WATER YEAR 2006 DATA REPORT

Compost-Amended Vegetated Filter Strip Performance Monitoring Project

Prepared for

Washington State Department of Transportation

February 2007 Draft

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WATER YEAR 2006 DATA REPORT

Compost-Amended Vegetated Filter Strip Performance Monitoring Project

Prepared for

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Introduction

The Washington State Department of Transportation (WSDOT) received research funds in 2003 from the Federal Highway Administration (FHWA) to install and document the flow control effectiveness of one low-impact development (LID) technique with potential application as a best management practice (BMP) for stormwater in urban environments. This grant is being administered through WSDOT's Environmental Services Office (ESO) Stormwater Program. In late fall 2003, the ESO conducted a preliminary evaluation of low-impact treatment options available in the Puget Sound region to identify potential candidates for inclusion in this study. Based on the results of this evaluation, the ESO Stormwater and Watershed Programs jointly selected the shoulder/median application of compost-amended vegetated filter strip(s) (CAVFS) as the subject of a pilot study to be conducted with FHWA support.

Herrera Environmental Consultants was subsequently retained by the ESO to design and implement a monitoring program to evaluate the treatment performance of CAVFS. The primary goal of this monitoring program is to document the performance of CAVFS with regard to reducing the peak discharge rates, flow volumes, and flow durations of highway runoff. This information would then be used to support the acceptance of this technology for flow control by the Washington Department of Ecology (Ecology). The secondary goal of this monitoring program is assess the performance of CAVFS with regard to treating common pollutants in highway runoff.

A quality assurance project plan (QAPP) was subsequently developed for the project (Herrera 2004) to describe the monitoring procedures that will be used to meet these goals. The QAPP also presents design criteria and as-built drawings for three pilot filter strips that were specifically constructed for this study. Finally, this QAPP documents the quality assurance procedures to be implemented during the monitoring program to ensure that resultant data from this study are scientifically and legally defensible. This QAPP was prepared in accordance with the Ecology (2001) *Guidelines and Specifications for Preparing Quality Assurance Project Plans*.

Pursuant to a schedule presented in the QAPP, monitoring for the project is occurring over a 3-year period starting in December 2004 and ending in September 2007. (Note that WSDOT is currently weighing the benefits of collecting additional data for the project through the addition of a fourth year of monitoring.) Annual monitoring reports are to be prepared at the end of each water year within this period. (A water year initiates in October and ends in September of the following year.) This document is the second annual monitoring report for the project that summarizes data collected over water year 2006 (i.e., October 2005 through September 2006). (Data collected over water year 2005 were summarized in the first annual monitoring report for the project [Herrera 2005]). This document specifically evaluates and compares the hydrologic and water quality treatment performance of filter strips with and without compost amendment.

This document is organized to include the following major sections:

- Monitoring Design Overview
- Test Site Description
- Methods
- Results and Discussion
- Conclusions.

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Monitoring Design Overview

As described in the Highway Runoff Manual (WSDOT 2004a), CAVFS is one design variation of the vegetated filter strip (BMP RT.02). Vegetated filter strips are land areas of planted vegetation and amended soils situated between the pavement surface and a surface water collection system, pond, wetland, stream, or river. Vegetated filter strips accept overland sheet flow runoff from adjacent impervious areas and rely on their flat cross-slope and dense vegetation to maintain sheet flows. Their primary purpose is to remove sediments and other pollutants coming directly off the pavement. Vegetated filter strips function by reducing runoff velocities, trapping sediment and other pollutants, and providing some hydraulic infiltration and biologic uptake. Frequently planted with turf grasses, the strips may also include native vegetation such as small herbaceous shrubs that make the system more effective in treating runoff by providing infiltration enhancing root penetration into the subsoils.

Once permanent vegetation is established, the advantages of CAVFS over standard vegetated filter strips are a rougher surface, greater retention and infiltration capacity, improved removal of soluble cationic contaminants through sorption, improved overall vegetative health, and fewer invasive weeds. CAVFS have somewhat higher construction costs due to more expensive materials but may require less land area for runoff treatment, which can reduce overall costs.

