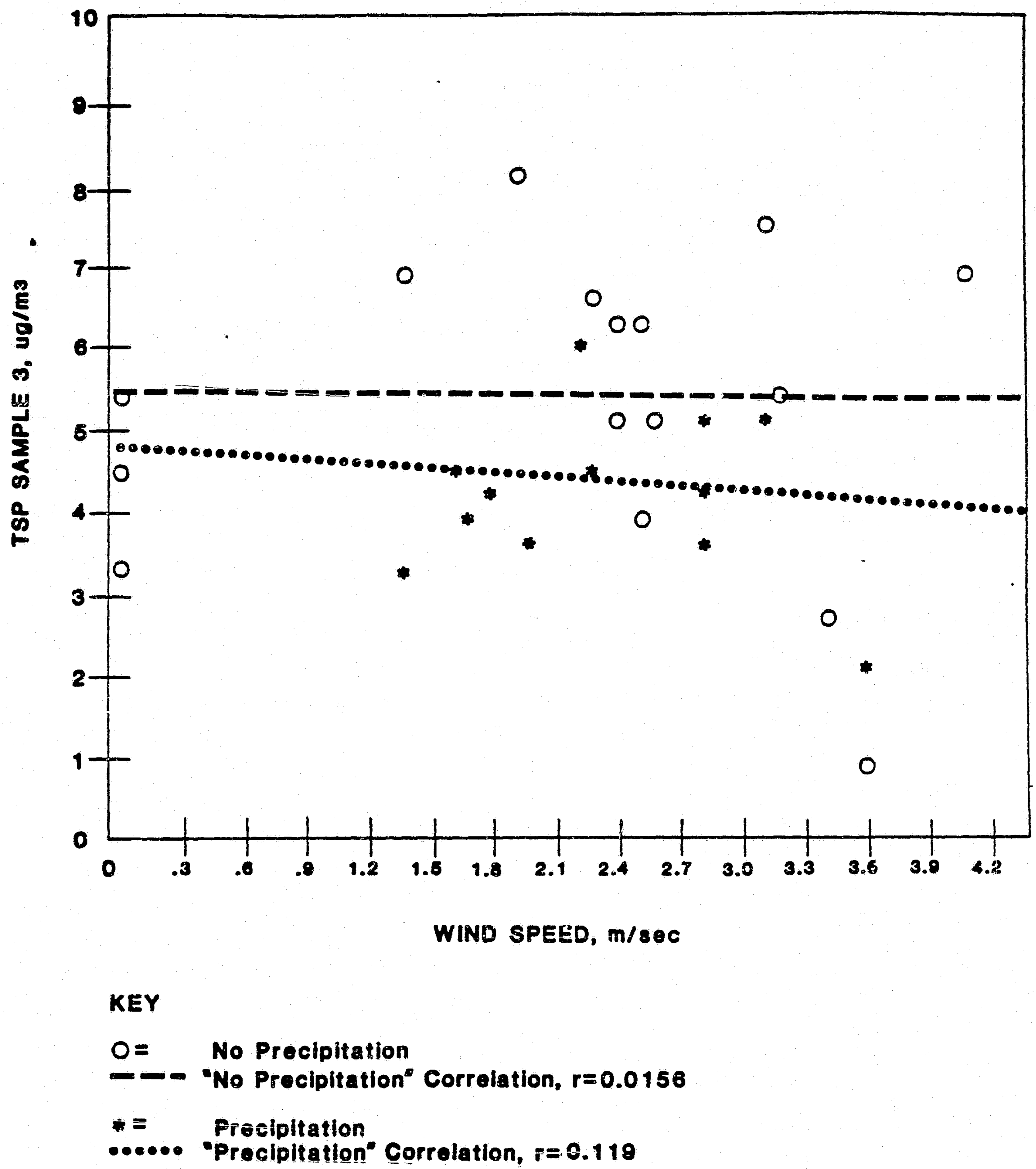
○ = No Precipitation

— — — "No Precipitation" Correlation, r=0.088

* = Precipitation

•••••• "Precipitation" Correlation, r=0.413

HARZA-EBASCO SUSITNA JOINT VENTURE	TSP CONCENTRATION VS. WIND SPEED AND PRECIPITATION FOR SAMPLER 1 (CAMPSITE) V-12	Figure V-5a



