MONITORING PESTICIDE USE IN THE WILDER RANCH STATE PARK, SANTA CRUZ COUNTY, 1982

ENVIRONMENTAL HAZARDS ASSESSMENT PROGRAM

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MONITORING PESTICIDE USE IN THE WILDER RANCH STATE PARK, SANTA CRUZ COUNTY, 1982

by

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ABSTRACT

Wilder Ranch State Park is a recent addition to the State Park system, and is located just north of Santa Cruz. Presently, many of the designated recreational high-use areas are adjacent to prime agricultural lands, which historically have been used for Brussels sprout production. Cultural practices for this crop include the use of several highly toxic pesticides. The objective of the study was to characterize pesticide residues in the park.

Pesticide use patterns compiled between 1979 and 1982 showed that more than 90% of the total reported pesticides were applied as fumigants, during May. Most of the rest were insecticides applied during the growing season, June through September. The majority of the sampling was conducted during actual spray applications of insecticides. The results showed only small increases above background levels of pesticide residue in soil, and no detectable residue in water. As expected, air concentrations were highest at locations adjacent to sprayed fields (maximum of 5.6 micrograms diazinon per cubic meter air). Pesticide residues were still detectable in air several hundred meters downwind during applications. Several background soil samples collected during the winter, off-season period contained DDT, and its breakdown products DDE, and DDD (maximum of 6.7 ppm DDT). Some of these samples containing DDT were collected from areas not currently under cultivation.

Based on these residue measurements there is no indication of a potential health hazard to individuals who might be visiting the area.

ACKNOWLEDGMENTS

We are indebted to all of the Brussels sprout growers at Wilder Ranch who cooperated with EHAP personnel conducting this study.

Thanks are extended to Jerry Kato whose help aided in the scheduling of application monitoring.

Thanks also to Rick Bergman, and the rest of the staff at the Santa Cruz Agricultural Commissioner's Office for their assistance.

Special thanks to Peter Gaidula, and the Department of Parks and Recreation for their guidance, patience, and financial support.

DISCLAIMER

The mention of commercial products, their source or their use in connection with material reported herein is not to be construed as either an actual or implied endorsement of such product.

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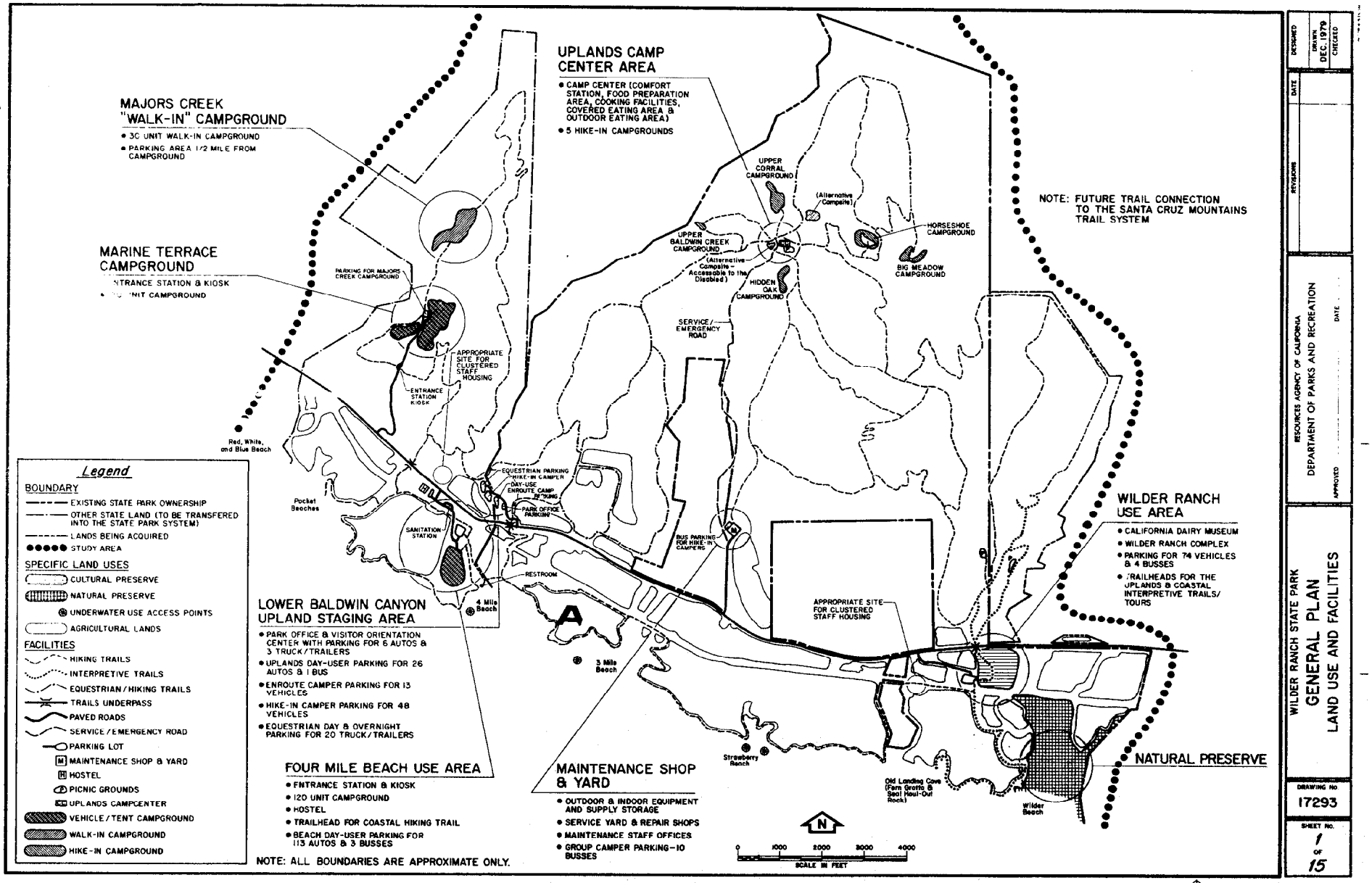
INTRODUCTION

Wilder Ranch State Park is a recent addition to the State Park System. Current plans for the park include the preservation of existing cultural and natural resources, and to make them more available for public use. Presently, many of the proposed high-use areas are adjacent to prime agricultural lands, which historically have been used for Brussels sprout production (Figure 1). Cultural practices for this crop includes use of several highly toxic pesticides. The Environmental Hazards Assessment Program (EHAP) of the California Department of Food and Agriculture (CDFA), under contract to the Department of Parks and Recreation, initiated a study in January 1981 to characterize pesticide residues in the park.

The specific objectives of the study were to determine pesticide concentrations in and near agricultural lands, and in proposed high use areas. Most of the monitoring occurred in specific Brussels sprout fields. Sampling sites were selected surrounding each of these fields and monitored before, during, and after pesticide applications. Monitoring also took place earlier in the year to determine background levels during the off-season, and at arbitrary times during the growing season to determine ambient levels. Details of the monitoring plan are presented in Appendix A.

The results of this study will provide the Department of Parks and Recreation with information upon which to base decisions as to what measures might be necessary to reduce

Figure 1. General Plan and Land Use for Wilder Ranch State Park.



pesticide hazards to recreationists and environmental resources.

STUDY LOCATIONS

Wilder Ranch State Park is located along Highway 1, just north of Santa Cruz. The park contains a total of 4500 acres with approximately 900 acres in Brussels sprouts production. Most of the Brussels sprout fields are located on the south side of Highway 1. The general plan and land use for the park is shown in Figure 1.

Most of the sampling for this study was done near agricultural fields in three areas of the park; Four-mile Beach, Wilder Beach, and the main complex. These areas were chosen because of their proximity to proposed trails, campgrounds, and natural preserve areas. Descriptions of individual sampling sites are given in Appendix B. All three areas were adjacent to Brussels sprout fields which are located on bluffs 15-20 meters above them. The soil in these areas is only about one foot deep, beneath this is a hard, rocky layer.

STUDY TIMETABLE

This study was initiated in February 1981 with the collection of winter background samples. A pesticide air drift study at Four-mile Beach was conducted in June 1981. However, starting in July, all EHAP resources were committed to the Medfly Eradication Project, forcing a postponement of this project until the following year.

Background samples were collected again in March 1982. Application monitoring was then conducted during the highest pesticide use period, June through August.

MATERIALS AND METHODS

1. Pesticide Use Patterns

Pesticide use patterns were obtained by tabulating Pesticide Use Reports filed between 1979 and 1982. Pesticide Use Reports contain the dates, locations, pesticides used, and the number of acres treated for each application of a highly hazardous (category I) pesticide. The data for all applications in the Wilder Ranch area was entered on a computer from the reports submitted to the County Agricultural Commissioner. Only restricted pesticides require use reports, so most unrestricted pesticide applications were not reported, and are not included in this report.

2. Pesticide Application Methods

All pesticides were applied using ground spray rigs. Configuration of the spray rigs (nozzle type, boom pressure, etc.) was governed by the compound being sprayed and the application rate. Applications took place in the early morning hours to avoid high winds that occurred later in the day. The timing of pesticide applications was closely tied to the irrigation schedule for the sprout fields. Pesticides were sprayed after an irrigated field dried out, usually two to three days after irrigation. Since the fields were irrigated in

sections, the field was treated with pesticides in sections. These practices required 10-14 days to spray an entire field, and some portion of a field was treated approximately every other day.

3. Sample Security

Each sample collected was accompanied by a chain of custody record (Appendix C) documenting the sequence of transfers from sample origin to chemical analysis. All individuals who handled the sample were required to sign the form acknowledging receipt of the sample. The chain of custody was also used to record sampling information such as sample type, location, and time of collection. Lab results were also recorded on this form.

4. Chemical Analysis

Laboratory methods varied with the media being analyzed and the compounds being analyzed for. All samples were either analyzed for specific pesticides or screened for pesticides belonging to one of the major insecticide groups: organophosphates, chlorinated hydrocarbons, or carbamates. With the screening procedure instrumentation was adjusted to detect many pesticides within a major group. Identification of individual pesticides was determined by comparison with known pesticides and/or mass spectrometry. Although the screening procedure was able to detect pesticides for which there was no documented applications, it was not as sensitive as the procedures used for specific pesticides.

Resin from air samples was placed in jars and extracted once with solvent and/or placed in a column and eluted with solvent. The solvents were a 50/50 mixture of hexane/acetone when analyzed for organophosphates and carbamates, or acetone when analyzed for chlorinated hydrocarbons. The extracts were evaporated to dryness on a rotary evaporator; and then brought to final volume with ethyl acetate for organophosphates and carbamates, or hexane for chlorinated hydrocarbons.

Soil samples were analyzed by taking a 100g aliquot and extracting one to three times with solvent, ethyl acetate for organophosphates and carbamates or acetonitrile for chlorinated hydrocarbons. The samples were then filtered and evaporated to dryness with a rotary evaporator. All extracts were brought to final volume with ethyl acetate.

Water samples were extracted three times with dichloromethane, and the extracts passed through a column of anhydrous sodium sulfate. The extracts were then evaporated to dryness with a rotary evaporator and; brought to final volume with ethyl acetate for organophosphates and carbamates, or hexane for chlorinated hydrocarbons.

Final extracts were analyzed by gas liquid chromatography. Instrumentation used for organophosphates and carbamates was either a Varian 3700 with flame photometric and thermionic specific detectors or a Perkin-Elmer Series II equipped with a nitrogen/phosphorous detector. For chlorinated hydrocarbons a Varian 3700 with a Hall electroconductivity detector was used.

Columns, gas flows, and temperatures varied with the compounds being analyzed for.

5. Air Samples

Most of the air samples were collected on XAD-2 macroreticular resin, which collected pesticides in the gas phase. The resin was contained in glass cartridges and mounted on General Metal Works high volume air samplers (hi-vol). The air samplers were equipped with a Kurz Instruments flow controller calibrated to a collection rate of 25 cubic feet per minute. All samples were replicated by running two hi-vols at the same location, spaced 100 feet apart. Off-season background samples were collected on XAD-2 resin cartridges mounted on low volume air samplers (Gast Model #2531). These air samplers were calibrated with limiting orifices at 20 liters per minute.

Additional background air samples were collected with hi-vols the day before application, followed by a spray sample taken the day of application, and then a post-spray sample collected the day after application. Background and post-spray samples were collected for approximately four hours, and spray samples were collected during the actual application and for one half hour after application.

The air samplers were situated in one of two different locations, depending on the purpose of the sample. Trailside air samplers were placed adjacent to a field and measured the highest concentration that a person would be exposed to. Air samplers

placed along a vector leading away and downwind from a field gave an indication of the amount of drift during applications.

Two, eight hour air samples were collected during the growing season using glass fiber filters instead of resin as the collecting media. The glass fiber filters collected any pesticide that was adsorbed onto particulate matter.

Immediately after collection air samples were placed on dry ice and kept frozen until analysis by the chemistry lab.

6. Soil Samples

Soil samples were collected both before and during the growing season. Soil samples were first collected in the winter, before any applications, to determine the presence of any pesticide residue from applications in previous years. Soil samples taken during the growing season were collected immediately after pesticide applications and analyzed for specific pesticides. Additional samples collected during the growing season were screened for organophosphates, chlorinated hydrocarbons, and carbamates. The majority of the samples were collected along trails adjacent to Brussels sprout fields.

Soil cores one inch in diameter were taken with a JMC soil sampler. Cores were taken at various depths depending on the soil hardness. Replicate samples were collected at each location, each sample consisting of four to six cores. Samples were stored on dry ice in 500 ml amber glass bottles until analysis.

Replicate samples of surface soil were obtained by collecting two 4x5 inch sections of soil approximately one inch deep. Several sites at which core samples were more desirable could not be sampled because the soil was too hard, and surface samples were collected instead. Surface samples were stored in the same manner as cores.

7. Water Samples

Water samples were collected during the winter to determine background residue and during the growing season after pesticide applications were made to fields adjacent to the water bodies.

Replicate water samples were collected from various sites along Wilder and Baldwin creeks, and from the reservoir near Four-mile Beach. Samples were collected in one liter amber glass bottles, and stored on wet ice or refrigerated until analysis.

8. Sediment Samples

Sediment samples were collected during the off-season and growing season from Wilder and Baldwin creeks. These samples were screened for insecticides in the three major groups. Sediment was sampled by scooping out the first inch of bottom sediment at each site. These samples were replicated and collected in 500 ml amber glass bottles. Storage methods were the same ones used for water samples.

9. Tank Samples

Tank samples were taken after the first tank of pesticide had been sprayed,and just before another tank was mixed. The spray booms were allowed to drip pesticide into a 500 ml amber glass bottle. The samples were stored on wet ice in a separate container from the other samples.

RESULTS

1. Pesticide Use Patterns

All of the reported pesticides used on Brussels sprouts were divided into four groups based on acute toxicity, chemical structure, and pattern of use. The first group, OP 1, contains organophosphate insecticides that have a rat oral LD50 of 10 mg/kg or less. The pesticides in all of the other groups have a LD50 of at least 20 mg/kg. The OP 2 group contains organophosphate insecticides that have a rat oral LD50 of greater than 10 mg/kg. The fumigants group contains small chain hydrocarbon fumigants used on Brussels sprouts. The rest of the pesticides were grouped as other, and contain fungicides and non-organophosphate insecticides. The specific pesticides in each group and yearly totals are displayed in Table 1.

There was a distinct pattern to the dates of application for the pesticides (Figures 2-4). Almost all of the fumigants were applied in May, and accounted for more than 90% of the total pesticides applied. Fumigant applications were followed by frequent organophosphate applications between June and September. Eighty five percent of all organophosphates were applied between

Table 1. Amounts of reported pesticides used on Brussels sprouts in the Wilder Ranch study area, 1979-1982.

Group	Pesticide	Trade Name	Weight of Active Ingredient (pounds) 1979	1980	1981	1982
OP 1 (Rat, oral $LD_{50} \leq 10$ mg/Kg)	Azinphosmethyl	Guthion	732	696	725	294
	Demeton	Systox	440	446	830	661
	Disulfoton	Disyston	74	149	361	216
	Methyl Parathion		0	0	2	90
	Mevinphos	Phosdrin/ Castle X-4	1048	1152	2118	790
		Total:	2294	2443	4036	2051
		Percent:	4.0	3.6	6.6	2.4
OP 2 (Rat, oral LD_{50} >10 mg/Kg)	Chlorpyrifos	Lorsban	0	0	64	284
	Diazinon	Diazinon/More-trol	189	138	716	248
	Methamidophos	Monitor	4	0	0	8
	Methyl Demeton	Metasystox	208	232	315	220
	Trichlorfon	Proxal/Dylox	201	194	185	311
		Total:	602	564	1280	1071
		Percent:	1.1	0.8	2.1	1.2
Fumigants	Methyl Bromide	Tricon/Tucon	3194	263	2315	2473
	1,3-D/1,2-D	DD/Telone	50304	63861	52559	80234
		Total:	53498	64124	54874	82707
		Percent:	93.8	94.9	90.3	96.0
Other	Chlorothalonil	Bravo	136	341	417	144
	Endosulfan	Thiodan	3	18	13	5
	Maneb	Maneb/Dithane	145	6	9	26
	Methomyl	Lannate	0	0	78	107
	Toxaphene		338	74	0	0
		Total:	622	439	517	282
		Percent:	1.1	0.6	0.9	0.3

Figure 2. Amounts of reported pesticides applied in the Wilder Ranch area by month.