This study is designed to simulate actual field conditions for WSDOT's implementation of vegetated filter strips. Accordingly, three separate pilot filter strips were constructed along Interstate 5 in Snohomish County (Figure 1) in accordance with specifications in the *Highway Runoff Manual* (WSDOT 2004a) for vegetated filter strips (BMP RT.02). Two of these filter strips (designated *CAVFS1* and *CAVFS2*) were amended with tilled-in compost, while a third (designated *VFS*) received no compost. (Note that these filter strips were designated as Compost 1, Compost 2, and Control, respectively, in previous documents that were prepared for this project [i.e., Herrera 2004, 2005]). The design criteria and as-built drawings for the pilot filter strips are documented in the QAPP that was prepared for the project (Herrera 2004).

Figure 2 provides a schematic diagram of the pilot filter strips and associated influent and effluent monitoring stations. Effluent flow volumes are measured continuously at three separate monitoring stations downgradient of each of the pilot filter strips. As shown in Figure 2, these stations are designated *VFS*, *CAVFS1*, and *CAVFS2* after their associated pilot filter strips (Note that these stations were designated Compost 1, Compost 2, and Control, respectively, in previous documents that were prepared for this project [i.e., Herrera 2004, 2005]). Stormwater that is not infiltrated within the pilot filter strips is conveyed to these monitoring stations via a shallow drainage ditch located immediately downgradient of each system and running parallel to the highway.

Because water enters each filter strip as highly diffuse sheet flow, influent discharge cannot be monitored directly. Therefore, untreated runoff from a curbed section of highway (designated *Curb and Gutter Control*) is routed to a single monitoring station in order to characterize influent discharge rates. This station is designated *Curb and Gutter Station* in Figure 2. A hydrologic

model is then used to scale the measured flows from this station up or down in a manner that is proportional to the contributing basin size for each pilot filter strip. In this way, influent flow rates can be estimated for each pilot filter strip based on data from one monitoring station.

A slope drain has also been constructed adjacent to each pilot filter strip to intercept any untreated surface and shallow subsurface runoff coming from areas that are adjacent to the drainage ditch (e.g., the noise berm shown in Figure 2). This intercepted water is routed to downgradient discharge locations to prevent it from commingling with filter strip effluent in the drainage ditch.

Automated equipment has been installed at each of the monitoring stations described above to facilitate continuous monitoring of influent and effluent discharge rates and volumes over the 3-year study. These data are subsequently processed and compared at the end of each water year to assess the performance of the pilot filter strips in reducing peak discharge rates, runoff volumes, and flow durations. To aid in the interpretation of these data, an automated rain gauge has also been installed at the CAVFS1 station (see Figure 2) and programmed to continuously record precipitation depths at the test site.

Automated water quality sampling equipment has also been installed in association with each monitoring station (i.e., VFS, CAVFS1, CAVFS2, and Curb and Gutter Control) to collect flow-weighted composite samples during discrete storm events. Triggering and pacing of the automated sampling equipment is controlled by the flow monitoring equipment described above. In addition, grab samples are collected during each storm event for analysis of parameters that cannot be evaluated based on composite samples. Water quality sampling for this project was not conducted during the first year of monitoring (i.e., water year 2005) to allow time for vegetation in the pilot filter strips to become fully established. Water quality sampling over water year 2006 occurred during seven discrete storm events. Collected samples were analyzed for the following parameters: total suspended solids, phosphorus (total and soluble reactive), total petroleum hydrocarbons, hardness, copper (dissolved and total), and zinc (dissolved and total). Water quality treatment performance of the filter strips is subsequently assessed based on comparisons of the concentrations and loads of these parameters as measured in the influent and effluent to each test system.

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Test Site Description

Site selection for the pilot filter strips in this study was guided by the following criteria developed by WSDOT during an earlier phase of this project:

- **Soil types.** The test site will be located on disturbed, compacted glacial till (i.e. freeway embankment soil) within urban areas of the Puget Sound region. This represents a worst-case scenario for assessing the performance of CAVFS on drained soils in Western Washington.

- **Rainfall.** The test site will be selected to approximate the mid- to upper range of the 35 to 50 inches of annual rainfall that is characteristic of the Puget Sound region urban areas.

- **Average daily trips (ADT).** The test site will represent the traffic volumes characteristic of the greater Puget Sound region. The minimum average daily trip threshold will be 100,000.

