FILE -

Shaugh. No. 111401

EAB Log Out Date: 23 MAY 1984

Init.: JHL

To: William Miller
Product Manager 16
Registration Division (TS-767)

From: Carolyn K. Offutt
Head, Environmental Processes and Guidelines Section
Exposure Assessment Branch, HED (TS-769)

Attached, please find the estimated environmental concentration review of:

Reg./File No.: 100-599

Chemical: Profenofos

Type Product: Insecticide

Product Name: CURACRON

Company Name: Ciba-Geigy

Submission Purposes: Runoff study review to satisfy a conditional registration requirement

ZBB Code: ?

Action Code: 575

Date In: 23 March 1984

EFB#: 4258

Date Completed: 18 APR 1984

TAIS (Level II)	Days
63	3.0

Deferrals To:

XX Ecological Effects Branch

____ Residue Chemistry Branch

____ Toxicology Branch

Profenofos

I. Introduction:

Profenofos (CURACRON) was applied to a cotton field in west central Mississippi to evaluate the effects of possible pesticide movement via runoff, leaching, and drift to the littoral and benthic animal population in a nearby pond. This study was done in response to a request by EEB due to the toxicity of profenofos to invertebrate animals.

II. Chemical/Physical Properties:

Common Name: Profenofos
Trade Name: CURACRON
Chemical Name: O-(4-bromo-2-chlorophenyl)-O-ethyl S-propyl phosphorothioate
(See attached one-liner for additional information.)

III. Discussion:

The study involved applying CURACRON six times to the cotton field on a regular schedule of every 5 days from mid-July to mid-August 1983. The 120 acre field was located 8 miles northwest of Greenville MS. Adjacent to and bordered on two sides by the field was a one hectare pond (Store Cut Pond) approximately 2 meters deep. The prevailing winds are from the west, but during the summer the winds can blow from the south or southeast from the Gulf of Mexico.

The application dates, nominal and actual rates, and associated weather for the dates are given in Table 2. The equipment and applcation procedures are also given in the table.

In addition to CURACRON, Orthene (acephate) was applied once on 9 June at 0.22 kg/ha. Galecron (chlordimeform) was applied three times, 28 June and 6 and 17 July at 30 g/l [quantity per area was not expressed]. Methyl parathion was applied on 1 September at 80 g/l [quantity per acre was not expressed].

Runoff Analysis:

The Simulator for Water in Rural Runoff Basins (SWRRB) was used to simulate a series of runoff events as they may have occurred in 1983 around Store Cut Pond. 1974 of the basin data was used as the basis as it most closely approximated the runoff events between April and June 1983 (as provided by Ciba-Geigy in their report). The rainfall events of July and August 1974 were modified using the data provided by Ciba-Geigy. The SWRRB input data is given in Table 3.

The total pesticide runoff was predicted to be considerable (>0.002 lb/acre) following the 17 July 1983 rainfall (Table 3). However, as noted in the report (Table 4-11), no profenofos was found in the pond following that 2 to 3 inch rain. It is noted

that there is a dirt road between the field and the pond, and this reviewer questioned whether this road precluded the movement of runoff from the field to the pond. Dr. Gary Dickson (Ciba-Geigy) was asked whether the field supplied the pond directly by runoff. The information that he received was that the pond was mainly supplied by ground water and runoff but with very little from runoff from the field in question.

Spray Drift

The results of the spray drift monitoring from the field to the pond are given in Figures 1 to 6 as drawn on a map of the area. In applications 2 and 6, the wind was away from the pond and no pesticide was found on the aluminum plates around or on the pond. For the other applications, the concentrations of profenofos at the various monitoring points are given. CURACRON did drift to the pond in all other applications in sufficient quantities to be detected (>0.01 ug/cm^2 liquid spray).

Water Quality

As seen in the report from Ciba-Geigy (Tables 4-11 to 4-13 attached), the quantity of profenofos in the water slowly increased over the period of 30 days from below the level of detection (0.1 ppb) to 0.2 ppb. This change may be insignificant.

Another point to be explored is the fact that the pH of the pond was between 8.2 and 9.7 during the 1983 summer. Profenofos will hydrolyze at pH 9 with a half-life of 9 hours. The photolysis half-life is 27 hours. Even if the samples were taken, cooled, and kept in the dark, hydrolysis could reduce the amount of profenofos in the samples to below detectable quantities in a fairly short time. In order to note whether the samples were degrading between sampling and analysis, spiked field samples should be taken. In this study spiked samples were not taken nor were the samples acidified to retard degradation. Therefore, the validity of the pond sample quantities is questionable.

If spray drift was the avenue of entry (Figures 1 to 6), the concentration at the surface two hours after the first application would be greater than found (<0.1 ppb) [mixing within the pond would be minimal in mid-July]. Also the concentration continued to build even after applications such as #6 (Figure 6) on 9 August where the wind was away from the pond. This would lead one to conclude that the entry was via leaching and ground water interflow or least by some other avenue. The SWRRB model does show that some chemical does leach (0.001 to 0.010 lb/A/day per rain event) but not enough to account for the quantity found in the pond. Another possible avenue would be a combination of runoff and leaching. The material could runoff to the edge of the field and then follow an underground seepage system into the pond.