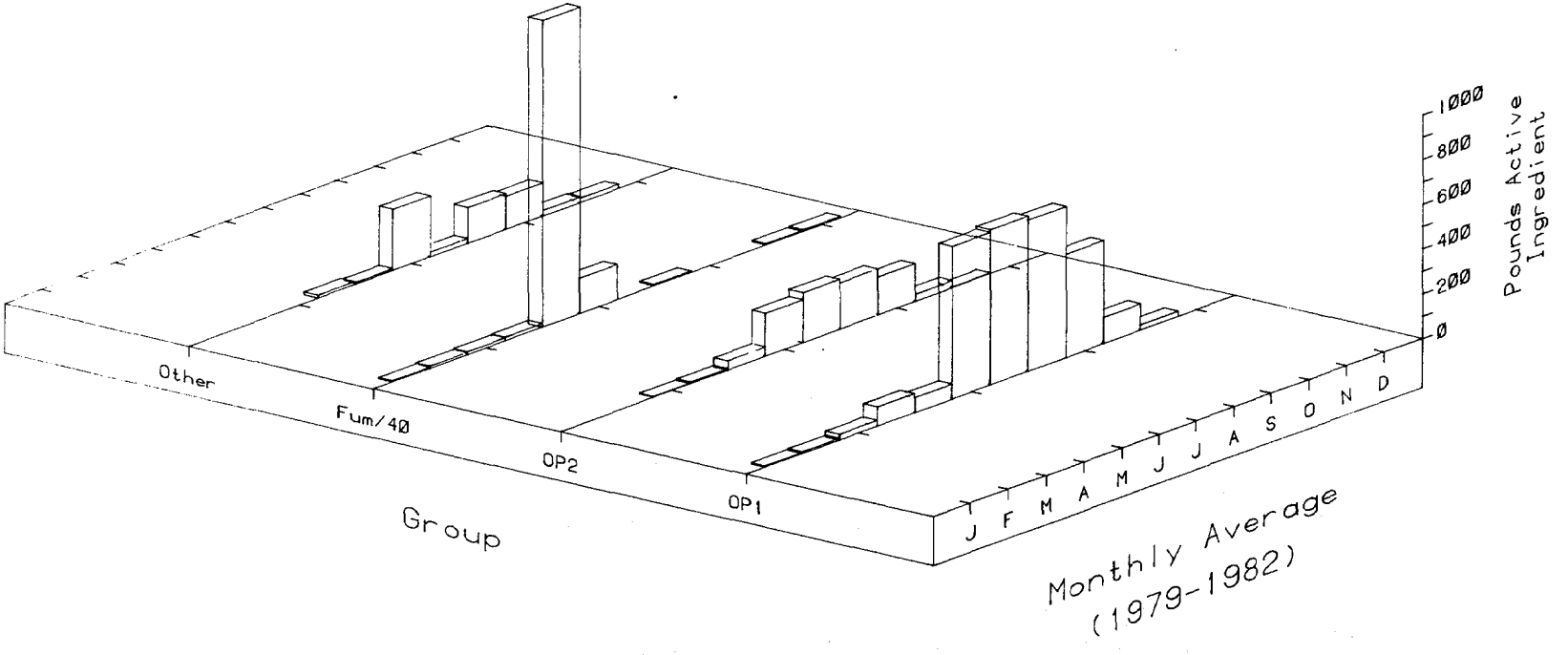


Figure 3. Amounts of pesticides in OP 1 and OP 2 applied in the Wilder Ranch area by month and year.

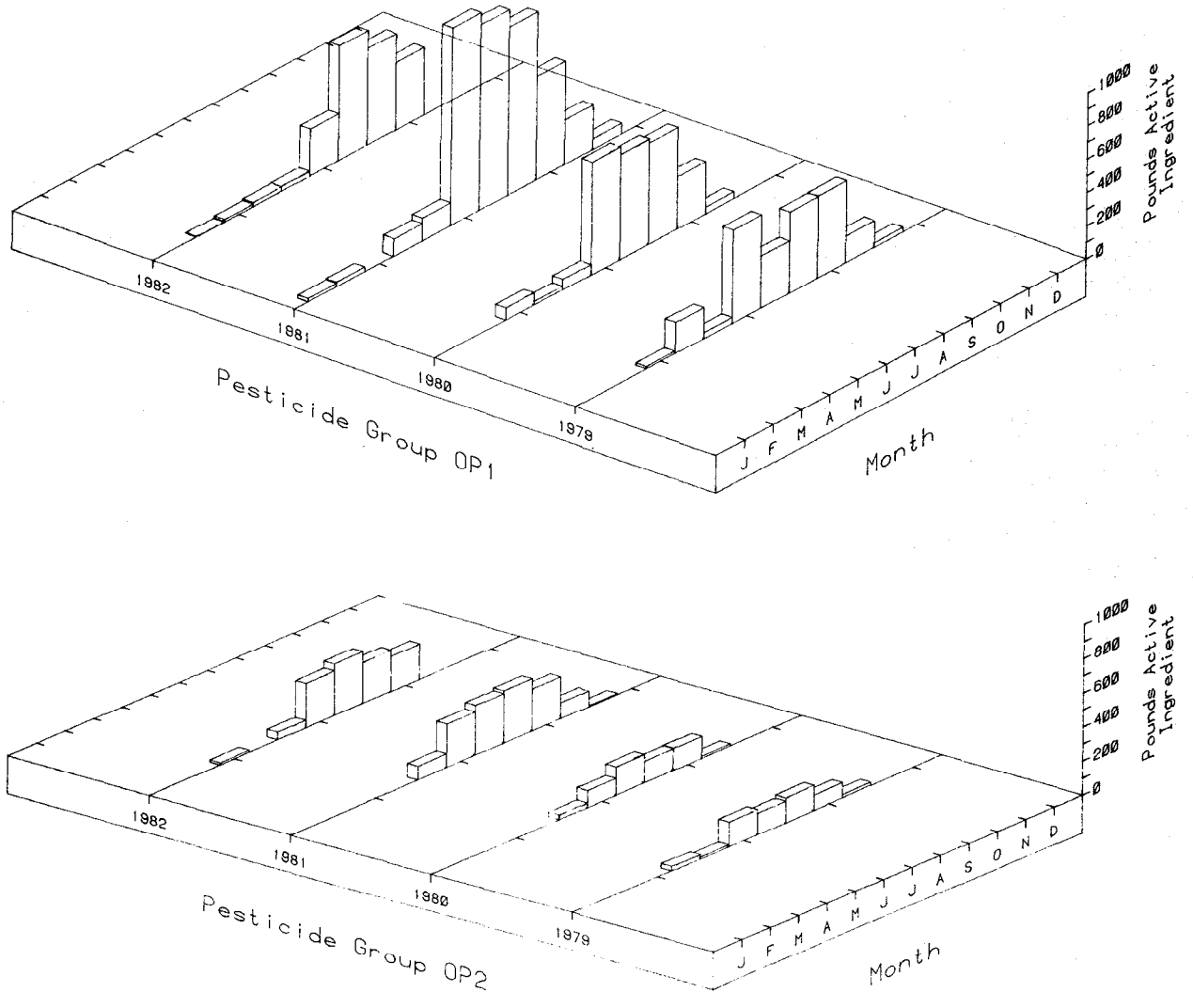
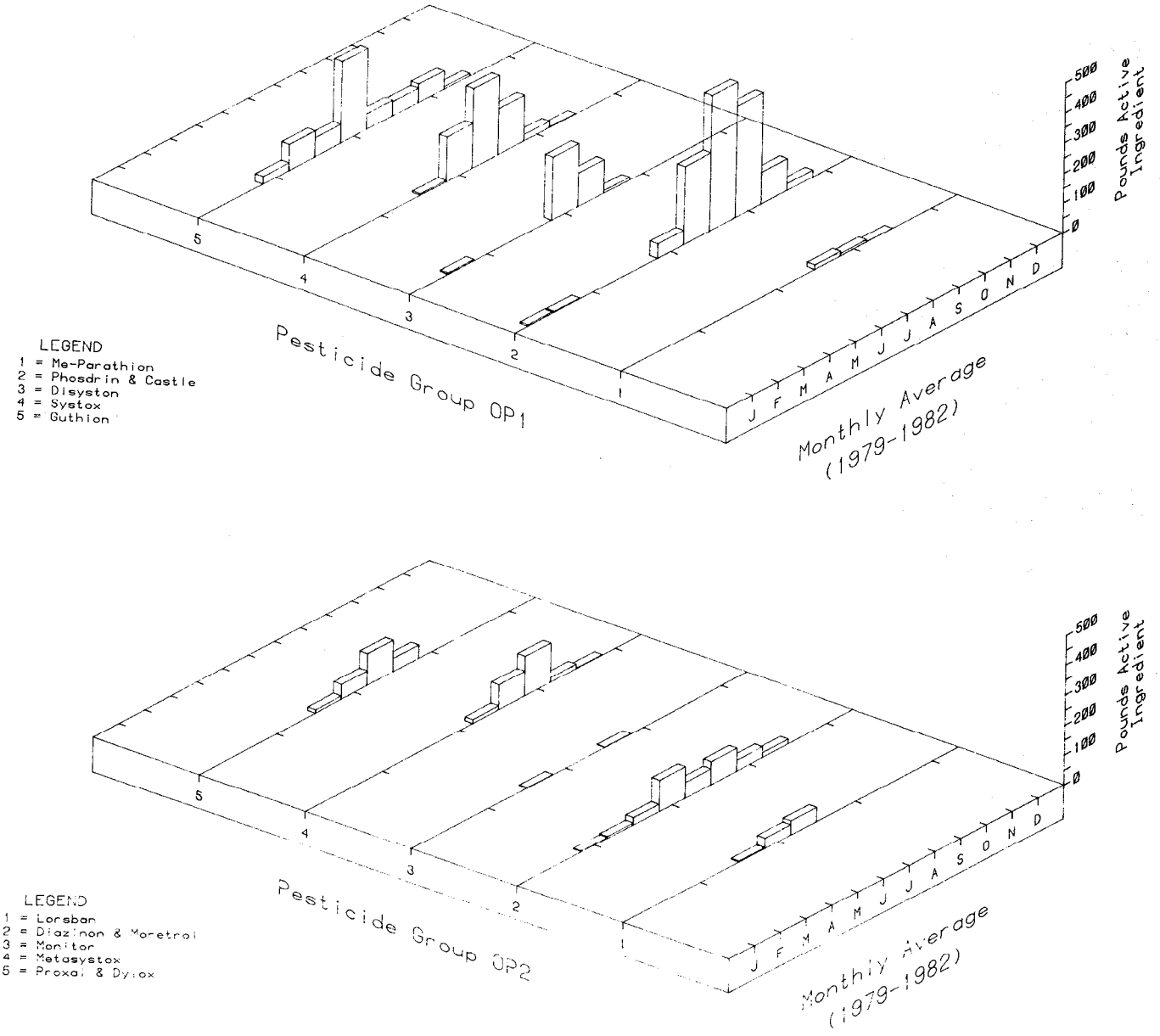


Figure 4. Amounts of individual pesticides (OP 1 and OP 2) applied in the Wilder Ranch area by month.



these months, but account for only about five percent of the total amount of pesticides applied.

1. Wind Patterns

Wind patterns have a large influence on the amount of pesticide drift. This can be seen in the results of the vector studies reported later. The practice of applying pesticides during the early morning hours is supported by the wind data collected from July to September, 1982 (Figures 5-8). The figures display the data by month and time of day. The top row in each figure shows the total miles traveled by a particle during the month in each direction. Comparison of the figures indicates the relative intensity of the wind in each direction. The bottom row in each figure shows the percentage of time the wind was blowing in each direction. Comparison of the figures indicates changes in direction during the day and month. During the early morning hours winds were relatively calm, but later in the day increased greatly. There was no predominant directional pattern early in the day, but winds from the west and southwest dominated the late morning through evening time periods.

2. Air Samples

Winter background samples had no detectable residues. Single, unreplicated samples were collected at three locations for two hours each, and screened for organophosphates and chlorinated hydrocarbons. The detection limit was approximately 0.2 micrograms per cubic meter of air.

Figure 5. Wind characteristics between 0500 and 2059 PDT in the Wilder Ranch area during July, 1982. The top row shows total miles (velocity x time), with each division representing 300 miles. The bottom row shows percent of time at each direction, with each division representing 8 percent.

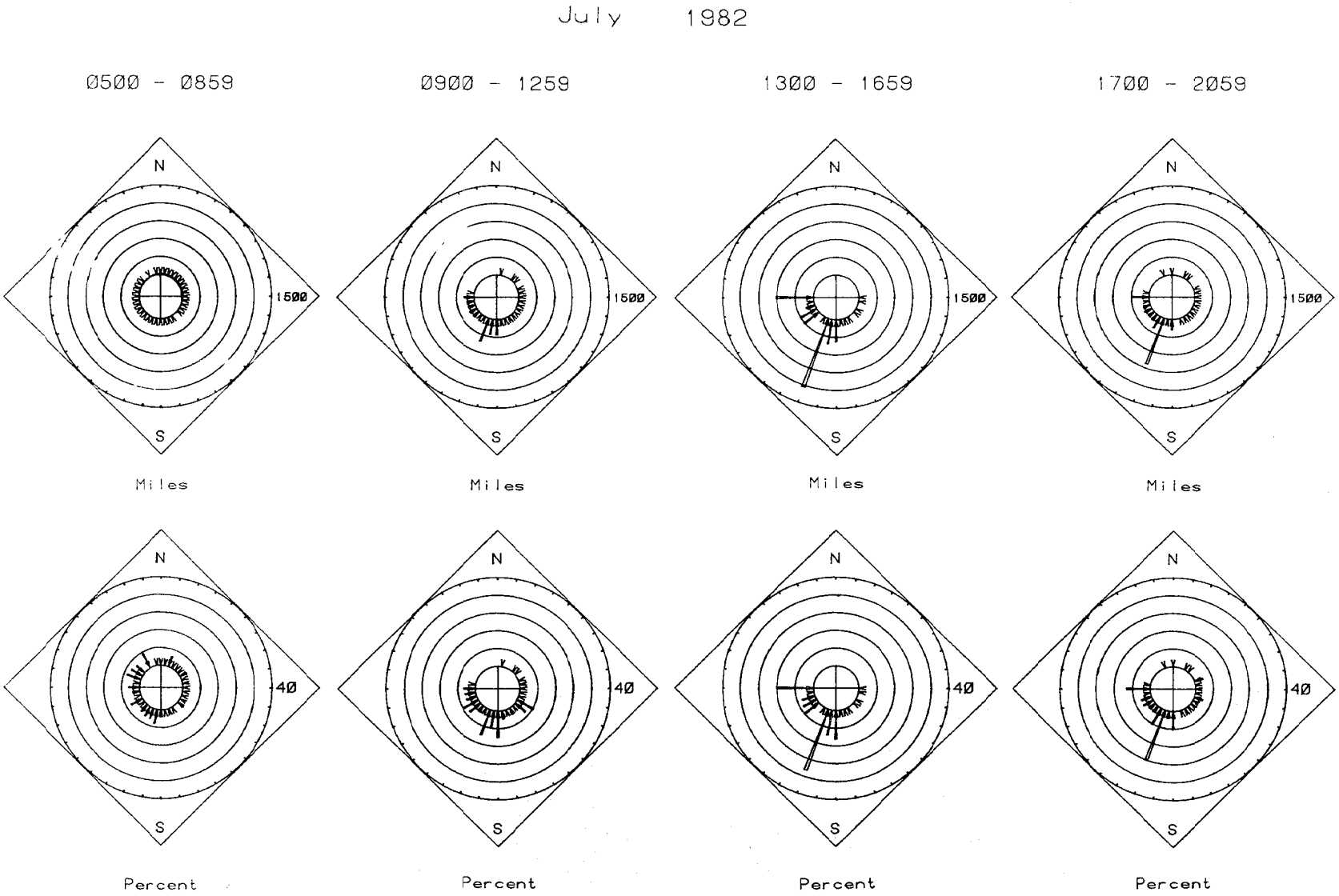


Figure 6. Wind characteristics between 0500 and 2059 PDT in the Wilder Ranch area during August, 1982. The top row shows total miles (velocity x time), with each division representing 300 miles. The bottom row shows percent of time at each direction, with each division representing 8 percent.