WSDOT determined that a section of Interstate 5 near Lynnwood, Washington, meets the criteria above and therefore has suitable attributes for this study (see Figure 1). Soils in this area are mapped as Urban Land within the Alderwood–Urban Land complex, 2 to 8 percent slopes (U.S. Department of Agriculture 1983). The Alderwood series consist of moderately well-drained soils on till plains. The surface layer of these soils typically consists of gravelly, sandy loam about 7 inches thick. The upper part (23 inches thick) and lower part (5 inches thick) of the subsoil consist of very gravelly, sandy loam. A weakly cemented hardpan is typically encountered at a depth of approximately 35 inches. However, the actual depth to hardpan can range from 20 to 40 inches.

The permeability of undisturbed Alderwood soil is moderately rapid above the hardpan and very slow through it. Infiltration rates are lower where construction activities result in incidental or deliberately compacted soil. The average annual rainfall total for the vicinity of the test sites is approximately 36.7 inches based on data from Everett, Washington (Western Regional Climate Center 2004); and the average daily trip value for this section of highway is 175,881 based on traffic data from 2003 (WSDOT 2004b).

The specific locations within this section of highway for the CAVFS1, CAVFS2, and VFS are shown in Figure 1. All are located on the east side of the highway between mileposts 185 and 186. As described previously, runoff from a curbed section of highway (designated Curb and Gutter Control) is being used to characterize influent flow and water quality for all of the pilot filter strips. As shown in Figure 1, the Curb and Gutter Control is located near milepost 184.3 on the east side of the highway. Catch basins located immediately upgradient and downgradient of each test location make it possible to isolate them hydrologically from other sections of roadway. The general characteristics of each pilot filter strip and the Curb and Gutter Control are presented

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in Table 1. Design criteria and as-builts for the pilot filter strips are also documented in the QAPP that was prepared for the project (Herrera 2004).

Table 1. General characteristics of the VFS, CAVFS1, and CAVFS2 filter strips and the Curb and Gutter Control[a].

	Location	Length (ft)	Impervious Basin Area[b] (sf)	Pervious Basin Area[c] (sf)	Total Basin Area (sf)	Percent impervious	Filter strip lateral slope[d] (percent)	Longitudinal slope[e] (percent)
Curb and Gutter Control	Near MP 184.3	240	8,303	0	8,303	100	n.a.	n.a.
VFS	Between MP 185.39 and 185.64	425.40	14,038	6,356	20,394	69	10-12	0.65
CAVFS1	Between MP 185.39 and 185.64	382.06	12,563	6,180	18,743	67	9-11	0.60
CAVFS2	Between MP 185.39 and 185.64	402.93	13,297	6,184	19,481	68	8-10	1.60

[a] Data are based on surveys conducted at the test site on November 15, 2004 to document as-built conditions.
[b] Impervious basin area includes asphalt highway and shoulder.
[c] Pervious basin area includes gravel highway shoulder, filter strip, and downgradient drainage ditch.
[d] Slope of filter strip from top at highway shoulder to bottom at convergence with downgradient drainage ditch.
[e] Slope of shallow drainage ditch located immediately downgradient of each filter strip and running parallel to the highway.
ft: feet.
sf: square feet.
MP: milepost.

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Methods

Discharge monitoring procedures, precipitation monitoring procedures, water quality sampling procedures, data management, and data analysis procedures for this study are described in the following sections. These procedures were originally presented in the QAPP that was developed for the project (Herrera 2004).

Discharge Monitoring Procedures

Automated monitoring equipment for measuring water levels (i.e., ISCO 6712 Full Size Portable Sampler and ISCO 730 Bubble Flow Module) was installed within vandalism-resistant housing at the VFS, CAVFS1, CAVFS2, and Curb and Gutter monitoring stations (see Figure 2). A 3-inch Parshall flume was also installed at each monitoring station so that accurate estimates of discharge can be derived from the water level measurements. Water from the three pilot filter strips and the Curb and Gutter Control is directed into the flumes using a combination of untreated plywood wingwalls and sandbags. The automated monitoring equipment at each station is programmed to record water levels in the flumes with a 15-minute logging interval. These data are uploaded remotely using telemetry systems (ISCO SPA 1215 Cell Phone System) that are integrated with the automated monitoring equipment. Power for all the equipment is maintained using a battery and solar panel charger (ISCO SPA 1399 95-watt solar panel charger).