The Exposure Analysis Modeling System (EXAMS) was not employed in order to determine the length of stay of the chemical. An input quantity could not determined.

In conclusion, it is reasonable to assume that the entry of profenofos into the pond could be either by spray drift, runoff, or leaching and ground water interflow or a combination of these routes. Rapid degradation by hydrolysis and photolysis may account for the low quantities detected in the pond.

IV. Recommendations:

This study illustrates the complexity of a natural system with respect to spray drift, runoff, and leaching/interflow and the interrelationships between the environment and these avenues of pesticide entrance into aquatic systems.

The study did show that even though spray drift did occur toward the pond and could be measured before it entered the pond, the drifting quantity was possibly not significant enough to be measured in the pond water even within two hours of application. For purposes of measuring spray drift into a pond adjacent to a field being sprayed under these or similar conditions, this study is acceptable.

As noted in the study, a 300 foot buffer zone will be required where spraying near aquatic systems.

Robert W. Holst, Ph.D.
Plant Physiologist
Exposure Assessment Branch/HED (TS-769)

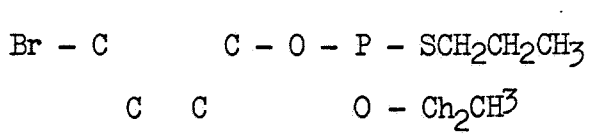
4/8

EXPOSURE ASSESSMENT BRANCH ONE LINER

SHAUGH. NO. 111401 TYPE PESTICIDE: Insecticide STRUCTURE

COMMON NAME: Profenofos

CHEMICAL NAME: O-(4-bromo-2-chlorophenyl)-
O-ethyl s-propyl phosphorothioate



TYPICAL USES Cotton

CHEMICAL PROPERTIES:

Molecular Wt	Aqueous Solubility	Vapor Pressure	K_{ow}	K_{oc}
373.65	20 (ppm)	$1x10^{-5}$ (torr)	47,863	

Soil Adsorption Coefficient

Soil Type	pH	% Soil O.M.	K	K_{om}	Soil TLC R_f	Mobility Class
sand	6.3	1.2	20.2			(1) Immobile
sand	7.8	2.2	4.56			(2) Low (3) Low to Mod.
sandy loam	6.7	5.6	55.6			(4) Moderate (5) Mobile
silt loam	6.1	3.6	22.2			

Degradation

Lab Half-life Soil	Field Half-life	Hydrolysis (23°) pH	$T^1/2$	Photolysis $T^1/2$
Aerobic: 4-7 wks	Soil 4.5 d loam	5	93 d	Soil:
Anaerobic:	16.8 d sandy	7	15 d	Water: 27 hr
Aquatic				
Aerobic:	Aquatic:	9	6 hr	
Anaerobic:				

ENVIRONMENTAL EXPOSURE

Found in Ground Water (Y/N)?

Site(s) Level:

Rotational Crop Restrictions

Reentry Interval Established

Leaching Potential

Lab: Yes No

Field: Yes No

5

EAB Chemical One-Liner

Chemical Profenofos

Fish Bioaccumulation Factors

Species	Tissue		Whole Fish	Duration (Half-life)
	Edible	Viscera		
	X	X	X	
	X	X	X	
	X	X	X	

DEGRADATION SUMMARY:

REFERENCES:

From Registration Actions.

Table 2. Spray Drift Evaluation

Chemical: Profenofos Acc. No: 252706
Company: Ciba-Geigy
Reviewer: Robert W. Holst, Ph.D., Plant Physiologist
Exposure Assessment Branch, HED/OPP
Date of Review: 10 April 1984

Location:
Winterville MS (10 km NW of Greenville MS)
Meteorological data from site (Store Cut Pond) and Stoneville MS (STVL).

Basic Information:

Date of Appl:	15 JUL	20 JUL	25 JUL	30 JUL	4 AUG	9 AUG
Tempeature: (°C) (0700 local)						
STVL:	26.6	27.3	28.7	25.7	25.1	26.5
Site:	25.6	22.8	25.6	22.2	-	-
Relative Humidity: (%) (0700 local)						
STVL:	82.0	82.0	74.3	75.8	78.5	90.1
Site:	?	?	76.0	(instrument broken)		
Wind Speed: (mph)(0700 local)						
STVL:	1.5	1.6	3.0	2.7	3.4	1.5
Site:	4.0	1.0	2.0(App)	2.0	1.0(App)	NT
Wind Dir: (°true)(0700 local; range based on winds from 0500-0900)						
STVL:	161	261	254	108	046	313
Range	090-270	190-270	200-260	030-120	045-200	310-030
Site:	150	280	200(App)	200	150(App)	NT
Range	060-170	270-300	-	170-225	-	-
Application Rate: (lb.ai./A & kg ai./ha) (Nominal rate was 1.0 lb.ai./A)						
	1.29 lb/A	2.60	1.17	0.90	0.49	0.42
	1.44 kg/ha	2.92	1.31	1.01	0.55	0.47