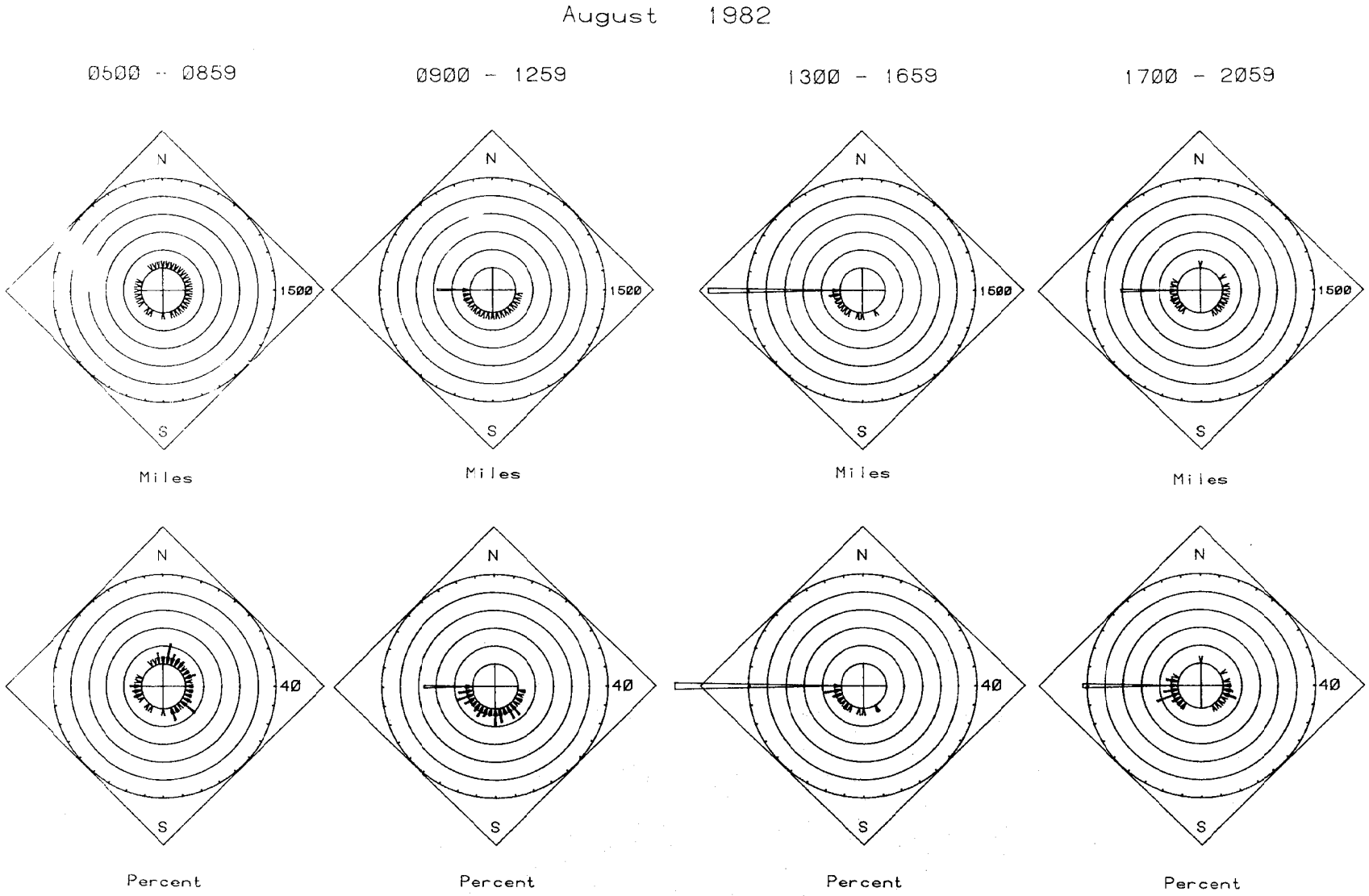


Figure 7. Wind Characteristics between 0500 and 2059 PDT in the Wilder Ranch area during September, 1982. The top row shows total miles (velocity x time), with each division representing 300 miles. The bottom row shows percent of time at each direction, with each division representing 8 percent.

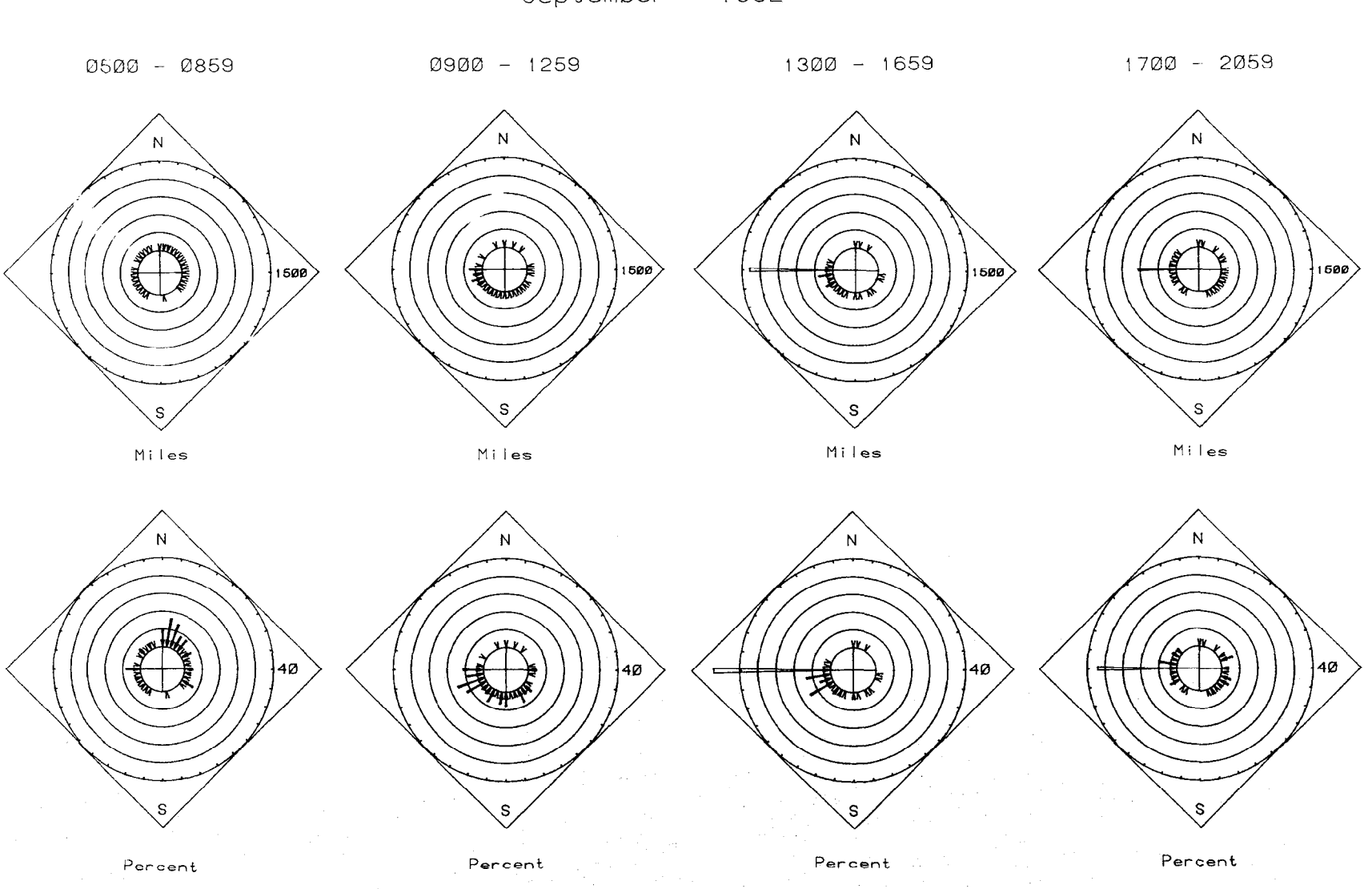
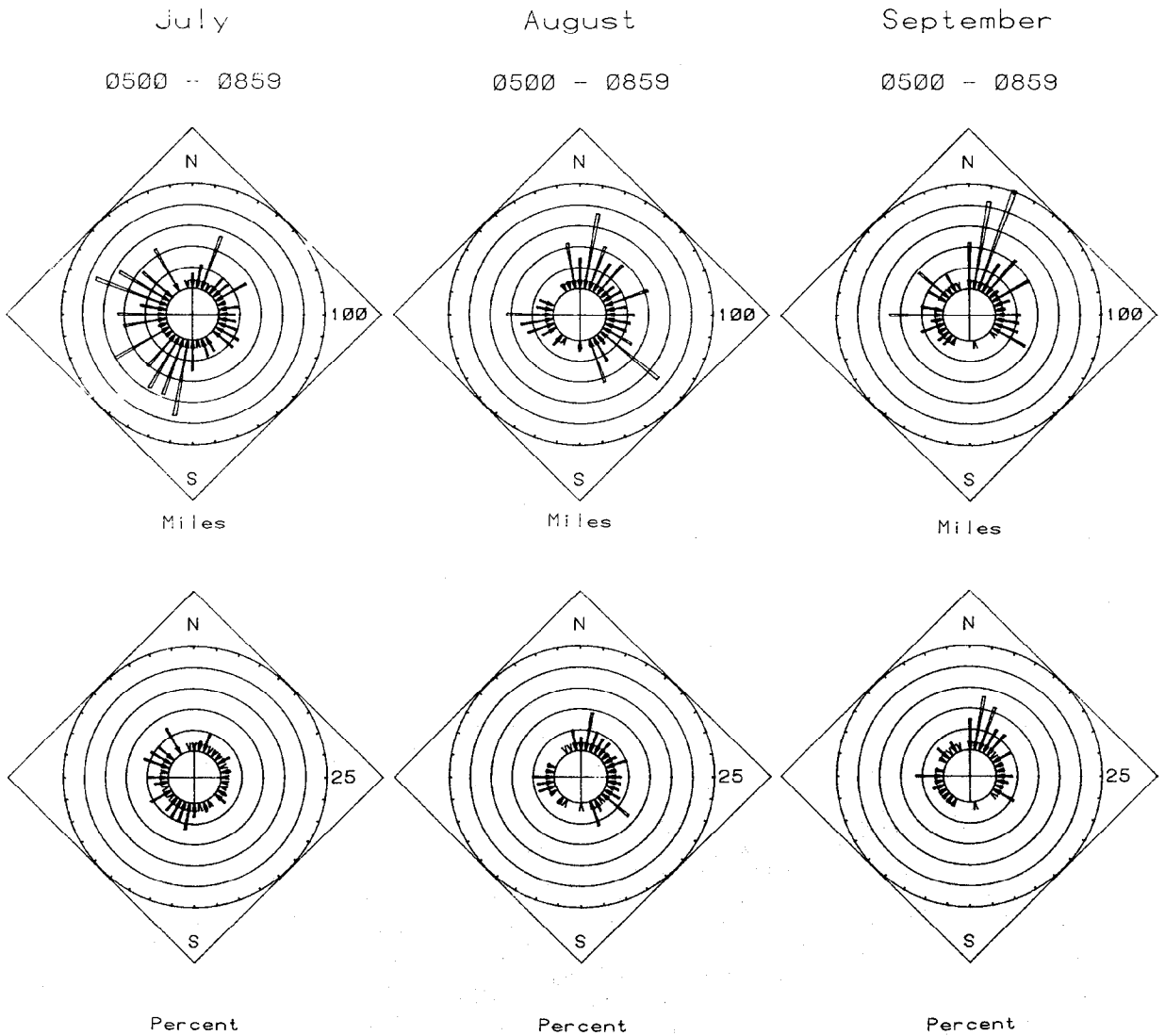


Figure 8. Wind characteristics between 0500 and 0859 PDT in the Wilder Ranch area during July-September, 1982. The top row shows total miles (velocity x time), with each division representing 20 miles. The bottom row shows percent time of each direction, with each division representing 5 percent.



Background air samples were collected again the day before application, and the results are shown in Table 2. The results indicate very low concentrations, and were not taken into account in the calculations of air sample concentrations collected during application. Several different oxidation products of systox were detected in many of the air samples during this study. For any one sample the amounts of all breakdown products were totaled and grouped under Systox Breakdown in the tables. Systox and its breakdown products are discussed later in the report.

Results for the trailside air samples collected during application are shown in Table 3. Although the study was originally designed to monitor an entire field at one time (Figures 9 and 10) the growers' practice of treating portions of a field made this impossible. Therefore, different areas of the field had to be monitored on different days. The concentrations show a wide variation which was probably due to changes in the wind pattern from day to day.

Three vector studies were conducted in 1982, and the results are presented in Table 4. The vector at Four-mile Beach was unusual in that parts of the two fields adjacent to the beach were treated on the same day. For this reason an additional site was established adjacent to the second field (site 33, Figure 9). The results for all three vector studies show the expected pattern, the highest concentration at the position closest to the field and decreasing concentrations with increasing distance from the field. The lack of detectable residues at Wilder Beach was

Table 2. Systox and diazinon background air concentrations.

Location[a/]	Date (1982)	Time Sampled	Concentration ($\mu g/m^3$) Systox	Systox Breakd.	Diazinon
29	6/28	1010-1416	N.D.[b/]	N.D.	0.006
47	7/16	0925-1725	N.D.	0.007	-[c/]

a/ Refer to Figures 9 and 10 for locations.

b/ None Detected. Detection limit approximately 0.001 $\mu g/m^3$.

c/ This pesticide was not applied at this site, and not analyzed for.

Table 3. Pesticide concentrations in trailside air during application.

Location[a]	Date (1982)	Time Sampled	Concentration ($\mu g/m^3$) Systox	Systox Breakd.	Diazinon	Phosdrin	Trichlorfon
24	8/5	0640-1040	2.95	4.65	5.56	-[d]	-
25	8/7	0700-1100	N.D.[b]	0.27	0.18	-	-
26	6/30	0637-1230	N.D.	0.91	0.01	-	-
27	6/30	0633-1220	N.D.	N.D.	0.36	-	-
28[c]	6/30	0633-1208	0.44	4.75	1.39	-	-
29	6/30	0641-1153	N.D.	0.004	0.01	-	-
44	7/26	0650-1030	1.53	1.18		N.D.	N.D.
45	7/17	0630-1055	2.22	1.20	-	-	-
46[c]	7/17	0630-1055	0.07	0.12	-	-	-
47	7/26	0650-1030	0.25	0.36	-	N.D.	N.D.
48	7/30	0610-1015	0.39	4.99	-	-	-
49	8/3	0000-1000	0.11	1.15	0.22	-	-
50	7/30	0615-1015	0.33	0.71	-	-	-
51[c]	7/24	0855-1030	3.41	0.89	-	3.40	N.D.

a/ Refer to Figures 9 and 10 for locations.

b/ None detected. Detection limit approximately 0.001 $\mu g/m^3$.

c/ This location also appears in the vector results.

d/ This pesticide was not applied at this site, and not analyzed for.

Figure 9. Sampling locations in the Four-Mile Beach area. Brussel sprout fields are outlined.

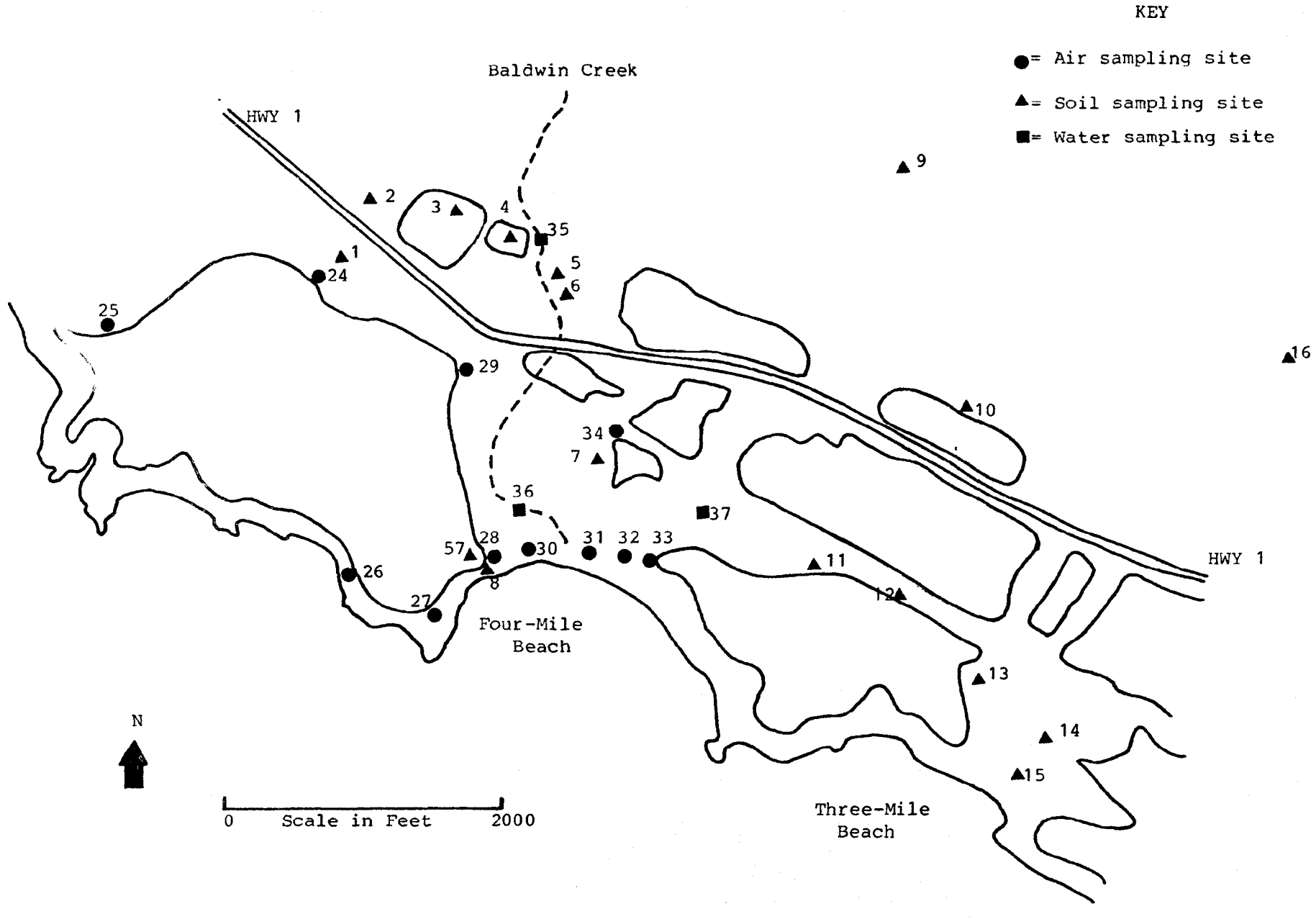


Figure 10. Sampling locations in the Wilder Beach and main complex areas. Brussel sprout fields are outlined.