Site visits are performed at least every month or as necessary to address operational problems and perform routine maintenance on the automated monitoring equipment. Maintenance activities include the following:

- Inspection of the battery and solar panel system
- Replacement of desiccant for the ISCO 730 Bubble Flow Module
- Removal of any debris that may be blocking the flumes.

The calibration of the automated monitoring equipment is also checked on each site visit by comparing their readings to a manual measurement of stage in the flumes. The equipment is then recalibrated as needed so that the measured water levels conform to the manual readings. Whenever possible, field personnel also make visual inspections during storm events to confirm that flows are properly routed to the flumes. Failures or partial failures of the flow management structures are documented in field notes along with any associated corrective actions.

Precipitation Monitoring Procedures

Precipitation is measured at the CAVFS1 station with an ISCO 674 Rain Gauge that is integrated with the automated monitoring equipment described in the section above. The equipment is

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programmed to continuously measure precipitation totals with a 15-minute logging interval. These data are uploaded remotely via the station's telemetry system.

Water Quality Sampling Procedures

Water quality sampling during the water year 2006 occurred during seven discrete storm events. As describe in the QAPP for the project (Herrera 2004), the following conditions served as guidelines for defining the acceptability of these storm events for sampling:

- **Precipitation depth:** A minimum of 0.25 inches of precipitation over a 24-hour period. (Note: While the goal is to target larger storms, samples from storms as small as 0.15 inches over 24 hours may be accepted as long as the other specified criteria are met.)
- **Antecedent conditions:** A period of at least 6 hours preceding the event with less than 0.04 inches of precipitation.
- **End of storm:** A continuous 6-hour period with no measurable rainfall.

During each storm event, samples were generally not collected at all the monitoring sites because runoff volumes were frequently too low at some of the stations (especially CAVFS1) to facilitate sampling and/or equipment malfunctions made sample collection impossible. The specific dates and locations for water quality sampling over water year 2006 are summarized in Table 2.

Table 2. Dates and locations sampled during the 2006 water year.

Storm Start Time	Storm Stop Time	Curb and Gutter	VFS	CAVFS1	CAVFS2
11/2/05 17:30	11/3/05 20:00	S	S	NS	S
12/19/05 22:15	12/20/05 7:45	S	S	NS	NS
12/20/05 13:00	12/22/05 10:00	S	S	NS	S
12/28/05 3:30	12/28/05 12:00	S	S	NS	S
1/5/06 7:30	1/6/06 0:00	S	S	NS	S
1/8/06 15:45	1/11/06 0:15	S	S	S[a]	S
1/16/06 2:30	1/16/06 22:45	S	S	NS	S

S: Sample collected at indicated station.
NS: Sample not collected at indicated station due to insufficient runoff volumes during storm event.
[a] Flow-weighted composite sample collected during event but no grab sample.

The specific procedures used during each storm event for the collection of flow-weighted composite and grab samples are described in the following subsections.

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Flow-weighted Composite Samples

To facilitate the collection of flow-weighted composite samples, dedicated automated water quality sampling equipment (i.e., ISCO 6712 Full Size Portable Samplers) were installed in association with each of the flow monitoring stations described above. For the VFS, CAVFS1, and CAVFS2 stations, the sampler intakes were positioned just up gradient of the flumes used for flow monitoring (see description in Discharge Monitoring Procedures section). For the Curb and Gutter station, the sampler intake was suspended in a plastic tray mounted at the top of the catch basin that receives water from the curbed section of highway. In each case, the sampler intakes were positioned to ensure the homogeneity and representativeness of the sample. Specifically, sampler intakes were installed to make sure adequate depth is available for sampling, and to avoid capture of litter, debris, and other gross solids that might be present at the base of the channel. The sampler suction lines consist of Teflon® tubing with a 3/8-inch inner diameter.

During actual sampling, antecedent conditions and storm predictions are monitored via Internet accessible weather information sites to determine when specific storms should be targeted for sampling. Once a storm is targeted, field personnel visit each station to verify that the equipment is operational and start the sampling program. A clean 2.5-gallon polyethylene carboy and several bags of crushed ice are also placed in the sampling equipment at this time. The speed and intensity of incoming storm events is then tracked using Internet-accessible images from a Doppler radar site in Seattle, Washington (King 5 News 2006). (Actual rainfall totals during sampled storm events are quantified on the basis of data from the rain gauge installed at the CAVFS1 station.)