Equipment:

Noz Type:	D-4 (disc not specified if used)
Noz Ort:	90° (down)
Press:	276 kPa; 40 psi
Height	2 to 3 m; 6 to 10 feet
A/C SPD:	90 mph
Appl. Dir.	multiple swath; 300 foot buffer zone
Rate of liquid:	18.7 l/ha or 2.25 gal/A

---

* (App) = Apparent wind direction and speed derived from the mapping of the profenofos concentrations. Instrument failure did not provide site information.
NT = Not taken due to instrument failure.

Table 3. SWRRB Input Information and Results

Kd = 20.0

Foliar half-life = 2.0

Soil half-life = 0.015 /day (4.5 days)

Application Efficiency = 70%

Application Dates and Rates and Results

Julian Date (1983)	Appl. Rate (lb/A)	Rain (in)	Leach (lb/A)	Runoff (lb/A)
196	1.0			
197		0.40	.002	
198		2.80	.010	.030
199		0.30	.007	.004
200		0.05	.004	
201	1.0		.004	
206	1.0			
208		0.14	.002	
211	1.0			
216	1.0			
221	1.0			
230		0.60		
236		1.40		
237		0.15		

Rains in July and August 1983 incorporated into MISS basin data. 1974 in this basin was used as this was the available year which had the wettest April through June. which approximated the total rainfall of April to June 1983.

The leach data is that which leaches below the two cm depth. The runoff is total pesticide runoff.