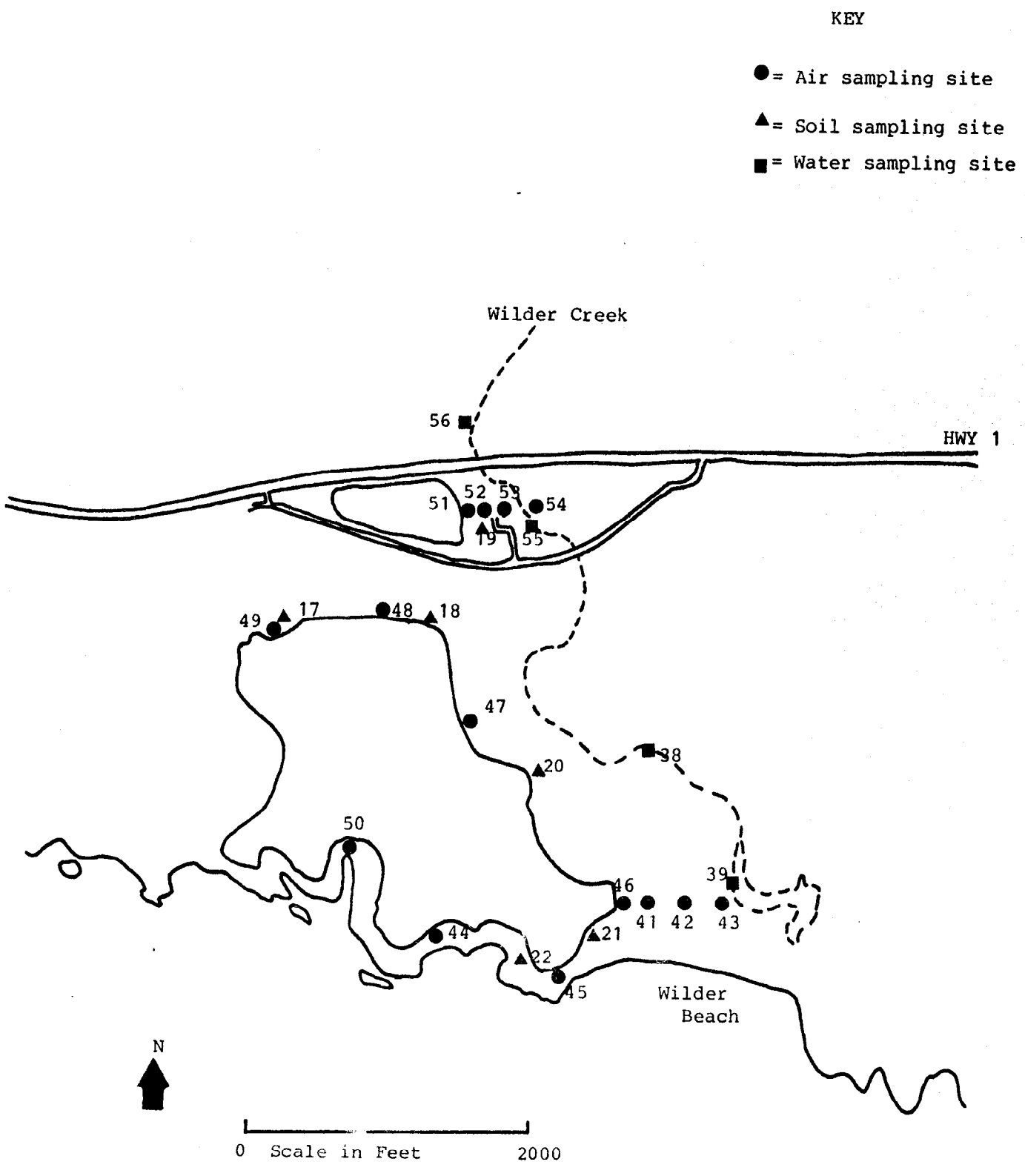


Table 4. Pesticide concentrations in air at various distances from the treatment area during application.

Area	Location[a]	Date (1982)	Time Sampled	Distance from field (m)	Concentration (µg/m^3) Systox	Systox Breakd	Diazinon	Phosdrin	Trichlorfon
Four Mile Beach	28[b,c]	6/30	0633-1208	2	0.440	4.750	1.390	-[d]	-
	30	6/30	0640-1200	80	0.004	0.630	0.320	-	-
	31	6/30	0640-1200	240	N.D.[e]	0.540	0.140	-	-
	32	6/30	0645-1200	412	0.003	0.280	0.090	-	-
	33	6/30	0645-1155	470	0.002	0.350	0.090	-	-
Wilder Beach	46[c]	7/17	0630-1055	2	0.070	0.120	-	-	-
	41	7/17	0630-0955	30	N.D.	N.D.	-	-	-
	42	7/17	0630-0955	150	N.D.	N.D.	-	-	-
	43	7/17	0720-0955	270	N.D.	N.D.	-	-	-
Main Complex	51[c]	7/24	0855-1030	2	3.410	0.890	-	3.400	N.D.
	52	7/24	0855-1030	35	1.640	0.830	-	1.660	N.D.
	53	7/24	0855-1030	140	0.710	0.380	-	0.290	N.D.
	54[b]	7/24	0855-1030	262	0.240	0.220	-	0.160	N.D.

a/ Refer to Figures 9 and 10 for locations.
b/ Values for this location are results of a single sample.
c/ This location also appears in the trailside results.
d/ This pesticide was not applied at this site, and not analyzed for.
e/ None Detected. Detection limit approximately 0.001 µg/m^3.

probably due to the sudden shift in wind direction during application. The wind speed and direction during the applications are shown in Figures 11-13. The results and other relevant information are summarized in Figures 14-16.

Pesticide concentrations in air on the day after treatment are presented in Table 5. These concentrations were very low, and in most cases below the detection limit.

The particulate air samples showed no detectable residues. However, the air samplers were not able to maintain a constant flow and the actual amount of air sampled could not be determined.

3. Soil Samples

Results of the winter (off-season) soil sampling are presented in Tables 6 and 7. These samples were screened for the three major insecticide groups, chlorinated hydrocarbons, organophosphates, and carbamates. The results show that many locations were contaminated with DDT, and its breakdown products DDE, and DDD. The contaminated locations were widespread indicating that most of the study area may already have been contaminated, including areas not currently being used for agriculture. The sites where telone was found correspond to locations where it was applied just three days before sampling, so the residues detected were not due to the previous year's application. Diazinon was also found at several locations, primarily in the Four-mile Beach area. However, this may not be

Figure 11. Wind speed and direction during the Four-Mile Beach vector study.

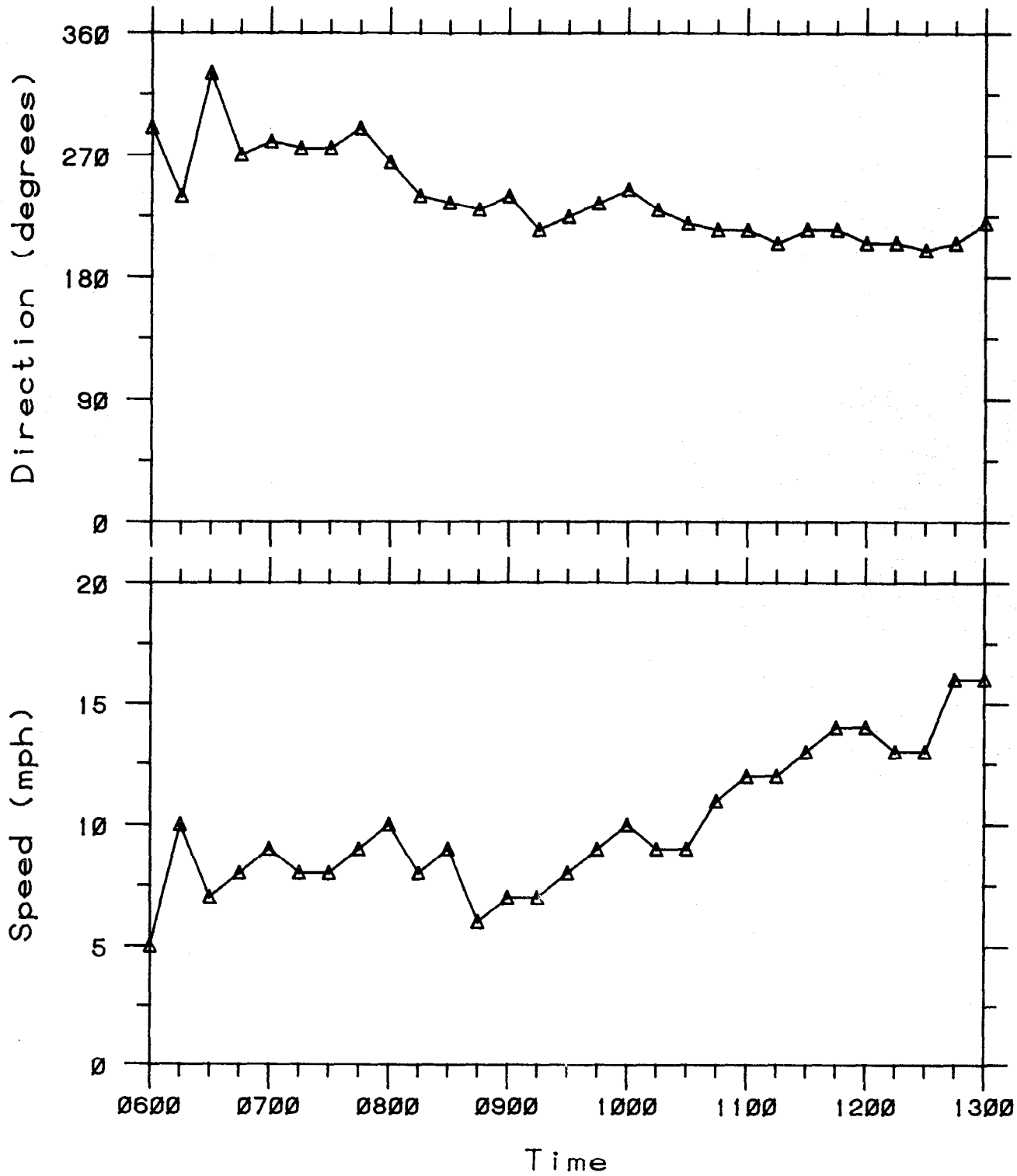


Figure 12. Wind speed and direction during the Wilder Beach vector study.

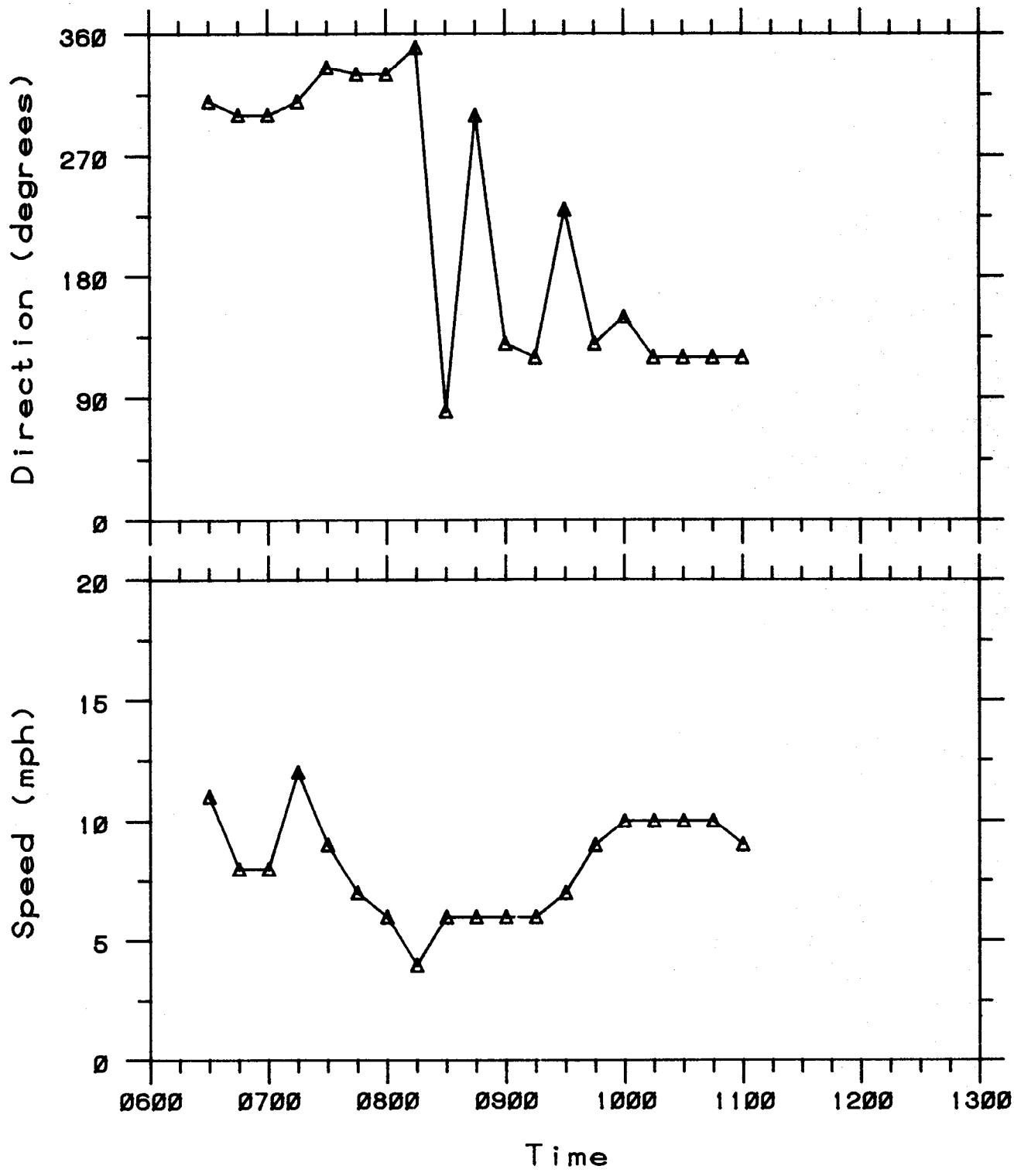


Figure 13. Wind speed and direction during the Main Complex vectory study.