During the storm event sampling, each automated sampler is programmed to trigger in response to a predefined increase in flow at the respective station. The automated samplers then collect 250-milliliter sample aliquots at preset flow increments. The particular flow increments are adjusted for each station based on the anticipated size of the incoming storm. In general, sampler pacing at each station is targeted at a goal of sampling at least 75 percent of the storm hydrograph. However, pursuant to the QAPP for the project, sampling only the rising limb of the hydrograph is considered acceptable for very long storms (>24 hours). The maximum duration of automated sample collection for all stations is 36-hours. Periodic monitoring of each station occurs during storm events via the remote access system. If this monitoring indicates that a carboy at a particular station is likely to fill before the end of the rain event, field personnel visit the site and replace the nearly full carboy with an empty one.

After each targeted storm event, field personnel return to each station, make visual and operational checks of the sampling equipment, and determine the total number of aliquots composited. Pursuant to the QAPP for the project, the minimum number of composites that constitutes an acceptable sample is ten. (A minimum volume of 2 liters must be collected to perform all the targeted analyzes in this study with the associated laboratory quality control requirements.) If the sample is acceptable, the carboy is immediately capped, removed from the automated sampler, and kept at 4°C using ice during transport to the laboratory. Once in the laboratory, water from the carboy is used to fill pre-cleaned, preserved (where appropriate)

sample bottles for the required analyses. All collected samples are then analyzed for total suspended solids, total phosphorus, soluble reactive phosphorus, total hardness, total and dissolved copper, and total and dissolved zinc.

Grab Samples

In addition to the flow-weighted composite samples described above, samples for total petroleum hydrocarbons (TPH) analysis were collected as grab samples from each station during sampled storm events. Grab samples collected from the Curb and Gutter monitoring station were targeted to capture the rising limb of the storm hydrograph. Sample collection from the VFS, CAVFS1, and CAVFS2 monitoring stations occurred once sustained flow was observed at each respective location. Once collected, the TPH samples were kept at 4°C in a cooler and transported to the laboratory with the automated samples after the end of the storm event.

Analytical Procedures

Laboratory analytical procedures followed methods approved by the U.S. Environmental Protection Agency (APHA et al. 1992; U.S. EPA 1983, 1984). Preservation methods, analytical methods, reporting limits, and sample holding times are presented in Table 3.

The laboratory identified for this project (Aquatic Research, Inc.) is certified by Ecology and participates in audits and interlaboratory studies by Ecology and U.S. EPA. These performance and system audits have verified the adequacy of the laboratory's standard operating procedures, which include preventive maintenance and data reduction procedures.

Data Management Procedures

Hydrologic data from automated instrumentation were uploaded from each station on a weekly basis using the installed telemetry systems (ISCO SPA 1215 Cell Phone System) and the ISCO Flowlink® software program. The uploaded data were immediately checked for evidence of an equipment malfunction or other operational problems. At the end of the current monitoring period, the data from each station were exported to an Excel® spreadsheet for subsequent data management, quality assurance review, and archiving tasks related to this report. The data quality assurance review procedures are described in the Hydrologic Data Quality Assurance Review Memorandum that is presented in Appendix A.

Water quality analytical results were received from the laboratory (Aquatic Research, Inc.) within 30 days of receipt of the associated samples. The laboratory provided sample and quality control data in standardized reports that are suitable for evaluating the project data. These reports included all quality control results associated with the data. The reports also included a case narrative summarizing any problems encountered in the analyses, corrective actions taken, changes to the referenced method, and an explanation of data qualifiers.

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Table 3. Bottle type, preservation methods, analytical methods, reporting limits, and sample holding times for water quality analyses.