HARZA-EBASCO SUSITNA JOINT VENTURE	TSP CONCENTRATION VS. WIND SPEED AND PRECIPITATION FOR SAMPLER 3 (SUSITNA RIVER) V-13	Figure V-5b

F. COMPARISON TO STATE STANDARDS

The Alaska Department of Environmental Conservation has promulgated ambient air quality standards for particulate matter in Alaska. The standards which must not be exceeded are an annual geometric mean TSP concentration of 60 ug/m^3 and a 24-hour concentration of 150 ug/m^3, not to be exceeded more than once per year.

As expected in remote areas, the TSP monitoring data show that the background air quality is excellent. Geometric mean values are all below 5 ug/m^3. The maximum observed 24-hour particulate concentration is 12.8 ug/m^3. Both observations are far below the applicable standards.

VI. QUALITY ASSURANCE PROGRAM

A. PROCEDURES AND PROTOCOLS

Measurement of the mass concentration of suspended particulate matter in the ambient air for determining compliance with Ambient Air Quality Standards requires use of the Reference Method for that pollutant; 40 CFR 50, Appendix B: Reference Method for the Determination of Suspended Particulate Matter in the Atmosphere (High-Volume Method). Use of the reference method in conjunction with a quality assurance program assures that measurements have adequate accuracy and reliability.

Specific quality assurance procedures and forms used in the 1984 monitoring program are derived from those in Volumes 1 and 2 of the Quality Assurance Handbook for Air Pollution Measurement Systems (EPA 1977b). These include controls and documentation of procurement and calibration of equipment, filter selection and preparation, sampling procedures, sample analysis, calculation and data reporting, and audit procedures.

B. DATA RECOVERY

Data recovery relates the number of valid samples to the number of possible samples during the monitoring period. The Quality Assurance Handbook defines availability to be the ratio of equipment uptime to the sum of the uptime and downtime. There is, however, no standard of performance of availability required for monitoring systems. The availability of the 1984 monitoring program was 96.5 percent. The overall recovery rate for the monitoring program including allowance for all invalid samples during the period is 91.0 percent. After June 17, the overall recovery rate was 97.8 percent.

C. INVALID SAMPLES

A summary of data losses is given in Table VI-1. Several samples were declared to be invalid early in the program due to reported negative filter weights (see Table V-1). This was determined to be the result of not completely removing loose filter lint from the filters prior to installation in the samplers. After being in the samplers for 24 hours, enough air had been pulled through the filters that some lint was also removed. The extremely low concentration of particulate matter in the atmosphere was not sufficient to overcome the weight loss. The laboratory procedures were adjusted early in the program to correct this problem.

D. AUDITS

An audit is an independent assessment of the accuracy of the data. Independence requires that the auditor not be the person conducting the routine monitoring program and that audit standards and equipment be different from those used in monitoring. The system audit in Hi-Vol monitoring is mainly to evaluate the air flow rate, exposed filter weighing, and data processing. Of these, air flow rate is the most likely to be a source of errors or to lack accuracy. Flow rate was calibrated with a critical orifice on several occasions during the program.

An independent quality assurance audit was conducted on July 31, 1984 in accordance with the QA procedures described in Volume 1 "Initial Monitoring and Quality Assurance Report." The audit was conducted by Dr. Jean Marx of Frank Moolin and Associates, Inc., a subcontractor of the Harza-Ebasco Susitna Joint Venture. The audit covered the following topics:

- Laboratory procedures
- Hi-Vol operations
- Hi-Vol flow rate check.

