Data Evaluation Report of Vegetative Buffer Study

PMRA Submission Number {.....} EPA MRID Number 46490301

Test material: Fipronil
IUPAC name: 5-amino-1-(2,6-dichloro-α,α,α-trifluoro-*p*-tolyl)-4-trifluoromethylsulfinylpyrazole-3-carbonitrile
CAS name: 5-amino-1-[2,6-dichloro-4-(trifluoromethyl)phenyl]-4-[(trifluoromethyl)sulfinyl]-1*H*-pyrazole-3-carbonitrile

Primary Reviewer: James Hetrick, Ph.D.
EPA
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Date: 5/1/08

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Signature:
Date: 5/4/08

EPA PC Code: 129121

CITATION: Braun, D., J. Cappy, and J. W. White. 2004. Effect of Vegetative Buffer Strips on Fipronil Runoff Losses from Warm-Season CHIPCO Choice Treated Turfgrass and Simulated Rainfall. Sponsored by BayerCrop Science, RTP, NC. Performed by Stone Environmental, Montpelier, VT; White Environmental, Lexington, KY; Bayer CropSciences, RTP, NC; and AgVise Laboratories, Northward, ND. MRID 4690301.

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EXECUTIVE SUMMARY:

The fipronil buffer effectiveness study (MRID 46490301) provides acceptable data on the impact of a 15 feet grass buffer for controlling runoff of fipronil and its degradation products (MB46136, MB46513, and MB 46950) from warm-season grass in Julian, NC. The study was submitted to fulfill a condition of registration regarding runoff concerns of fipronil residues from broadcast use of fipronil for control of fire ants. The registrant did not provide any concurrent biological monitoring of the aquatic environment to assess the impact of fipronil and its degradation products on aquatic invertebrates.

Paired-runoff plots were constructed to assess the effectiveness of a 15 feet grass buffer in reducing edge-of- field fipronil residue runoff from 60 feet treated test plots in Julian, NC. Paired treatment plots consisted of a plot with the 15 feet untreated grass buffer at the top of plot (WST) to serve as a control site with no runoff buffer. The other plot (WSB) had the 15 feet untreated grass buffer at the bottom of the plot to serve as a runoff buffer. Chipco® Topchoice™ was applied at a rate of 87 lbs /A (~0.013 lbs ai/A). Rainfall was simulated at an intensity of 1 inch hr^{-1} for two runoff events. Time-paced and flow proportional samples of runoff water were collected at the edge-of-field. Fipronil and its degradation products (MB46136, MB46513, and MB 46950) were analyzed in the runoff samples. The total suspended sediment (TSS) was also measured in runoff samples.

In the WST (control) treatment , the maximum fipronil concentration during for runoff events ranged from 2.875 to 1.286 µg/L in time paced samples and 2.166 to 1.259 µg/L in flow proportional samples. In the WSB (buffer) treatment, the maximum fipronil concentration for two runoff events ranged from 0.724 to 0.456 µg/L in time paced samples and 0.597 to 0.425 µg/L in flow proportional samples.

Based on the average fipronil mass in runoff, the 15 foot grass buffer reduced runoff of fipronil by 64% to 71%.

I. MATERIALS AND METHODS

GUIDELINE FOLLOWED: The SETAC-Europe: Procedures for Assessing the Environmental Fate and Ecotoxicity of Pesticides (March 1995; pp. 1, 34) is not applicable.

COMPLIANCE: This study was conducted in compliance with USEPA FIFRA Good Laboratory Practices (40 CFR Part 160), which are consistent with the OECD Principles of GLP (p. 3). Signed and dated GLP, Data Confidentiality, Quality Assurance, and Certificate of Authenticity statements were provided (pp. 2-3, 5-6).

A. MATERIALS:

1. Site Description

The vegetative buffer study was conducted on a golf course in Julian, NC **(Figures 2, 3, and 4, pp 84-86)**. The site is characterized as a "moderately sloping field in an area that is generally out of play on the golf course". The vegetation on the site is predominately Bermuda grass with some fescue. The soil series on the site is classified as an Enon fine sandy loam (fine, mixed, thermic Ultic Hapludalfs) with a 6% slope. Soil characteristics of the site are shown in **Table 6 (page 53)**. A ring infiltrometer was used to measure the soil infiltration rates prior to irrigation. The soil had infiltration rates ranging from 0.9 to 1.8 cm hr^{-1} **(Table 7, pp 54-55)**.

2. Site Preparation and Maintenance

The test site did not receive any chemical treatment prior to 2002. In 2002, the site was treated with 2,4-D and MSMA for control of broadleaf weeds and crabgrass. No fipronil treatments had been applied to the site prior to the study.

The test site was irrigated four times between May 29th and June 5th. The cumulative amount of irrigation was 1 inch. The turf was mowed to a height of 2.5 inches during the study. The frequency of mowing was approximately once pre week. During the experiment, mowing was conducted on June 13th (four days prior to the fipronil application) and June 22nd (five days post fipronil application). These mowing events were conducted using a mulching mower to eliminate removal of fipronil residues.

3. Rainfall Simulator

The rainfall simulator was designed according to Coody and Lawrence (1994). The water source for the rainfall simulator was an irrigation pond near the test plots. The water quality of the pond water is shown in **Tables 4 and 5 (pp 51 and 52)**. Collection jars were used to gauge rainfall volume and intensity. Rainfall intensity and volume ranged from 1.02 to 1.08 in/hr and 2.41 to 2.67 inches **(Table 11, pp 59)**. Time-dependent flow from the test plots are shown in **Tables 12,13, 14 and 15 (pp 60 to 71).** Cumulative runoff ranged from 1,937 to 1,980 liters from the WST test plot (buffer at top of plot) and 2,206 to 2,223 liters from the WSB test plot (buffer at bottom of plot). Runoff yield, expressed as a percentage of simulated rainfall, was 35% for the WST test plot and 37.7 to 40.9 % for the WSB test plot **(Table 16, pp 72)**. The total suspended sediments (TSS) in the time paced runoff samples ranged from 59 mg/L (Event 1) to 27 mg/L (Event 2) for WST test plots and 30 mg/L (Event 1) to 27 mg/L (Event 2) to for WSB test plots **(Tables 17 and 18, pp 74 and 75).** In flow proportional runoff samples, the TSS ranged 23 mg/L (Event 1) to 16 mg/L (Event 2) for WST test plot and 9 mg/L (Event 1) to 7 mg/L (Event 2) WSB test plot **(Table 19, pp 75).**

4. Experimental Design

Two adjacent runoff test plots (12 ft X 75 ft) were oriented parallel to the slope using metal flashing to provide hydrologic separation (**Figures 5 and 6, pp 87-88**). Each test plot had an untreated buffer section (12 ft X15 ft) within the test plot. The WST treatment had the untreated buffer section at the top of the plot. The WSB treatment had the untreated buffer section at the bottom of the plot. On June17, 2002, the fipronil treated section in each plot (12 ft X 60 ft) was amended with 87 lbs/A of CHIPCO ® Topchoice™ (94.1 to 96.4 mg fipronil/treated section) using a broadcast applicator (**Table 10, pp 58**). After the fipronil application, each test plot was irrigated for 15 minutes as recommended by the label.

On June 19, 2002 (2 days post application) and June 27, 2002 (10 days post application), the test plots were irrigated at rainfall intensity of 1.0 inch per hour. The rainfall simulations were terminated when a minimum of 10 runoff samples were collected, and a minimum of 0.5 inches (1,062 liters) of runoff had been produced from each test plot. The rainfall intensity was measured using 10 randomly placed catch cups.

At the downhill side boundary of the test plots, a metal flume and gutter system were installed to direct water into a sampling basin. Each metal flume was equipped with a flow meter. Additionally, each flume was equipped with a stilling well to allow accurate measurement of runoff depth. Runoff flow for the flume system was calculated using the flow equation $Q=1.55H^{2.58}$, where Q = flow rate in cubic feet per second and H = head in feet.

Two autosamplers for each test plot were used to collect time-dependent runoff samples for pesticide analysis. One autosampler was calibrated to collect runoff samples at regular time intervals (75 ml every 3 minutes) from a splash pan. Consecutive samples for three sampling times (3, 6, and 9 minutes) were composited from the initial runoff event, mid term runoff events, and the end of the runoff event. The other autosampler was calibrated to collect flow-proportional samples from a 55 gallon drum. One liter samples were collected for each 30 liters of runoff passing through the flume.

The site was instrumented with an electronic weather station. Weather data includes air temperature, soil temperature at 4 inches below-ground surface (BGS), rainfall, wind speed, and solar radiation. Weather data were recorded on 1 minute time intervals and then averaged for hourly and daily time periods.

5. Analytical

Samples of runoff water were collected and stored for chemical analysis. In time- paced samples, the samples were collected and stored in Teflon capped 350 ml glass vessels. In the flow proportional samples, the runoff water in the stainless steel collection drum was mixed and then sampled using agitated and submerged 250 ml HDPE bottles. Five replicate samples were taken for residue analysis. Samples were stored in field coolers prior to transfer to the

Bayer CropScience for residue analysis. Water quality characterization and TSS analysis were performed by Agvise Laboratories.

Residues of fipronil in runoff water were analyzed using a LC/MS/MS method entitled "Insecticides, Fipronil: Method of Analysis for Possible Residues of Fipronil, MB46513, MB45950, and MB46136 in Water-Revision 2000-4" issued May 21, 2002. This method has method detection limit (MDL) of 0.004 µg/L and limit of quantification (LOQ) of 0.010 µg/L. (Reviewer Note: The method procedure requires filtration through 0.45 or 0.2 µM nylon filtration disk after an acetoanitrile extraction of unfiltered runoff water **(p 176)**. No storage stability study was conducted because samples were analyzed within a month of sampling **(Table 6, pp 165-166)**.

Procedural method verification in HPCL water at concentrations of 0.01, 1, and 2 µg/L showed recoveries of 99± 9% for fipronil (n=14), 99± 7% for MB46513 (n=14), 96± 7% for MB45950 (n=14), and 96± 7% for MB46136 (n=14) **(Table 2, p 167).** Method verification was conducted using irrigation water and HPLC water at the LOQ (0.010 µg/L) and 10X LOQ (0.100 µg/L). Residue recoveries ranged from 77% to 105% **(Table 1, p 160)**. Field spikes at 0.10 and 2.00 ug/L were prepared by spiking irrigation water with fipronil residues in glass and HDPE containers. The field spike samples were stored in a cooler on blue ice and then stored in a refrigerator at 2-8°C. Recoveries of the field spikes were 65 -100% for fipronil, 78%-98% for MB46513, 87-102% for MB45950, and 84-110% for MB46136 **(Table 5, p 164)**.

B. REPORTED RESULTS

1. Sediment Concentration and Transport

The maximum sediment concentration in runoff water was 30 mg/L in runoff Event 1 (Event 1) and 27 mg/L in runoff Event 2 (Event 2) were detected in the WSB treatment. **(Table 20, pp 76)**. In the WST treatment, the maximum sediment concentration in runoff water was 59 mg/L in Event 1 and 27 mg/L in Event 2. The buffer effectiveness for sediment trapping ranged from 4% (Event 1) to 10% (Event 2) for the Time-Paced Method, 24% (Event 1) to 14% (Event 2) for the Flow-Proportional Method, and 17% (Event 1) to 18% (Event 2) for the Method Average. The total suspended sediment accounted for 4.08 kg/ha (Event 1) and 1.76 kg/ha (Event 2) in the WST treatment. In the WSB treatments, the TSS accounted for 3.40 kg/ha (Event 1) and 1.54 kg/ha (Event 2). The registrant believes the low sediment concentrations in runoff water are expected for turf environments. The registrant noted that some suspended solids were introduced into the test plots from the irrigation water.

2. Concentration of Fipronil and its Metabolites in Runoff

In the time-paced samples for Event 1, the maximum fipronil concentration was 2.875 µg/L (mean=2.433 µg/L) 1 in the WST test plot and 0.724 µg/L (mean=0.517 µg/L) in the CSB test plot (**Table 21, pp 77**). For Event 2, the maximum fipronil concentration was 1.286 µg/L (mean= 1.150 µg/L) for the WST test plot and 0.456 µg/L (mean= 0.291 µg/L) for the WSB test plot (**Table 22, pp 78**). In the flow proportional samples for Event 1, the maximum fipronil concentration was 2.166 µg/L in the WST test plot and 0.597 µg/L in the WSB test plot (**Table 23, pp 79**). For Event 2, the maximum fipronil concentration was 1.259 µg/L for the WST test plot and 0.425 µg/L for the WSB test plot (**Table 23, pp 79**).

Chemographs show that fipronil and total fipronil concentrations in runoff waters from the WST test plot were consistently higher than the WSB test plot (**Figures 12, 13, 14, and 15, pp 94-97**). The chemographs showed different patterns of fipronil residue concentrations in runoff waters for runoff Event 1 and 2. In the WST plots in Event 1, fipronil concentrations gradually decreased after the simulated rainfall from ~ 2.8 µg/L @ 40 minutes during rainfall event to ~ 2.3 µg/L @ 147 minutes during the rainfall event. In the runoff Event 2, the fipronil concentration increased from ~ 0.6 µg/L @ 70 minutes during rainfall event to a plateau of ~ 1.2 µg/L @ 142 minutes during the rainfall event. In contrast, the WSB plot showed fipronil concentrations gradually increasing to a plateau of ~ 0.4 µg/L @ 142 to 147 minutes during the rainfall event. The registrant believes these data show the effectiveness of the 15 feet buffer in reducing fipronil residue runoff.

3. Fipronil Mass Transport

The fipronil mass transport calculations for percent of applied fipronil show the 15 feet buffer lowers the average mass transport of fipronil by 71% for Event 1 and 64% for Event 2 (**Table 24, pp 80**). For total fipronil residues, the 15 feet buffer removed the average fipronil residue mass by 71% for Event 1 and 65% for Event 2 (**Table 25, pp 81**). **Figures 16 and 17 (pp 98-99)** illustrate the difference in mass loading of fipronil and its degradation products from the WSB and WST treatments. The registrant believes the difference in the total fipronil concentrations in runoff from the WSB and WST test plots can be directly attributed to the runoff buffer.

C. REVIEWER COMMENTS

1. A fixed small plot field study:buffer zone (4.0) ratio was used in the study. Available data suggest the effectiveness of the buffer zone is dependent on numerous factors including runoff flow rate and depth, soil type, antecedent moisture, source area size, rainfall intensity and quantity, etc. (USDA/NRCS, 2000Ω). Sediment filter strip design also is dependent on the rainfall amount and intensity. The Universal Soil Loss Equation rainfall-erosivity factor for the Southeastern United States ranges from 250 to 350 (EPA, 1985ℓ). Under these conditions, effective sediment trapping in filter strips is expected for source area:filter ratios of < 50 (USDA/NRCS, 2000). This information suggest effective sediment trapping would be expected for the proposed source area: buffer ratio of 4.0. More importantly, the use of a low field area to buffer area ratio may bias the assessment of buffer effectiveness.

2. The registrant did not attempt to conduct separate analysis of fipronil residues on entrained sediments and dissolved in runoff water. This analysis would be useful in understanding the importance of fipronil sorption on entrained sediments.

3. Fipronil residue concentrations in this study are edge-of-field concentrations in runoff waters from a treated site. They do not account for any off-site attenuation or dilution due to site specific hydrology or topography. The reviewer notes the reported concentrations are expected to be most representative of first-order streams, where water quality characteristics are dominated by runoff.

Ω USDA. 2000.Conservation Buffers to Reduce Pesticide Losses. USDA/NRCS

ℓ EPA. 1985 Field Agricultural Runoff Monitoring (FARM) Manual. EPA/600/3-85/043. Athens, GA.

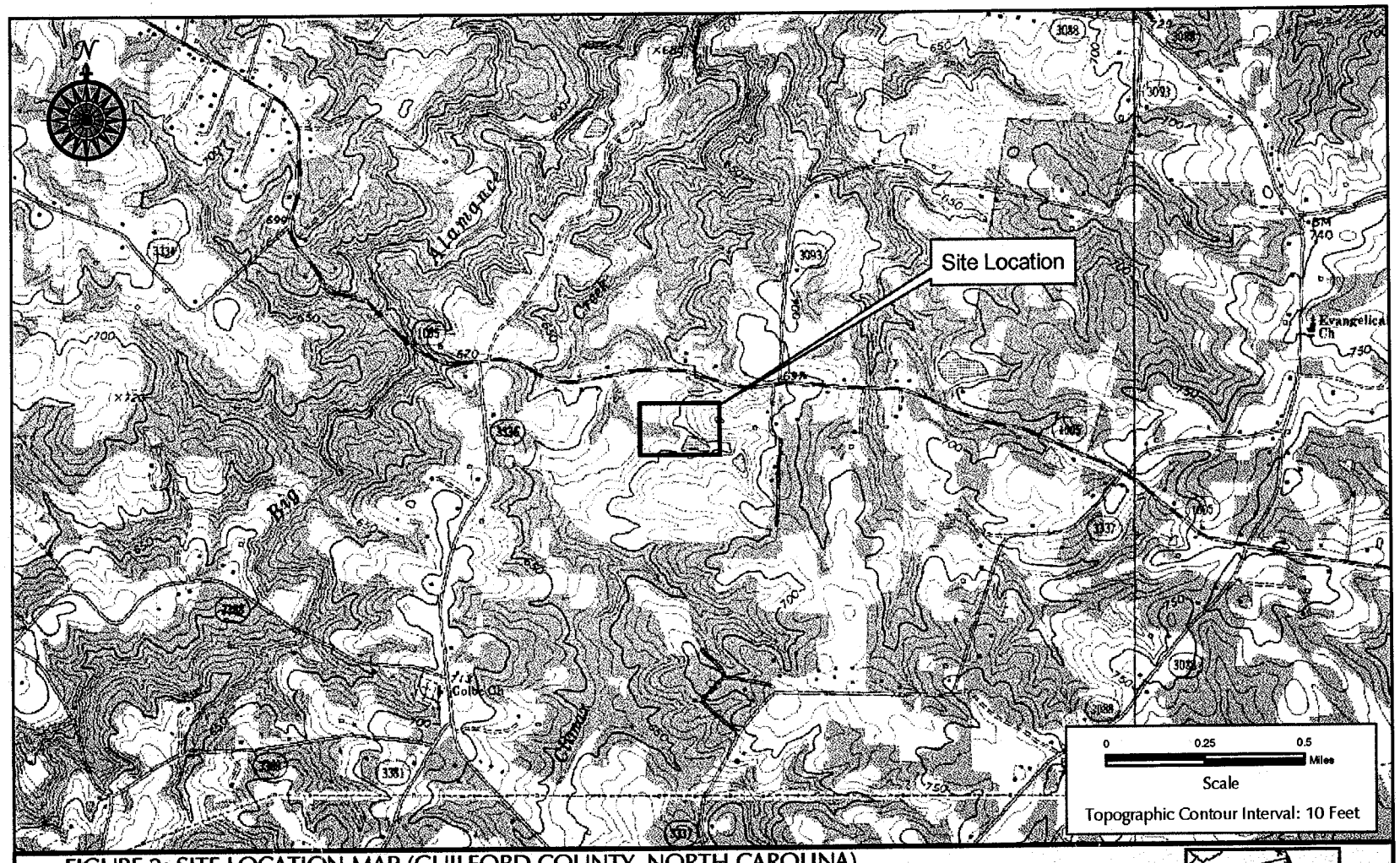

FIGURE 2: SITE LOCATION MAP (GUILFORD COUNTY, NORTH CAROLINA)
Effect of Vegetative Buffer Strips on Fipronil Runoff Losses from Warm Season Chipco TopChoice Treated Turfgrasses under Simulated Rainfall

Sources: Topographic Map from USGS 1:24,000 Scale Series, Climax and Kimesville quads