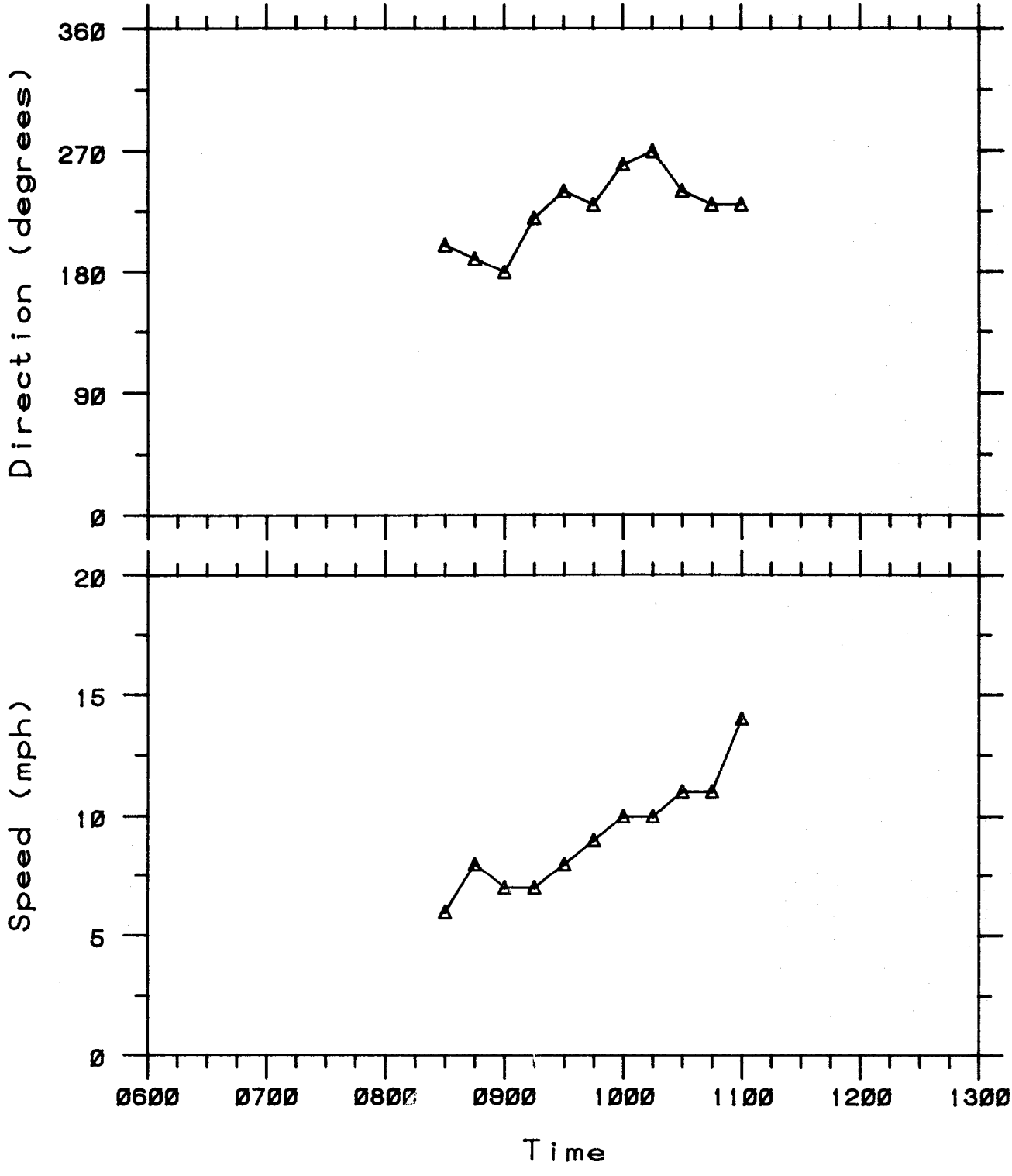
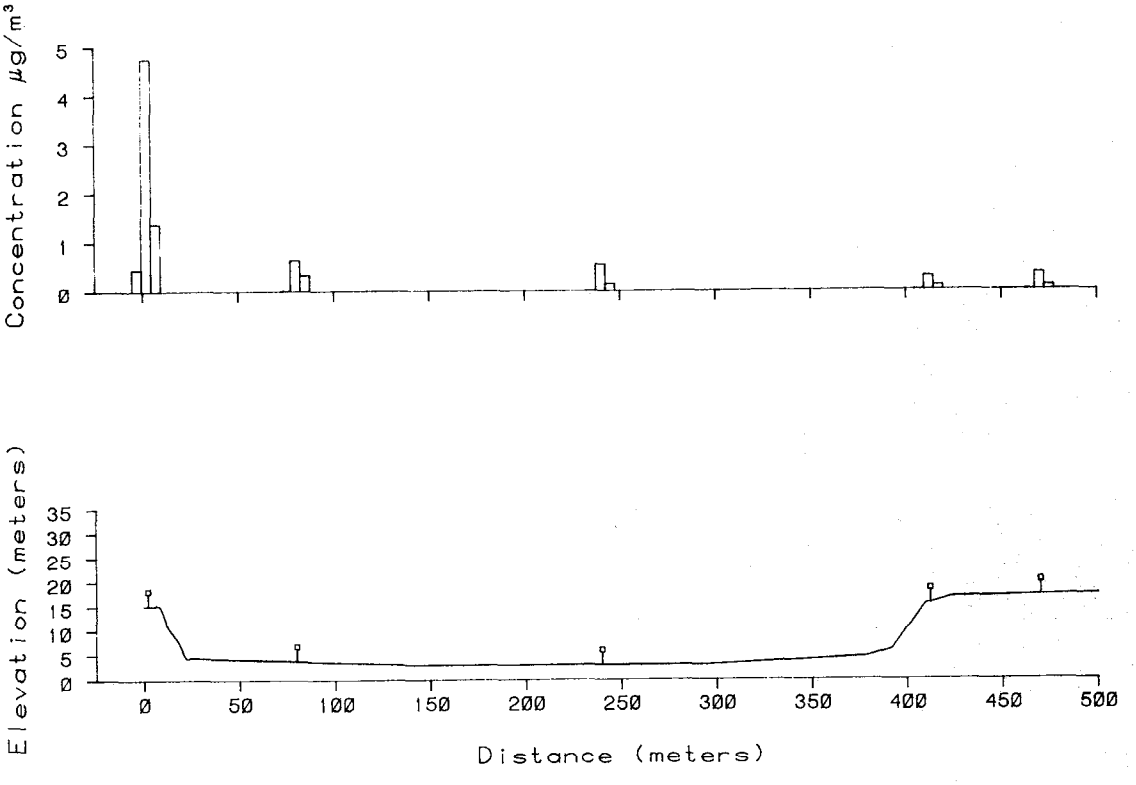


Figure 14. Summary of the air vector sampling at Four-Mile Beach. Top Figure shows the concentration of systox, systox breakdown, and diazinon. Middle figure shows the elevation at each Hi-Vol site. Bottom figure shows the locations of each Hi-Vol (O). Diamond figure shows the wind direction and percent of time at each direction during the sampling period.



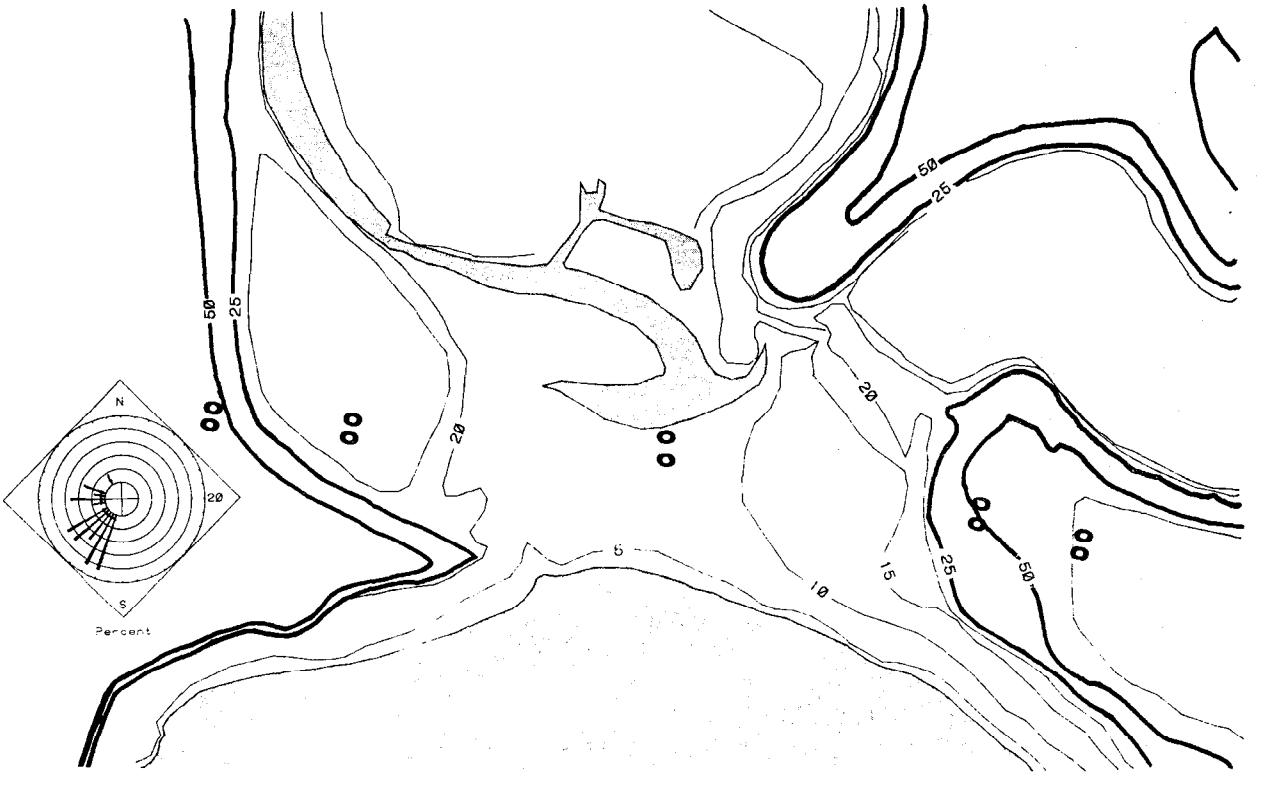
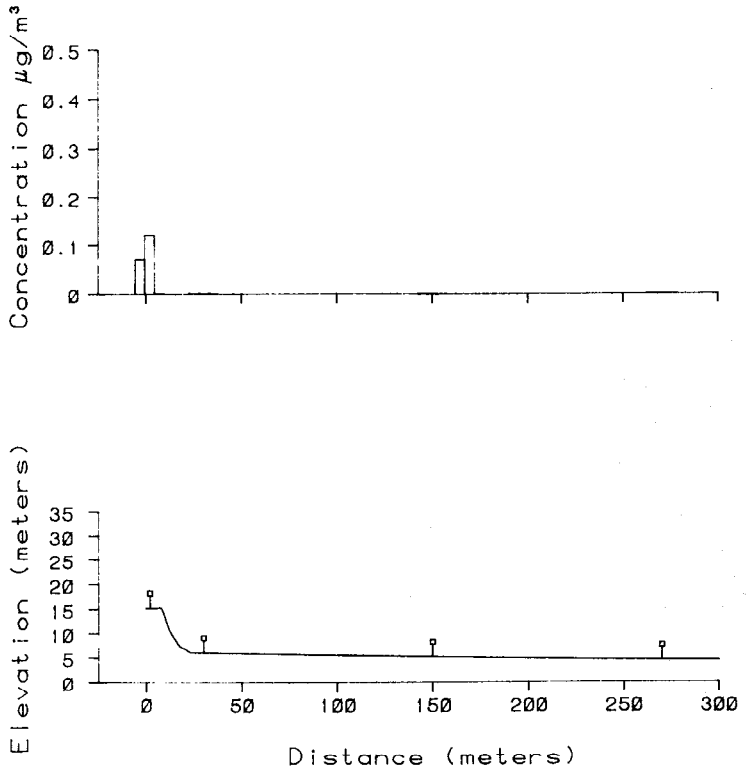


Figure 15. Summary of the air vector sampling at Wilder Beach. Top figure shows the concentration of systox breakdown. Middle figure shows the elevation at each Hi-Vol site(O). Bottom figure shows the locations of each Hi-Vol. Diamond figure shows the wind direction and percent of time at each direction during the sampling period.



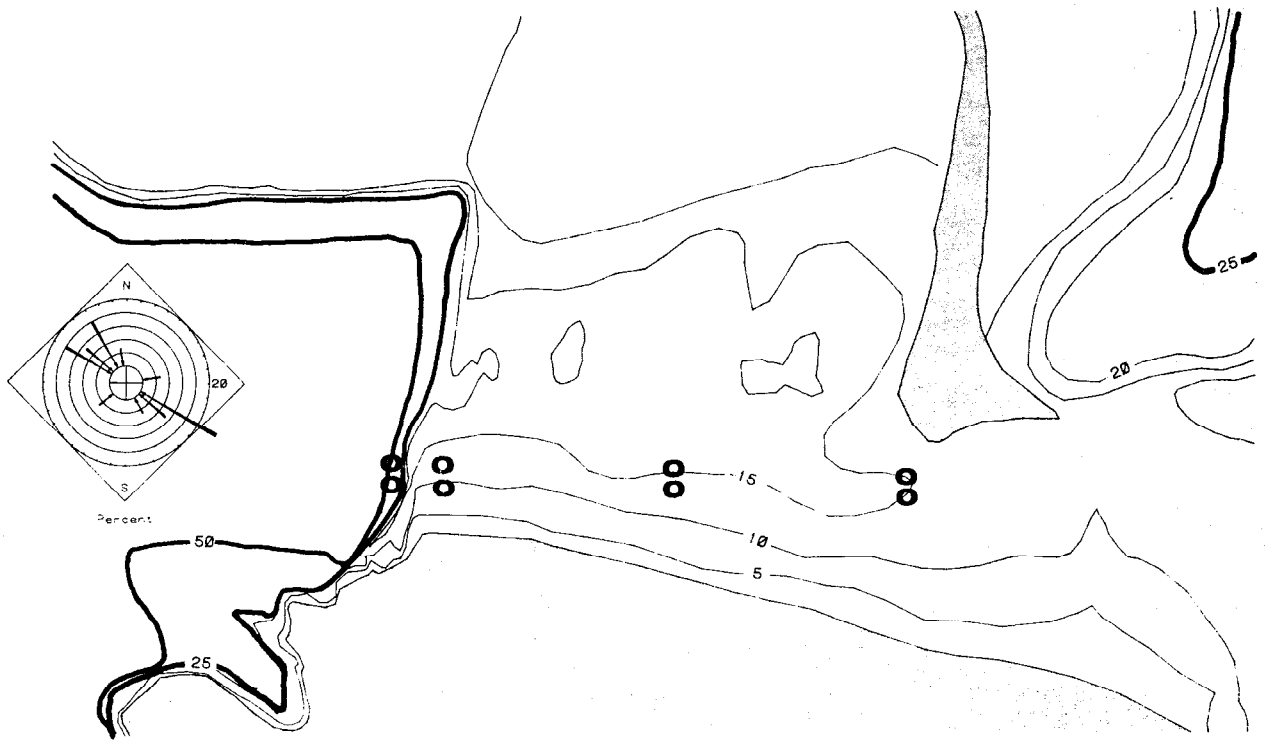
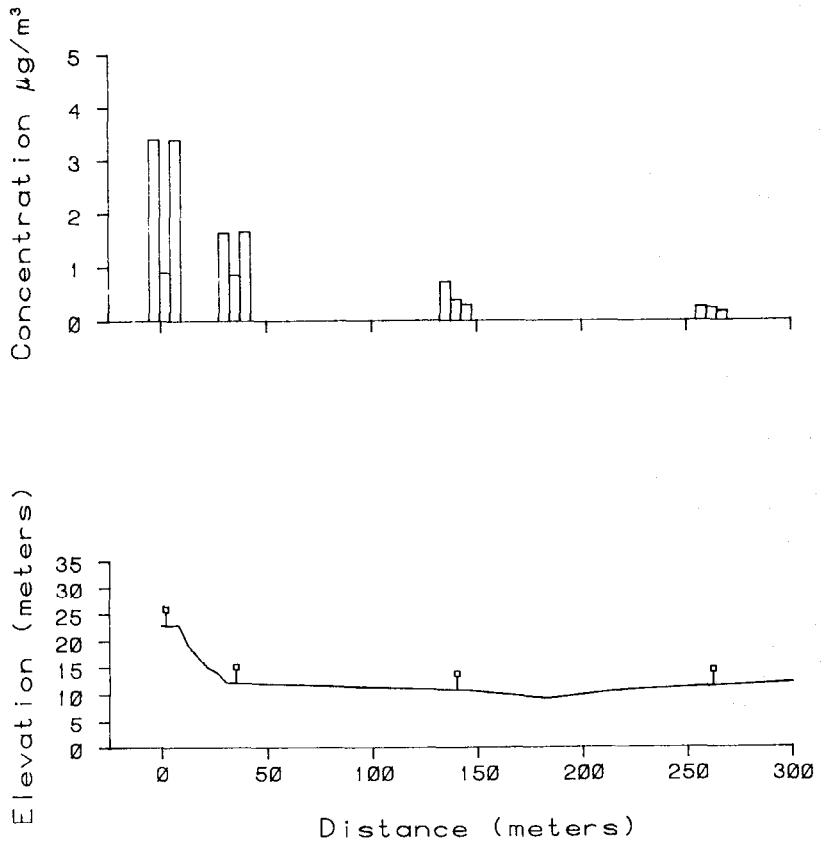


Figure 16. Summary of the air vector sampling at the Main Complex. Top figure shows the concentration of systox, systox breakdown, and diazinon. Middle figure shows the elevation at each Hi-Vol. Bottom figure shows the locations of each Hi-Vol (O). Diamond figure shows the wind direction and percent of time at each direction during the sampling period.