Parameter	Bottle Type	Preservation Method	Analytical Method	Method Number [a]	Reporting Limit [b]	Sample Holding Times
Total suspended solids	P	Cool, 4°C	Gravimetric, 103°C	EPA 160.2	0.50 mg/L	7 days
Total phosphorus	P	Cool, 4°C; H_2SO_4 to pH<2	Automated ascorbic acid	EPA 365.1	0.002 mg/L	28 days
Soluble reactive phosphorus	P	Cool, 4°C; filtration, 0.45 µm	Automated ascorbic acid	EPA 365.1	0.001 mg/L	48 hours [c]
Total petroleum hydrocarbons	G	Cool, 4°C; HCl to pH<2	GCFID	NWTPH-Dx	0.05 mg/L (diesel) 0.1 mg/L (motor oil)	14 days [c]
Hardness	P	Cool, 4°C; HNO_3 to pH<2	EDTA titrimetric	SM 2340C	2 mg/L as $CaCO_3$	6 months
Copper, dissolved	P	Cool, 4°C; filtration, 0.45 µm; HNO_3 to pH<2	GFAA	EPA 220.2	0.001 mg/L	6 months [c]
Copper, total	P	Cool, 4°C; HNO_3 to pH<2	GFAA	EPA 220.2	0.001 mg/L	6 months
Zinc, dissolved	P	Cool, 4°C; filtration, 0.45 µm; HNO_3 to pH<2	ICP	EPA 200.7	0.005 mg/L	6 months [c]
Zinc, total	P	Cool, 4°C; HNO_3 to pH<2	ICP	EPA 200.7	0.005 mg/L	6 months

[a] SM method numbers are from APHA et al. 1992; EPA method numbers are from U.S. EPA 1983, 1984.
[b] Reporting limit refers to the practical quantitation limit.
[c] Sample filtration and/or preservation will occur within 12 hours of sample collection.
EDTA = ethylenediaminetetraacetic acid.
GFAA = graphite furnace atomic absorption.
GCFID = gas chromatograph, flame ionization detector.
ICP = inductively coupled plasma.
mg/L = milligrams per liter.
$CaCO_3$ = calcium carbonate.
NWTPH = northwest total petroleum hydrocarbon.
P = polyethylene, polypropylene, fluoropolymer.
G = glass.

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Laboratory data were subsequently entered into an Excel® spreadsheet for all subsequent data management, analysis, and archiving tasks related to this report. Herrera's quality assurance officer performed an independent review to ensure all the data were entered without error. Specifically, ten percent of the sample values were randomly selected for rechecking and crosschecking with laboratory reports. If errors are detected, they will be corrected, and then an additional 10 percent will be selected for validation. This process was repeated until no errors are found in the data. The Herrera quality assurance officer also provided an independent review of the quality control data from each sampling event relative to method quality objectives (MQOs) that are identified in the QAPP for the project (Herrera 2004). The procedures and results from this review are documented in the Water Quality Data Quality Assurance Review Memorandum that is presented in Appendix B.

Data Analysis Procedures

The sections below present data analysis procedures that were used to evaluate flow control and water quality treatment performance of the pilot filter strips.

Flow Control Performance

Separate data analyses were performed to assess flow control performance with regard to reducing runoff volumes, peak discharge rates, and flow durations based on the following comparisons:

- Curb and Gutter station relative to the three filter strip stations (VFS, CAVFS1, and CAVFS2). These comparisons were performed to provide a general assessment of filter strip performance for treating highway runoff.

- Compost amended filter strip stations (CAVFS1 and CAVFS2) relative to the vegetated filter strip station (VFS). These comparisons were performed to specifically examine the potential benefits of compost amendment for improving filter strip performance.

In order to conduct these analyses, the following information was compiled for each storm that occurred during the monitoring period:

- Storm precipitation depth
- Storm duration
- Storm average intensity
- Storm peak intensity
- Storm antecedent dry period
- Peak discharge rate at each station
- Runoff volume at each station
- Flow duration at each station

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Once this information was compiled, additional analyses were performed to identify a subset of storms that had sufficient precipitation totals and/or intensities to produce runoff into the pilot filter strips. Specifically, any storm that produced a measurable discharge volume at the Curb and Gutter station was flagged as runoff-producing. When data from the Curb and Gutter station were not available for a particular storm, the storm precipitation total and discharge records from other stations were examined collectively to determine if the storm produced runoff. In order to account for differences in contributing basin size when comparing the hydrologic performance of the filter strips, the peak discharge rate, runoff volume, and flow duration data from all stations were also normalized by contributing basin area. This was done using the following generalized equation for all three measures of hydrologic performance:

$$N_{si} = \frac{H_{si}}{A_s}$$

Where:

N_{si} = normalized data for station *s*, event *i*
H_i = raw data for station *s*, event *i*
A_s = contributing basin area for station *s*

Note that the contributing basin area in these calculations included both the impervious and pervious areas that are associated with each station (see Table 1). The normalized data for each measure of hydrologic performance were subsequently expressed in the following units: cubic feet per second (cfs) per acre for peak discharge rate; cubic feet (cf) per acre for runoff volume; and hours per acre for flow duration.