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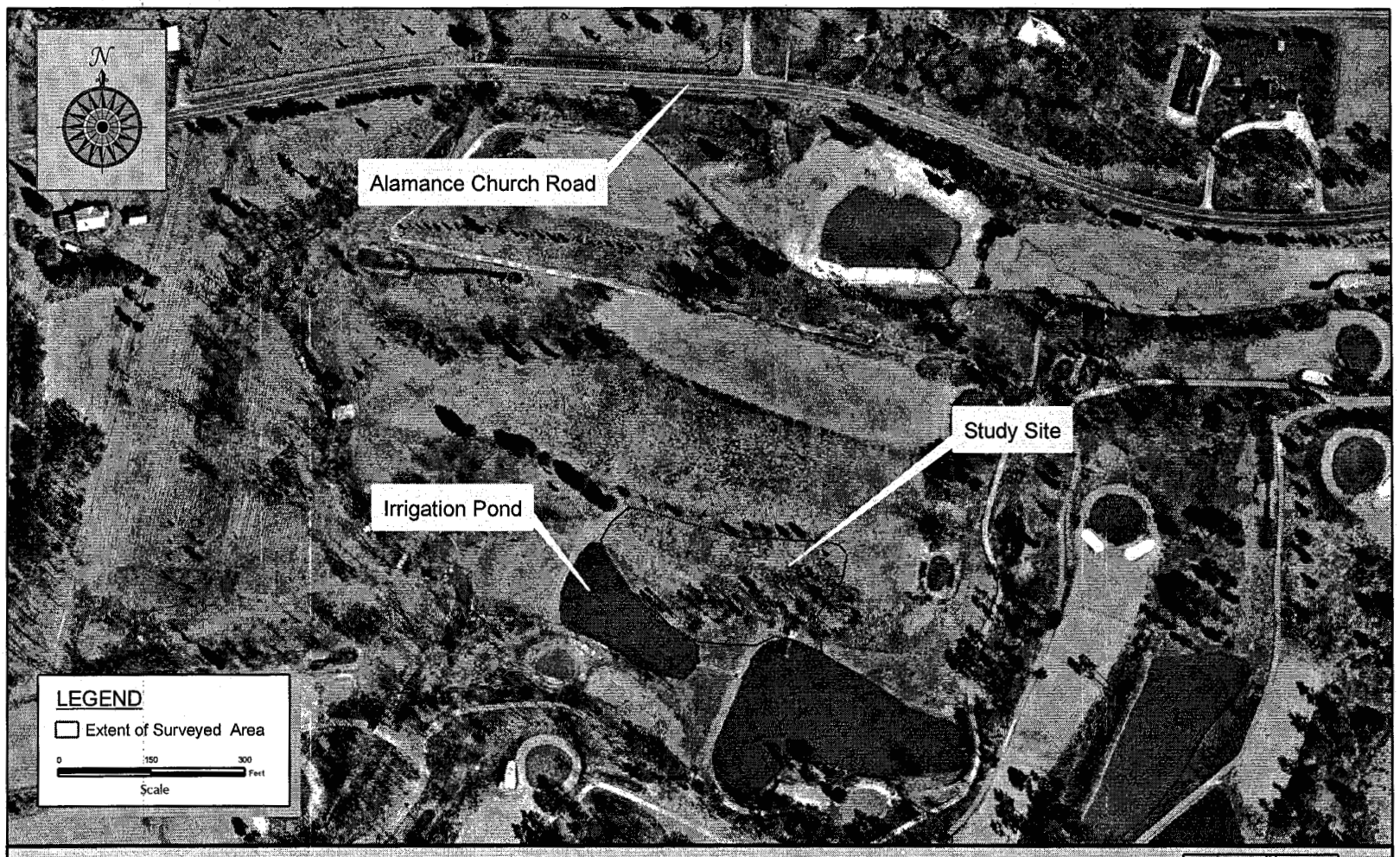

FIGURE 3: STUDY SITE ORTHOPHOTO (GUILFORD COUNTY, NORTH CAROLINA)
Effect of Vegetative Buffer Strips on Fipronil Runoff Losses from Warm Season Chipco TopChoice Treated Turfgrasses under Simulated Rainfall

Sources: Orthophopto from Guilford County GIS Department

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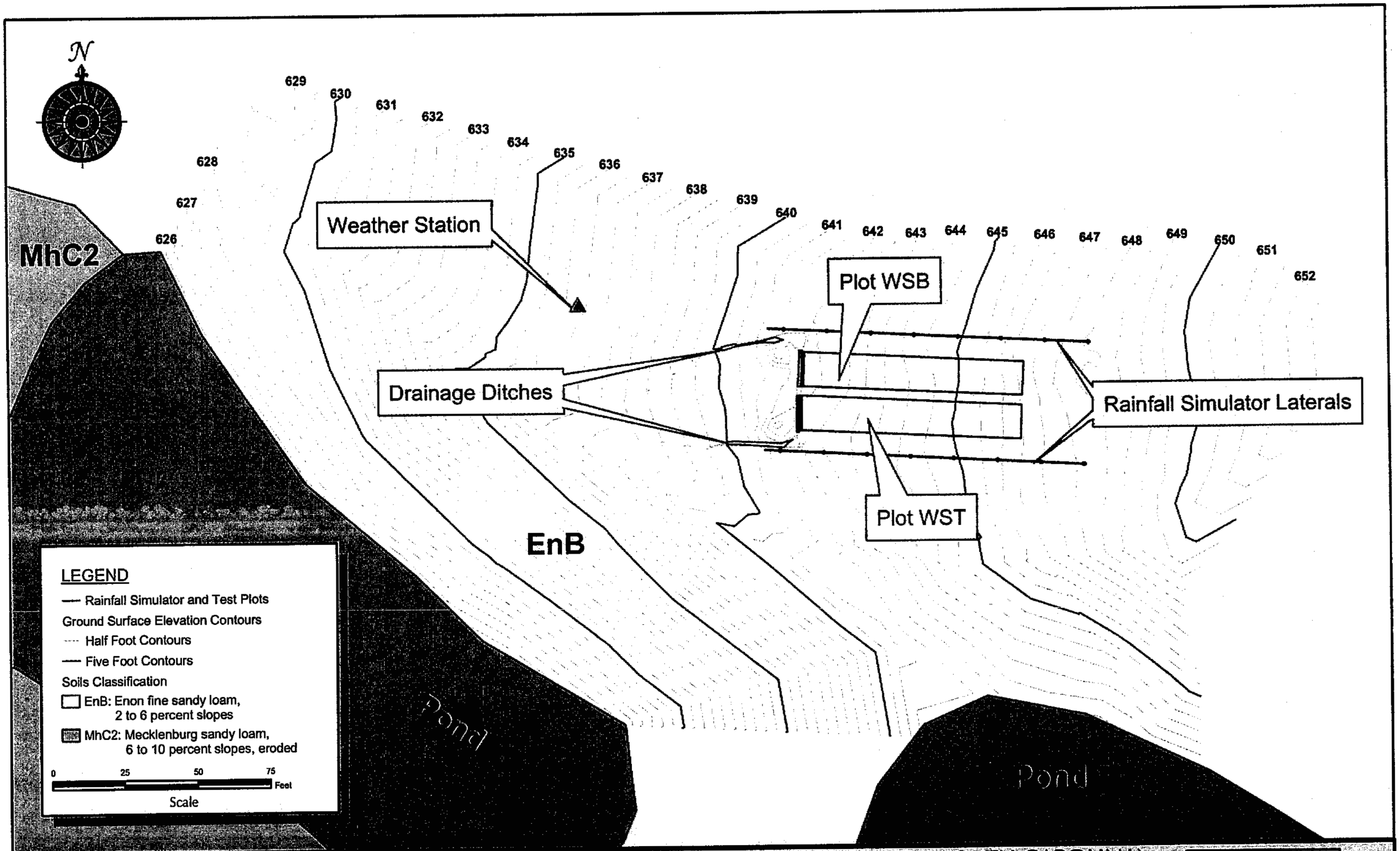

FIGURE 4: SITE TOPOGRAPHY AND SOIL CLASSIFICATION (GUILFORD COUNTY, NORTH CAROLINA)
Effect of Vegetative Buffer Strips on Fipronil Runoff Losses from Warm Season Chipco TopChoice Treated Turfgrasses under Simulated Rainfall

Sources: Soils Classification from Natural Resource Conservation Service SSURGO database (May 2000)
Topographic survey from ENT Land Surveys, Inc., Hillsborough, NC (June 2002)
Ponds digitized from orthophoto, Guilford County GIS Department

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TABLE 6
Soil Sample Characterization Data

Depth Interval (in. bgs)	Sample ID	Sand (%)	Silt (%)	Clay (%)	USDA Texture	Bulk Density	CEC (meq/100g)	OM (%)	pH[1]	Ca (ppm)	Mg (ppm)	K (ppm)	Na (ppm)	H (ppm)
0 - 4	36528-S-01-C-0-4	43	30	27	Loam	0.95	11.2	3.4	7.0	1060	293	116	18	30
	36528-S-02-C-0-4	57	30	13	Sandy Loam	0.93	11.4	4.2	7.1	1260	334	103	16	20
	36528-S-03-C-0-4	53	34	13	Sandy Loam	1.03	8.8	2.3	6.5	790	215	75	14	28
	36528-S-04-C-0-4	61	26	13	Sandy Loam	1.03	9.7	2.7	7.4	1040	291	74	13	18
	Mean	54	30	17		0.99	10.3	3.2	7.0	1038	283	92	15	24
	Standard Deviation	8	3	7		0.05	1.2	0.8	0.4	193	50	21	2	6
4 - 12	36528-S-01-C-4-12	45	36	19	Loam	1.18	9.5	0.9	7.5	935	223	27	17	28
	36528-S-02-C-4-12	49	30	21	Loam	1.09	15.6	0.9	7.6	1850	411	33	13	28
	36528-S-03-C-4-12	49	34	17	Loam	1.11	10.6	0.7	7.0	1100	246	41	13	29
	36528-S-04-C-4-12	59	28	13	Sandy Loam	1.15	10.8	0.7	7.7	1250	252	19	17	23
	Mean	51	32	18		1.13	11.6	0.8	7.5	1284	283	30	15	27
	Standard Deviation	6	4	3		0.04	2.7	0.1	0.3	399	86	9	2	3

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Source: Agvise Laboratories Soil Characterization Report, 6/28/02

Abbreviations: in. bgs = inches below ground surface; ppm = parts per million; CEC = cation exchange capacity; meq/100g = milliequivalents per 100 g; OM = organic matter

Notes: 1. pH determined with a pH electrode in a 1:1 soil:water suspension (Agvise SOP NUT.02.05)

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Date/Initials: 7/26/02 DCB; rev. 12/2/03 DCB

TABLE 7
Soil Infiltration Test Results

INFILTRATION TEST ID: 36528-IT-01

Time (hr:min)	Volume Added (mL)	Cumulative Volume (mL)	Cumulative Depth[1] (cm)	Cumulative Depth[2] (in.)	Elapsed Time (hr:min)
11:02					0:00
11:07	455	455	0.23	0.09	0:05
11:12	0	455	0.23	0.09	0:10
11:17	250	705	0.36	0.14	0:15
11:22	220	925	0.47	0.19	0:20
11:27	260	1185	0.60	0.24	0:25
11:32	120	1305	0.66	0.26	0:30
11:37	160	1465	0.75	0.29	0:35
11:42	150	1615	0.82	0.32	0:40
11:47	160	1775	0.90	0.36	0:45
11:52	200	1975	1.01	0.40	0:50
11:57	140	2115	1.08	0.42	0:55
12:02	140	2255	1.15	0.45	1:00
12:07	150	2405	1.22	0.48	1:05
12:12	135	2540	1.29	0.51	1:10
12:17	210	2750	1.40	0.55	1:15
12:22	110	2860	1.46	0.57	1:20
12:27	145	3005	1.53	0.60	1:25
12:32	155	3160	1.61	0.63	1:30
12:37	175	3335	1.70	0.67	1:35

Test Method:	Single Ring Infiltrometer
Ring Diameter (2):	20 1/2 in., 18 7/8 in.
Ring Area (in.^{2}):	304.4
Ring Area (cm^2):	1963.9

INFILTRATION RATE RESULTS

Calculation Method	(cm/hr)	(in./hr)
Arithmetic Method[3]	1.1	0.42
Regression Method[4]	0.9	0.37

Source: SEI Field Data Sheets, 6/18/02

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Notes: 1. Cumulative Depth (cm) = Cumulative Volume (ml)/Ring Infiltrometer Area (cm^2)

2. Cumulative Depth (in.) = Cumulative Depth (cm)/2.54

3. Infiltration Rate = Cumulative Depth/Elapsed Time (min) x 60 (min/hr)

4. Infiltration Rate calculated as the slope of the best fit (sum of least squares) line through the cumulative depth (cm)/elapsed time (min) data, multiplied by 60 min/hr. Due to a slight shift in the rate at approximately 25 minutes, the regression line was fit through the data between elapsed time = 25 minutes and the termination of the test (R2 = 0.9992). *Using only these later data points in the analysis* provides an estimate for the infiltration rate after the system has fully equilibrated and the soils are saturated.

Abbreviations: cm/hr = centimeters/hour; in./hr = inches/hour

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Date/Initials: 07/25/02 DCB; rev. 12/10/03 DCB

TABLE 7 (Continued)
Soil Infiltration Test Results

INFILTRATION TEST ID: 36528-IT-02

Time (hr:min)	Volume Added (mL)	Cumulative Volume (mL)	Cumulative Depth[1] (cm)	Cumulative Depth[2] (in.)	Elapsed Time (hr:min)
10:51					0:00
11:00	595	595	0.30	0.12	0:09
11:05	300	895	0.46	0.18	0:14
11:10	560	1455	0.74	0.29	0:19
11:15	95	1550	0.79	0.31	0:24
11:20	405	1955	1.00	0.39	0:29
11:25	225	2180	1.11	0.44	0:34
11:30	440	2620	1.33	0.53	0:39
11:35	310	2930	1.49	0.59	0:44
11:40	380	3310	1.69	0.66	0:49
11:45	155	3465	1.76	0.69	0:54
11:50	260	3725	1.90	0.75	0:59
11:55	295	4020	2.05	0.81	1:04
12:00	290	4310	2.19	0.86	1:09
12:05	190	4500	2.29	0.90	1:14
12:10	280	4780	2.43	0.96	1:19
12:15	305	5085	2.59	1.02	1:24
12:20	200	5285	2.69	1.06	1:29
12:25	245	5530	2.82	1.11	1:34
12:26	65	5595	2.85	1.12	1:35

Test Method:	Single Ring Infiltrometer
Ring Diameter (2):	19 3/4 in., 19 5/8 in.
Ring Area (in.^{2}):	304.4
Ring Area (cm^2):	1963.9

INFILTRATION RATE RESULTS

Calculation Method	(cm/hr)	(in./hr)
Arithmetic Method[3]	1.8	0.71
Regression Method[4]	1.6	0.61

Source: SEI Field Data Sheets, 6/18/02

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Notes: 1. Cumulative Depth (cm) = Cumulative Volume (ml)/Ring Infiltrometer Area (cm^2)

2. Cumulative Depth (in.) = Cumulative Depth (cm)/2.54

3. Infiltration Rate = Cumulative Depth/Elapsed Time (min) x 60 (min/hr)

4. Infiltration Rate calculated as the slope of the best fit (sum of least squares) line through the cumulative depth (cm)/elapsed time (min) data, multiplied by 60 min/hr. Due to a slight shift in the rate at approximately 49 minutes, the regression line was fit through the data between elapsed time = 49 minutes and the termination of the test (R2 = 0.9983). Using only these later data points in the analysis provides an estimate for the infiltration rate after the system has fully equilibrated and the soils are saturated.

Abbreviations: cm/hr = centimeters/hour; in./hr = inches/hour

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Date/Initials: 07/25/02 DCB; rev. 12/10/03 DCB

TABLE 4
Characterization of Simulator Source Water Collected Prior to Event 1

Parameter	Sample ID			Sample Average	Field Measurement[1]
	36528-SW-01-C	36528-SW-02-C	36528-SW-03-C		
Temperature (°C)	na	na	na	na	26.0
pH	7.8	8.0	8.0	7.9	7.25
Conductivity (mmhos/cm)	0.32	0.27	0.26	0.28	0.338
Sodium (ppm)	11	12	11	11	
Calcium (ppm)	25	25	25	25	
Magnesium (ppm)	9	9	9	9	
Hardness mg equivalent $CaCO_3$/L (ppm)	99	100	99	99	
Sodium Absorption Ratio (SAR)	0.50	0.50	0.50	0.50	
Total Dissolved Solids (ppm)	142	160	158	153	
Turbidity (NTU)	5.53	7.63	4.77	5.98	

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Source: SEI field data, 6/19/02; Agvise Laboratories Water Characterization Report, 6/24/02

Notes: 1 = Field measurements recorded on 6/19/02 immediately prior to sample collection

Abbreviations: na = not analyzed; ppm = parts per million; mmhos/cm = millimhos per centimeter; NTU = nephelometric turbidity units

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Date/Initials: 7/15/02 DCB; rev. 12/2/03 DCB; rev. 2/6/04 DCB

TABLE 5
Characterization of Simulator Source Water Collected Prior to Event 2

Parameter	Sample ID			Sample Average	Field Measurement[1]
	36528-SW-04-C	36528-SW-05-C	36528-SW-06-C		
Temperature (°C)	na	na	na	na	25.5
pH	7.5	7.8	7.7	7.7	7.30
Conductivity (mmhos/cm)	0.35	0.29	0.31	0.32	0.378
Sodium (ppm)	12	12	12	12	
Calcium (ppm)	28	28	29	28	
Magnesium (ppm)	10	10	10	10	
Hardness mg equivalent $CaCO_3$/L (ppm)	112	112	112	112	
Sodium Absorption Ratio (SAR)	0.50	0.50	0.51	0.50	
Total Dissolved Solids (ppm)	248	276	294	273	
Turbidity (NTU)	3.90	8.32	4.81	5.68	

STONE ENVIRONMENTAL, INC.

Source: SEI field data, 6/27/02; Agvise Laboratories Water Characterization Report, 7/3/02
Notes: 1 = Field measurements recorded on 6/27/02 immediately prior to sample collection
Abbreviations: na = not analyzed; ppm = parts per million; mmhos/cm = millimhos per centimeter; NTU = nephelometric turbidity units
O:\Proj-02\1281-F-FipRO\Report_36528\Tables\SiteCharacterization.xls~Simulator WaterChar_E2
Date/Initials: 7/15/02 DCB; rev. 12/2/03 DCB; rev. 2/6/04 DCB

TABLE 11
Rainfall Simulator Performance

	Event 1 (June 19, 2002)		Event 2 (June 27, 2002)	
	Plot WSB	Plot WST	Plot WSB	Plot WST
Number of Collection Jars (n)	10	10	10	10
Mean Volume (ml)	324	308	293	298
Standard Deviation (ml)	37	21	39	40
Coefficient of Variation (percent)	12	7	13	13
Coefficient of Uniformity (CU) [1]	91	94	91	91
Simulator Start Time (hr:min:sec)	11:59:53	11:59:53	11:38:05	11:38:05
Simulator End Time (hr:min:sec)	14:27:30	14:27:30	14:00:00	14:00:00
Simulated Rainfall Duration (min)	147.62	147.62	141.92	141.92
Rainfall Delivery (cm) [2]	6.78	6.45	6.13	6.24
Rainfall Delivery (in.) [3]	2.67	2.54	2.41	2.46
Rainfall Intensity (in./hr) [4]	1.08	1.03	1.02	1.04
Total Simulated Rainfall Input (L) [5]	5,665	5,396	5,125	5,214
Percent of 1.0 in./hr Target [6]	108	103	102	104

Source: Stone Environmental field data sheets 6/19/02 and 6/27/02

STONE ENVIRONMENTAL, INC.