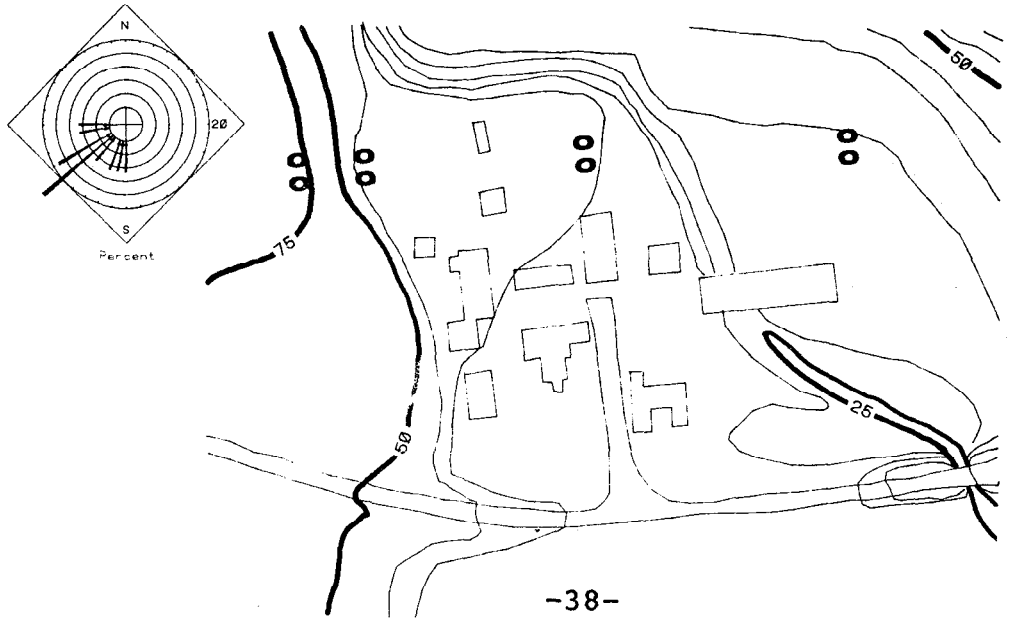


Table 5. Pesticide concentrations in air after treatment.

Location[a/]	Date (1982)	Time Sampled	Pesticide (µg/m^3) Syxtox	Systox Breakd	Diazinon	Phosdrin	Trichlorfon
Trailside							
24	8/6	0820-1220	N.D.[b/]	0.08	0.38	-[c/]	-
25	8/8	0800-1200	N.D.	N.D.	0.20	-	-
26	7/1	0825-1240	N.D.	N.D.	N.D.	-	-
27	7/1	0825-1240	N.D.	N.D.	0.02	-	-
28	7/1	0825-1240	N.D.	0.03	0.16	-	-
29	7/1	0825-1240	N.D.	N.D.	0.01	-	-
44	7/27	0900-1230	N.D.	N.D.	-	N.D.	N.D.
45	7/18	0800-1130	N.D.	N.D.	-	-	-
46	7/18	0749-1115	N.D.	N.D.	-	-	-
47	7/27	0845-1215	N.D.	N.D.	-	N.D.	N.D.
48	7/31	0730-1130	N.D.	N.D.	-	-	-
49	8/4	0745-1145	0.003	0.26	0.02	-	-
50	7/31	0750-1150	N.D.	N.D.	-	-	-
Vector							
31	7/1	0855-1310	N.D.	N.D.	0.008	-	-
41	7/18	0814-1145	N.D.	N.D.	N.D.	-	-
52	7/25	0915-1045	N.D.	N.D.	-	-	-

a/ Refer to Figures 9 and 10 for locations.

b/ None Detected. Detection limit approximately 0.001 µg/m^3.

c/ This pesticide was not applied at this site, and not analyzed for.

Table 6. Pesticide concentrations in surface soil during the off-season sampling period.

		Concentration (ppm)					
		Chlorinated Hydrocarbons[b]				Organophosphates[c]	Carbamates[d]
Location[a]	Date	DDT	DDE	DDD	Telone	Diazinon	
B	5/18/82	0.80				N.D.	-[f]
C	1/21/81	4.45	1.80	0.40		N.D.	N.D.
C	5/18/82				0.35[e]	-	-
D	1/21/81	0.95	0.20	0.10		N.D.	N.D.
D	5/18/82	None Detected				N.D.	-
F	2/3/81	2.25	2.65	0.65		0.012	N.D.
H	2/3/81	None Detected				0.006	N.D.
I	2/3/81	0.06	0.03	0.03		0.020	N.D.
I	5/18/82	None Detected				N.D.	-
J	2/5/81	None Detected				N.D.	N.D.
K	2/5/81	None Detected				N.D.	N.D.
L	2/5/81	0.15				N.D.	N.D.
M	2/5/81	0.20				N.D.	N.D.
N	2/5/81	None Detected				N.D.	N.D.
O	2/5/81	0.02				N.D.	N.D.
R	5/18/82				0.85[e]	N.D.	-
U	2/5/81	None Detected				N.D.	N.D.

a/ Refer to Figure 7 for locations.

b/ Samples screened for chlorinated hydrocarbons. Detection limit= 0.01 ppm.

c/ Samples screened for organophosphates. Detection limit= 0.001 ppm

d/ Samples screened for carbamates. Detection limit= 0.05 ppm

e/ Telone applied at this site on 5/15/82.

f/ Not analyzed for these compounds.

Figure 17. Winter sampling locations. Brussel sprout fields are outlined.

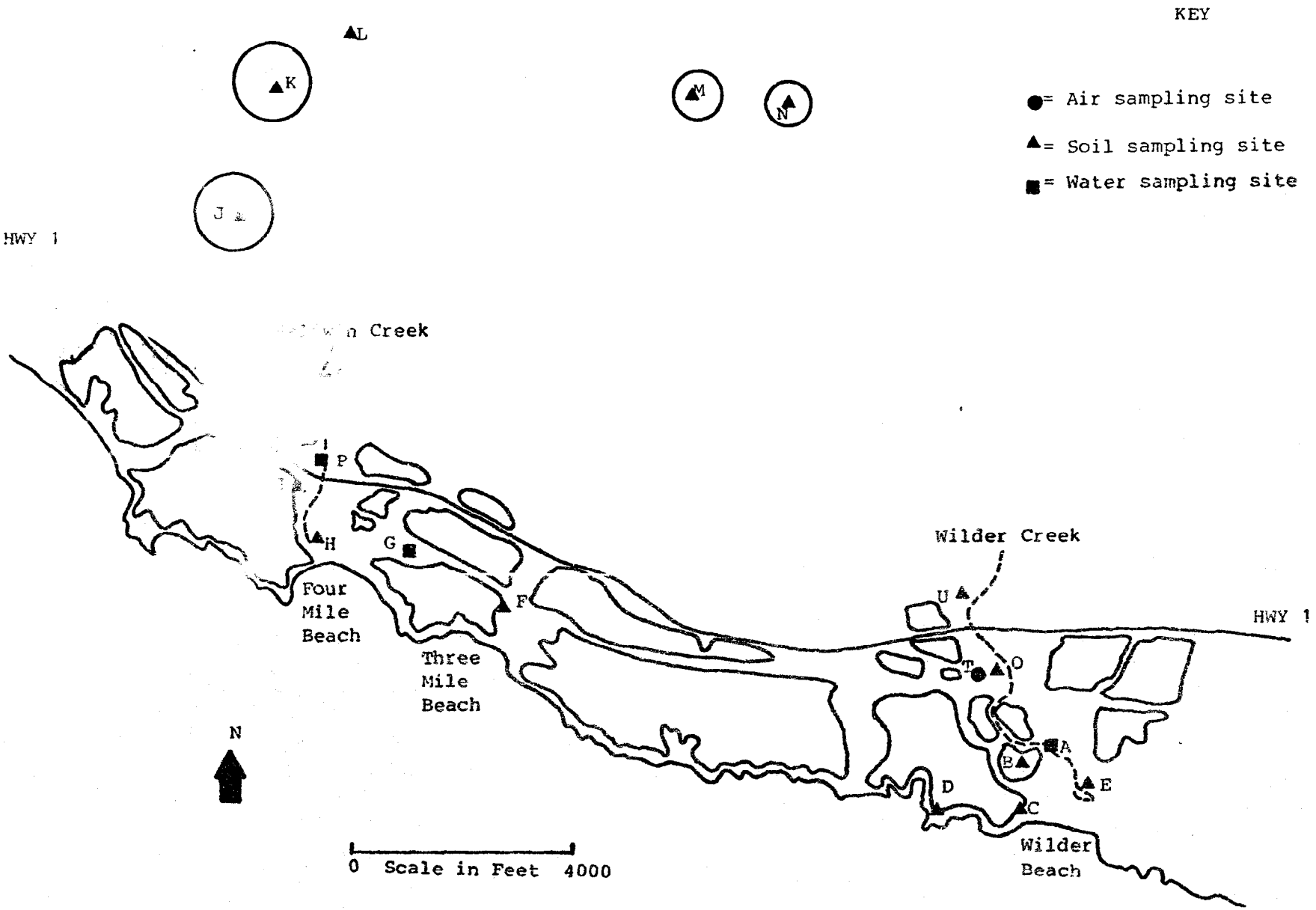


Table 7. Pesticide concentrations in soil cores during the off-season sampling period.

Location[a]	Date	Depth (cm)	Concentration (ppm) Chlorinated Hydrocarbons[b] DDT	DDE	DDD	Organophosphates[c] Diazinon	Carbamates[d]
B[e]	1/21/81	0-15	4.0	1.95	0.95	N.D.	N.D.
Q	2/5/81	0-15	6.70	0.90	0.90	N.D.	N.D.
Q	2/5/81	15-30	3.00	2.30	1.10	0.006	N.D.
R	2/5/81	0-15	1.20	1.60	0.60	0.010	N.D.
R	2/5/81	15-30	5.72	0.70	0.60	N.D.	N.D.

a/ Refer to Figure 17for locations.

b/ All samples screened for chlorinated hydrocarbons. Detection limit= 0.10 ppm.

c/ All samples screened for organophosphates. Detection limit= 0.001 ppm.

d/ All samples screened for carbamates. Detection limit= 0.05 ppm.

e/ Concentrations are the means of replicate samples, all other locations represent single values.

an indication that diazinon degrades slower than the other organophosphates. The detection limit for diazinon is lower than most other organophosphates, and the residue detected may be a reflection of diazinon's greater analytical sensitivity. Other pesticides may have been present at non-detectable levels.

Table 8 presents the results of the soil sampling conducted immediately after application. These locations had very low levels, and in most cases no detectable residue was found.

To determine the amount of pesticide that went off-target and landed on the ground soil samples were collected at various distances from the field immediately after treatment. These results, shown in Table 9, do not show any pattern.

Soil samples taken during the growing season and screened for pesticides in the major insecticide groups show residue levels similar to those seen in the winter samples (Table 10). One location had DDT, and four had diazinon. However, there was no apparent buildup of residue between treatments or years.

4. Water and Sediment Samples

None of the water or sediment samples contained detectable residues. Samples collected in the winter were screened for the major insecticides. Water samples collected after application were taken upstream and downstream of treated areas from Baldwin and Wilder Creeks. Water samples were also collected from the reservoir near Four-mile Beach after treatment to adjacent fields.

Table 8. Systox and diazinon concentration in surface soil before and after application.

Location[a/]	Date	Sampling Period	Concentration (ppm) Systox	Systox Breakdown	Diazinon
7	6/28/82	Background	N.D.[b/]	N.D.	N.D.
7	7/1/82	Post-spray	N.D.	N.D.	N.D.
8	6/28/82	Background	N.D.	N.D.	N.D.
8	7/1/82	Post-spray	N.D.	N.D.	N.D.
11	6/28/82	Background	N.D.	N.D.	0.045
11	7/1/82	Post-spray	N.D.	N.D.	0.035
20	7/16/82	Background	N.D.	N.D.	N.D.
20	7/19/82	Spray	0.035	0.120	0.010
22	7/19/82	Spray	N.D.	N.D.	0.105

a/ Refer to Figures 9 and 10 for locations.

b/ None Detected. Detection limit approximately 0.001 ppm.

Table 9. Systox and diazinon concentrations in off-target surface soil immediately after treatment.

Location[a/]	Date	Distance from Edge of Field (meters)	Concentration (ppm)		
			Systox	Systox Breakdown	Diazinon
21	7/19/82	1	0.075	N.D.[b/]	N.D.
21	7/19/82	3	N.D.	N.D.	N.D.
57	6/30/82	3	N.D.	N.D.	0.040
57	6/30/82	10	N.D.	N.D.	0.008
57	6/30/82	17	N.D.	N.D.	0.145

a/ Refer to Figures 9 and 10 for locations.

b/ None Detected. Detection limit approximately 0.001 ppm.

Table 10. Pesticide concentrations in soil during the growing season.

Location[a]	Date	Sample Type[b]	Concentration (ppm) Chlorinated Hydrocarbons DDT	Organophosphates Diazinon	Carbamates
1	9/2/82	Surface	N.D.[c]	N.D.[d]	N.D.[e]
2	9/2/82	Surface	N.D.	N.D.	N.D.
3	9/2/82	Surface	N.D.	N.D.	N.D.
4	9/2/82	Core	2.70	N.D.	N.D.
5	9/2/82	Surface	N.D.	N.D.	N.D.
6	9/2/82	Core	N.D.	N.D.	N.D.
9	8/26/82	Surface	N.D.	N.D.	N.D.
10	8/26/82	Surface	N.D.	N.D.	N.D.
12	7/30/82	Surface	-[f]	0.075	-
13	7/30/82	Surface	-	0.070	-
14	7/30/82	Surface	-	N.D.	-
15	7/30/82	Surface	-	N.D.	-
16	8/26/82	Surface	N.D.	N.D.	N.D.
17	9/2/82	Surface	N.D.	0.50	N.D.
18	9/2/82	Surface	N.D.	0.25	N.D.
19	9/2/82	Surface	N.D.	N.D.	N.D.
39	8/26/82	Surface	-	N.D.	-

a/ Refer to Figures 9 and 10 for locations.

b/ Surface samples collected from 0-2 cm depth. Core samples collected from 0-15 cm.

c/ None Detected. Samples screened for chlorinated hydrocarbons, detection limit approximately 0.001 ppm.

d/ None Detected. Samples screened for organophosphates, detection limit approximately 0.001 ppm.

e/ None Detected. Samples screened for carbamates, detection limit approximately 0.05 ppm.

f/ Not analyzed for these compounds.

5. Tank Samples

Tank samples were collected when a specific treatment was monitored. These results are shown in Table 11. Variation in the tank concentrations was mainly due to different application rates and tank capacity.

DISCUSSION

1. Pesticide Use Patterns

The data shows that almost all of the pesticides were applied between May and September, coinciding with the period of highest potential park use. The pesticide group with the highest use were the fumigants, primarily Telone and DD. These fumigants were applied in a very narrow time frame, but required a high rate of application (approximately 150 gallons per acre). The active ingredient in Telone is 1,3-Dichloropropene (1,3-D), while DD is a mixture of 1,3-D and 1,2-Dichloropropane (1,2-D). Both compounds have been widely used throughout the state. Recently, 1,2-D has been found in ground water in several areas of the state, which has lead to the suspension of DD in at least one county. The organophosphate insecticides (OP 1 and OP 2) were the other major use groups. Although these pesticides were applied at a much lower rate, they are more acutely toxic and were applied more frequently.

Table 11. Pesticide concentrations in spray rig tanks.

Date	Concentration (%)			
	Systox	Diazinon	Phosdrin	Trichlorfon
6/30/82	0.073	0.17	-	-
7/17/82	0.210	-	-	-
7/24/82	0.038	-	0.069	0.040
7/26/82	0.008	-	-	-
7/30/82	0.022	-	-	-
8/3/82	0.019	-	-	-
8/5/82	0.042	0.061	-	-
8/7/82	0.041	0.041	-	-

a/ This pesticide was not used.

2. Monitoring Data

In general, pesticide residues in all media sampled were very low. Air concentrations were elevated during pesticide applications, but then decreased to low concentrations the day following applications. This may have been due to accelerated volatilization by high winds which usually followed applications in the afternoon. Results of the vector air sampling indicated that pesticide drifted several hundred meters downwind during applications, but that the total amount of pesticide drift was minimal. One factor which may have contributed to this was the dilution of pesticide in air as the spray drifted away from the fields. Most of the fields, and all of the ones EHAP monitored, were located on bluffs elevated above the park use areas. The edges of the fields were only five meters from the cliff ledges, so as the spray drift moved over the cliffs it could have been diluted by the larger air mass associated with the lower elevation.

The downwind vector air concentrations were comparable to the trailside air concentrations the day after application. Additionally, there was very little change in soil residues before or after applications. This suggests that the treatment schedule used by the growers contributes to the low, constant residue levels found. A small number of acres were treated with pesticides almost every day througout the growing season, rather than large acreages at a few, specific times during the season. Therefore, the suggestion to close parts of the park where

pesticides were recently applied would be impractical.

The one compound common to all applications which EHAP monitored was Systox. While it was not the most heavily used pesticide, it was applied most often. Systox is a mixture of two isomers, demeton-O and demeton-S. Both isomers are readily oxidized to several breakdown products. The breakdown products detected in one or more samples were demeton-O sulfoxide, demeton-O sulfone, demeton-S sulfoxide, demeton-S sulfone, and sulfotepp. These compounds were grouped under Systox Breakdown in the tables. Since all soil and air samples were kept frozen from collection until analysis, oxidation during storage was probably minimal. However, the hi-vols draw a large amount of air during operation (30 CFM) and much of the oxidation of demeton in air samples was probably due to this sampler oxidation. Since each compound has a different toxicity it is very hard to evaluate the possible impacts of systox.