The standard checklist that was used during the audit is shown in Figure VI-1. Corrective action would have been taken had any nonconformances with procedures been noted. No nonconformances were detected.

The electronic flowmeter and "top hat" flowmeter that are used in the site were both checked against a separate "top hat" calibrator that was brought to the site for the audit. The results of that audit are shown in Figure VI-2. Both the reporting calibrator and the audit calibrator gave slightly lower values than did the electronic flowmeter. However, the audit and reporting calibrators gave nearly equal readings, indicating that the reporting calibrator was operated properly.

TABLE VI-1

SUMMARY OF DATA LOSSES

Date	Type of Data	Remarks
05/30/84 06/02/84 06/05/84 06/08/84	Negative net particle weights on exposed filters.	The first set of filters were inadvertently not brushed to remove loose fibers before the initial weighing.
06/17/84 08/10/84 09/18/84	Negative net particle weights on exposed filters.	Reason for negative weight is not known.

Note: Total data recovery from May 30, 1984 through September 18, 1984 = 91.0 percent.

Total data recovery from June 17, 1984 through September 18, 1984 = 97.8 percent.

E. SYSTEM PRECISION

The precision of the measured TSP concentrations between the two collocated samplers at the campsite is shown in Figure VI-3. The precision of the two collocated samples often did not satisfy the ± 15 percent limit set by the federal guidelines (EPA 1980). However, considering the extremely low measured TSP concentrations, it is unreasonable to expect the precision to consistently be within that limit. When sampling very low TSP concentrations with collocated Hi-Vols, relatively minor wind shifts and very minor difficulties during sampling and filter processing can cause apparently major precision problems.

Ten percent of the new and exposed filters were redessicated and reweighed to confirm the precision of the filter processing. The results of the filter reweighing are shown in Figure VI-4. As shown in that figure, the reweight differences were all well within the ± 5.0 mg precision limit set by the federal guidelines (EPA 1977b).

The measured Hi-Vol flow rate using the Kurz Model 341 electronic flowmeter was periodically checked against the same flow rate using a standard critical orifice "top hat" flowmeter. The results of those flow rate checks are shown in Figure VI-5. The two measured flow rates were within the ±7.0 percent limits allowed under the federal guidelines (EPA 1979), except on July 31, 1984 when the flow rate difference was 7.9 percent. On that day, the flow rate check had to be conducted during a windy period, under conditions where the "top hat" flowmeters are recognized to give unreliable results.

1. What type of hi-vol samplers are used in the network? General Metal Works : Model 2000 units

2. How often are the samplers run? (a) daily (b) once every 6 days (c) once every 12 days (d) other every three days

3. What type of filter and how many are being used? Glass fiber: 2 ea sampler (one blank; one weighed)

4. Are there any preexposure checks for pin holes or imperfections run on the filters? yes in the lab and visually in the field

5. What is the collection efficiency for your filters? ____

6. What is the calibration procedure for the hi-vol sampler? Flowrates measured before and after 24. hr sampling period *

7. Which statement most closely estimates the frequency of flow rate calibration? (a) once when purchased (b) once when purchased, then after every sampler modification (c) when purchased, then at regular intervals thereafter c

8. Are flow rates measured before and after the sampling period? Yes X No ____

9. Is there a log book for each sampler for recording flows and times? Yes X No ____

10. Are filters conditioned before initial and final weighings? yes If so, for how long? 24 hrs At what percentage humidity? desiccator - heated < 1% humidity

11. Is the balance checked periodically? yes If so, how often? daily - internal std With which standard weights? electronic with its own electronic classification

12. How often are the hi-vol filters weighed? twice plus every 10th checked twice per pt. How are the data from these weighings handled? Data sheets are kept on file at the lab