Notes: Diameter of collection jar opening = 7.8 cm; Radius = 3.9 cm

1. CU = 100 (1-D/M), where D = $(1/n)\Sigma|Xi-M|$, and M= $(1/n)\Sigma Xi$
2. Rainfall Delivery (cm) = Mean Volume (ml)/pi(3.9 cm)2
3. Rainfall Delivery (in.) = Rainfall Delivery (cm)/(2.54 cm/in.)
4. Rainfall Intensity (in./hr) = Rainfall Delivery (in.)*(60 min/hr)/Event Duration (min)
5. Total Input = Delivery (in.)/12)*(plot length--75 ft)(plot width--12 ft)*(7.48052 gal/ft^3)(3.785 L/gal)
6. Percent of Target = Rainfall Intensity (in./hr)/(1.0 in./hr)*100, where 1.0 in./hr is the target rainfall input

Path: O:\Proj-02\1281-F-FipRO\Report_36528\Tables\Simulator Performance.xls

int: 7/25/02 DCB; 9/3/02 DCB; 12/2/03 DCB

TABLE 12
Runoff Flow from Plot WST (Top Buffer) on Event 1, June 19, 2002

	Elapsed Time			Runoff Flow				
Time[1] (24 hour)	Simulated Rainfall[2] (minutes)	Runoff Duration[3] (minutes)	Flume Depth[4] (m)	Rate[5] (L/sec)	Rate[6] (L/min)	Rate[7] (mm/hr)	Cumulative[8] (L)	Sample Interval[9] (L)
12:56	56	0	0.011	0.008	0.48	0.34	0.00	
12:57	57	1	0.012	0.022	1.32	0.95	1.32	
12:58	58	2	0.013	0.023	1.38	0.99	2.70	
12:59	59	3	0.013	0.023	1.38	0.99	4.08	
13:00	60	4	0.015	0.027	1.62	1.16	5.70	
13:01	61	5	0.016	0.027	1.62	1.16	7.32	
13:02	62	6	0.017	0.032	1.92	1.38	9.24	9.24
13:03	63	7	0.019	0.038	2.28	1.64	11.52	
13:04	64	8	0.021	0.044	2.64	1.89	14.16	
13:05	65	9	0.023	0.055	3.30	2.37	17.46	
13:06	66	10	0.025	0.070	4.20	3.01	21.66	
13:07	67	11	0.027	0.085	5.10	3.66	26.76	
13:08	68	12	0.029	0.098	5.88	4.22	32.64	
13:09	69	13	0.031	0.116	6.96	4.99	39.60	
13:10	70	14	0.032	0.125	7.50	5.38	47.10	
13:11	71	15	0.033	0.137	8.22	5.90	55.32	46.08
13:12	72	16	0.033	0.140	8.40	6.03	63.72	
13:13	73	17	0.034	0.147	8.82	6.33	72.54	
13:14	74	18	0.033	0.144	8.64	6.20	81.18	
13:15	75	19	0.034	0.149	8.94	6.42	90.12	
13:16	76	20	0.034	0.152	9.12	6.54	99.24	
13:17	77	21	0.035	0.159	9.54	6.85	108.78	
13:18	78	22	0.035	0.164	9.84	7.06	118.62	
13:19	79	23	0.036	0.175	10.50	7.53	129.12	
13:20	80	24	0.037	0.190	11.40	8.18	140.52	85.20
13:21	81	25	0.038	0.202	12.12	8.70	152.64	
13:22	82	26	0.040	0.231	13.86	9.95	166.50	
13:23	83	27	0.042	0.263	15.78	11.32	182.28	
13:24	84	28	0.043	0.278	16.68	11.97	198.96	
13:25	85	29	0.043	0.281	16.86	12.10	215.82	
13:26	86	30	0.044	0.297	17.82	12.79	233.64	
13:27	87	31	0.045	0.317	19.02	13.65	252.66	
13:28	88	32	0.045	0.315	18.90	13.56	271.56	
13:29	89	33	0.045	0.324	19.44	13.95	291.00	150.48
13:30	90	34	0.045	0.324	19.44	13.95	310.44	
13:31	91	35	0.046	0.328	19.68	14.12	330.12	
13:32	92	36	0.046	0.337	20.22	14.51	350.34	
13:33	93	37	0.047	0.349	20.94	15.03	371.28	
13:34	94	38	0.047	0.358	21.48	15.41	392.76	
13:35	95	39	0.048	0.366	21.96	15.76	414.72	
13:36	96	40	0.048	0.370	22.20	15.93	436.92	
13:37	97	41	0.048	0.370	22.20	15.93	459.12	
13:38	98	42	0.048	0.374	22.44	16.10	481.56	190.56
13:39	99	43	0.048	0.374	22.44	16.10	504.00	
13:40	100	44	0.048	0.370	22.20	15.93	526.20	
13:41	101	45	0.048	0.366	21.96	15.76	548.16	
13:42	102	46	0.049	0.385	23.10	16.58	571.26	
13:43	103	47	0.049	0.389	23.34	16.75	594.60	
13:44	104	48	0.049	0.385	23.10	16.58	617.70	
13:45	105	49	0.049	0.397	23.82	17.09	641.52	

TABLE 12 (Continued)
Runoff Flow from Plot WST (Top Buffer) on Event 1, June 19, 2002

	Elapsed Time			Runoff Flow				
Time[1] (24 hour)	Simulated Rainfall[2] (minutes)	Runoff Duration[3] (minutes)	Flume Depth[4] (m)	Rate[5] (L/sec)	Rate[6] (L/min)	Rate[7] (mm/hr)	Cumulative[8] (L)	Sample Interval[9] (L)
13:46	106	50	0.050	0.408	24.48	17.57	666.00	
13:47	107	51	0.050	0.421	25.26	18.13	691.26	209.70
13:48	108	52	0.051	0.427	25.62	18.38	716.88	
13:49	109	53	0.051	0.432	25.92	18.60	742.80	
13:50	110	54	0.051	0.427	25.62	18.38	768.42	
13:51	111	55	0.051	0.432	25.92	18.60	794.34	
13:52	112	56	0.051	0.432	25.92	18.60	820.26	
13:53	113	57	0.051	0.427	25.62	18.38	845.88	
13:54	114	58	0.051	0.441	26.46	18.99	872.34	
13:55	115	59	0.051	0.445	26.70	19.16	899.04	
13:56	116	60	0.051	0.441	26.46	18.99	925.50	234.24
13:57	117	61	0.052	0.452	27.12	19.46	952.62	
13:58	118	62	0.052	0.452	27.12	19.46	979.74	
13:59	119	63	0.052	0.456	27.36	19.63	1007.10	
14:00	120	64	0.052	0.456	27.36	19.63	1034.46	
14:01	121	65	0.052	0.466	27.96	20.06	1062.42	
14:02	122	66	0.052	0.466	27.96	20.06	1090.38	
14:03	123	67	0.053	0.482	28.92	20.75	1119.30	
14:04	124	68	0.052	0.466	27.96	20.06	1147.26	
14:05	125	69	0.052	0.470	28.20	20.24	1175.46	249.96
14:06	126	70	0.053	0.475	28.50	20.45	1203.96	
14:07	127	71	0.053	0.487	29.22	20.97	1233.18	
14:08	128	72	0.053	0.477	28.62	20.54	1261.80	
14:09	129	73	0.053	0.482	28.92	20.75	1290.72	
14:10	130	74	0.052	0.470	28.20	20.24	1318.92	
14:11	131	75	0.053	0.477	28.62	20.54	1347.54	
14:12	132	76	0.053	0.475	28.50	20.45	1376.04	
14:13	133	77	0.053	0.482	28.92	20.75	1404.96	
14:14	134	78	0.053	0.487	29.22	20.97	1434.18	258.72
14:15	135	79	0.053	0.487	29.22	20.97	1463.40	
14:16	136	80	0.053	0.482	28.92	20.75	1492.32	
14:17	137	81	0.053	0.487	29.22	20.97	1521.54	
14:18	138	82	0.053	0.492	29.52	21.18	1551.06	
14:19	139	83	0.054	0.496	29.76	21.36	1580.82	
14:20	140	84	0.053	0.492	29.52	21.18	1610.34	
14:21	141	85	0.053	0.482	28.92	20.75	1639.26	
14:22	142	86	0.053	0.487	29.22	20.97	1668.48	
14:23	143	87	0.054	0.504	30.24	21.70	1698.72	264.54
14:24	144	88	0.053	0.487	29.22	20.97	1727.94	
14:25	145	89	0.053	0.482	28.92	20.75	1756.86	
14:26	146	90	0.051	0.427	25.62	18.38	1782.48	
14:27	147	91	0.048	0.366	21.96	15.76	1804.44	
14:28	148	92	0.045	0.317	19.02	13.65	1823.46	
14:29	149	93	0.043	0.281	16.86	12.10	1840.32	
14:30	150	94	0.040	0.228	13.68	9.82	1854.00	
14:31	151	95	0.038	0.202	12.12	8.70	1866.12	
14:32	152	96	0.036	0.175	10.50	7.53	1876.62	177.90
14:33	153	97	0.034	0.152	9.12	6.54	1885.74	
14:34	154	98	0.033	0.139	8.34	5.98	1894.08	
14:35	155	99	0.031	0.121	7.26	5.21	1901.34	24.72

TABLE 12 (Continued)
Runoff Flow from Plot WST (Top Buffer) on Event 1, June 19, 2002

	Elapsed Time			Runoff Flow				
Time[1] (24 hour)	Simulated Rainfall[2] (minutes)	Runoff Duration[3] (minutes)	Flume Depth[4] (m)	Rate[5] (L/sec)	Rate[6] (L/min)	Rate[7] (mm/hr)	Cumulative[8] (L)	Sample Interval[9] (L)
14:36	156	100	0.030	0.108	6.48	4.65	1907.82	
14:37	157	101	0.029	0.098	5.88	4.22	1913.70	
14:38	158	102	0.028	0.091	5.46	3.92	1919.16	
14:39	159	103	0.027	0.085	5.10	3.66	1924.26	
14:40	160	104	0.026	0.077	4.62	3.32	1928.88	
14:41	161	105	0.025	0.072	4.32	3.10	1933.20	
14:42	162	106	0.024	0.066	3.96	2.84	1937.16	
14:43	163	107	0.024	0.063	3.78	2.71	1940.94	
14:44	164	108	0.024	0.061	3.66	2.63	1944.60	
14:45	165	109	0.022	0.052	3.12	2.24	1947.72	
14:46	166	110	0.021	0.046	2.76	1.98	1950.48	
14:47	167	111	0.020	0.044	2.64	1.89	1953.12	
14:48	168	112	0.020	0.042	2.52	1.81	1955.64	
14:49	169	113	0.020	0.041	2.46	1.77	1958.10	
14:50	170	114	0.019	0.039	2.34	1.68	1960.44	
14:51	171	115	0.019	0.037	2.22	1.59	1962.66	
14:52	172	116	0.019	0.037	2.22	1.59	1964.88	
14:53	173	117	0.018	0.035	2.10	1.51	1966.98	
14:54	174	118	0.018	0.034	2.04	1.46	1969.02	
14:55	175	119	0.018	0.033	1.98	1.42	1971.00	
14:56	176	120	0.018	0.033	1.98	1.42	1972.98	
14:57	177	121	0.017	0.032	1.92	1.38	1974.90	
14:58	178	122	0.017	0.031	1.86	1.33	1976.76	
14:59	179	123	0.017	0.031	1.86	1.33	1978.62	
15:00	180	124	0.015	0.026	1.56	1.12	1980.18	

Source: Automated flow data collection with ISCO 3230 flowmeter STONE ENVIRONMENTAL, INC.

Notes: 1. Clock time recorded in flow meter memory during runoff event

2. Elapsed Time since start of simulated rainfall event

3. Elapsed Time since first observation of runoff from plot

4. Flume Depth (m) recorded in flow meter memory during runoff event

5. Flow Rate (L/sec) calculated using Isco's Flowlink ver. 3.22 software

6. Flow Rate (L/min) calculated as: Flow Rate (L/sec) x 60 sec/min

7. Flow Rate (mm/hr) calculated as: (Flow Rate (L/min) x 60 min/hr x 1000 ml/L x cm^3/ml x 10 mm/cm) /(900 ft^2 x (30.48 cm/ft)^2)

8. Cumulative Runoff Flow (L) = previous minutes cumulative flow (L) + current flow rate (L/min). The flow total was reset to zero at the start of the first minute of runoff

9. Sample Interval runoff flow (L) =current cumulative flow (L) - cumulative flow of previous sample (L)

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int: 7/28/02 DCB

TABLE 13
Runoff Flow from Plot WSB (Bottom Buffer) on Event 1, June 19, 2002

	Elapsed Time			Runoff Flow				
Time[1] (24 hour)	Simulated Rainfall[2] (minutes)	Runoff Duration[3] (minutes)	Flume Depth[4] (m)	Rate[5] (L/sec)	Rate[6] (L/min)	Rate[7] (mm/hr)	Cumulative[8] (L)	Sample Interval[9] (L)
13:09	69	0	0.031	0.118	7.08	5.08	0.00	
13:10	70	1	0.034	0.157	9.42	6.76	9.42	
13:11	71	2	0.037	0.185	11.10	7.97	20.52	
13:12	72	3	0.038	0.209	12.54	9.00	33.06	
13:13	73	4	0.040	0.225	13.50	9.69	46.56	
13:14	74	5	0.041	0.240	14.40	10.33	60.96	
13:15	75	6	0.041	0.255	15.30	10.98	76.26	76.26
13:16	76	7	0.043	0.276	16.56	11.88	92.82	
13:17	77	8	0.044	0.297	17.82	12.79	110.64	
13:18	78	9	0.044	0.300	18.00	12.92	128.64	
13:19	79	10	0.045	0.315	18.90	13.56	147.54	
13:20	80	11	0.046	0.331	19.86	14.25	167.40	
13:21	81	12	0.046	0.337	20.22	14.51	187.62	
13:22	82	13	0.047	0.353	21.18	15.20	208.80	
13:23	83	14	0.047	0.358	21.48	15.41	230.28	
13:24	84	15	0.047	0.362	21.72	15.59	252.00	175.74
13:25	85	16	0.048	0.379	22.74	16.32	274.74	
13:26	86	17	0.048	0.381	22.86	16.40	297.60	
13:27	87	18	0.049	0.393	23.58	16.92	321.18	
13:28	88	19	0.049	0.389	23.34	16.75	344.52	
13:29	89	20	0.050	0.408	24.48	17.57	369.00	
13:30	90	21	0.050	0.408	24.48	17.57	393.48	
13:31	91	22	0.050	0.408	24.48	17.57	417.96	
13:32	92	23	0.050	0.416	24.96	17.91	442.92	
13:33	93	24	0.051	0.427	25.62	18.38	468.54	216.54
13:34	94	25	0.051	0.427	25.62	18.38	494.16	
13:35	95	26	0.050	0.425	25.50	18.30	519.66	
13:36	96	27	0.051	0.432	25.92	18.60	545.58	
13:37	97	28	0.051	0.427	25.62	18.38	571.20	
13:38	98	29	0.051	0.445	26.70	19.16	597.90	
13:39	99	30	0.051	0.432	25.92	18.60	623.82	
13:40	100	31	0.051	0.432	25.92	18.60	649.74	
13:41	101	32	0.051	0.445	26.70	19.16	676.44	
13:42	102	33	0.051	0.441	26.46	18.99	702.90	234.36
13:43	103	34	0.052	0.452	27.12	19.46	730.02	
13:44	104	35	0.052	0.450	27.00	19.38	757.02	
13:45	105	36	0.051	0.445	26.70	19.16	783.72	
13:46	106	37	0.051	0.432	25.92	18.60	809.64	
13:47	107	38	0.052	0.452	27.12	19.46	836.76	
13:48	108	39	0.052	0.450	27.00	19.38	863.76	
13:49	109	40	0.052	0.466	27.96	20.06	891.72	
13:50	110	41	0.052	0.456	27.36	19.63	919.08	
13:51	111	42	0.052	0.466	27.96	20.06	947.04	244.14
13:52	112	43	0.052	0.466	27.96	20.06	975.00	
13:53	113	44	0.053	0.477	28.62	20.54	1003.62	
13:54	114	45	0.053	0.477	28.62	20.54	1032.24	
13:55	115	46	0.053	0.477	28.62	20.54	1060.86	
13:56	116	47	0.053	0.482	28.92	20.75	1089.78	

TABLE 13 (Continued)
Runoff Flow from Plot WSB (Bottom Buffer) on Event 1, June 19, 2002

	Elapsed Time			Runoff Flow				
Time[1] (24 hour)	Simulated Rainfall[2] (minutes)	Runoff Duration[3] (minutes)	Flume Depth[4] (m)	Rate[5] (L/sec)	Rate[6] (L/min)	Rate[7] (mm/hr)	Cumulative[8] (L)	Sample Interval[9] (L)
13:57	117	48	0.053	0.477	28.62	20.54	1118.40	
13:58	118	49	0.053	0.477	28.62	20.54	1147.02	
13:59	119	50	0.053	0.482	28.92	20.75	1175.94	
14:00	120	51	0.054	0.496	29.76	21.36	1205.70	258.66
14:01	121	52	0.054	0.508	30.48	21.87	1236.18	
14:02	122	53	0.054	0.504	30.24	21.70	1266.42	
14:03	123	54	0.054	0.504	30.24	21.70	1296.66	
14:04	124	55	0.054	0.501	30.06	21.57	1326.72	
14:05	125	56	0.054	0.501	30.06	21.57	1356.78	
14:06	126	57	0.054	0.501	30.06	21.57	1386.84	
14:07	127	58	0.054	0.508	30.48	21.87	1417.32	
14:08	128	59	0.054	0.501	30.06	21.57	1447.38	
14:09	129	60	0.054	0.496	29.76	21.36	1477.14	271.44
14:10	130	61	0.054	0.501	30.06	21.57	1507.20	
14:11	131	62	0.054	0.508	30.48	21.87	1537.68	
14:12	132	63	0.054	0.508	30.48	21.87	1568.16	
14:13	133	64	0.055	0.523	31.38	22.52	1599.54	
14:14	134	65	0.054	0.508	30.48	21.87	1630.02	
14:15	135	66	0.054	0.513	30.78	22.09	1660.80	
14:16	136	67	0.055	0.523	31.38	22.52	1692.18	
14:17	137	68	0.054	0.504	30.24	21.70	1722.42	
14:18	138	69	0.054	0.501	30.06	21.57	1752.48	275.34
14:19	139	70	0.054	0.496	29.76	21.36	1782.24	
14:20	140	71	0.054	0.496	29.76	21.36	1812.00	
14:21	141	72	0.054	0.496	29.76	21.36	1841.76	
14:22	142	73	0.053	0.492	29.52	21.18	1871.28	
14:23	143	74	0.054	0.496	29.76	21.36	1901.04	
14:24	144	75	0.054	0.496	29.76	21.36	1930.80	
14:25	145	76	0.053	0.492	29.52	21.18	1960.32	
14:26	146	77	0.052	0.466	27.96	20.06	1988.28	
14:27	147	78	0.049	0.404	24.24	17.39	2012.52	260.04
14:28	148	79	0.047	0.349	20.94	15.03	2033.46	
14:29	149	80	0.045	0.307	18.42	13.22	2051.88	
14:30	150	81	0.043	0.278	16.68	11.97	2068.56	
14:31	151	82	0.040	0.234	14.04	10.08	2082.60	
14:32	152	83	0.038	0.209	12.54	9.00	2095.14	
14:33	153	84	0.037	0.185	11.10	7.97	2106.24	
14:34	154	85	0.035	0.168	10.08	7.23	2116.32	
14:35	155	86	0.034	0.152	9.12	6.54	2125.44	
14:36	156	87	0.032	0.134	8.04	5.77	2133.48	120.96
14:37	157	88	0.032	0.127	7.62	5.47	2141.10	
14:38	158	89	0.030	0.112	6.72	4.82	2147.82	
14:39	159	90	0.029	0.103	6.18	4.43	2154.00	
14:40	160	91	0.028	0.095	5.70	4.09	2159.70	
14:41	161	92	0.027	0.088	5.28	3.79	2164.98	
14:42	162	93	0.027	0.082	4.92	3.53	2169.90	
14:43	163	94	0.026	0.078	4.68	3.36	2174.58	
14:44	164	95	0.025	0.072	4.32	3.10	2178.90	

TABLE 13 (Continued)
Runoff Flow from Plot WSB (Bottom Buffer) on Event 1, June 19, 2002

	Elapsed Time			Runoff Flow				
Time[1] (24 hour)	Simulated Rainfall[2] (minutes)	Runoff Duration[3] (minutes)	Flume Depth[4] (m)	Rate[5] (L/sec)	Rate[6] (L/min)	Rate[7] (mm/hr)	Cumulative[8] (L)	Sample Interval[9] (L)
14:45	165	96	0.025	0.070	4.20	3.01	2183.10	
14:46	166	97	0.024	0.066	3.96	2.84	2187.06	
14:47	167	98	0.024	0.063	3.78	2.71	2190.84	
14:48	168	99	0.024	0.061	3.66	2.63	2194.50	
14:49	169	100	0.021	0.047	2.82	2.02	2197.32	
14:50	170	101	0.021	0.046	2.76	1.98	2200.08	
14:51	171	102	0.021	0.045	2.70	1.94	2202.78	
14:52	172	103	0.020	0.042	2.52	1.81	2205.30	
14:53	173	104	0.020	0.041	2.46	1.77	2207.76	
14:54	174	105	0.019	0.039	2.34	1.68	2210.10	
14:55	175	106	0.020	0.040	2.40	1.72	2212.50	
14:56	176	107	0.019	0.037	2.22	1.59	2214.72	
14:57	177	108	0.019	0.037	2.22	1.59	2216.94	
14:58	178	109	0.019	0.036	2.16	1.55	2219.10	
14:59	179	110	0.018	0.035	2.10	1.51	2221.20	
15:00	180	111	0.018	0.034	2.04	1.46	2223.24	

Source: Automated flow data collection with ISCO 3230 flowmeter STONE ENVIRONMENTAL, INC.