Statistical analyses were then performed on the normalized data from the runoff-producing storms to compare hydrologic characteristics (i.e., runoff volumes, peak discharge, flow duration) for the Curb and Gutter station to those for the three filter strip stations (VFS, CAVFS1, and CAVFS2). In these analyses, data from the Curb and Gutter station were used to evaluate these characteristics for untreated highway runoff (i.e., system influent) whereas data from the three filter strip stations were used to evaluate these characteristics for treated runoff (i.e., system effluent). The specific null hypotheses (H_o) and alternative hypotheses (H_a) for these analyses are as follows:

Hypothesis 1:

H_o: Runoff volumes for the VFS, CAVFS1, and CAVFS2 stations are equal to or higher than those for the Curb and Gutter station.

H_a: Runoff volumes for the VFS, CAVFS1, and CAVFS2 stations are lower than those for the Curb and Gutter station.

Hypothesis 2:

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H_o: Peak discharge rates for the VFS, CAVFS1, and CAVFS2 stations are equal to or higher than those at the Curb and Gutter station.

H_a: Peak discharge rates for the VFS, CAVFS1, and CAVFS2 stations are lower than those at the Curb and Gutter station.

Hypothesis 3:

H_o: Flow durations for the VFS, CAVFS1, and CAVFS2 stations are equal to or higher than those at the Curb and Gutter station.

H_a: Flow durations for the VFS, CAVFS1, and CAVFS2 stations are lower than those at the Curb and Gutter station.

To evaluate these hypotheses, a Friedman test (Helsel and Hirch 1992) was used to compare performance data from all four stations. The Freidman test is a non-parametric analogue to the "blocked" analysis of variance (ANOVA) test. Through the use of a blocked test, differences in the performance data for each monitoring station could be more efficiently assessed, because the noise (or variance) associated with monitoring over a range of storm sizes was blocked out of the statistical analyses (Helsel and Hirch 1992). The Friedman test was used in lieu of the blocked ANOVA because visual examinations of the data indicated they do not meet the assumptions required for a parametric test (e.g., normality and homoscedasticity). In cases where the Friedman test indicated there was a significant difference between the stations, a follow-up one-tailed nonparametric multiple comparison test (Zar 1984) was performed to determine which specific filter strip monitoring stations were significantly different from the Curb and Gutter station. (These tests were performed using the Dunnett's procedure for comparing various treatment groups to a control.) In all tests, statistical significance was assessed based on an alpha (α) level of 0.05.

Statistical analyses were also performed on the normalized data from the runoff-producing storms to test three hypotheses relating to the performance of filter strips with and without compost amendment. The specific null hypotheses (H_o) and alternative hypotheses (H_a) for these analyses are as follows:

Hypothesis 1:

H_o: Peak discharge rates for filter strips with compost amendment are equal to or greater than those for filter strips without compost amendment.

H_a: Peak discharges rates for filter strips with compost amendment are less than those for filter strips without compost amendment.

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Hypothesis 2:

H_o: Runoff volumes for filter strips with compost amendment are equal to or greater than those for filter strips without compost amendment.

H_a: Runoff volumes for filter strips with compost amendment are less than those for filter strips without compost amendment.

Hypothesis 3:

H_o: Runoff durations for filter strips with compost amendment are equal to or greater than those for filter strips without compost amendment.

H_a: Runoff durations for filter strips with compost amendment are less than those for filter strips without compost amendment.