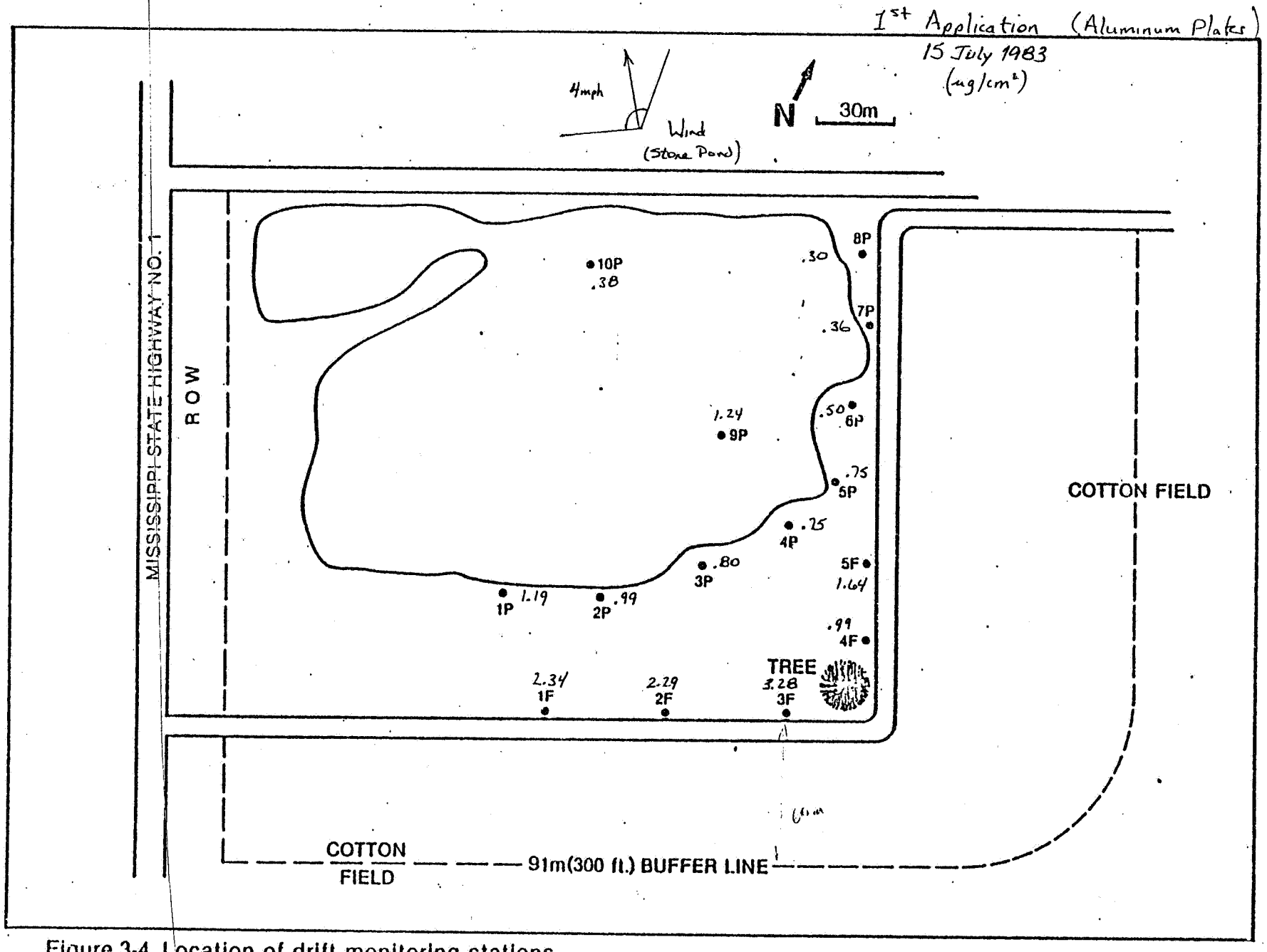


Figure 3-4 Location of drift monitoring stations

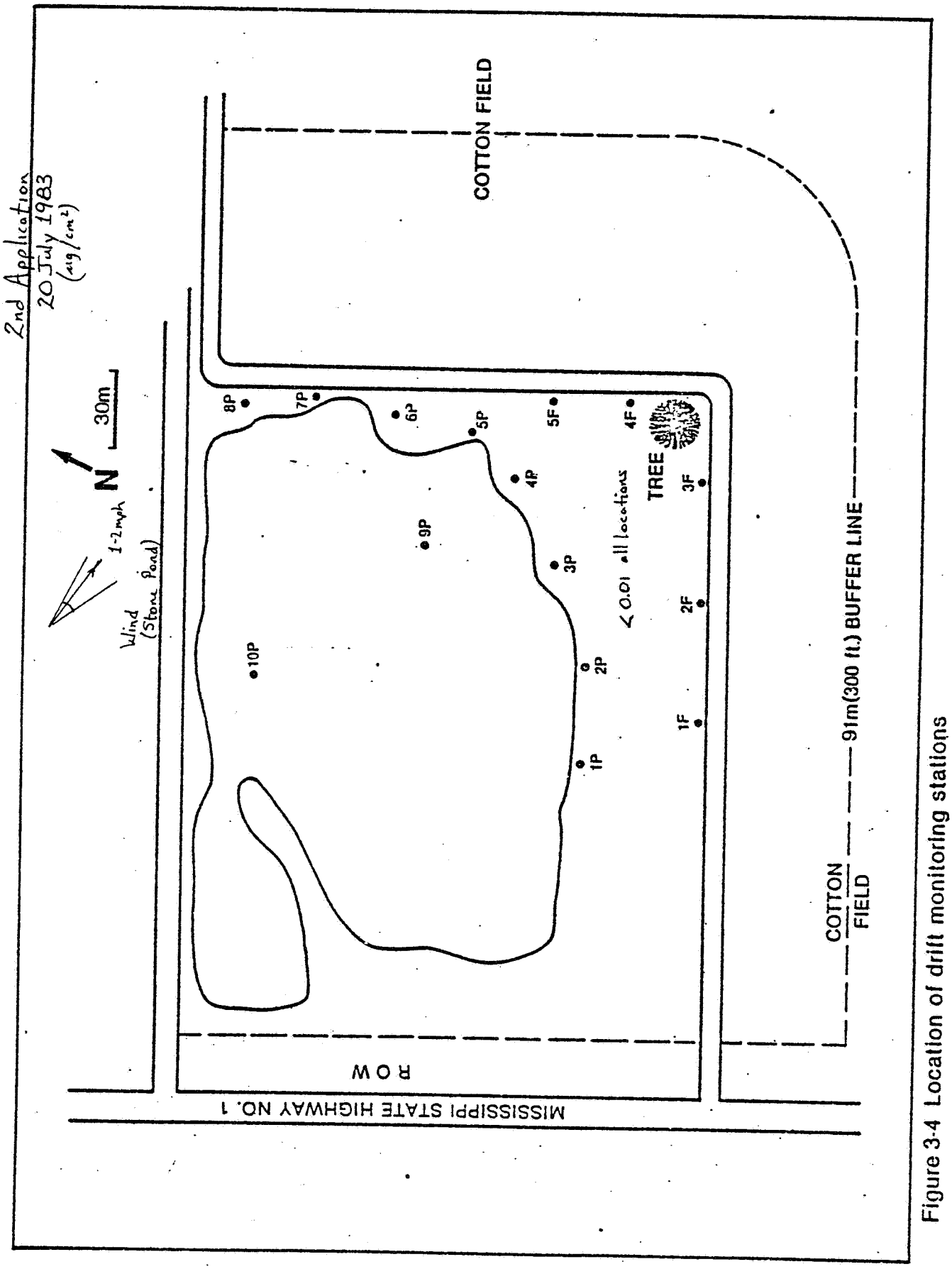


Figure 3-4 Location of drift monitoring stations

10

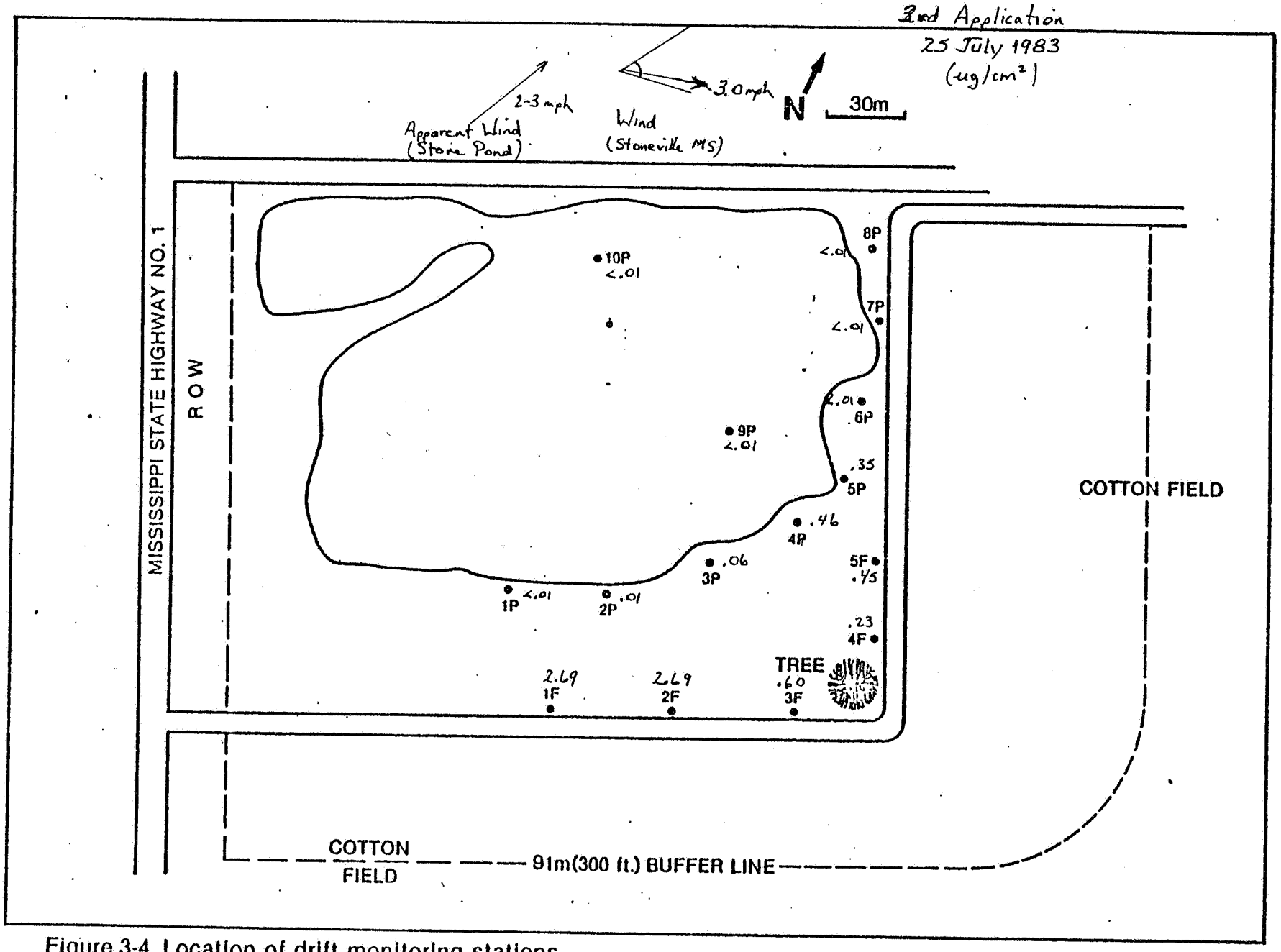


Figure 3-4 Location of drift monitoring stations

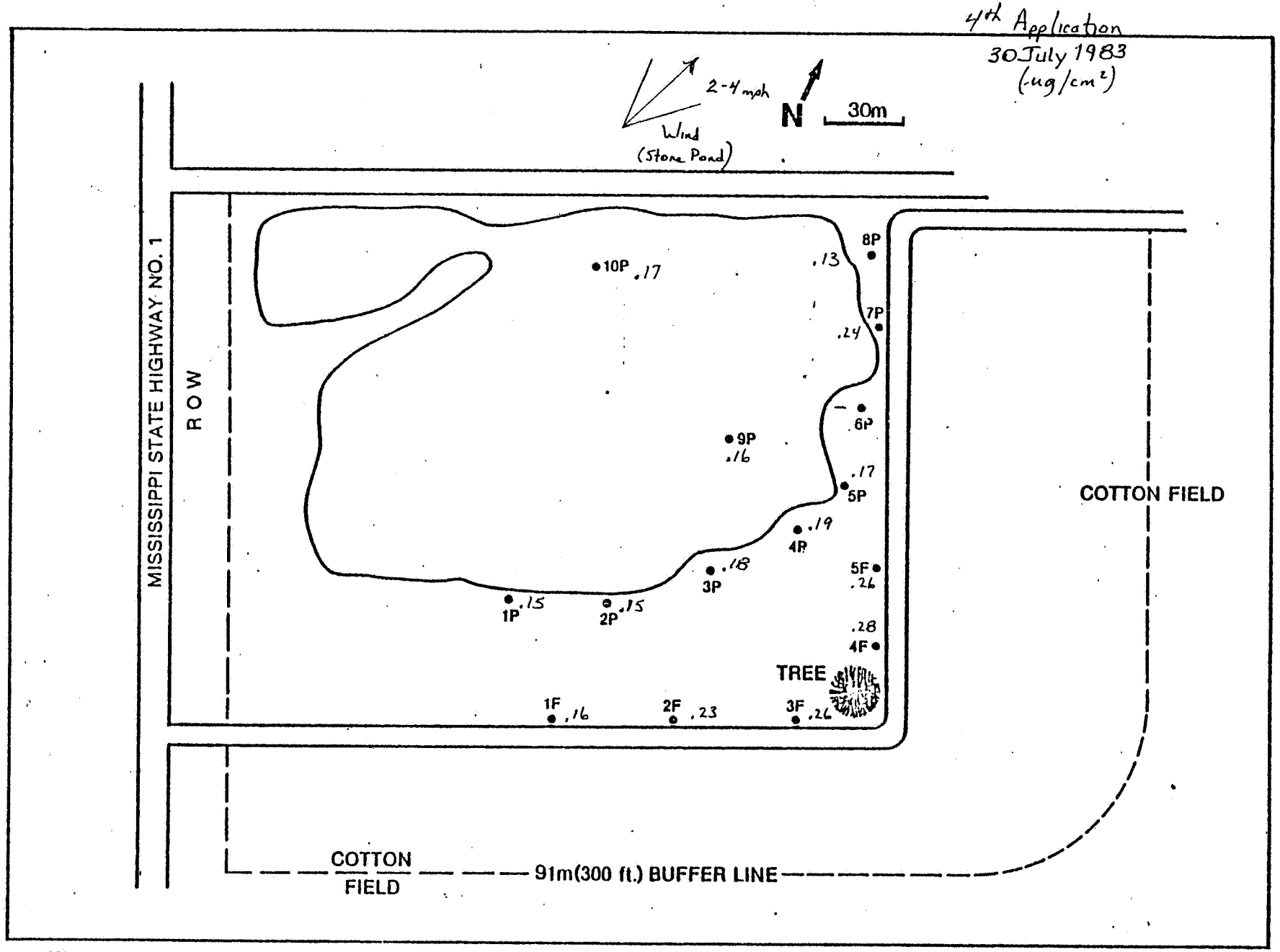


Figure 3-4 Location of drift monitoring stations

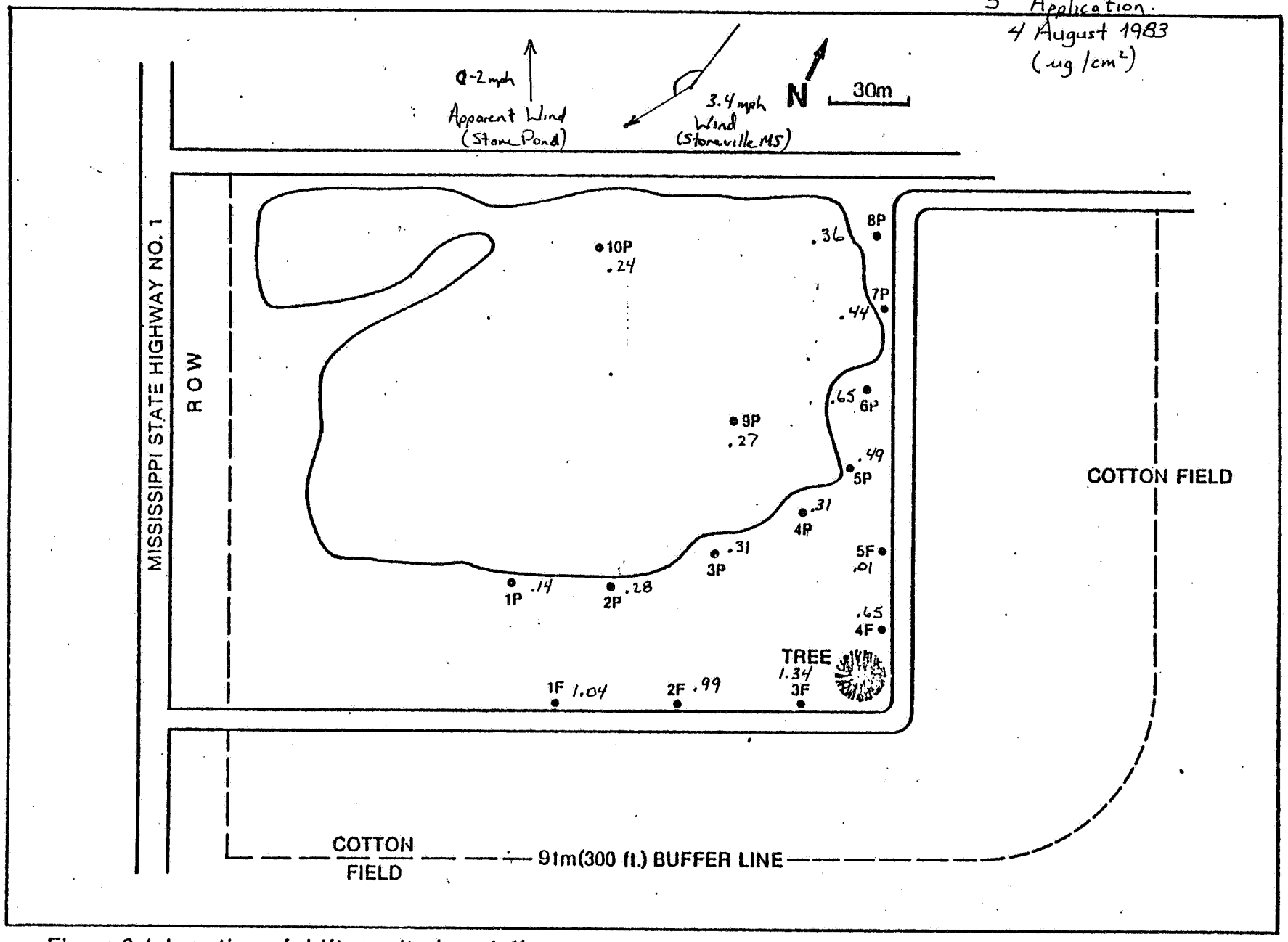


Figure 3-4 Location of drift monitoring stations

13

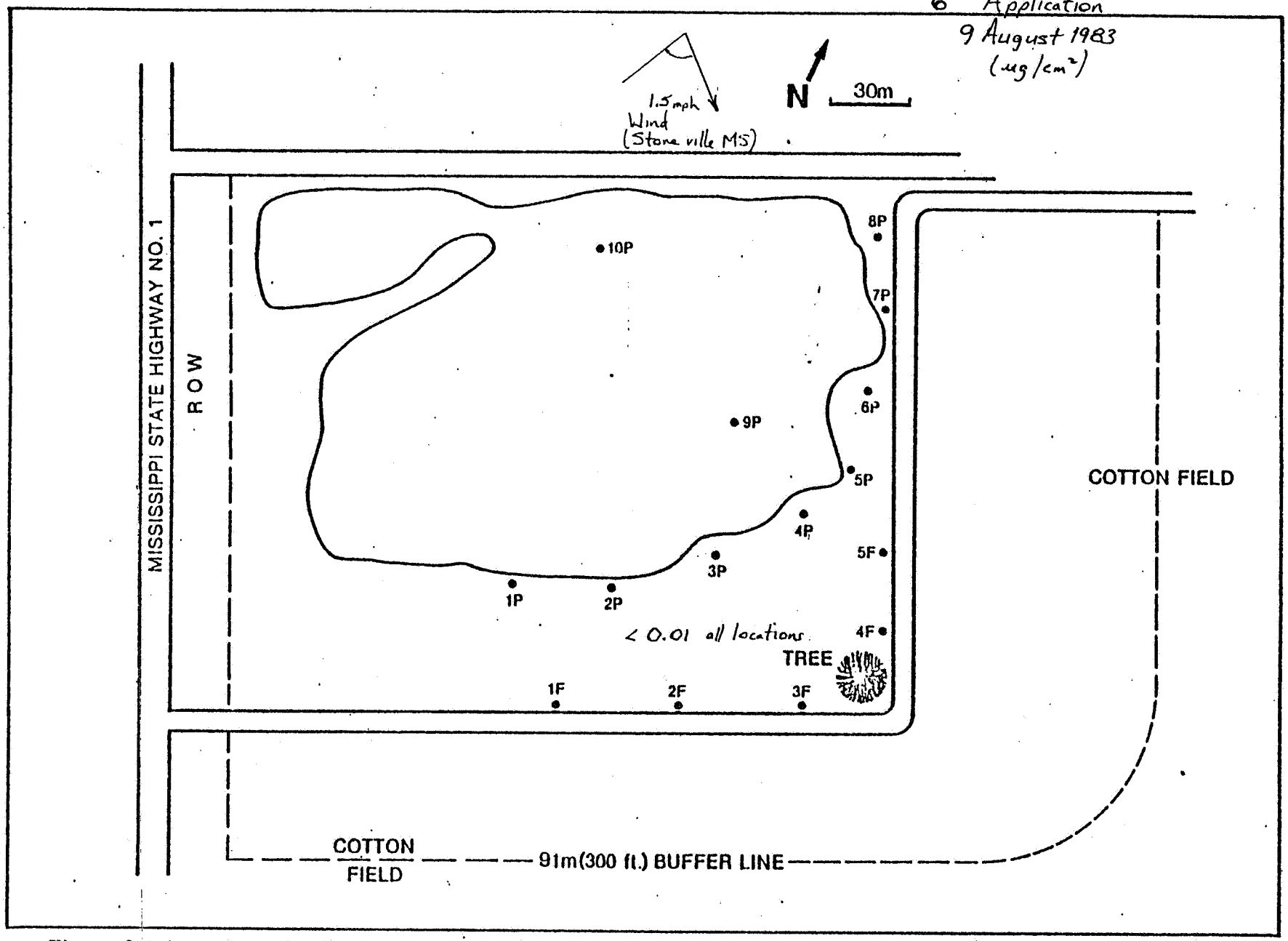


Figure 3-4 Location of drift monitoring stations

TABLE 4-11

CURACRON® CONCENTRATIONS FOUND IN WATER, FILTER, AND SEDIMENT SAMPLES COLLECTED FROM STORE CUT POND, MISSISSIPPI AFTER AERIAL APPLICATION TO AN ADJACENT COTTON FIELD AT 0630 ON JULY 15, 1983

Station	Sample Type	Depth	Date and Time of Collection					
			July 15 (0930)	July 15 (1130)	July 15 (1400)	July 16 (0930)	July 18 (0930)	July 19 (1000)