Notes: 1. Clock time recorded in flow meter memory during runoff event

2. Elapsed Time since start of simulated rainfall event

3. Elapsed Time since first observation of runoff from plot

4. Flume Depth (m) recorded in flow meter memory during runoff event

5. Flow Rate (L/sec) calculated using Isco's Flowlink ver. 3.22 software

6. Flow Rate (L/min) calculated as: Flow Rate (L/sec) x 60 sec/min

7. Flow Rate (mm/hr) calculated as: (Flow Rate (L/min) x 60 min/hr x 1000 ml/L x cm^3/ml x 10 mm/cm) /(900 ft^2 x (30.48 cm/ft)^2

8. Cumulative Runoff Flow (L) = previous minutes cumulative flow (L) + current flow rate (L/min). The flow total was reset to zero at the start of the first minute of runoff

9. Sample Interval runoff flow (L) =current cumulative flow (L) - cumulative flow of previous sample (L)

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int: 7/28/02 DCB

TABLE 14
Runoff Flow from Plot WST (Top Buffer) on Event 2, June 27, 2002

	Elapsed Time			Runoff Flow				
Time[1] (24 hour)	Simulated Rainfall[2] (minutes)	Runoff Duration[3] (minutes)	Flume Depth[4] (m)	Rate[5] (L/sec)	Rate[6] (L/min)	Rate[7] (mm/hr)	Cumulative[8] (L)	Sample Interval[9] (L)
12:41	63	0	0.012	0.022	1.32	0.95	0.00	
12:42	64	1	0.014	0.024	1.44	1.03	1.44	
12:43	65	2	0.014	0.025	1.50	1.08	2.94	
12:44	66	3	0.015	0.026	1.56	1.12	4.50	
12:45	67	4	0.015	0.027	1.62	1.16	6.12	
12:46	68	5	0.016	0.029	1.74	1.25	7.86	
12:47	69	6	0.017	0.031	1.86	1.33	9.72	9.72
12:48	70	7	0.018	0.035	2.10	1.51	11.82	
12:49	71	8	0.019	0.038	2.28	1.64	14.10	
12:50	72	9	0.020	0.040	2.40	1.72	16.50	
12:51	73	10	0.024	0.062	3.72	2.67	20.22	
12:52	74	11	0.028	0.094	5.64	4.05	25.86	
12:53	75	12	0.031	0.117	7.02	5.04	32.88	
12:54	76	13	0.032	0.134	8.04	5.77	40.92	
12:55	77	14	0.034	0.152	9.12	6.54	50.04	
12:56	78	15	0.035	0.166	9.96	7.15	60.00	50.28
12:57	79	16	0.036	0.182	10.92	7.84	70.92	
12:58	80	17	0.038	0.209	12.54	9.00	83.46	
12:59	81	18	0.041	0.245	14.70	10.55	98.16	
13:00	82	19	0.043	0.278	16.68	11.97	114.84	
13:01	83	20	0.045	0.311	18.66	13.39	133.50	
13:02	84	21	0.045	0.317	19.02	13.65	152.52	
13:03	85	22	0.046	0.328	19.68	14.12	172.20	
13:04	86	23	0.046	0.328	19.68	14.12	191.88	
13:05	87	24	0.047	0.349	20.94	15.03	212.82	152.82
13:06	88	25	0.047	0.349	20.94	15.03	233.76	
13:07	89	26	0.047	0.362	21.72	15.59	255.48	
13:08	90	27	0.047	0.362	21.72	15.59	277.20	
13:09	91	28	0.048	0.374	22.44	16.10	299.64	
13:10	92	29	0.048	0.379	22.74	16.32	322.38	
13:11	93	30	0.048	0.381	22.86	16.40	345.24	
13:12	94	31	0.049	0.385	23.10	16.58	368.34	
13:13	95	32	0.049	0.404	24.24	17.39	392.58	
13:14	96	33	0.049	0.397	23.82	17.09	416.40	203.58
13:15	97	34	0.049	0.404	24.24	17.39	440.64	
13:16	98	35	0.049	0.401	24.06	17.27	464.70	
13:17	99	36	0.050	0.408	24.48	17.57	489.18	
13:18	100	37	0.051	0.436	26.16	18.77	515.34	
13:19	101	38	0.051	0.432	25.92	18.60	541.26	
13:20	102	39	0.051	0.436	26.16	18.77	567.42	
13:21	103	40	0.051	0.445	26.70	19.16	594.12	
13:22	104	41	0.051	0.441	26.46	18.99	620.58	
13:23	105	42	0.052	0.450	27.00	19.38	647.58	231.18
13:24	106	43	0.052	0.456	27.36	19.63	674.94	
13:25	107	44	0.052	0.456	27.36	19.63	702.30	
13:26	108	45	0.052	0.466	27.96	20.06	730.26	
13:27	109	46	0.053	0.477	28.62	20.54	758.88	
13:28	110	47	0.052	0.470	28.20	20.24	787.08	

TABLE 14 (Continued)
Runoff Flow from Plot WST (Top Buffer) on Event 2, June 27, 2002

	Elapsed Time			Runoff Flow				
Time[1] (24 hour)	Simulated Rainfall[2] (minutes)	Runoff Duration[3] (minutes)	Flume Depth[4] (m)	Rate[5] (L/sec)	Rate[6] (L/min)	Rate[7] (mm/hr)	Cumulative[8] (L)	Sample Interval[9] (L)
13:29	111	48	0.052	0.470	28.20	20.24	815.28	
13:30	112	49	0.052	0.461	27.66	19.85	842.94	
13:31	113	50	0.052	0.466	27.96	20.06	870.90	
13:32	114	51	0.052	0.470	28.20	20.24	899.10	251.52
13:33	115	52	0.052	0.470	28.20	20.24	927.30	
13:34	116	53	0.053	0.482	28.92	20.75	956.22	
13:35	117	54	0.053	0.487	29.22	20.97	985.44	
13:36	118	55	0.053	0.487	29.22	20.97	1014.66	
13:37	119	56	0.053	0.487	29.22	20.97	1043.88	
13:38	120	57	0.053	0.487	29.22	20.97	1073.10	
13:39	121	58	0.053	0.487	29.22	20.97	1102.32	
13:40	122	59	0.053	0.487	29.22	20.97	1131.54	
13:41	123	60	0.053	0.487	29.22	20.97	1160.76	261.66
13:42	124	61	0.053	0.487	29.22	20.97	1189.98	
13:43	125	62	0.053	0.487	29.22	20.97	1219.20	
13:44	126	63	0.053	0.487	29.22	20.97	1248.42	
13:45	127	64	0.054	0.501	30.06	21.57	1278.48	
13:46	128	65	0.054	0.504	30.24	21.70	1308.72	
13:47	129	66	0.054	0.513	30.78	22.09	1339.50	
13:48	130	67	0.054	0.518	31.08	22.30	1370.58	
13:49	131	68	0.054	0.508	30.48	21.87	1401.06	
13:50	132	69	0.054	0.513	30.78	22.09	1431.84	271.08
13:51	133	70	0.054	0.513	30.78	22.09	1462.62	
13:52	134	71	0.054	0.504	30.24	21.70	1492.86	
13:53	135	72	0.054	0.518	31.08	22.30	1523.94	
13:54	136	73	0.054	0.518	31.08	22.30	1555.02	
13:55	137	74	0.055	0.531	31.86	22.86	1586.88	
13:56	138	75	0.055	0.536	32.16	23.08	1619.04	
13:57	139	76	0.055	0.531	31.86	22.86	1650.90	
13:58	140	77	0.055	0.528	31.68	22.73	1682.58	
13:59	141	78	0.052	0.466	27.96	20.06	1710.54	278.70
14:00	142	79	0.050	0.408	24.48	17.57	1735.02	
14:01	143	80	0.047	0.345	20.70	14.85	1755.72	
14:02	144	81	0.044	0.292	17.52	12.57	1773.24	
14:03	145	82	0.042	0.266	15.96	11.45	1789.20	
14:04	146	83	0.039	0.221	13.26	9.52	1802.46	
14:05	147	84	0.037	0.190	11.40	8.18	1813.86	
14:06	148	85	0.035	0.168	10.08	7.23	1823.94	
14:07	149	86	0.034	0.149	8.94	6.42	1832.88	
14:08	150	87	0.032	0.134	8.04	5.77	1840.92	130.38
14:09	151	88	0.031	0.123	7.38	5.30	1848.30	
14:10	152	89	0.030	0.112	6.72	4.82	1855.02	
14:11	153	90	0.029	0.105	6.30	4.52	1861.32	
14:12	154	91	0.028	0.095	5.70	4.09	1867.02	
14:13	155	92	0.027	0.088	5.28	3.79	1872.30	
14:14	156	93	0.026	0.079	4.74	3.40	1877.04	
14:15	157	94	0.026	0.075	4.50	3.23	1881.54	
14:16	158	95	0.025	0.069	4.14	2.97	1885.68	

TABLE 14 (Continued)
Runoff Flow from Plot WST (Top Buffer) on Event 2, June 27, 2002

	Elapsed Time			Runoff Flow				
Time[1] (24 hour)	Simulated Rainfall[2] (minutes)	Runoff Duration[3] (minutes)	Flume Depth[4] (m)	Rate[5] (L/sec)	Rate[6] (L/min)	Rate[7] (mm/hr)	Cumulative[8] (L)	Sample Interval[9] (L)
14:17	159	96	0.024	0.065	3.90	2.80	1889.58	
14:18	160	97	0.024	0.063	3.78	2.71	1893.36	
14:19	161	98	0.022	0.052	3.12	2.24	1896.48	
14:20	162	99	0.022	0.049	2.94	2.11	1899.42	
14:21	163	100	0.021	0.047	2.82	2.02	1902.24	
14:22	164	101	0.021	0.045	2.70	1.94	1904.94	
14:23	165	102	0.020	0.042	2.52	1.81	1907.46	
14:24	166	103	0.020	0.042	2.52	1.81	1909.98	
14:25	167	104	0.020	0.040	2.40	1.72	1912.38	
14:26	168	105	0.019	0.038	2.28	1.64	1914.66	
14:27	169	106	0.019	0.037	2.22	1.59	1916.88	
14:28	170	107	0.019	0.036	2.16	1.55	1919.04	
14:29	171	108	0.018	0.035	2.10	1.51	1921.14	
14:30	172	109	0.018	0.033	1.98	1.42	1923.12	
14:31	173	110	0.018	0.033	1.98	1.42	1925.10	
14:32	174	111	0.017	0.032	1.92	1.38	1927.02	
14:33	175	112	0.017	0.032	1.92	1.38	1928.94	
14:34	176	113	0.016	0.029	1.74	1.25	1930.68	
14:35	177	114	0.016	0.029	1.74	1.25	1932.42	
14:36	178	115	0.016	0.027	1.62	1.16	1934.04	
14:37	179	116	0.016	0.027	1.62	1.16	1935.66	
14:38	180	117	0.015	0.027	1.62	1.16	1937.28	

Source: Automated flow data collection with ISCO 3230 flowmeter STONE ENVIRONMENTAL, INC.

Notes: 1. Clock time recorded in flow meter memory during runoff event

2. Elapsed Time since start of simulated rainfall event

3. Elapsed Time since first observation of runoff from plot

4. Flume Depth (m) recorded in flow meter memory during runoff event

5. Flow Rate (L/sec) calculated using Isco's Flowlink ver. 3.22 software

6. Flow Rate (L/min) calculated as: Flow Rate (L/sec) x 60 sec/min

7. Flow Rate (mm/hr) calculated as: (Flow Rate (L/min) x 60 min/hr x 1000 ml/L x cm^3/ml x 10 mm/cm) /(900 ft^2 x (30.48 cm/ft)^2

8. Cumulative Runoff Flow (L) = previous minutes cumulative flow (L) + current flow rate (L/min). The flow total was reset to zero at the start of the first minute of runoff

9. Sample Interval runoff flow (L) =current cumulative flow (L) - cumulative flow of previous sample (L)

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int: 7/28/02 DCB

TABLE 15
Runoff Flow from Plot WSB (Bottom Buffer) on Event 2, June 27, 2002

	Elapsed Time			Runoff Flow				
Time[1] (24 hour)	Simulated Rainfall[2] (minutes)	Runoff Duration[3] (minutes)	Flume Depth[4] (m)	Rate[5] (L/sec)	Rate[6] (L/min)	Rate[7] (mm/hr)	Cumulative[8] (L)	Sample Interval[9] (L)
12:42	64	0	0.009	0.000	0.00	0.00	0.00	
12:43	65	1	0.009	0.000	0.00	0.00	0.00	
12:44	66	2	0.009	0.000	0.00	0.00	0.00	
12:45	67	3	0.010	0.000	0.00	0.00	0.00	
12:46	68	4	0.010	0.000	0.00	0.00	0.00	
12:47	69	5	0.011	0.000	0.00	0.00	0.00	
12:48	70	6	0.011	0.022	1.32	0.95	1.32	1.32
12:49	71	7	0.012	0.022	1.32	0.95	2.64	
12:50	72	8	0.014	0.025	1.50	1.08	4.14	
12:51	73	9	0.019	0.037	2.22	1.59	6.36	
12:52	74	10	0.024	0.061	3.66	2.63	10.02	
12:53	75	11	0.028	0.088	5.28	3.79	15.30	
12:54	76	12	0.033	0.142	8.52	6.11	23.82	
12:55	77	13	0.038	0.209	12.54	9.00	36.36	
12:56	78	14	0.042	0.269	16.14	11.58	52.50	
12:57	79	15	0.045	0.315	18.90	13.56	71.40	70.08
12:58	80	16	0.047	0.345	20.70	14.85	92.10	
12:59	81	17	0.048	0.370	22.20	15.93	114.30	
13:00	82	18	0.049	0.389	23.34	16.75	137.64	
13:01	83	19	0.050	0.408	24.48	17.57	162.12	
13:02	84	20	0.050	0.421	25.26	18.13	187.38	
13:03	85	21	0.051	0.436	26.16	18.77	213.54	
13:04	86	22	0.051	0.432	25.92	18.60	239.46	
13:05	87	23	0.051	0.445	26.70	19.16	266.16	
13:06	88	24	0.051	0.445	26.70	19.16	292.86	221.46
13:07	89	25	0.052	0.456	27.36	19.63	320.22	
13:08	90	26	0.052	0.452	27.12	19.46	347.34	
13:09	91	27	0.052	0.466	27.96	20.06	375.30	
13:10	92	28	0.052	0.466	27.96	20.06	403.26	
13:11	93	29	0.052	0.466	27.96	20.06	431.22	
13:12	94	30	0.053	0.477	28.62	20.54	459.84	
13:13	95	31	0.053	0.482	28.92	20.75	488.76	
13:14	96	32	0.053	0.477	28.62	20.54	517.38	
13:15	97	33	0.053	0.475	28.50	20.45	545.88	253.02
13:16	98	34	0.053	0.482	28.92	20.75	574.80	
13:17	99	35	0.053	0.477	28.62	20.54	603.42	
13:18	100	36	0.053	0.482	28.92	20.75	632.34	
13:19	101	37	0.053	0.492	29.52	21.18	661.86	
13:20	102	38	0.053	0.482	28.92	20.75	690.78	
13:21	103	39	0.054	0.501	30.06	21.57	720.84	
13:22	104	40	0.054	0.496	29.76	21.36	750.60	
13:23	105	41	0.054	0.504	30.24	21.70	780.84	
13:24	106	42	0.054	0.508	30.48	21.87	811.32	265.44
13:25	107	43	0.054	0.508	30.48	21.87	841.80	
13:26	108	44	0.054	0.508	30.48	21.87	872.28	
13:27	109	45	0.054	0.508	30.48	21.87	902.76	
13:28	110	46	0.055	0.523	31.38	22.52	934.14	
13:29	111	47	0.055	0.531	31.86	22.86	966.00	

TABLE 15 (Continued)
Runoff Flow from Plot WSB (Bottom Buffer) on Event 2, June 27, 2002

	Elapsed Time			Runoff Flow				
Time[1] (24 hour)	Simulated Rainfall[2] (minutes)	Runoff Duration[3] (minutes)	Flume Depth[4] (m)	Rate[5] (L/sec)	Rate[6] (L/min)	Rate[7] (mm/hr)	Cumulative[8] (L)	Sample Interval[9] (L)
13:30	112	48	0.055	0.531	31.86	22.86	997.86	
13:31	113	49	0.055	0.523	31.38	22.52	1029.24	
13:32	114	50	0.055	0.523	31.38	22.52	1060.62	
13:33	115	51	0.055	0.528	31.68	22.73	1092.30	280.98
13:34	116	52	0.055	0.523	31.38	22.52	1123.68	
13:35	117	53	0.054	0.513	30.78	22.09	1154.46	
13:36	118	54	0.055	0.523	31.38	22.52	1185.84	
13:37	119	55	0.055	0.531	31.86	22.86	1217.70	
13:38	120	56	0.055	0.528	31.68	22.73	1249.38	
13:39	121	57	0.055	0.531	31.86	22.86	1281.24	
13:40	122	58	0.055	0.523	31.38	22.52	1312.62	
13:41	123	59	0.055	0.528	31.68	22.73	1344.30	
13:42	124	60	0.055	0.536	32.16	23.08	1376.46	284.16
13:43	125	61	0.055	0.541	32.46	23.29	1408.92	
13:44	126	62	0.055	0.528	31.68	22.73	1440.60	
13:45	127	63	0.055	0.531	31.86	22.86	1472.46	
13:46	128	64	0.055	0.528	31.68	22.73	1504.14	
13:47	129	65	0.055	0.531	31.86	22.86	1536.00	
13:48	130	66	0.055	0.528	31.68	22.73	1567.68	
13:49	131	67	0.055	0.531	31.86	22.86	1599.54	
13:50	132	68	0.055	0.541	32.46	23.29	1632.00	
13:51	133	69	0.055	0.541	32.46	23.29	1664.46	288.00
13:52	134	70	0.055	0.531	31.86	22.86	1696.32	
13:53	135	71	0.056	0.546	32.76	23.51	1729.08	
13:54	136	72	0.056	0.546	32.76	23.51	1761.84	
13:55	137	73	0.056	0.546	32.76	23.51	1794.60	
13:56	138	74	0.056	0.551	33.06	23.72	1827.66	
13:57	139	75	0.056	0.551	33.06	23.72	1860.72	
13:58	140	76	0.056	0.551	33.06	23.72	1893.78	
13:59	141	77	0.055	0.523	31.38	22.52	1925.16	
14:00	142	78	0.052	0.461	27.66	19.85	1952.82	288.36
14:01	143	79	0.050	0.408	24.48	17.57	1977.30	
14:02	144	80	0.047	0.358	21.48	15.41	1998.78	
14:03	145	81	0.045	0.320	19.20	13.78	2017.98	
14:04	146	82	0.043	0.285	17.10	12.27	2035.08	
14:05	147	83	0.041	0.248	14.88	10.68	2049.96	
14:06	148	84	0.039	0.218	13.08	9.39	2063.04	
14:07	149	85	0.037	0.194	11.64	8.35	2074.68	
14:08	150	86	0.036	0.175	10.50	7.53	2085.18	
14:09	151	87	0.034	0.157	9.42	6.76	2094.60	141.78
14:10	152	88	0.033	0.142	8.52	6.11	2103.12	
14:11	153	89	0.032	0.128	7.68	5.51	2110.80	
14:12	154	90	0.031	0.118	7.08	5.08	2117.88	
14:13	155	91	0.030	0.107	6.42	4.61	2124.30	
14:14	156	92	0.029	0.099	5.94	4.26	2130.24	
14:15	157	93	0.028	0.093	5.58	4.00	2135.82	
14:16	158	94	0.027	0.088	5.28	3.79	2141.10	
14:17	159	95	0.027	0.080	4.80	3.44	2145.90	

TABLE 15 (Continued)
Runoff Flow from Plot WSB (Bottom Buffer) on Event 2, June 27, 2002

	Elapsed Time			Runoff Flow				
Time[1] (24 hour)	Simulated Rainfall[2] (minutes)	Runoff Duration[3] (minutes)	Flume Depth[4] (m)	Rate[5] (L/sec)	Rate[6] (L/min)	Rate[7] (mm/hr)	Cumulative[8] (L)	Sample Interval[9] (L)
14:18	160	96	0.026	0.075	4.50	3.23	2150.40	
14:19	161	97	0.024	0.066	3.96	2.84	2154.36	
14:20	162	98	0.024	0.063	3.78	2.71	2158.14	
14:21	163	99	0.023	0.059	3.54	2.54	2161.68	
14:22	164	100	0.023	0.057	3.42	2.45	2165.10	
14:23	165	101	0.022	0.053	3.18	2.28	2168.28	
14:24	166	102	0.023	0.055	3.30	2.37	2171.58	
14:25	167	103	0.022	0.052	3.12	2.24	2174.70	
14:26	168	104	0.022	0.049	2.94	2.11	2177.64	
14:27	169	105	0.021	0.049	2.94	2.11	2180.58	
14:28	170	106	0.021	0.046	2.76	1.98	2183.34	
14:29	171	107	0.021	0.046	2.76	1.98	2186.10	
14:30	172	108	0.020	0.042	2.52	1.81	2188.62	
14:31	173	109	0.020	0.042	2.52	1.81	2191.14	
14:32	174	110	0.020	0.041	2.46	1.77	2193.60	
14:33	175	111	0.020	0.040	2.40	1.72	2196.00	
14:34	176	112	0.019	0.037	2.22	1.59	2198.22	
14:35	177	113	0.019	0.036	2.16	1.55	2200.38	
14:36	178	114	0.018	0.035	2.10	1.51	2202.48	
14:37	179	115	0.018	0.034	2.04	1.46	2204.52	
14:38	180	116	0.018	0.033	1.98	1.42	2206.50	

Source: Automated flow data collection with ISCO 3230 flowmeter STONE ENVIRONMENTAL, INC.