13. Are all weighings and serials numbers of filters kept in a log book at the laboratory? Data sheets on file

14. What is the approximate time delay between sample collection and the final weighing? 6-9 days

* Kurz Model 341 Calibration Unit

Jean a. Meri

Figure VI-1

SUSITNA HYDROELECTRIC PROJECT
HI-VOL PROJECT AUDIT CHECKLIST

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SUSITNA JOINT VENTURE

Date	Ambient Temperature T_a		Barometric Pressure P_a (mmHg)	Manometer ΔH (inches H_2O)	Calculated Orifice Flowrate Q_s		Electronic Flowmeter Q_M ft^3/min	Flowrate Deviation (%)	Remarks
	°F	°K			m^3/min	ft^3/min			
7/31/84 Reporting Flowmeter	14°C	287	763	7.5		48.8	53.0	+7.9	Audit had to be conducted during gusty weather conditions
7/31/84 Audit Flowmeter	14°C	287	763	7.4		48.5	53.0	+8.5	

$°K = °C + 273$
mmHg = 25.4 x (in.Hg)

ft^3/min = 35.3 x m^3/min

Flow Deviation = 100 x $(Q_s - Q_m)/Q_s$

Figure VI-2

Hi-Vol Flowrate Audit Form

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SUSITNA JOINT VENTURE

Figure VI-3

$\bar{X}$ AND R CHART FOR TSP MEASUREMENTS

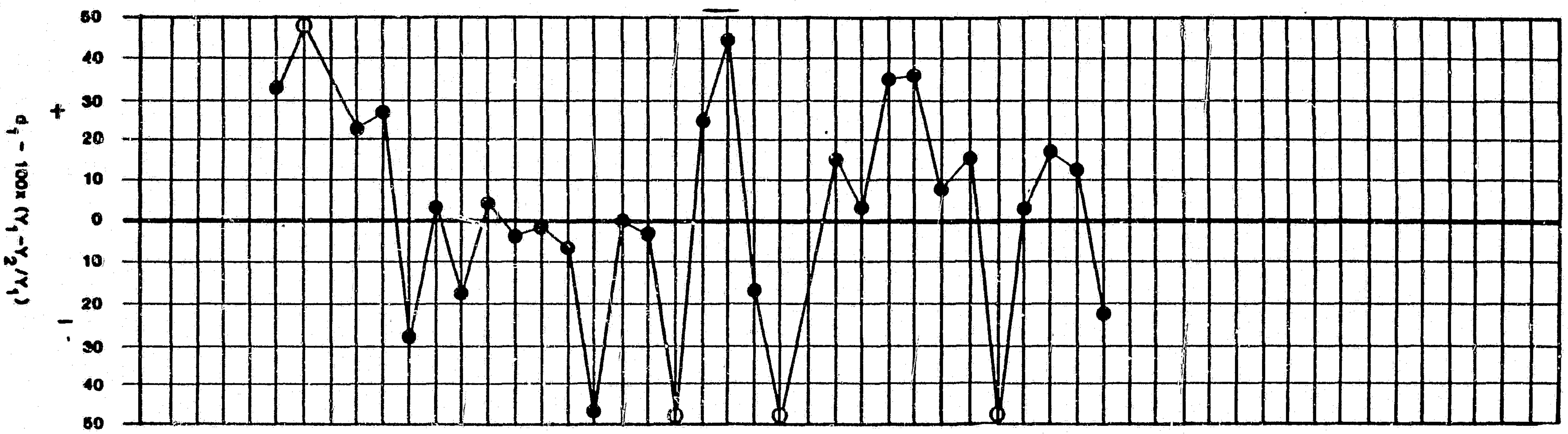
PROJECT NAME: Susitna Hydroelectric Project

MEASUREMENT PERFORMED: Watana Camp TSP Values

MEASUREMENT UNITS: μg/m3

DATE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y_1	-	-	-	2.46	[illegible]	[illegible]	-	[illegible]	[illegible]	1.76	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y_2	-	[illegible]	-	-	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
d_1	-	-	-	-	[illegible]	[illegible]	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-1.0	[illegible]	-46	0	-3.4