I	Water[1]	Surface	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Water	Middle	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Water	Bottom	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
II	Water	Surface	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Water	Middle	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Water	Bottom	2.05[4]	<0.1	<0.1	<0.1	<0.1	<0.1
I	Filter[2]	Surface	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Filter	Middle	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Filter	Bottom	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
II	Filter	Surface	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Filter	Middle	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Filter	Bottom	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
II	Sediment[3]	---	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

[1]Concentrations in µg/l (ppb)

[2]Concentrations in µg/filtrate

[3]Concentrations in mg/kg (ppm)

[4]Contaminated sample

TABLE 4-12

CURACRON® CONCENTRATIONS FOUND IN WATER, FILTER, AND SEDIMENT SAMPLES COLLECTED FROM STORE CUT POND, MISSISSIPPI AFTER AERIAL APPLICATION TO AN ADJACENT COTTON FIELD AT 0630 ON JULY 20, 1983

Station	Sample Type	Depth	Date and Time of Collection					
			July 20 (0900)	July 20 (1100)	July 20 (1330)	July 21 (1100)	July 23 (1030)	July 24 (1100)
I	Water[1]	- Surface	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Water	- Middle	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Water	- Bottom	<0.1	<0.1	<0.1	<0.1	0.46	<0.1
II	Water	- Surface	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Water	- Middle	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	Water	- Bottom	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