Notes: 1. Clock time recorded in flow meter memory during runoff event

2. Elapsed Time since start of simulated rainfall event

3. Elapsed Time since first observation of runoff from plot

4. Flume Depth (m) recorded in flow meter memory during runoff event

5. Flow Rate (L/sec) calculated using Isco's Flowlink ver. 3.22 software

6. Flow Rate (L/min) calculated as: Flow Rate (L/sec) x 60 sec/min

7. Flow Rate (mm/hr) calculated as: (Flow Rate (L/min) x 60 min/hr x 1000 ml/L x cm^3/ml x 10 mm/cm) /(900 ft^2 x (30.48 cm/ft)^2

8. Cumulative Runoff Flow (L) = previous minutes cumulative flow (L) + current flow rate (L/min). The flow total was reset to zero at the start of the first minute of runoff

9. Sample Interval runoff flow (L) =current cumulative flow (L) - cumulative flow of previous sample (L)

Path: O:\Proj-02\1281-F-FipRO\Report_36528\Tables\36528_RunoffData.xls~WSB_E2

int: 7/28/02 DCB

TABLE 16
Rainfall Input and Runoff Yield

Simulated Rainfall Event	Plot	Buffer Position	Rainfall Intensity (in./hr)	Total Simulated Rainfall Input (in.)	Total Simulated Rainfall Input (L)	Total Runoff Volume (L)	Runoff Yield[1] (%)
Event 1, June 19, 2002							
	WST	Top	1.03	2.54	5,396	1,901	35.2
	WSB	Bottom	1.08	2.67	5,665	2,133	37.7
	Percent difference between top buffer and bottom buffer plots[2]			-5%	-5%	-12%	-7%
Event 2, June 27, 2002							
	WST	Top	1.04	2.46	5,214	1,841	35.3
	WSB	Bottom	1.02	2.41	5,125	2,095	40.9
	Percent difference between top buffer and bottom buffer plots[2]			2%	2%	-14%	-16%

Sources: Sources: SEI field data sheets and ISCO 3230 flowmeter data, 6/19/02 and 6/27/02

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Notes: 1. Runoff yield (%) calculated as: 100 x total runoff volume (L)/total simulated rainfall input (L)

2. Percent difference calculated as: 100 x (Plot WST Value - Plot WSB Value)/Plot WST Value

Path: O:\Proj-02\1281-F-FipRO\Report_36528\Tables\36528_Runoff Data~RunoffYield

int: 7/30/02 DCB

TABLE 17
Total Suspended Solids in Time-Paced Runoff Samples, Event 1

Plot ID	Sample ID	Runoff Duration[1] (minutes)	Interval Flow[2] (L)	TSS[3] (ppm)
WST (Top Buffer)				
	36528-WST-TP-01-S	6	9.2	59
	36528-WST-TP-02-S	15	46.1	56
	36528-WST-TP-03-S	24	85.2	16
	36528-WST-TP-04-S	33	150.5	26
	36528-WST-TP-05-S	42	190.6	18
	36528-WST-TP-06-S	51	209.7	13
	36528-WST-TP-07-S	60	234.2	14
	36528-WST-TP-08-S	69	250.0	6
	36528-WST-TP-09-S	78	258.7	9
	36528-WST-TP-10-S	87	264.5	9
	36528-WST-TP-11-S	96	177.9	3
	max			59
	mean			21
WSB (Bottom Buffer)				
	36528-WSB-TP-01-S	6	76.3	30
	36528-WSB-TP-02-S	15	175.7	16
	36528-WSB-TP-03-S	24	216.5	19
	36528-WSB-TP-04-S	33	234.4	13
	36528-WSB-TP-05-S	42	244.1	12
	36528-WSB-TP-06-S	51	258.7	9
	36528-WSB-TP-07-S	60	271.4	8
	36528-WSB-TP-08-S	69	275.3	8
	36528-WSB-TP-09-S	78	260.0	5
	36528-WSB-TP-10-S	87	121.0	3
	max			30
	mean			12

Source: Agvise Laboratories Analytical Reports, 6/28/02 and 7/1/02 STONE ENVIRONMENTAL, INC.

Notes: 1. Elapsed time since first observation of runoff from plot

2. Interval runoff flow (L) =current cumulative flow (L) - cumulative flow (L) of previous sample

3. TSS = Total Suspended Solids (parts per million)

Path: O:\Proj-02\1281-F-FipRO\Report_36528\Tables\36528_Runoff Data~TP TSS_E1

Date/Initials: 7/29/02 DCB; rev. 2/5/04 DCB

TABLE 18
Total Suspended Solids in Time-Paced Runoff Samples, Event 2

Plot ID	Sample ID	Runoff Duration[1] (minutes)	Interval Flow[2] (L)	TSS[3] (ppm)
WST (Top Buffer)				
	36528-WST-TP-12-S	6	9.7	7
	36528-WST-TP-13-S	15	50.3	22
	36528-WST-TP-14-S	24	152.8	10
	36528-WST-TP-15-S	33	203.6	6
	36528-WST-TP-16-S	42	231.2	8
	36528-WST-TP-17-S	51	251.5	9
	36528-WST-TP-18-S	60	261.7	5
	36528-WST-TP-19-S	69	271.1	6
	36528-WST-TP-20-S	78	278.7	4
	36528-WST-TP-21-S	87	130.4	4
	max			27
	mean			10
WSB (Bottom Buffer)				
	36528-WSB-TP-11-S	6	1.3	7
	36528-WSB-TP-12-S	15	70.1	21
	36528-WSB-TP-13-S	24	221.5	9
	36528-WSB-TP-14-S	33	253.0	7
	36528-WSB-TP-15-S	42	265.4	5
	36528-WSB-TP-16-S	51	281.0	5
	36528-WSB-TP-17-S	60	284.2	4
	36528-WSB-TP-18-S	69	288.0	3
	36528-WSB-TP-19-S	78	288.4	4
	36528-WSB-TP-20-S	87	141.8	3
	max			27
	mean			9

Source: Agvise Laboratories Analytical Reports, 7/10/02 STONE ENVIRONMENTAL, INC.

Notes: 1. Elapsed time since first observation of runoff from plot

2. Interval runoff flow (L) =current cumulative flow (L) - cumulative flow (L) of previous sample

3. TSS = Total Suspended Solids (parts per million)

Path: O:\Proj-02\1281-F-FipRO\Report_36528\Tables\36528_Runoff Data~TP TSS_E2

Date/Initials: 7/29/02 DCB; rev. 2/5/04 DCB

TABLE 19
Total Suspended Solids in Flow Proportional Runoff Samples, Events 1 and 2

Simulated Rainfall Runoff Event 1, June 19, 2002

Plot WST (Top Buffer)		Plot WSB (Bottom Buffer)	
Sample ID	TSS (ppm)[1]	Sample ID	TSS (ppm)[1]
36528-WST-QP-01-S	24	36528-WSB-QP-01-S	17
36528-WST-QP-02-S	20	36528-WSB-QP-02-S	14
36528-WST-QP-03-S	23	36528-WSB-QP-03-S	16
36528-WST-QP-04-S	21	36528-WSB-QP-04-S	9
36528-WST-QP-05-S	27	36528-WSB-QP-05-S	22
mean	23	*mean*	16
standard deviation	2.7	*standard deviation*	4.7

Simulated Rainfall Runoff Event 2, June 27, 2002

Plot WST (Top Buffer)		Plot WSB (Bottom Buffer)	
Sample ID	TSS (ppm)[1]	Sample ID	TSS (ppm)[1]
36528-WST-QP-06-S	9	36528-WSB-QP-06-S	8
36528-WST-QP-07-S	8	36528-WSB-QP-07-S	7
36528-WST-QP-08-S	8	36528-WSB-QP-08-S	8
36528-WST-QP-09-S	10	36528-WSB-QP-09-S	
36528-WST-QP-10-S	10	36528-WSB-QP-10-S	6
mean	9	*mean*	7
standard deviation	1.0	*standard deviation*	1.3

Source: Agvise Laboratories Analytical Report, 6/28/02 & 7/10/02 STONE ENVIRONMENTAL, INC.

Notes: 1. *TSS = Total Suspended Solids (parts per million)*

Path: O:\Proj-02\1281-F-FipRO\Report_36528\Tables\36528_Runoff Data~QP TSS

int: 7/29/02 DCB

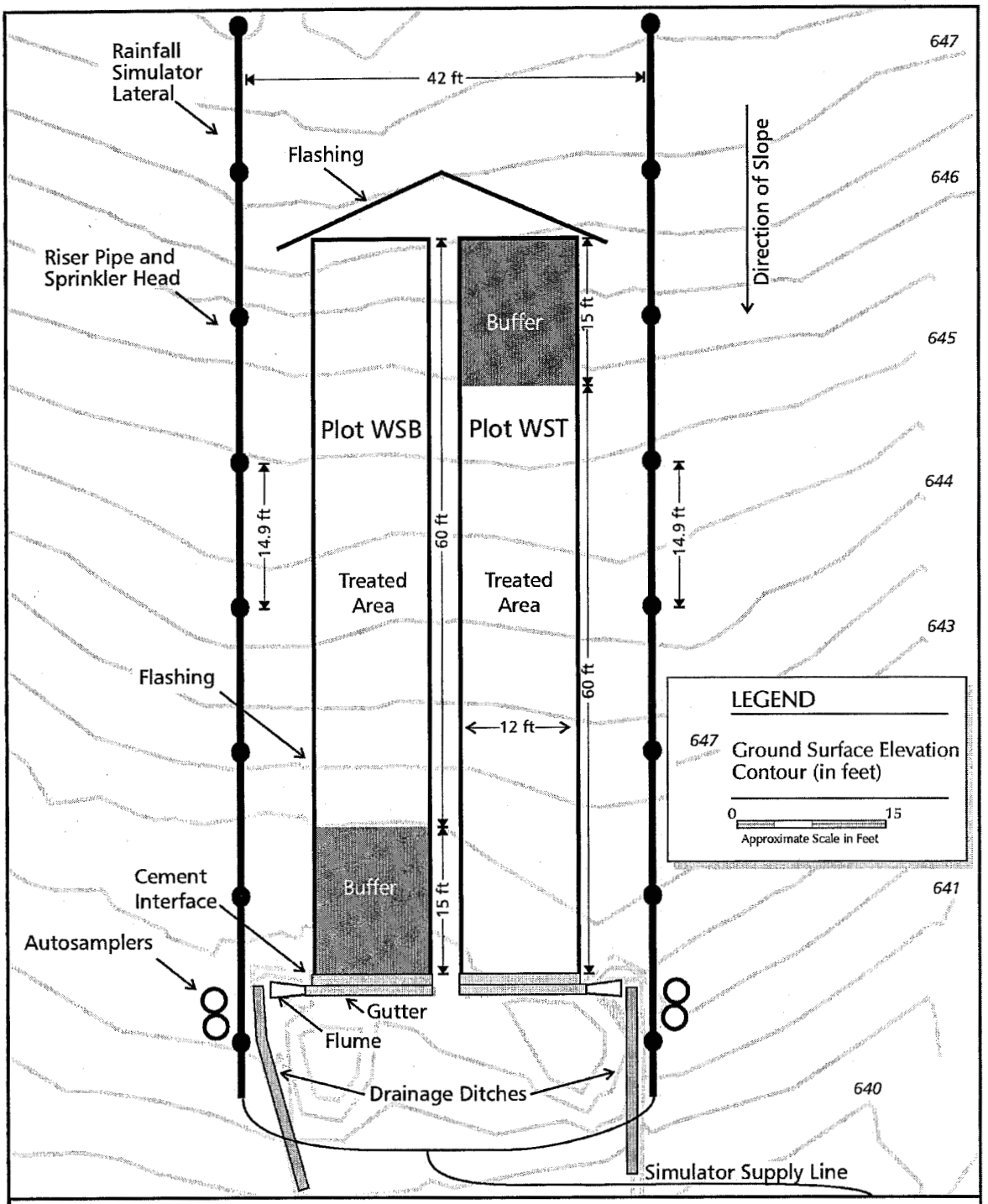

FIGURE 5: STUDY SITE PLAN
Effect of Vegetative Buffer Strips on Fipronil Runoff Losses from Warm Season Chipco Topchoice™ Treated Turfgrasses Under Simulated Rainfall
Julian, North Carolina

Source: SEI Field Notes
o:\proj-02\1281-F-FIPRO\36528\figures\siteplan.cdr
int:07-31-02 gwth; 08-29-02 jms

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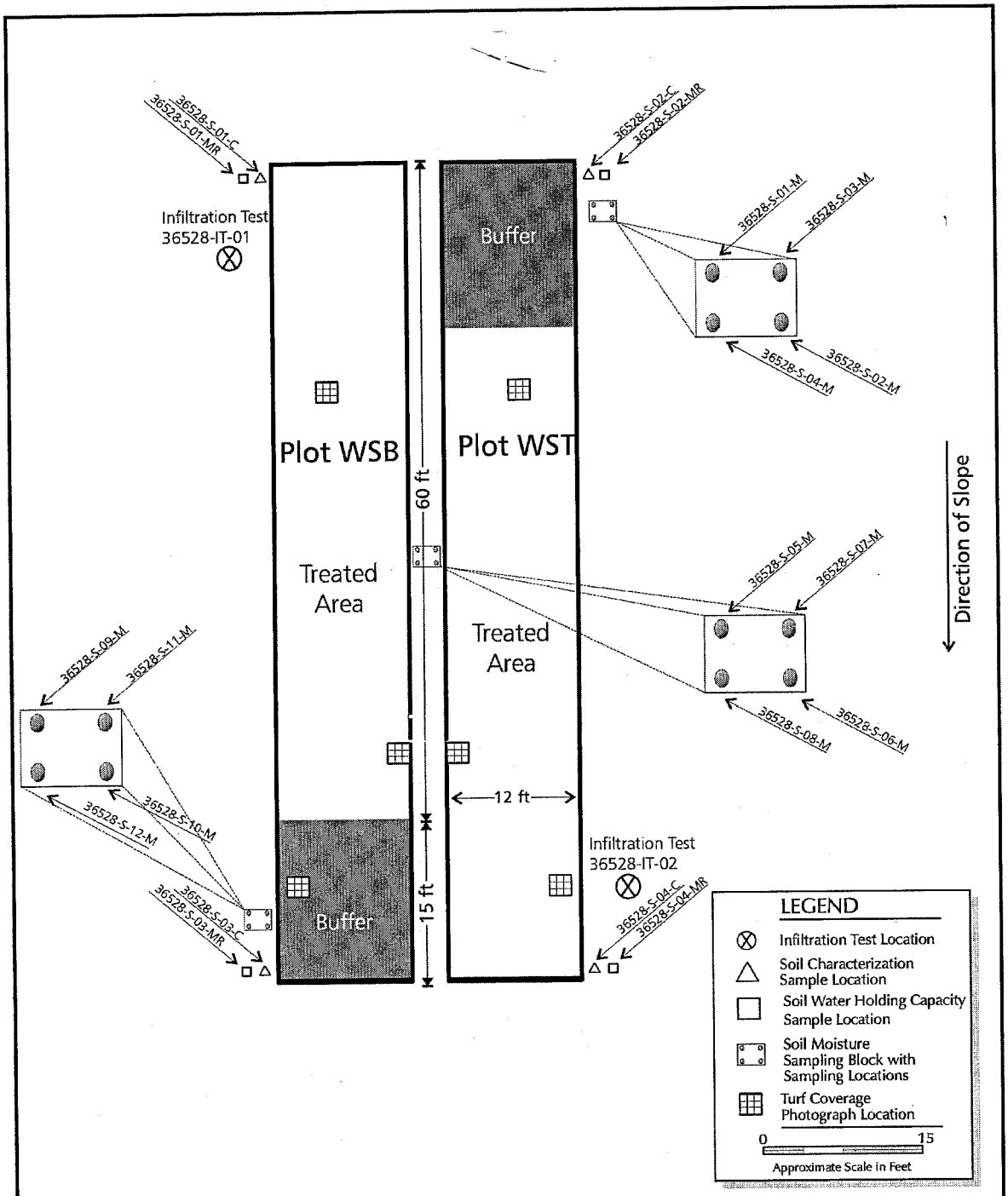

FIGURE 6: SITE CHARACTERIZATION PLAN
Effect of Vegetative Buffer Strips on Fipronil Runoff Losses from Warm Season Chipco Topchoice™ Treated Turfgrasses Under Simulated Rainfall
Julian, North Carolina

Source: SEI Field Notes
o:\proj-02\1281-F-FIPRO\36528\Figures\sitecharplan.cdr
int:07-31-02 gwth; 08-30-02 jms

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TABLE 10
Test Substance Application Details

	Plot WSB	Plot WST
Test Substance Lot:	C1275002	C1275002
Applicator Type:	drop spreader[1]	drop spreader[1]/hand spread[2]
Spreader Setting:	3.5	3.5
Ambient Temperature (°C):	34	NR
Wind Speed (mph):	0 - 2	2 - 7
Wind Direction:	southeast	southeast
Application Date:	June 17, 2002	June 17, 2002
Application Start Time:	13:42	14:09
Application End Time:	13:46	14:13[2]
Application Pass Times (sec.):		
Pass Number		
1	10.21	10.83
2	10.64	10.45
3	10.62	10.75
4	10.61	11.00
5	10.12	10.55
6	10.45	10.62
average:	10.44	10.70
Test Substance Start Weight (g):	2270.4	2270.2
Test Substance End Weight (g):	1634.5	1619.1
Test Substance Applied[3] (g):	635.9	651.1
Active Ingredient Applied[4] (mg):	94.1	96.4
Target Application Rate[5] (g a.i./ha):	13.9	13.9
Target Application Rate[6] (oz. a.i./acre):	0.199	0.199
Actual Application Rate[7] (g a.i./ha):	14.1	14.4
Actual Application Rate[8] (oz. a.i./acre):	0.201	0.206
Percent of Target Application Rate (%):	101	103

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Source: SEI field data sheets, 6/17/02; Bayer CropScience Certificate of Analysis #202FKT31, 5/10/02

Notes: 1. Application made using a Scotts AccuGreen drop spreader

2. Approximately 86.5 g of test substance was applied by hand after the timed passes were completed because the amount of product applied with the drop spreader was significantly below the target application rate, based on the weight of the remaining test substance. The end time recorded is for the completion of the timed passes with the drop spreader; the hand application was conducted immediately after the end time recorded.