The insecticide DDT, and its breakdown products DDE, and DDD were found in our study even though it has been banned for many years. Residues were found throughout the study area during the 1981 winter sampling period, but was found at only one location in 1982. This may have been due to changes in the detection limit of the chemical analysis. Four of the five locations where soil cores were taken during the entire study had DDT, while surface sampling sites had 7 of 31 locations contaminated. This suggests that contamination below the surface may be more widespread than on the surface. Since DDT was detected in areas

not currently under cultivation the extent of contamination cannot be correlated with current agricultural activities. A systematic sampling survey would be necessary to define the geographical distribution of DDT residues.

The potential human health impacts of the pesticide residues documented in this report have been assessed by Dr. Peter H. Kurtz, Medical Coordinator for CDFA. His evaluation is presented in Appendix D.

Appendix A

MONITORING PLAN FOR WILDER RANCH STATE PARK SITE
SANTA CRUZ COUNTY

A cooperative project involving the California Department of Food and Agriculture and the California Department of Parks and Recreation.

I. Objective

To determine the presence (quantitative) or absence of selected pesticides within areas of the proposed Wilder Ranch State Park designated for visitor use. This determination will be for both the time period of heavy agricultural activity and during the season when fields are fallow.

II. Monitoring Plan

The cooperative Wilder Ranch study will be under the overall supervision of Ronald J. Oshima, Environmental Hazards Assessment Program (EHAP) and will involve cooperation from the Worker Health and Safety unit of the California Department of Food and Agriculture (CDFA) and the State Department of Parks and Recreation. Key personnel participating from the EHAP-CDFA are listed below along with their responsibilities:

Tom Mischke

Responsible for the selection of sampling methodology, preparation of sampling mediums, and all aspects of the chemical analysis of collected samples. Phone (916) 322-2395 or ATSS 492-2395.

Lee Neher

Responsible for study design, all technical aspects used in sampling, supervision over the collection, storage, and transport of samples, and dissemination of progress and final reports. Phone (714) 787-4684 or ATSS 651-4684.

Ingrid Carmean

Responsible for the collection and transport of samples. Also responsible for maintaining liaison within CDFA and between EHAP and the Santa Cruz County Agricultural Commissioner's staff. Phone (916) 322-2395 or ATSS 492-2395.

It is understood that the State Department of Parks and Recreation will assist in obtaining the cooperation of growers involved in the study area.

Sampling methods - Sampling and chemical analysis will be limited to the analysis and reporting of levels of selected pesticides extracted from soil, water and air. Selection of the pesticides monitored will be based on past use history and present usage as defined by the pesticide use report records from the Santa Cruz Agricultural Commissioner's Office. This procedure is further defined in Section 3 of the Implementation Timetable. Soil and water sources will be sampled using standard techniques taken from scientific literature and EPA recommended methods. Airborne dusts will be collected on an 8" X 10" fiber filter mounted in a high volume sampler. Volatile air pollutants

will be collected by concentrating aerial concentrations on a sorbant (XAD-2). All air samples will be frozen immediately on dry ice for transport to the State Chemistry Laboratory for analysis. Soil and water samples will be cooled to near freezing for transport to the State Chemistry Laboratory in Sacramento. The attached maps locate sampling sites within the park lands.

Implementation Timetable

1) August through December 1980 - California Department of Parks and Recreation will establish an agreement with the CDFA covering this study. Use report data for 1979 and 1980 growing season will be obtained from the County Agricultural Commissioner to ascertain pesticide use history for the study site.

2) January, February 1981 - Sampling will occur during the winter season (fallow fields) when no pesticides are applied to determine possible residue carry-over to the following application season. Since past use histories at these sites may be obscure, the samples will be screened for organophosphate, organochlorates and carbamate pesticides. This screening procedure will be performed only on winter season samples.

   a) Two replicate soil samples will be collected at nine sites of proposed campground and recreational use. Map #1 shows the physical locations of these sites

      (2 X 9) = 18 samples

   b) Four replicate water samples will be collected when water is present at the irrigation reservoir site, Baldwin and Wilder Creeks south of Highway #1, and Baldwin Creek above the Equestrian parking site.

      (4 X 2) = 8 samples

   c) Replicate bottom sediment samples will be collected at each of the geographical locations listed in 2b.

      (4 X 2) = 8 samples

   d) Replicate air samples will be drawn at three sites to establish background levels for chemical analysis.

      (3 X 2) = 6 samples

3) May through July 1981 - Current use report data for 1981 will be obtained and pesticide selection will be made from those materials identified. These materials will be identified in writing to the Department of Parks and Recreation and the Division of Pest Management. Department of Fish and Game will also be given this information.

   Sampling will occur during actual pesticide applications for agricultural acreage. Maps 2 through 4 show the physical locations for the following sampling:

a) Two replicate soil samples will be collected at each of 22 proposed campground, parking and recreational areas utilized for or close to the brussel sprout acreage (see map #2). These will be analyzed for up to four pesticides.

(2 X 22X 4) = 176 analyses

b) Two replicate soil samples will be collected at sites numbered 7, 8, 11, 12, 13, 14, 20, and 22 in item (a) above. These samples will be collected on the day following application of pesticides to the fields immediately bordering each collection site. Analysis will be for up to two pesticide residuals.

(9 X 2 X 2) = 36 analyses

One set of replicate soil samples will be collected along the proposed trail route west of Three Mile Beach. These will be held at the State Chemistry Laboratory and analyzed only if the leeward soil samples (11, 12, & 13) indicate pesticide residuals.

c) Two replicate air samples will be taken at seven locations in each of two brussel sprout production areas south of Highway 1 (see maps #3 & #4). This sampling will occur at both areas during actual applications and at one area on the day following application to establish off target drift levels which would impact proposed trails. These samples will be analyzed for up to four pesticides.

(2 X 7 X 3 X 4) = 168 analyses

d) Three separate vector studies will determine off target drift levels during application at the four mile beach area and the Wilder Beach Natural Preserve (see maps #3 & #4). Each study will incorporate two rows of four air samplers extending from the fields, downwind to the area of interest. These samples will be analyzed for one pesticide.

(3 X 2 X 4) = 24 analyses

e) Four replicate water samples will be collected, when water is present at the irrigation reservoir site, Baldwin and Wilder Creeks south of Highway #1, and Baldwin Creek above the Equestrian parking site. Analysis will be for two pesticides.

(4 X 2 X 2) = 16 analyses

f) Replicate bottom sediment samples will be collected at each of the geographical locations listed in 3e. Analysis will be for two pesticides.

(4 X 2 X 2) = 16 analyses

g) Two replicate airborne particulate samples will be collected at two sites (see maps #3 & #4). These will be analyzed for two pesticides.

(2 X 2 X 2) = 8 analyses

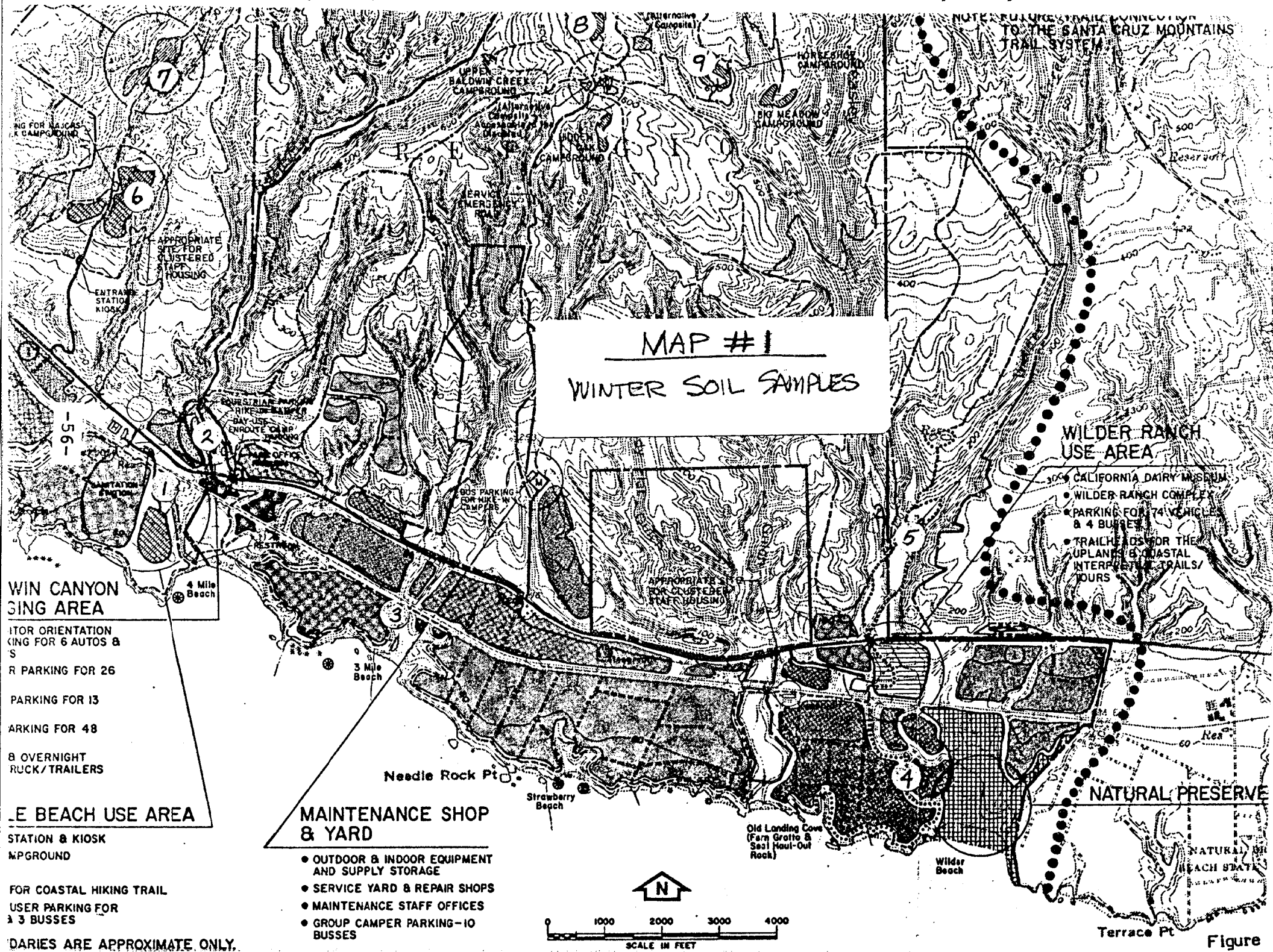
h) Two replicate soil and two replicate water samples will be collected from the natural preserve site north of Wilder Beach. These will be analyzed for one pesticide.

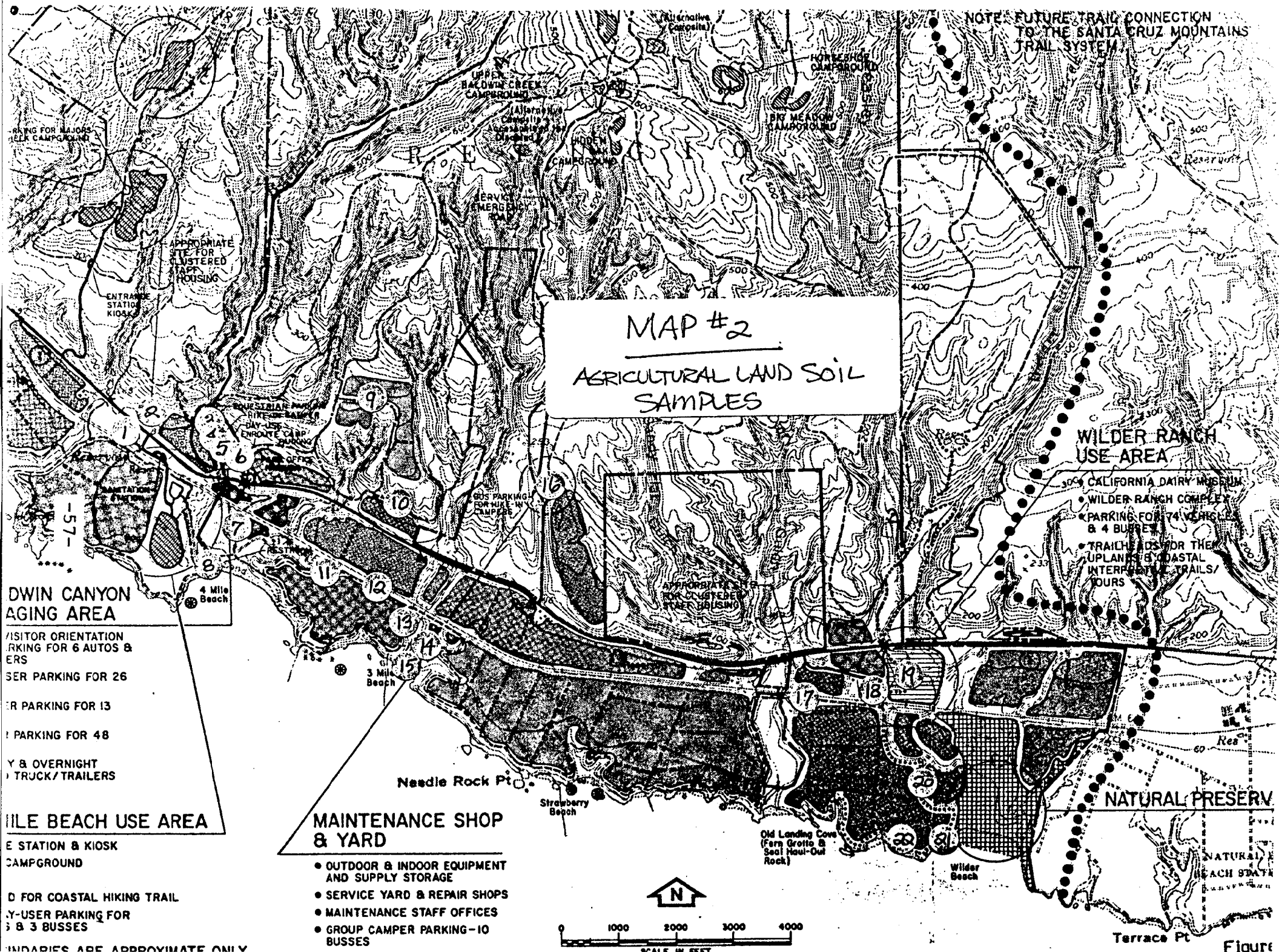
(4 X 2) = 8 analyses

4) February 1981 through September 1981 - Chemical analysis will be performed at the CDFA Chemistry Laboratory in Sacramento, California. Following analysis, EHAP will quantify the presence or absence of pesticides in each media sampled during both sampling periods. The Worker Health and Safety Unit (CDFA) will then evaluate the monitoring data in terms of human health.

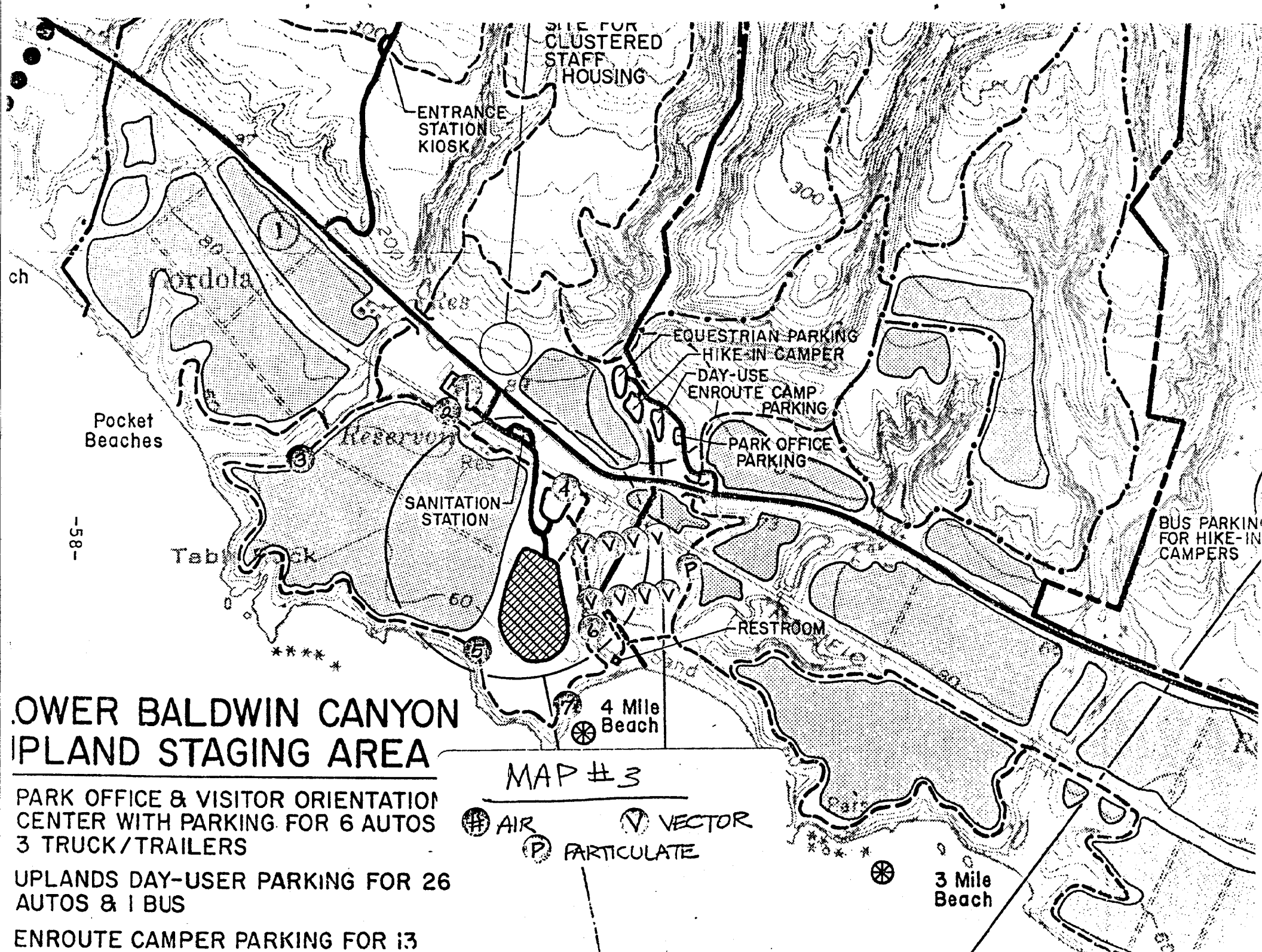
If the initial samples collected in 3 (b) and (c) show pesticide residues additional samples will be taken to define their persistance.