I	Filter[2]	- Surface	<0.2	<0.2	<0.2	No data	<0.2	0.2
	Filter	- Middle	<0.2	<0.2	<0.2	No data	<0.2	<0.2
	Filter	- Bottom	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
II	Filter	- Surface	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Filter	- Middle	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Filter	- Bottom	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
II	Sediment[3]	---	<0.2	<0.02	<0.02	<0.02	<0.02	<0.02

[1]Concentrations in µg/l (ppb)

[2]Concentrations in µg/filtrate

[3]Concentrations in mg/kg (ppm)

16

TABLE 4-13

CURACRON® CONCENTRATIONS FOUND IN WATER, FILTER, AND SEDIMENT SAMPLES COLLECTED FROM STORE CUT POND, MISSISSIPPI AFTER AERIAL APPLICATION TO AN ADJACENT COTTON FIELD AT 0630 ON JULY 25 AND AUGUST 9, 1983

Station	Sample Type	Depth	Date and Time of Collection					
			July 26 (1230)	July 27 (1130)	Aug 9 (1030)	Aug 10 (1330)	Aug 12 (1330)	Aug 14 (1300)
I	Water[1]	Surface	<0.1	<0.1	0.3	<0.1	0.1	0.1
	Water	Middle	<0.1	<0.1	0.95	0.15	0.1	0.1
	Water	Bottom	<0.1	<0.1	0.2	0.1	0.1	0.2
II	Water	Surface	<0.1	<0.1	0.1	0.1	0.1	0.1
	Water	Middle	<0.1	<0.1	0.45	0.1	<0.1	0.2
	Water	Bottom	<0.1	<0.1	0.2	0.1	0.2	0.2
I	Filter[2]	Surface	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Filter	Middle	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Filter	Bottom	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
II	Filter	Surface	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Filter	Middle	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
	Filter	Bottom	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
II	Sediment[3]	---	<0.02	<0.02	<0.02	No Data	<0.02	<0.02

[1]Concentrations in µg/l (ppb)

[2]Concentrations in µg/filtrate

[3]Concentrations in mg/kg (ppm)