DATE	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Y_1	1.80	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-	4.40	[illegible]	[illegible]	[illegible]	[illegible]	1.67	4.11	[illegible]	[illegible]	[illegible]	[illegible]	-
Y_2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
d_1	-67	+25	+48	-17	-71	-	[illegible]	[illegible]	[illegible]	[illegible]	7.7	14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	-



OPEN DOT (O) INDICATES POINT BEYOND THE GRAPH

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Filter No.	First Weighing (grams)	Second Weighing (grams)	Difference (mg)	Remarks
5366-10	3.5319	3.5319	0	Unexposed Filters
5366-20	3.5271	3.5268	-0.30	Unexposed Filters
5366-28	3.4427	3.4422	-0.50	Unexposed Filters
5366-38	3.4500	3.4498	-0.20	Unexposed Filters
5366-55	3.5187	3.5179	-0.80	Unexposed Filters
5366-66	3.4803	3.4799	-0.40	Unexposed Filters
5366-32	3.4731	3.4730	-0.1	Exposed Filters
5366-46	3.5015	3.5012	-0.3	Exposed Filters
5366-48	3.5089	3.5099	+1.0	Exposed Filters
5366-82	3.4859	3.4862	+0.3	Exposed Filters
5366-66	3.4842	3.4841	-0.1	Exposed Filters
5366-65	3.5057	3.5054	-0.3	Exposed Filters
5366-83	3.3977	3.3951	-2.6	Unexposed Filter
5366-93	3.4077	3.4069	-0.8	Unexposed Filter

Figure VI-4

LABORATORY QUALITY ASSURANCE LOG

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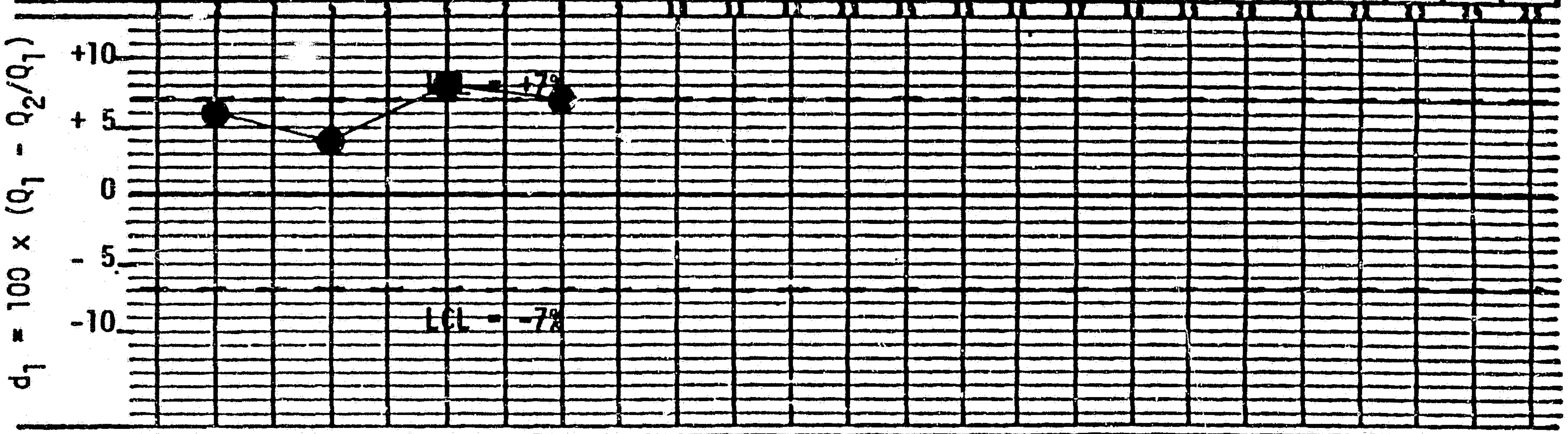
SUSITNA JOINT VENTURE