3. Calculated as: Test Substance Start Weight (g) - Test Substance End Weight (g)

4. Calculated as: Test Substance Applied (g) x (% a.i./100) x 1000 mg/g; % a.i. (0.0148%) from Certifcate of Analysis #202FKT31

5. Calculated as: 87 lb/A Product x (% a.i./100) x (453.5924 g/lb) x (2.471 A/ha); % a.i. (0.0143%) per product label

6. Calculated as: 87 lb/A Product x (% a.i./100) x (16 oz./lb); % a.i. (0.0143%) per product label

7. Calculated as: (a.i. Applied (mg)/720 ft^2 treated area) x (0.001 g/mg) x 43,560 ft^2/A x 2.471 A/ha

8. Calculated as: (a.i. Applied (mg)/720 ft^2 treated area) x (0.001 g/mg) x 43,560 ft^2/A x (16 oz./453.5924 g)

Abbreviations: a.i. = active ingredient; NR = not recorded

Path: O:\Proj-02\1281-F-FipRO\Report_36528\Tables\SiteCharacterization.xls~Application

Date/Initials: 7/25/02 DCB; rev. 12/2/03 DCB; rev. 12/22/03 DCB

TABLE 3

Daily Site Climatological Data

Date	Days After Application	Precipitation (inches)	Air Temperature (°C) Min	Max	Mean	Mean Soil Temperature Under Turf[1] (°C)	Mean Soil Temperature at 4 in. bgs[2] (°C)	Mean Relative Humidity (%)	Mean Wind Speed (mph)	Mean Wind Direction[3] (°N)	Maximum Solar Radiation[4] (MJ/m²/min)
6/17/2002	0	0.00	15.5	29.8	22.5	24.9	25.4	54.7	1.8	0	0.0749
6/18/2002	1	0.02	12.6	29.8	21.9	23.9	24.6	66.4	1.3	112	0.0571
6/19/2002	2	0.00	15.4	31.0	23.3	26.0	26.5	69.3	2.0	70	0.0640
6/20/2002	3	0.00	16.1	30.5	23.1	25.7	26.1	64.9	3.0	61	0.0655
6/21/2002	4	0.00	10.9	30.8	22.5	24.7	25.1	56.7	2.9	68	0.0648
6/22/2002	5	0.00	15.1	30.4	23.6	24.7	25.1	66.8	2.6	85	0.0877
6/23/2002	6	0.00	18.3	32.8	24.7	25.3	25.6	74.8	1.4	212	0.0762
6/24/2002	7	0.00	17.7	34.0	26.1	25.8	26.2	69.7	1.8	203	0.0632
6/25/2002	8	0.00	19.2	33.8	27.1	26.5	27.0	66.0	2.3	205	0.0505
6/26/2002	9	0.22	21.2	30.2	24.9	26.3	26.7	83.1	2.3	214	0.0669
6/27/2002	10	0.48	20.7	31.9	24.1	26.8	27.4	88.4	1.8	214	0.0678

Source: SEI on-site weather station

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Notes:
1. Probe positioned in soil directly below thatch layer
2. Probe positioned at four inches below ground surface (in. bgs)
3. Wind direction measured in degrees from magnetic north
4. A malfunction caused an unknown number of erroneous readings (zero values) in the 1-minute interval solar radiation data. The maximum values reported here are believed to be reliable.

Abbreviations: mph = miles per hour; MJ/m² =megajoules per square meter

Path: O:\Proj-02\1281-F-FIPRO\Report_36528\tables\dailyweather.pdf

Date: 8/8/2002 BH; 9/3/02 DCB; 12/2/03 BP; 12/16/03 DCB

Table 6. Critical Dates for Runoff Water Samples Analyzed for Fipronil-Related Residues

Sample Identification[a]	Collection Date	Date Received	Sample Work-up Dates		Storage Interval (Days)[b]
			Extraction Date	Analysis Date	
WSB-QP-01-R	6/19/2002	6/19/2002	7/1/2002	7/1/2002	12
WSB-QP-02-R	6/19/2002	6/19/2002	7/1/2002	7/1/2002	12
WSB-QP-03-R	6/19/2002	6/19/2002	7/1/2002	7/1/2002	12
WSB-QP-04-R	6/19/2002	6/19/2002	7/1/2002	7/1/2002	12
WSB-QP-05-R	6/19/2002	6/19/2002	7/1/2002	7/1/2002	12
WSB-QP-06-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WSB-QP-07-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WSB-QP-08-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WSB-QP-09-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WSB-QP-10-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WSB-TP-01-R	6/19/2002	6/19/2002	6/27/2002	6/28/2002	9
WSB-TP-02-R	6/19/2002	6/19/2002	6/27/2002	6/28/2002	9
WSB-TP-03-R	6/19/2002	6/19/2002	6/27/2002	6/28/2002	9
WSB-TP-04-R	6/19/2002	6/19/2002	6/27/2002	6/28/2002	9
WSB-TP-05-R	6/19/2002	6/19/2002	6/27/2002	6/28/2002	9
WSB-TP-06-R	6/19/2002	6/19/2002	6/27/2002	6/28/2002	9
WSB-TP-07-R	6/19/2002	6/19/2002	6/27/2002	6/28/2002	9
WSB-TP-08-R	6/19/2002	6/19/2002	6/27/2002	6/28/2002	9
WSB-TP-09-R	6/19/2002	6/19/2002	6/27/2002	6/28/2002	9
WSB-TP-10-R	6/19/2002	6/19/2002	6/27/2002	6/28/2002	9
WSB-TP-11-R	6/27/2002	6/27/2002	7/8/2002	7/8/2002	11
WSB-TP-12-R	6/27/2002	6/27/2002	7/8/2002	7/8/2002	11
WSB-TP-13-R	6/27/2002	6/27/2002	7/8/2002	7/8/2002	11
WSB-TP-14-R	6/27/2002	6/27/2002	7/8/2002	7/8/2002	11
WSB-TP-15-R	6/27/2002	6/27/2002	7/8/2002	7/8/2002	11
WSB-TP-16-R	6/27/2002	6/27/2002	7/8/2002	7/8/2002	11
WSB-TP-17-R	6/27/2002	6/27/2002	7/8/2002	7/8/2002	11
WSB-TP-18-R	6/27/2002	6/27/2002	7/8/2002	7/8/2002	11
WSB-TP-19-R	6/27/2002	6/27/2002	7/8/2002	7/8/2002	11
WSB-TP-20-R	6/27/2002	6/27/2002	7/8/2002	7/8/2002	11
WST-QP-01-R	6/19/2002	6/19/2002	7/1/2002	7/1/2002	12
WST-QP-02-R	6/19/2002	6/19/2002	7/1/2002	7/1/2002	12
WST-QP-03-R	6/19/2002	6/19/2002	7/1/2002	7/1/2002	12
WST-QP-04-R	6/19/2002	6/19/2002	7/1/2002	7/1/2002	12
WST-QP-05-R	6/19/2002	6/19/2002	7/1/2002	7/1/2002	12
WST-QP-06-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-QP-07-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-QP-08-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-QP-09-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-QP-10-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-TP-01-R	6/19/2002	6/19/2002	6/26/2002	6/26/2002	7
WST-TP-02-R	6/19/2002	6/19/2002	6/26/2002	6/26/2002	7
WST-TP-03-R	6/19/2002	6/19/2002	6/26/2002	6/26/2002	7
WST-TP-04-R	6/19/2002	6/19/2002	6/26/2002	6/26/2002	7

(continued; footnotes to follow)

Table 6. Critical Dates for Runoff Water Samples Analyzed for Fipronil-Related Residues (continued)

Sample Identification[a]	Collection Date	Date Received	Sample Work-up Dates		Storage Interval (Days) [b]
			Extraction Date	Analysis Date	
WST-TP-05-R	6/19/2002	6/19/2002	6/26/2002	6/26/2002	7
WST-TP-06-R	6/19/2002	6/19/2002	6/26/2002	6/26/2002	7
WST-TP-07-R	6/19/2002	6/19/2002	6/26/2002	6/26/2002	7
WST-TP-08-R	6/19/2002	6/19/2002	6/26/2002	6/26/2002	7
WST-TP-09-R	6/19/2002	6/19/2002	6/26/2002	6/26/2002	7
WST-TP-10-R	6/19/2002	6/19/2002	6/26/2002	6/26/2002	7
WST-TP-11-R	6/19/2002	6/19/2002	6/26/2002	6/26/2002	7
WST-TP-12-R	6/19/2002	6/19/2002	6/26/2002	6/26/2002	7
WST-TP-13-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-TP-14-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-TP-15-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-TP-16-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-TP-17-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-TP-18-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-TP-19-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-TP-20-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-TP-21-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11
WST-TP-22-R	6/27/2002	6/27/2002	7/5/2002	7/8/2002	11

a The following sample codes were used to identify the treated samples:
WSB = Warm Season Turf, Bottom Buffer Plot. WST = Warm Season Turf, Top Buffer Plot.
QP = Flow Proportional Runoff. TP = Time Paced Runoff.

b Storage interval is the number of days between the sample collection and analysis dates.

Table 2. Procedural Recoveries of Fipronil and Its Metabolites from Fortified Control HPLC Grade Water

Sample Identification	Analytical Set No.	Spike Level (ppb)	% Recovery			
			Fipronil	MB46513	MB45950	MB46136
HPLC Water Spike 10 ppt-6-26-02	Set #2	0.010	111	99	96	96
HPLC Water Spike 10 ppt-07-01-02	Set #4	0.010	102	98	89	86
HPLC Water Spike 10 ppt-07-05-02	Set #6	0.010	103	107	95	100
HPLC Water Spike 10 ppt-6-27-02	Set #3	0.010	97	109	102	95
HPLC Water Spike 10 ppt-7-05-02	Set #5	0.010	102	96	93	89
HPLC Water Spike 10 ppt-7-08-02	Set #8	0.010	97	93	89	92
HPLC Water Spike 10 ppt-7-8-02	Set #7	0.010	104	106	110	109
HPLC Water Spike 1.0 ppb-07-01-02	Set #4	1.000	94	93	91	92
HPLC Water Spike 1.0 ppb-6-27-02	Set #3	1.000	104	106	102	101
HPLC Water Spike 1000 ppt-07-05-02	Set #6	1.000	104	101	97	98
HPLC Water Spike 1000 ppt-7-08-02	Set #8	1.000	72	81	86	86
HPLC Water Spike 2.000 ppb-6-26-02	Set #2	2.000	102	102	105	104
HPLC Water Spike 2000 ppt-7-05-02	Set #5	2.000	98	97	95	98
HPLC Water Spike 2000 ppt-7-8-02	Set #7	2.000	100	97	97	98
Average ± S.D.			99 ± 9 (n=14)	99 ± 7 (n=14)	96 ± 7 (n=14)	96 ± 7 (n=14)

Table 3. Summary of Residue Results for Untreated Control Runoff Water Samples Analyzed for Fipronil -Related Residues

Analytical Set No.	Sample ID. 36528- [a]	Residues (ppb) [b]			
		Fipronil	MB46513	MB45950	MB46136
Set #2	IS-01	ND	ND	ND	ND
Set #6	IS-01-R	ND	ND	ND	ND
Set #8	IS-01-R	ND	ND	ND	ND
Set # 3	IS-02	ND	ND	ND	ND
Set #4	IS-02	ND	ND	ND	ND
Set #5	IS-02-R	ND	ND	ND	ND
Set #2	SW-01-R	ND	ND	ND	ND
Set # 3	SW-02-R	ND	ND	ND	ND
Set #4	SW-03-R	ND	ND	ND	ND
Set #5	SW-04-R	ND	ND	ND	ND
Set #8	SW-05-R	ND	ND	ND	ND
Set #6	SW-06-R	ND	ND	ND	ND

a The following sample codes were used identify the control samples:
IS = Irrigation Source Water. These samples were collected from the irrigation source water prior to the start of the study.
SW = Simulator Water. These samples were collected from the rain simulator and were transported from the field along with the field samples.

b MDL = 0.004 ppb; LOQ = 0.010 ppb; ND = none detected.

Table 1. Water Method Verification Results

Analyte	Sample Identification	Fortification Level (ppb)	Measured Residue Level (ppb)	% Recovery
Fortified Irrigation Source Water				
Fipronil	36528-IS-01	---	ND	NA
	36528-IS-01 Dup	---	ND	NA
	36528-IS-01 Spiked 10 ppt	0.010	0.010	100
	36528-IS-01 Spiked 10 ppt Dup	0.010	0.010	101
	36528-IS-01 Spiked 100 ppt	0.100	0.100	100
	36528-IS-01 Spiked 100 ppt Dup	0.100	0.077	77
MB46513	36528-IS-01	---	ND	NA
	36528-IS-01 Dup	---	ND	NA
	36528-IS-01 Spiked 10 ppt	0.010	0.010	98
	36528-IS-01 Spiked 10 ppt Dup	0.010	0.010	98
	36528-IS-01 Spiked 100 ppt	0.100	0.091	91
	36528-IS-01 Spiked 100 ppt Dup	0.100	0.093	93
MB45950	36528-IS-01	---	ND	NA
	36528-IS-01 Dup	---	ND	NA
	36528-IS-01 Spiked 10 ppt	0.010	0.009	88
	36528-IS-01 Spiked 10 ppt Dup	0.010	0.009	93
	36528-IS-01 Spiked 100 ppt	0.100	0.094	94
	36528-IS-01 Spiked 100 ppt Dup	0.100	0.087	87
MB46136	36528-IS-01	---	ND	NA
	36528-IS-01 Dup	---	ND	NA
	36528-IS-01 Spiked 10 ppt	0.010	0.009	94
	36528-IS-01 Spiked 10 ppt Dup	0.010	0.009	93
	36528-IS-01 Spiked 100 ppt	0.100	0.089	89
	36528-IS-01 Spiked 100 ppt Dup	0.100	0.088	88
Fortified Control HPLC Grade Water				
Fipronil	HPLC Water 10 ppt	0.010	0.010	104
	HPLC Water 100 ppt	0.100	0.104	104
MB46513	HPLC Water 10 ppt	0.010	0.011	105
	HPLC Water 100 ppt	0.100	0.098	98
MB45950	HPLC Water 10 ppt	0.010	0.010	98
	HPLC Water 100 ppt	0.100	0.097	97
MB46136	HPLC Water 10 ppt	0.010	0.010	98
	HPLC Water 100 ppt	0.100	0.097	97

--- = control sample
ND = none detected
NA= not applicable

Table 5. Summary of Results for Water Field Recovery Samples

Sample ID. 36528- [a]	Spiking Level (ppb)	Fipronil		MB46513		MB45950		MB46136	
		Residues (ppb) [b]	% Rec.	Residues (ppb) [b]	% Rec.	Residues (ppb) [b]	% Rec.	Residues (ppb) [b]	% Rec.
Field Recovery Samples [c]									
WS-SP-G-01	0.01	0.010	100	0.010	98	0.010	95	0.010	98
WS-SP-G-02	0.01	0.008	76	0.009	87	0.009	94	0.010	97
WS-SP-G-03	0.01	0.009	94	0.010	98	0.010	102	0.011	110
WS-SP-G-04	2.00	1.659	83	1.708	85	1.802	90	1.865	93
WS-SP-G-05	2.00	1.376	69	1.568	78	1.733	87	1.783	89
WS-SP-G-06	2.00	1.739	87	1.748	87	1.826	91	1.911	96
WS-SP-P-01	0.01	0.007	65	0.008	83	0.009	90	0.008	84
WS-SP-P-02	0.01	0.009	89	0.010	97	0.009	94	0.010	100
WS-SP-P-03	0.01	0.010	97	0.009	91	0.010	95	0.010	97
WS-SP-P-04	2.00	1.723	86	1.758	88	1.815	91	1.866	93
WS-SP-P-05	2.00	1.718	86	1.731	87	1.850	93	1.933	97
WS-SP-P-06	2.00	1.657	83	1.750	88	1.848	92	1.922	96
Untreated Controls									
WS-UTC-G-01	---	ND	---	ND	---	ND	---	ND	---
WS-UTC-G-02	---	ND	---	ND	---	ND	---	ND	---
WS-UTC-P-01	---	ND	---	ND	---	ND	---	ND	---
WS-UTC-P-02	---	ND	---	ND	---	ND	---	ND	---
Procedural Recoveries									
HPLC Water Spike 10 ppt-7-8-02	0.010	0.010	104	0.011	106	0.011	110	0.011	109
HPLC Water Spike 2000 ppt-7-8-02	2.000	2.002	100	1.943	97	1.931	97	1.965	98

a All samples analyzed in Analytical Set #7. The following sample codes were used to identify the field recovery samples: WS = Warm Season Turf. UTC = Control. SP = Spiked Samples. P = Plastic Containers. G = Glass Containers.

b Values shown are the measured residue levels found. ND = none detected. MDL = 0.004 ppb; LOQ = 0.010 ppb.

c Field spike recoveries were not corrected for procedural recoveries.

TABLE 20
Sediment Yields Calculated From Time-Paced and Flow Proportional Runoff Samples

Simulated Rainfall Event	Plot	Buffer Position	Mean TSS Concentration[1] (ppm)	Maximum TSS Concentration[2] (ppm)	Cumulative TSS Export (g)			TSS Export (kg/ha)
					Time Paced Method[3]	Flow Proportional Method[4]	Method Average	
Event 1, June 19, 2002								
	WST	Top	23	59	24.6	43.7	34.2	4.08
	WSB	Bottom	16	30	23.6	33.3	28.4	3.40
	Percent difference between top buffer and bottom buffer plots[5]							
			32%	49%	4%	24%	17%	17%
Event 2, June 27, 2002								
	WST	Top	9	27	12.8	16.6	14.7	1.76
	WSB	Bottom	7	27	11.6	14.2	12.9	1.54
	Percent difference between top buffer and bottom buffer plots[5]							
			24%	0%	10%	14%	12%	12%

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Sources: SEI field data sheets and ISCO 3230 flowmeter data, 6/19/02 and 6/27/02; Agvise Laboratories Analytical Reports, 6/28/02, 7/1/02, 7/10/02

Notes: 1. Calculated as the mean of the TSS concentrations of the flow proportional composite subsamples

2. The maximum TSS concentration for each plot is the maximum among the time-paced sample data

3. Calculated as the sum of the products of time-paced sample concentration multiplied by cumulative flow for the interval preceding collection of the sample

4. Calculated as the product of the mean TSS concentration in the flow proportional subsamples and total runoff volume

5. Percent difference calculated as: 100 x (Plot WST Value - Plot WSB Value)/Plot WST Value

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int: 7/30/02 DCB

TABLE 21
Fipronil and Metabolite Residues in Time-Paced Runoff Samples, Event 1

Plot ID	Sample ID	Runoff Duration[1] (minutes)	Interval Flow[2] (L)	Residue Concentration (ppb) Fipronil	MB46513	MB45950	MB46136	Total[3]
WST (Top Buffer)								
	36528-WST-TP-01-R	6	9.2	2.733	0.016	0.015	0.112	2.875
	36528-WST-TP-02-R	15	46.1	2.875	0.014	0.017	0.121	3.025
	36528-WST-TP-03-R	24	85.2	2.459	0.010	0.014	0.099	2.580
	36528-WST-TP-04-R	33	150.5	2.651	0.013	0.013	0.097	2.773
	36528-WST-TP-05-R	42	190.6	2.593	0.012	0.013	0.098	2.715
	36528-WST-TP-06-R	51	209.7	2.444	0.012	0.013	0.093	2.561
	36528-WST-TP-07-R	60	234.2	2.297	0.013	0.012	0.089	2.410
	36528-WST-TP-08-R	69	250.0	2.287	0.013	0.012	0.091	2.402
	36528-WST-TP-09-R	78	258.7	2.197	0.014	0.012	0.086	2.308
	36528-WST-TP-10-R	87	264.5	2.237	0.014	0.012	0.087	2.349
	36528-WST-TP-11-R	96	177.9	2.182	0.012	0.012	0.080	2.285
	36528-WST-TP-12-R[4]	99	24.7	2.272/2.216	0.016/0.016	0.012/0.011	0.106/0.019	2.334
	max			2.875	0.016	0.017	0.121	3.025
	mean			2.433	0.013	0.013	0.093	2.551
WSB (Bottom Buffer)								
	36528-WSB-TP-01-R	6	76.3	0.128	ND	ND	ND	0.134
	36528-WSB-TP-02-R	15	175.7	0.304	ND	ND	(0.005)	0.313
	36528-WSB-TP-03-R	24	216.5	0.437	ND	ND	(0.009)	0.450
	36528-WSB-TP-04-R	33	234.4	0.387	ND	ND	0.011	0.402
	36528-WSB-TP-05-R	42	244.1	0.477	ND	ND	0.014	0.495
	36528-WSB-TP-06-R	51	258.7	0.628	ND	ND	0.015	0.647
	36528-WSB-TP-07-R	60	271.4	0.687	ND	ND	0.017	0.708
	36528-WSB-TP-08-R	69	275.3	0.699	ND	ND	0.018	0.721
	36528-WSB-TP-09-R	78	260.0	0.724	ND	ND	0.018	0.746
	36528-WSB-TP-10-R	87	121.0	0.702	ND	ND	0.018	0.724
	max			0.724	ND	ND	0.018	0.746
	mean[5]			0.517	ND	ND	0.013	0.534

Source: Bayer CropScience Amended Final Analytical Report, January 15, 2004 STONE ENVIRONMENTAL, INC.