A draft final report will be submitted to all participants for review at the earliest possible date. After review, a final report will be produced.


MAP #1
WINTER SOIL SAMPLES
NOTE: FUTURE TRAIL CONNECTION TO THE SANTA CRUZ MOUNTAINS TRAIL SYSTEM
WILDER RANCH USE AREA
CALIFORNIA DAIRY MUSEUM
WILDER RANCH COMPLEX
PARKING FOR 74 VEHICLES & 4 BUSSES
TRAILHEADS FOR THE UPLAND & COASTAL INTERPRETIVE TRAILS/ TOURS
NATURAL PRESERVE
WIN CANYON
SING AREA
ITOR ORIENTATION
KING FOR 6 AUTOS &
S
R PARKING FOR 26
PARKING FOR 13
ARKING FOR 48
8 OVERNIGHT
RUCK/TRAILERS
E BEACH USE AREA
STATION & KIOSK
MPGROUND
FOR COASTAL HIKING TRAIL
USER PARKING FOR
3 BUSSES
DARIES ARE APPROXIMATE ONLY.
MAINTENANCE SHOP & YARD
• OUTDOOR & INDOOR EQUIPMENT AND SUPPLY STORAGE
• SERVICE YARD & REPAIR SHOPS
• MAINTENANCE STAFF OFFICES
• GROUP CAMPER PARKING–10 BUSSES
N
0 1000 2000 3000 4000
SCALE IN FEET
Needle Rock Pt
Strawberry Beach
Old Landing Cove (Farm Grotto & Seal Haul-Out Rock)
Wilder Beach
Terrace Pt
4 Mile Beach
3 Mile Beach
UPPER BALDWIN CREEK CAMPGROUND
HORSESHOE CAMPGROUND
SKY MEADOW CAMPGROUND
HIDDEN POND CAMPGROUND
APPROPRIATE SITE FOR CLUSTERED STAFF HOUSING
ENTRANCE STATION KIOSK
BUS PARKING FOR HIKE-IN CAMPERS
RESTROOM
Figure


MAP #2
AGRICULTURAL LAND SOIL SAMPLES
NOTE: FUTURE TRAIL CONNECTION TO THE SANTA CRUZ MOUNTAINS TRAIL SYSTEM
WILDER RANCH USE AREA
• CALIFORNIA DAIRY MUSEUM
• WILDER RANCH COMPLEX
• PARKING FOR 74 VEHICLES & 4 BUSSES
• TRAILHEADS FOR THE UPLANDS & COASTAL INTERPRETIVE TRAILS/ TOURS
MAINTENANCE SHOP & YARD
• OUTDOOR & INDOOR EQUIPMENT AND SUPPLY STORAGE
• SERVICE YARD & REPAIR SHOPS
• MAINTENANCE STAFF OFFICES
• GROUP CAMPER PARKING–10 BUSSES
DWIN CANYON AGING AREA
ISITOR ORIENTATION
RKING FOR 6 AUTOS & ERS
SER PARKING FOR 26
R PARKING FOR 13
PARKING FOR 48
Y & OVERNIGHT TRUCK/TRAILERS
ILE BEACH USE AREA
E STATION & KIOSK
CAMPGROUND
D FOR COASTAL HIKING TRAIL
Y-USER PARKING FOR 8 & 3 BUSSES
INDARIES ARE APPROXIMATE ONLY
Needle Rock Pt
Strawberry Beach
Old Landing Cove (Fern Grotto & Seal Haul-Out Rock)
Wilder Beach
Terrace Pt
NATURAL PRESERV
UPPER BALDWIN CREEK CAMPGROUND
HORSESHOE CAMPGROUND
BIG MEADOW CAMPGROUND
HIDDEN OAK CAMPGROUND
SERVICE/EMERGENCY ROAD
ENTRANCE STATION KIOSK
EQUESTRIAN PARKING
DAY-USE ENROUTE CAMP PARKING
BUS PARKING FOR HIKE-IN CAMPERS
APPROPRIATE SITE FOR CLUSTERED STAFF HOUSING
4 Mile Beach
3 Mile Beach
N
0 1000 2000 3000 4000
SCALE IN FEET

Figure

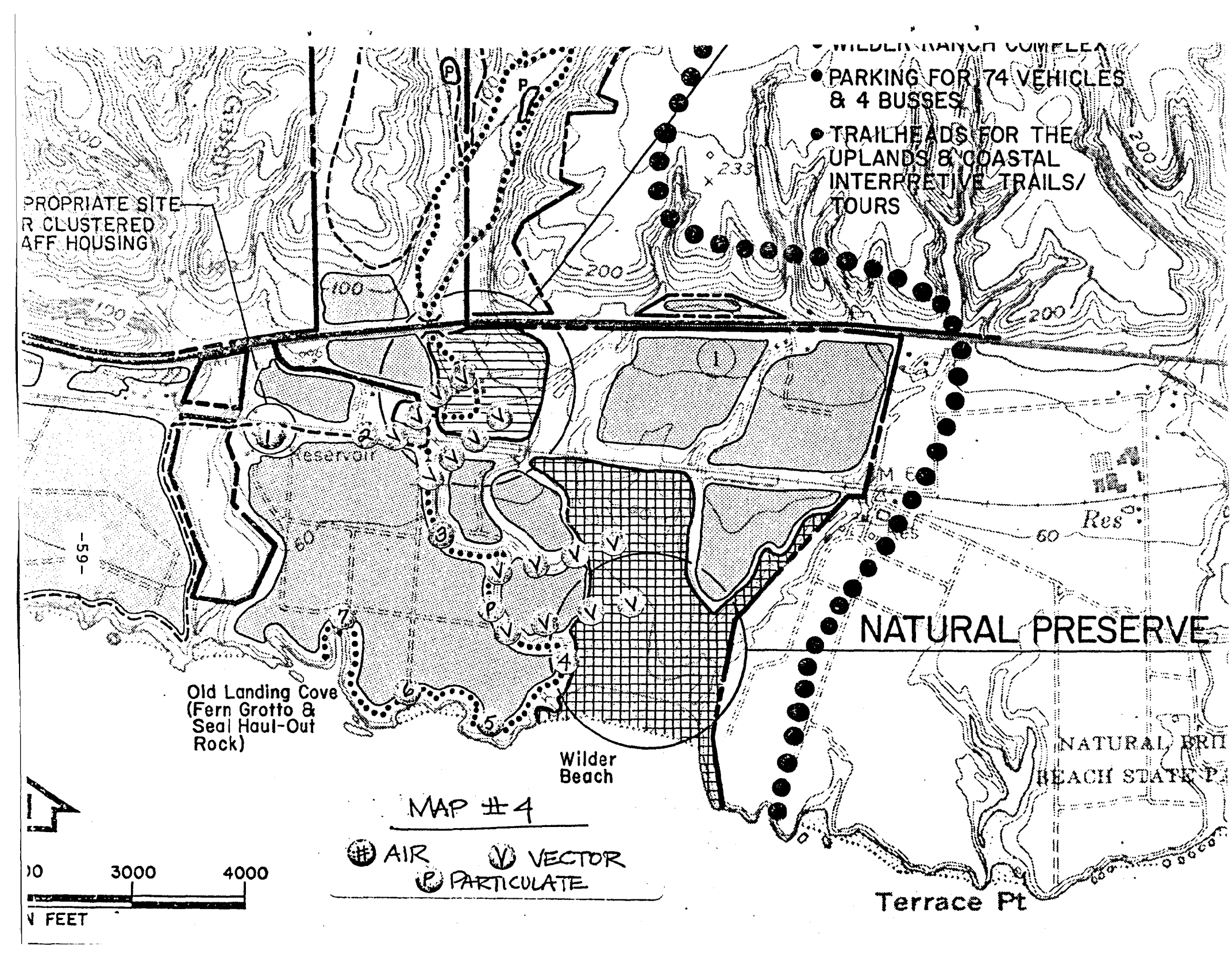


LOWER BALDWIN CANYON
UPLAND STAGING AREA

PARK OFFICE & VISITOR ORIENTATION CENTER WITH PARKING FOR 6 AUTOS 3 TRUCK/TRAILERS

UPLANDS DAY-USER PARKING FOR 26 AUTOS & 1 BUS

ENROUTE CAMPER PARKING FOR 13


PARKING FOR 74 VEHICLES & 4 BUSSES
TRAILHEADS FOR THE UPLANDS & COASTAL INTERPRETIVE TRAILS/ TOURS
PROPRIATE SITE
R CLUSTERED
AFF HOUSING
Reservoir
NATURAL PRESERVE
Old Landing Cove (Fern Grotto & Seal Haul-Out Rock)
Wilder Beach
Terrace Pt
MAP #4
AIR
V VECTOR
P PARTICULATE
3000
4000
FEET
-59-

Appendix B

Descriptions of Sampling Sites

A - Water sampling site; Wilder creek near Wilder Beach

B - Soil sampling site; in Brussels sprout field

C - Soil Sampling site; along proposed trail adjacent to sprout field.

D - Soil Sampling site; along proposed trail adjacent to sprout field.

E - Sediment sampling site; small pond at end of Wilder Creek

F - Soil Sampling site; along proposed trail adjacent to sprout field.

G - Water and air sampling site; reservoir near Four-mile Beach

H - Soil and water sampling site; soil collected along trail leading toward Four-mile Beach; water collected from Baldwin Creek at small dam

I - Soil Sampling site; along proposed trail adjacent to sprout field.

J - Soil sampling site; proposed Marine Terrace campground, south of Macadam vein

K - Soil sampling site; proposed Majors Creek campground, mid-level clearing, school lands "walk-in"

L - Soil sampling site; adjacent to Majors Creek, upper canyon area

M - Soil sampling site; proposed Uplands Camp Center, upper Baldwin Creek staging area

N - Soil sampling site; proposed Horseshoe campground, north end

O - Soil sampling site; main complex area

P - Water and air sampling site; Baldwin Creek, just north of Hwy 1, near old garden

Q - Soil sampling site; in lower seed bed, just north of Hwy 1

R - Soil sampling site; in upper seed bed, just north of Hwy 1

S - Water sampling site; Baldwin Creek, above seed beds

T - Air sampling site; main complex area

U - Soil sampling site; upper corral area, just north of Hwy 1

01 - Soil sampling site; proposed hostel area

02 - Soil sampling site;

03 - Soil sampling site; in upper seed bed

04 - Soil sampling site; in lower seed bed

05 - Soil sampling site; just north of old barn

06 - Soil samplin site; near of house

07 - Soil sampling site; along proposed trail

08 - Soil sampling site; at end of Balwin Creek

09 - Soil sampling site; along proposed bridle path

10 - Soil sampling site; along proposed trail adjacent to seed bed

11 - Soil sampling site; along proposed trail, adjacent to sprout field

12 - Soil sampling site; along proposed trail, adjacent to sprout field

13 - Soil sampling site; along proposed trail, adjacent to sprout field

14 - Soil sampling site; Three-mile Beach

15 - Soil sampling site; Three-mile Beach

16 - Soil sampling site; dump area

17 - Soil sampling site; along proposed trail, adjacent to sprout field

18 - Soil sampling site; along proposed trail, adjacent to sprout field

19 - Soil sampling site; main complex area

20 - Soil sampling site; along proposed trail, adjacent to sprout

field

21 - Soil sampling site; along proposed trail, adjacent to sprout field

22 - Soil sampling site; along proposed trail, adjacent to sprout field

24 - Air sampling site; trailside location near Four-mile Beach

25 - Air sampling site; trailside location near Four-mile Beach

26 - Air sampling site; trailside location near Four-mile Beach

27 - Air sampling site; trailside location near Four-mile Beach

28 - Air sampling site; trailside and vector location near Four-mile Beach

29 - Air sampling site; trailside location near Four-mile Beach

30 - Air sampling site; vector location, Four-mile Beach

31 - Air sampling site; vector location, Four-mile Beach

32 - Air sampling site; vector location, Four-mile Beach

33 - Air sampling site; vector location, Four-mile Beach

34 - Air particulate sampling site; near Four-mile Beach

35 - Water sampling site; Baldwin Creek, near lower seed bed

36 - Water and sediment sampling site; end of Baldwin Creek

37 - Water sampling site; reservoir near Four-mile Beach

38 - Water and sediment sampling site; Wilder Creek near Wilder Beach

39 - Water sampling site; end of Wilder Creek

41 - Air sampling site; vector location, Wilder Beach

42 - Air sampling site; vector location, Wilder Beach

43 - Air sampling site; vector location, Wilder Beach

44 - Air sampling site; trailside location near Wilder Beach

45 - Air sampling site; trailside location near Wilder Beach

46 - Air sampling site; trailside and vector location near Wilder Beach

47 - Air sampling site; trailside location near Wilder Beach

48 - Air sampling site; trailside location near Wilder Beach

49 - Air sampling site; trailside location near Wilder Beach

50 - Air sampling site; trailside location near Wilder Beach

51 - Air sampling site; trailside and vector location near main complex

52 - Air sampling site; vector location, main complex

53 - Air sampling site; vector location, main complex

54 - Air sampling site; vector location, main complex

55 - Water sampling site; Wilder Creek, main complex

56 - Water sampling site; Wilder Creek, near corral area

57 - Soil sampling site; soil vector location near Four-mile Beach

Appendix C

CHAIN OF CUSTODY RECORD

USE BALL POINT PEN ONLY

STATE OF CALIFORNIA
DEPARTMENT OF FOOD
AND AGRICULTURE

ENVIRONMENTAL HAZARDS
ASSESSMENT PROGRAM
1220 N STREET - ROOM A328
SACRAMENTO, CALIFORNIA 95814

STUDY #	SAMPLE #	SAMPLING TIMESPAN: DATE ON	TIME ON	DATE OFF	TIME OFF	SAMPLER LOCATION CODE	SAMPLE TYPE: SOIL / WATER / AIR / VECTOR / OTHER	SAMPLER NUMBER	SAMPLER TYPE
0 1 3		8 2		8 2					-
1 2 3 4	5 6 7 8	9 10 11 12 13 14	15 16 17 18	19 20 21 22 23 24	25 26 27 28	29 30	31 32 33 34 35	36 37	38 39 40

SAMPLING MEDIUM: THV - GFF	XAD 2 RESIN	CASCADE	COMPANION SAMPLE #	SAMPLER FLOW RATE	COMPANION SAMPLE #	PERSON COLLECTING	
		S					
41	42	43 44 45	46 47 48 49	50 51 52	53 54 55 56	57 58	59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80

REMARKS, OBSERVATIONS, OTHER CHEMICALS USED, ETC.

LAB RESULTS

CHEMIST'S NAME DATE

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time
Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by: (Signature)	
Relinquished by: (Signature)	Date/Time	Received for Laboratory by. (Signature)	Date/Time	

Distribution: Original and One Copy Accompanies Shipment: Copy to Coordinator Field Files.

Appendix D

State of California

Memorandum

To : Ron Oshima
Environmental Monitoring and Pest Management

Date : April 13, 1984

Place : Sacramento

Telephone: 5-8474

From : **Department of Food and Agriculture** – P. H. Kurtz, M.D., Ph.D.
Medical Coordinator
Worker Health and Safety Unit

Subject: Wilder Ranch State Park Pesticide Monitoring-Health Hazard Evaluation

I reviewed the draft document dated January 1984. Based on the residue measurements in air and soil, I find nothing to indicate a potential health hazard to individuals who might be visiting the area.

In reaching this conclusion, I considered individuals who may be camping and sleeping on the ground, as well as those who may be using hiking trails, etc. None of the values reported represent any kind of a health risk in terms of acute hazard or in terms of possible chronic exposure. The residue concentrations are not excessive and certainly are encountered in daily living in rural areas.

Once the final "draft" is completed, I recommend that a copy of the document be given to the Community Toxics Unit of the Department of Health Services, which is headed by Dr. Richard Jackson, for a review prior to issuing the final document.