Figure VI-5

$\bar{X}$ AND R CHART FOR HI-VOL FLOWRATE

PROJECT NAME Susitna Hydroelectric Proj. **MEASUREMENT PERFORMED** Hi Vol Flowrate Audits **MEASUREMENT UNITS** SCFM

DATE		7/2	7/14	7/31	8/20
MEASUREMENT Q_1	1				
	2	52	51.0	53.0	53
	3				
MEASUREMENT Q_2	1				
	2	49.0	48.8	48.8	49.3
	3				
d_1		5.8	4.3	7.9	7.0



Comments (Correct Action, etc.)

HARZA-EBASCO
SUSITNA JOINT VENTURE

VII. SUMMARY AND CONCLUSIONS

A. SOURCES OF AIR POLLUTION

Because the Watana site is remote and undeveloped, no traditional sources of air pollution exist in the vicinity. The nearest major source of particulate matter is the coal-fired power plant at Healy, which is too far removed by both distance and topographic features to affect the site. This conclusion was confirmed by the extremely low concentrations of total suspended particulate matter (TSP) measured during the summer of 1984. It was also apparent from the low TSP concentrations that the site is not subject to episodes of wind-blown fugitive dust. Based on standard meteorological parameters, the monitoring period included the months most prone to wind-blown dust.

B. METEOROLOGY

Meteorological data were available from a three-meter tower near the Watana field camp. These data included precipitation, wind speed and direction, and several other parameters.

C. AMBIENT MONITORING

Air quality monitoring for suspended particulates was conducted from late May into September, 1984. Results show that background concentrations of TSP are very low and will not present a problem in assessing impacts of facility construction on local air quality. The measured particulate concentrations at the three Hi-Vols ranged from 0.99 to 12.8 (ug/m^3) for a 24-hour average. The highest geometric mean value for the three Hi-Vols was 4.57 ug/m^3.

VIII. REFERENCES

Alaska Administrative Code. 1983. Title 18, Environmental Conservation, Chapter 50. Alaska Air Quality Control Regulations. Revisions through October 30, 1983.

Alaska Power Authority. 1984. Processed Climatic Data, October 1982 - September 1983, Volume IV, Watana Station, March 1984.

Alaska Power Authority. 1983. Processed Climatic Data, October 1981 - September 1982, Volume IV, Watana Station, March 1983.

Alaska Power Authority. 1982. Processed Climatic Data, October 1980 - September 1981, Volume IV, Watana Station, March 1982.

Alaska Power Authority. 1981. Processed Climatic Data, October 1979 - September 1980, Volume IV, Watana Station, March 1981.

Jutze, G.A. 1978. Factors Influencing Emissions from Fugitive Dust Sources. In: Symposium on Fugitive Emissions and Control. EPA, Hartford, CT. May 1976.

R&M Consultants. 1984. Personal Communication.

United States Code of Federal Regulations. 1983. Title 40, Protection of the Environment.

United States Environmental Protection Agency. 1980. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD) (EPA-450/4-80-012). Research Triangle Park, NC. November 1980.

United States Environmental Protection Agency. 1977a. Selecting Sites for Monitoring Total Suspended Particulates (EPA-450/3-77-018). Research Triangle Park, NC. Revised December 1977.

United States Environmental Protection Agency. 1977b. Quality Assurance Handbook for Air Pollution Measurement Systems, Volume II, Ambient Air Specific Methods (EPA-600/4-77-027a). Research Triangle Park, NC. May 1977.

United States Environmental Protection Agency. 1975. Air Quality Analysis Workshop, Volume I: Manual (EPA-450/3-75-080-a). Research Triangle Park, NC. November 1975.