Abbreviations: ppb = parts per billion; ND = none detected

Notes: Method Detection Limit (MDL) = 0.004 ppb; Limit of Quantitation (LOQ) = 0.010 ppb

Values in parentheses are greater than or equal to the MDL and less than the LOQ

1. Elapsed time since first observation of runoff from plot
2. Interval runoff flow (L) =current cumulative flow (L) - cumulative flow (L) of previous sample
3. Calculated in parent equivalents as follows: Total (ppb) = A + (B*C1) + (D*C2) + (E*C3), where:
   A = fipronil (ppb), B = MB46513 (ppb), D = MB45950 (ppb), E = MB46136 (ppb),
   C1 = molecular wt. of fipronil (437.1 g/mole)/molecular wt. of MB46513 (389.02 g/mole) = 1.124,
   C2 = molecular wt. of fipronil (437.1 g/mole)/molecular wt. of MB45950 (421.16 g/mole) = 1.038,
   C3 = molecular wt. of fipronil (437.1 g/mole)/molecular wt. of MB46136 (453.1 g/mole) = 0.965
   For analytes with ND residues, a value of ½ the MDL was assumed in the Total Residue calculations
4. Sample inadvertently re-analyzed; average value used in mean concentration and total residue calculations
5. For analytes with ND residues, a value of ½ the MDL was assumed in the Mean Residue Concentration calculations

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int: 7/29/02 DCB; 8/29/02 DCB; rev. 12/8/03 DCB; rev. 2/5/04 DCB

TABLE 22
Fipronil and Metabolite Residues in Time-Paced Runoff Samples, Event 2

Plot ID	Sample ID	Runoff Duration[1] (minutes)	Interval Flow[2] (L)	Residue Concentration (ppb) Fipronil	MB46513	MB45950	MB46136	Total[3]
WST (Top Buffer)								
	36528-WST-TP-13-R	6	9.7	0.595	(0.005)	0.013	0.096	0.707
	36528-WST-TP-14-R	15	50.3	1.233	(0.009)	0.025	0.164	1.427
	36528-WST-TP-15-R	24	152.8	1.084	(0.008)	0.025	0.164	1.277
	36528-WST-TP-16-R	33	203.6	1.162	(0.008)	0.025	0.162	1.353
	36528-WST-TP-17-R	42	231.2	1.286	(0.008)	0.026	0.158	1.474
	36528-WST-TP-18-R	51	251.5	1.270	(0.008)	0.024	0.158	1.456
	36528-WST-TP-19-R	60	261.7	1.235	(0.009)	0.024	0.151	1.416
	36528-WST-TP-20-R	69	271.1	1.152	(0.007)	0.023	0.139	1.318
	36528-WST-TP-21-R	78	278.7	1.219	(0.008)	0.022	0.144	1.390
	36528-WST-TP-22-R	87	130.4	1.261	(0.008)	0.024	0.152	1.442
	max			1.286	(0.009)	0.026	0.164	1.474
	mean			1.150	(0.008)	0.023	0.149	1.326
WSB (Bottom Buffer)								
	36528-WSB-TP-11-R	6	1.3	ND	ND	ND	ND	(0.008)
	36528-WSB-TP-12-R	15	70.1	0.037	ND	ND	(0.005)	0.046
	36528-WSB-TP-13-R	24	221.5	0.204	ND	ND	0.017	0.225
	36528-WSB-TP-14-R	33	253.0	0.236	ND	(0.004)	0.022	0.264
	36528-WSB-TP-15-R	42	265.4	0.273	ND	(0.004)	0.024	0.303
	36528-WSB-TP-16-R	51	281.0	0.395	ND	(0.005)	0.030	0.431
	36528-WSB-TP-17-R	60	284.2	0.417	ND	(0.006)	0.031	0.455
	36528-WSB-TP-18-R	69	288.0	0.439	ND	(0.006)	0.033	0.479
	36528-WSB-TP-19-R	78	288.4	0.446	ND	(0.006)	0.035	0.488
	36528-WSB-TP-20-R	87	141.8	0.456	ND	(0.006)	0.035	0.498
	max			0.456	ND	(0.006)	0.035	0.498
	mean[4]			0.291	ND	(0.004)	0.023	0.320

Source: Bayer CropScience Amended Final Analytical Report, January 15, 2004 — STONE ENVIRONMENTAL, INC.

Abbreviations: *ppb = parts per billion;* ND = none detected

Notes: Method Detection Limit (MDL) = 0.004 ppb; Limit of Quantitation (LOQ) = 0.010 ppb

Values in parentheses are greater than or equal to the MDL and less than the LOQ

1. Elapsed time since first observation of runoff from plot
2. Interval runoff flow (L) =current cumulative flow (L) - cumulative flow (L) of previous sample
3. Calculated in parent equivalents as follows: Total (ppb) = A + (B*C1) + (D*C2) + (E*C3), where:
   A = fipronil (ppb), B = MB46513 (ppb), D = MB45950 (ppb), E = MB46136 (ppb),
   C1 = molecular wt. of fipronil (437.1 g/mole)/molecular wt. of MB46513 (389.02 g/mole) = 1.124,
   C2 = molecular wt. of fipronil (437.1 g/mole)/molecular wt. of MB45950 (421.16 g/mole) = 1.038,
   C3 = molecular wt. of fipronil (437.1 g/mole)/molecular wt. of MB46136 (453.1 g/mole) = 0.965
   For analytes with ND residues, a value of ½ the MDL was assumed in the Total Residue calculations
4. For analytes with ND residues, a value of ½ the MDL was assumed in the Mean Residue Concentration calculations

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int: 7/29/02 DCB; 8/29/02 DCB; rev. 12/8/03 DCB; rev. 2/5/04 DCB

TABLE 23
Fipronil and Metabolite Residues in Flow Proportional Runoff Samples, Events 1 and 2

Plot ID	Sample ID	Residue Concentration (ppb) Fipronil	MB46513	MB45950	MB46136	Total[1]
Simulated Rainfall Runoff Event 1, June 19, 2002						
WST (Top Buffer)	36528-WST-QP-01-R	2.180	(0.007)	0.012	0.083	2.280
	36528-WST-QP-02-R	2.039	(0.006)	0.011	0.080	2.134
	36528-WST-QP-03-R	2.313	(0.006)	0.012	0.090	2.419
	36528-WST-QP-04-R	2.159	(0.007)	0.011	0.079	2.255
	36528-WST-QP-05-R	2.138	(0.006)	0.011	0.084	2.237
	mean	2.166	(0.006)	0.011	0.083	2.265
	standard deviation	0.098	0.001	0.001	0.004	0.102
WSB (Bottom Buffer)	36528-WSB-QP-01-R	0.612	ND	ND	0.013	0.629
	36528-WSB-QP-02-R	0.600	ND	ND	0.012	0.616
	36528-WSB-QP-03-R	0.599	ND	ND	0.013	0.616
	36528-WSB-QP-04-R	0.579	ND	ND	0.012	0.595
	36528-WSB-QP-05-R	0.597	ND	ND	0.012	0.613
	mean	0.597	ND	ND	0.012	0.614
	standard deviation	0.012	ND	ND	0.001	0.012
Simulated Rainfall Runoff Event 2, June 27, 2002						
WST (Top Buffer)	36528-WST-QP-06-R	1.191	(0.007)	0.024	0.154	1.372
	36528-WST-QP-07-R	1.278	(0.007)	0.025	0.155	1.461
	36528-WST-QP-08-R	1.240	(0.007)	0.024	0.149	1.417
	36528-WST-QP-09-R	1.295	(0.007)	0.024	0.148	1.471
	36528-WST-QP-10-R	1.289	(0.008)	0.025	0.158	1.476
	mean	1.259	(0.007)	0.024	0.153	1.439
	standard deviation	0.043	0.000	0.001	0.004	0.044
WSB (Bottom Buffer)	36528-WSB-QP-06-R	0.420	ND	(0.006)	0.032	0.459
	36528-WSB-QP-07-R	0.394	ND	(0.006)	0.031	0.432
	36528-WSB-QP-08-R	0.457	ND	(0.006)	0.034	0.498
	36528-WSB-QP-09-R	0.412	ND	(0.006)	0.032	0.451
	36528-WSB-QP-10-R	0.442	ND	(0.006)	0.031	0.480
	mean	0.425	ND	(0.006)	0.032	0.464
	standard deviation	0.025	ND	0.000	0.001	0.026

Source: Bayer CropScience Amended Final Analytical Report, January 15, 2004 STONE ENVIRONMENTAL, INC.

Abbreviations: ppb = parts per billion, ND = none detected

Notes: Method Detection Limit (MDL) = 0.004 ppb; Limit of Quantitation (LOQ) = 0.010 ppb

Values in parentheses are greater than or equal to the MDL and less than the LOQ

1. *Calculated in parent equivalents as follows:* Total (ppb) = A + (B*C1) + (D*C2) + (E*C3), where:
A = fipronil (ppb), B = MB46513 (ppb), D = MB45950 (ppb), E = MB46136 (ppb),
C1 = molecular wt. of fipronil (437.1 g/mole)/molecular wt. of MB46513 (389.02 g/mole) = 1.124,
C2 = molecular wt. of fipronil (437.1 g/mole)/molecular wt. of MB45950 (421.16 g/mole) = 1.038,
C3 = molecular wt. of fipronil (437.1 g/mole)/molecular wt. of MB46136 (453.1 g/mole) = 0.965
For analytes with ND residues, a value of ½ the MDL was assumed in the Total Residue calculations

Path: O:\Proj-02\1281-F-FipRO\Report_36528\Tables\36528_Runoff Data~QP Residue

int: 7/29/02 DCB; 8/29/02 DCB; rev. 12/8/03 DCB; rev. 2/5/04 DCB

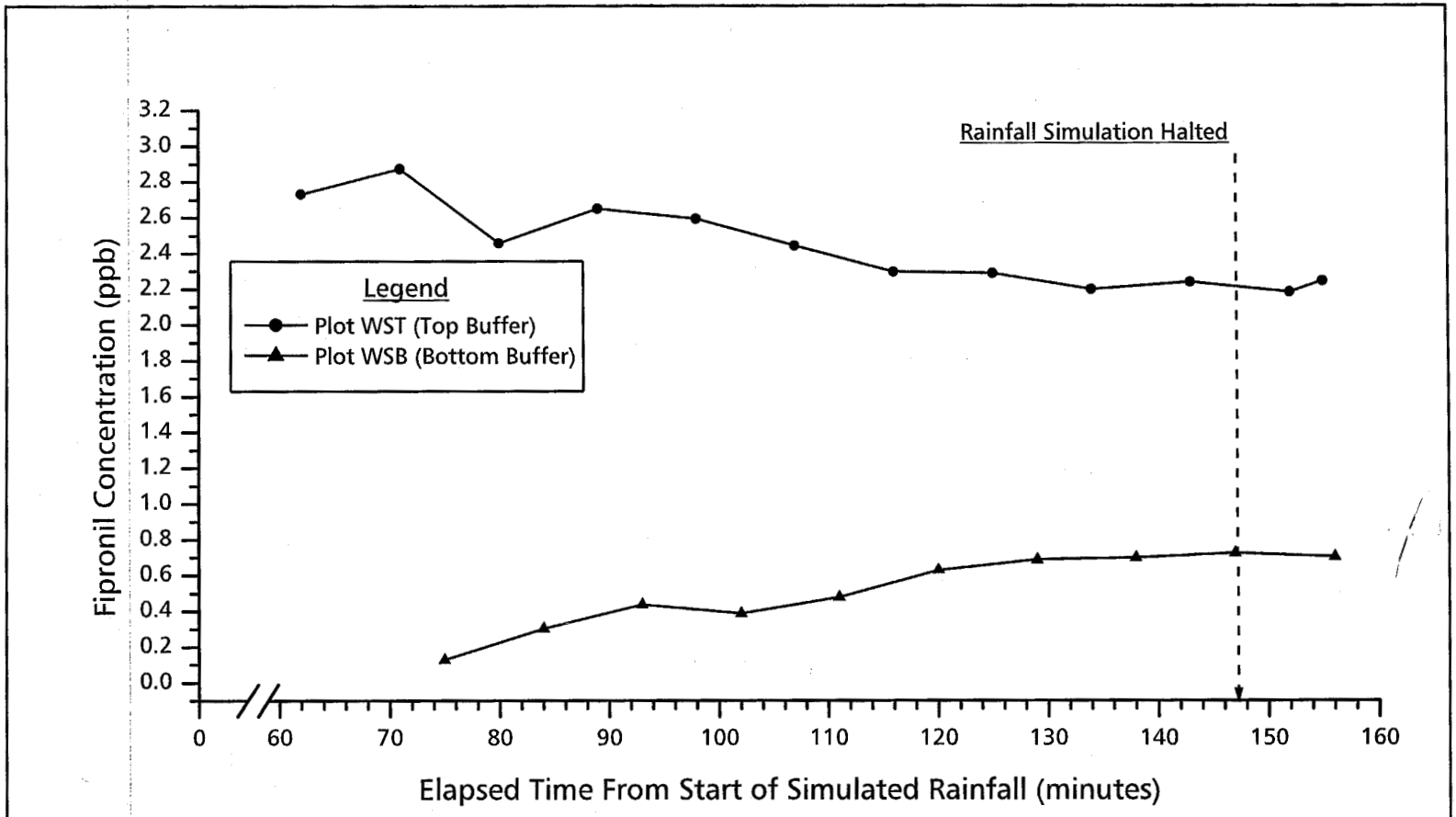

FIGURE 12: FIPRONIL CONCENTRATIONS IN TIME-PACED RUNOFF SAMPLES, EVENT 1

Effect of Vegetative Buffer Strips on Fipronil Runoff Losses from Warm Season Chipco TopChoice™ Treated Turfgrasses Under Simulated Rainfall
Julian, North Carolina

Source: Bayer CropScience Final Analytical Report, October 11, 2002
Path: O:\Proj-02\1281-F-FipRO\Report_36528\Figures\36528Conc.opj
int: 8/1/02 DCB; 8/29/02 DCB; 12/9/03 DCB

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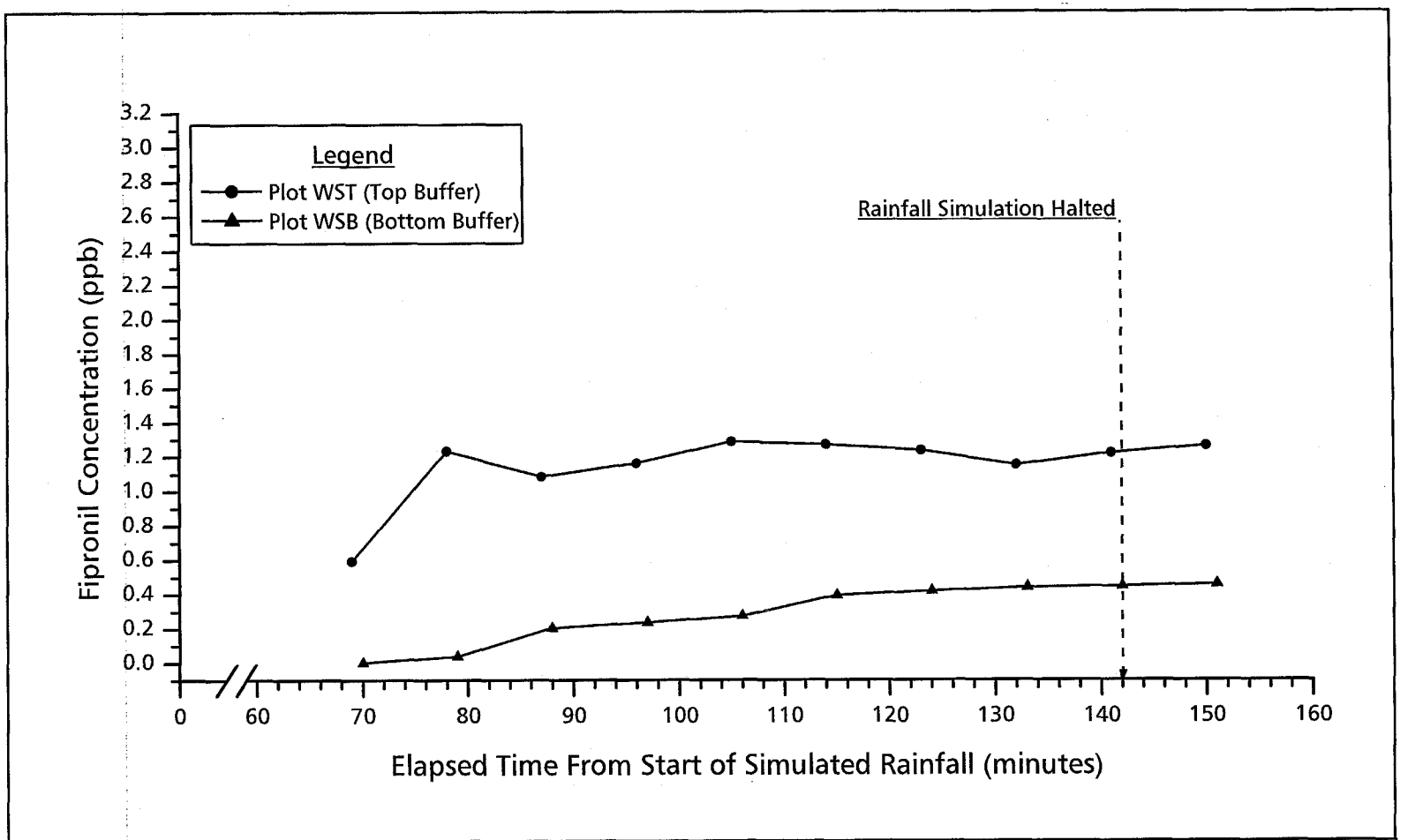

FIGURE 13: FIPRONIL CONCENTRATIONS IN TIME-PACED RUNOFF SAMPLES, EVENT 2

Effect of Vegetative Buffer Strips on Fipronil Runoff Losses from Warm Season Chipco TopChoice™ Treated Turfgrasses Under Simulated Rainfall
Julian, North Carolina

Source: Bayer CropScience Final Analytical Report, October 11, 2002
Path: O:\Proj-02\1281-F-FipRO\Report_36528\Figures\36528Conc.opj
int: 8/1/02 DCB; 8/29/02 DCB; 12/9/03 DCB

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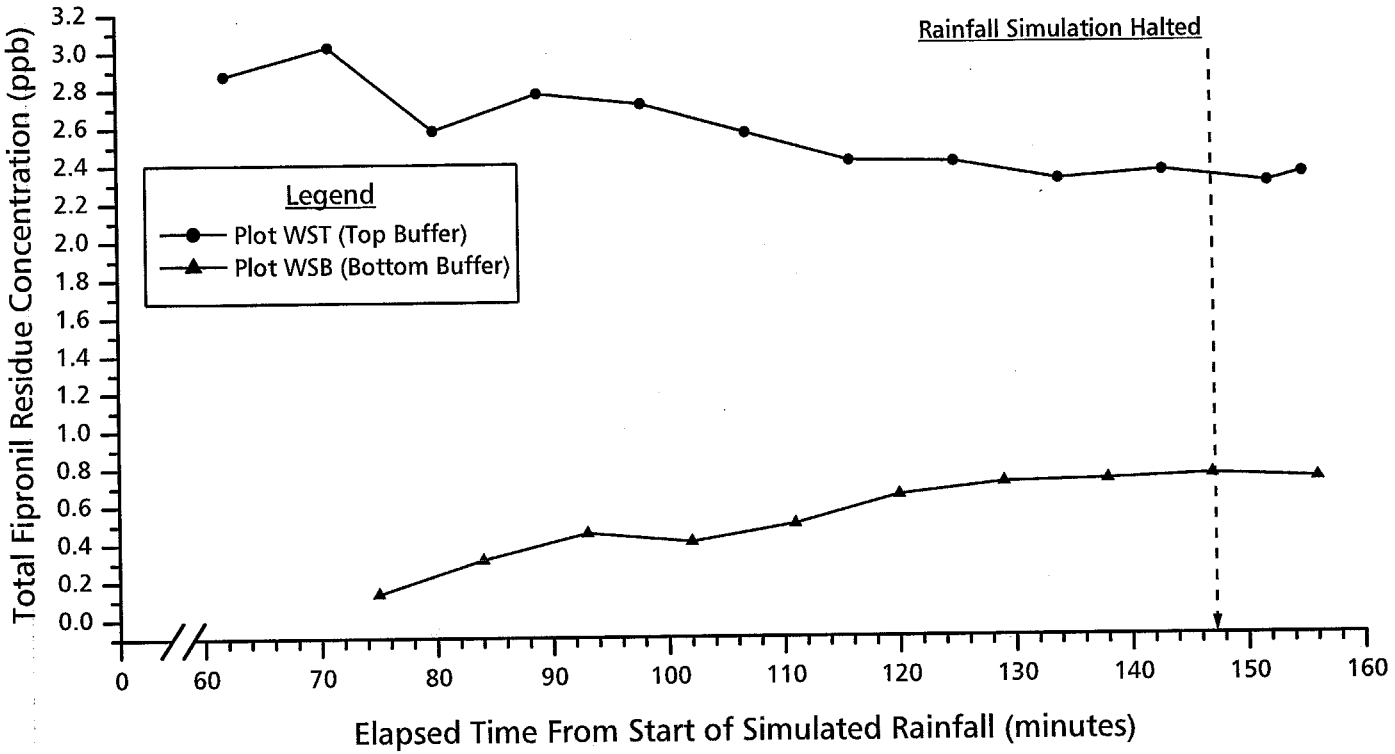

FIGURE 14: TOTAL FIPRONIL RESIDUE CONCENTRATIONS IN TIME-PACED RUNOFF SAMPLES, EVENT 1
Effect of Vegetative Buffer Strips on Fipronil Runoff Losses from Warm Season Chipco TopChoice™ Treated Turfgrasses Under Simulated Rainfall
Julian, North Carolina

Source: Bayer CropScience Final Analytical Report, October 11, 2002
Path: O:\Proj-02\1281-F-FipRO\Report_36528\Figures\36528Conc.opj
int: 8/1/02 DCB; 8/29/02 DCB; 12/9/03 DCB

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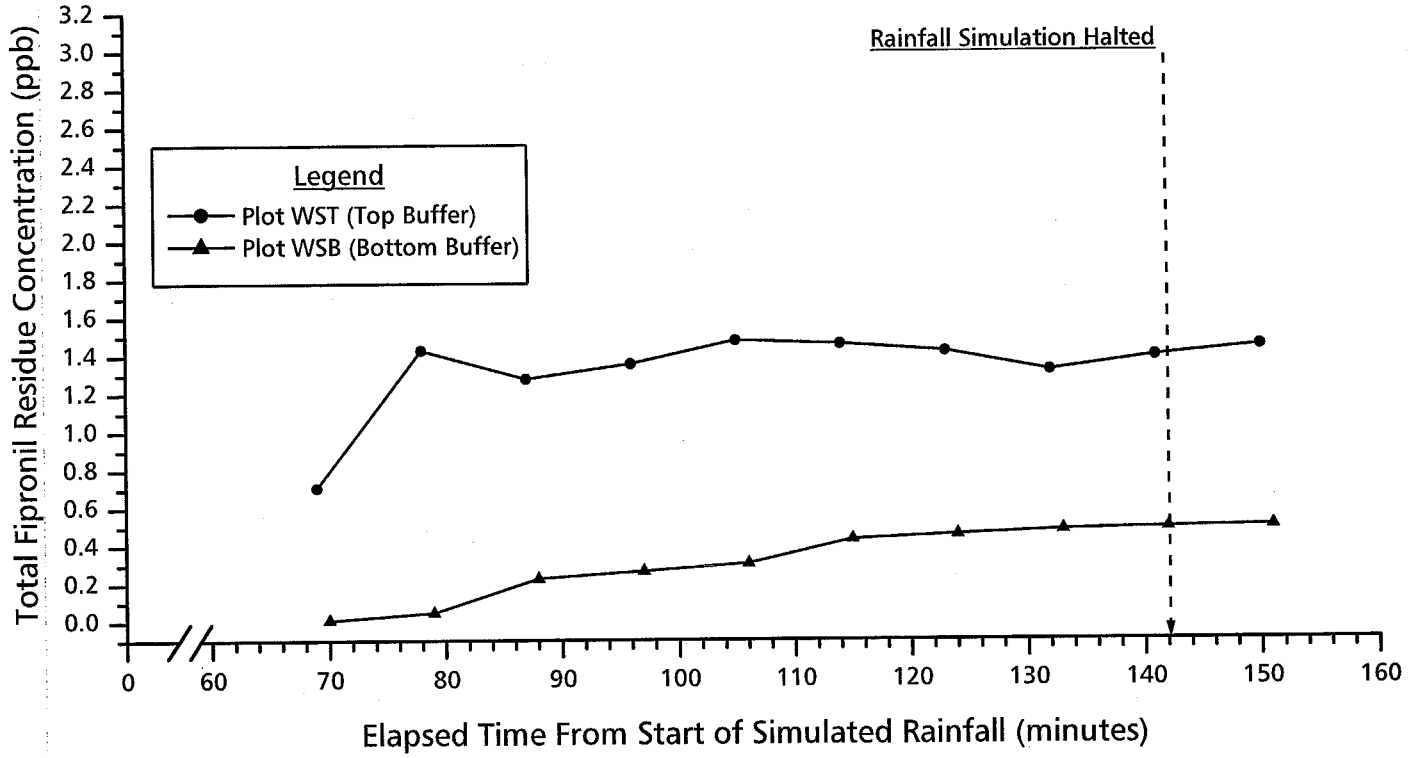

FIGURE 15: TOTAL FIPRONIL RESIDUE CONCENTRATIONS IN TIME-PACED RUNOFF SAMPLES, EVENT 2
Effect of Vegetative Buffer Strips on Fipronil Runoff Losses from Warm Season Chipco TopChoice™ Treated Turfgrasses Under Simulated Rainfall
Julian, North Carolina

Source: Bayer CropScience Final Analytical Report, October 11, 2002
Path: O:\Proj-02\1281-F-FipRO\Report_36528\Figures\36528Conc.opj
int: 8/1/02 DCB; 8/29/02 DCB; 12/9/03 DCB

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TABLE 24

Fipronil Concentration and Yield Calculated From Time-Paced and Flow Proportional Samples

Simulated Rainfall Event	Plot	Buffer Position	Mean Fipronil Concentration[1] (ppb)	Maximum Fipronil Concentration[2] (ppb)	Cumulative Fipronil Export: Time-Paced Method[3] (mg)	Cumulative Fipronil Export: Flow Proportional Method[4] (mg)	Cumulative Fipronil Export: Method Average (mg)	Percent of Applied Fipronil[5]
Event 1, June 19, 2002								
	WST	Top	2.166	2.875	4.5	4.1	4.3	4.5
	WSB	Bottom	0.597	0.724	1.2	1.3	1.2	1.3
	Percent difference between top buffer and bottom buffer plots[6]							
			72%	75%	74%	69%	71%	71%
Event 2, June 27, 2002								
	WST	Top	1.259	1.286	2.2	2.3	2.3	2.4
	WSB	Bottom	0.425	0.456	0.7	0.9	0.8	0.9
	Percent difference between top buffer and bottom buffer plots[6]							
			66%	65%	67%	62%	64%	64%

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Sources: SEI field data sheets and ISCO 3230 flowmeter data, 6/19/02 and 6/27/02; Bayer CropScience Amended Final Analytical Report, January 15, 2004

Notes: 1. Calculated as the mean of the fipronil concentrations of the flow proportional composite subsamples

2. The maximum fipronil concentration for each plot is the maximum among the time-paced sample data

3. Calculated as the sum of the products of time-paced sample concentration multiplied by cumulative flow for the interval preceding collection of the sample

4. Calculated as the product of the mean fipronil concentration in the flow proportional subsamples and total runoff volume

5. Calculated as: 100 x cumulative fipronil export ("Method Average")/(mass active ingredient applied/plot)

6. Percent difference calculated as: 100 x (Plot WST Value - Plot WSB Value)/Plot WST Value

Path: O:\Proj-02\1281-F-FipRO\Report_36528\Tables\36528_Runoff Data~Yield Summary_Fipronil

int: 7/29/02 DCB; 8/29/02 DCB; rev. 12/8/03 DCB; rev. 2/5/04 DCB

TABLE 25

Total Fipronil Residue Concentration and Yield Calculated From Time-Paced and Flow Proportional Samples

Simulated Rainfall Event	Plot	Buffer Position	Mean Total Residue Concentration[1] (ppb)	Maximum Total Residue Concentration[2] (ppb)	Cumulative Total Fipronil Residue Export: Time-Paced Method[3] (mg)	Cumulative Total Fipronil Residue Export: Flow Proportional Method[4] (mg)	Cumulative Total Fipronil Residue Export: Method Average (mg)	Percent of Applied Fipronil[5]
Event 1, June 19, 2002								
	WST	Top	2.265	3.025	4.7	4.3	4.5	4.7
	WSB	Bottom	0.614	0.746	1.2	1.3	1.3	1.3
	Percent difference between top buffer and bottom buffer plots[6]							
			73%	75%	74%	70%	72%	71%
Event 2, June 27, 2002								
	WST	Top	1.439	1.474	2.6	2.6	2.6	2.7
	WSB	Bottom	0.464	0.498	0.8	1.0	0.9	0.9
	Percent difference between top buffer and bottom buffer plots[6]							
			68%	66%	69%	63%	66%	65%

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Sources: SEI field data sheets and ISCO 3230 flowmeter data, 6/19/02 and 6/27/02; Bayer CropScience Amended Final Analytical Report, January 15, 2004

Notes: 1. Calculated as the mean of the total residue concentrations (sum of fipronil parent plus metabolites) of the flow proportional composite subsamples

2. The maximum total residue concentration for each plot is the maximum of the sums of fipronil plus metabolites among the time-paced sample data

3. Calculated as the sum of the products of time-paced sample concentration multiplied by cumulative flow for the interval preceding collection of the sample

4. Calculated as the product of the mean total residue concentration in the flow proportional subsamples and total runoff volume

5. Calculated as: 100 x cumulative total residue export ("Method Average")/(mass active ingredient applied/plot)

6. Percent difference calculated as: 100 x (Plot WST Value - Plot WSB Value)/Plot WST Value

Path: O:\Proj-02\1281-F-FipRO\Report_36528\Tables\36528_Runoff Data~Yield Summary_TotalRes

int: 7/29/02 DCB; 8/29/02 DCB; rev. 12/8/03 DCB; rev. 2/5/04 DCB

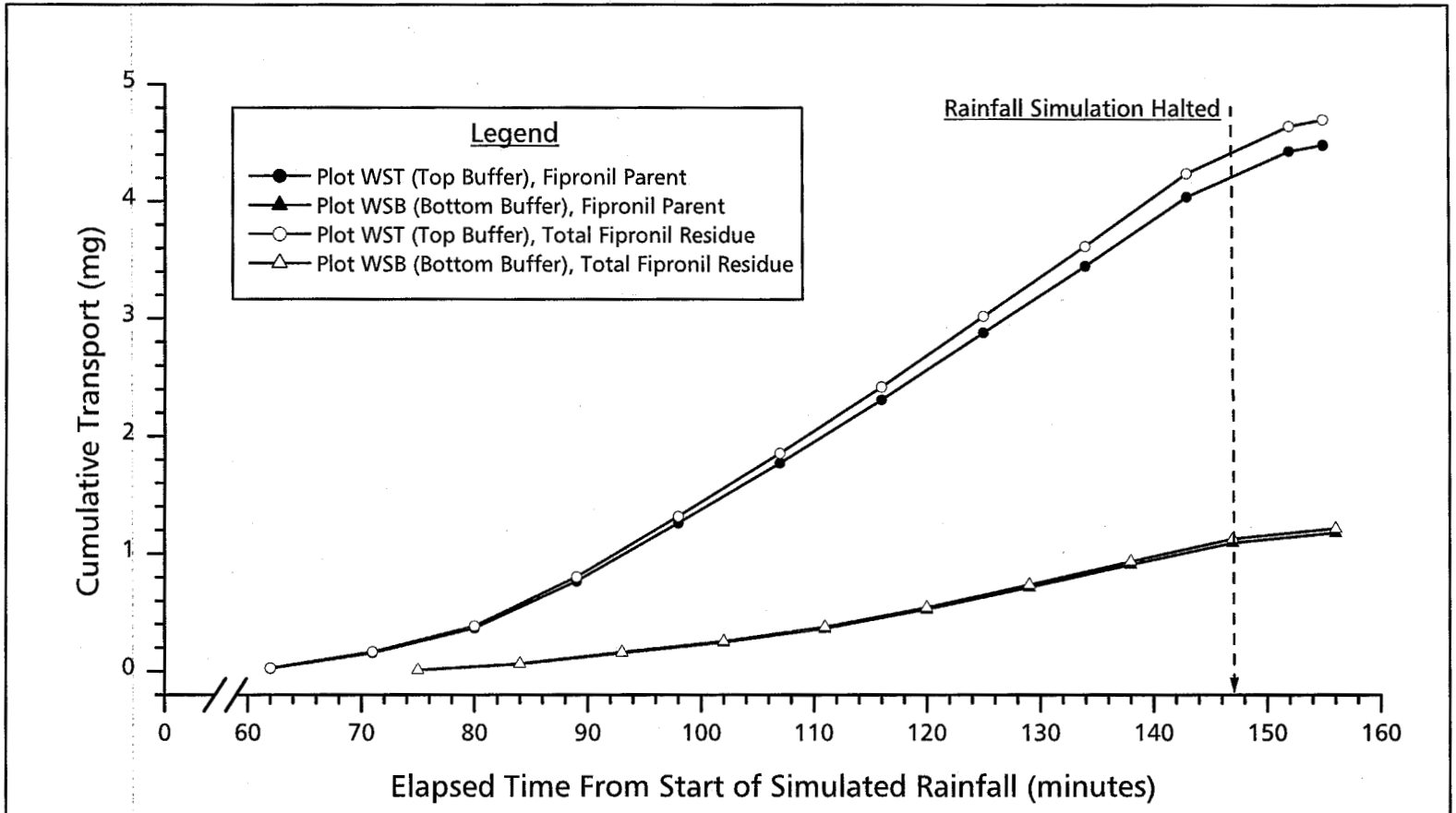

FIGURE 16: CUMULATIVE TRANSPORT OF FIPRONIL AND FIPRONIL + METABOLITES IN RUNOFF, EVENT 1

Effect of Vegetative Buffer Strips on Fipronil Runoff Losses from Warm Season Chipco TopChoice™ Treated Turfgrasses Under Simulated Rainfall
Julian, North Carolina

Source: Bayer CropScience Final Analytical Report, October 11, 2002
Path: O:\Proj-02\1281-F-FipRO\Report_36528\Figures\36528Transport.opj
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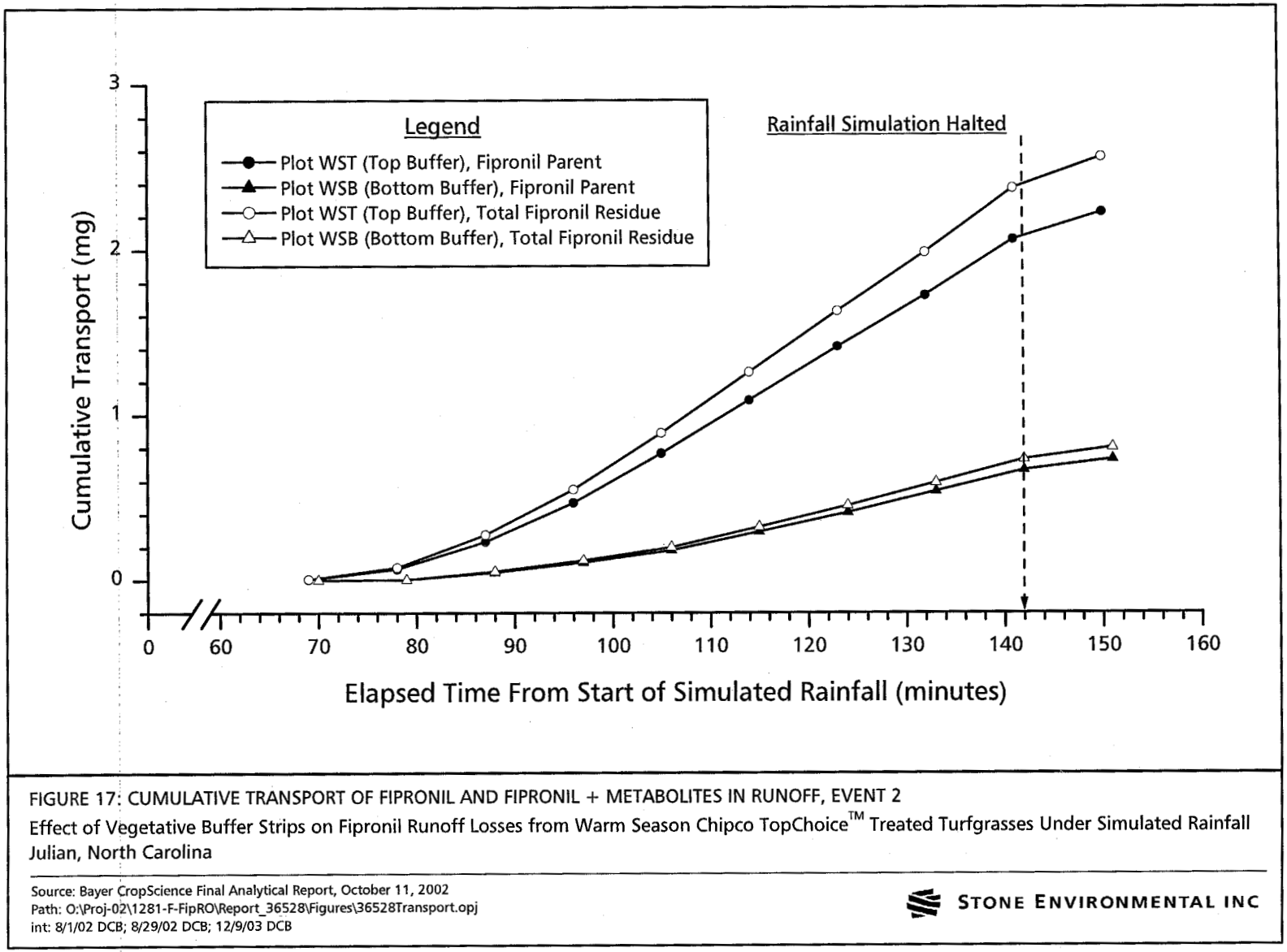

FIGURE 17: CUMULATIVE TRANSPORT OF FIPRONIL AND FIPRONIL + METABOLITES IN RUNOFF, EVENT 2

Effect of Vegetative Buffer Strips on Fipronil Runoff Losses from Warm Season Chipco TopChoice™ Treated Turfgrasses Under Simulated Rainfall
Julian, North Carolina

Source: Bayer CropScience Final Analytical Report, October 11, 2002
Path: O:\Proj-02\1281-F-FipRO\Report_36528\Figures\36528Transport.opj
int: 8/1/02 DCB; 8/29/02 DCB; 12/9/03 DCB

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