To evaluate these hypotheses, a one-tailed sign test (Helsel and Hirch 1992) was used to compare performance data from the compost amended filter strip stations (CAVFS1 and CAVFS2 stations) to those from the vegetated filter strip station (VFS). Specifically, two separate one-tailed sign tests were run for each hypothesis to obtain results for the following filter strip combinations: CAVFS1 versus VFS, and CAVFS2 versus VFS. The sign test is a non parametric analogue to the paired t-test. Like the Friedman test described above, a paired test was used in this analysis to remove noise in the data that stems from sampling over a range of storm sizes so that differences between the filters strips could be more efficiently assessed (Helsel and Hirch 1992). The sign test was used because visual examinations of the data indicated they do not meet the assumptions required for a parametric test (i.e., the paired differences of the data generally exhibited an asymmetrical distribution as opposed to a normal or symmetrical distribution). In all tests, statistical significance was assessed based on an alpha (α) level of 0.05.

Finally, scatter plots were also generated from the data to compare hydrologic data from the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations over storms of varying magnitudes. These plots specifically examined how performance varies with different storm precipitation totals and average storm intensities. To aid in the interpretation of these plots, separate lines were fitted to the data for each filter strip using Locally Weighted Scatterplot Smoothing (LOWESS) (Helsel and Hirsh 1992).

Water Quality Treatment Performance

Like the analysis of hydrologic treatment performance described above, separate data analyses were performed to provide a general assessment of filter strip water quality treatment performance and to specifically examine the potential benefits of compost amendment for improving performance. However, because sufficient flow volumes for sampling were rarely observed at the CAVFS1 station (see discussion in Discharge Monitoring Results section), data

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are only available from one sampling event for this station (see Table 2). Hence, data from this station are only included in a subset of these analyses. Treatment performance in this analysis was evaluated based on both pollutant concentrations and loads that were measured at each monitoring station. The specific procedures that were used in these respective evaluations are described in the following subsections.

Comparison of Treatment Performance Based on Pollutant Concentrations

In order to assess the general performance of filter strips at improving water quality, statistical analyses were performed to compare pollutant concentrations measured at the Curb and Gutter station to those from two of the filter strip stations (VFS and CAVFS2). In these analyses, data from the Curb and Gutter station were used to evaluate pollutant concentrations in untreated highway runoff (i.e., system influent) whereas data from the two filter strip stations were used to evaluate pollutant concentrations in the runoff following treatment (i.e., system effluent). The specific null hypothesis (H_o) and alternative hypothesis (H_a) for these analyses are as follows:

H_o: Pollutant concentrations for the VFS, CAVFS1, and CAVFS2 stations are equal to or higher than those for the Curb and Gutter station.

H_a: Pollutant concentrations for the VFS, CAVFS1, and CAVFS2 stations are lower than those for the Curb and Gutter station.

To evaluate these hypotheses, a Friedman test (see description in preceding section) was used to compare pollutant concentrations measured at all three stations. Separate tests were run from all the monitoring parameters identified in Table 3 except hardness. (Hardness data were only used in these analyses to assess compliance with state water quality standards for dissolved copper and zinc). In cases where the Friedman test indicated there was a significant difference between the stations, a follow-up one-tailed nonparametric multiple comparison test (Zar 1984) was performed to determined which specific filter strip monitoring stations were significantly different from the Curb and Gutter station. In all these tests, statistical significance was assessed based on an alpha (α) level of 0.05.

Statistical analyses were also performed to compare pollutant concentrations measured in the effluent from filter strips with and without compost amendment. The specific null hypothesis (H_o) and alternative hypothesis (H_a) for these analyses are as follows:

H_o: There is no difference in effluent pollutant concentrations between filter strips with and without compost amendment.

H_a: There are differences in effluent pollutant concentrations between filter strips with and without compost amendment.

To evaluate these hypotheses, a two-tailed sign test (see description preceding section) was used to compare pollutant concentrations at the CAVFS1 station to those from the VFS station with

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separate tests run from all the monitoring parameters identified in Table 3 except hardness. In all these tests, statistical significance was assessed based on an alpha (α) level of 0.05.

Comparison of Treatment Performance Based on Pollutant Loads

Water quality treatment performance was also assessed based on pollutant loads measured at each station. Specifically, flow and water quality data from each monitoring station were used to compute annual pollutant loads using the following equation:

$$L = F \times \left(\frac{\sum_{i=1}^{N} l}{\sum_{i=1}^{N} f} \right)$$

where: L = pollutant load at station for water year (kilograms)

F = measured flow volume at station for water year (liters)

l_i = measured load during each sampled storm event that occurred during the water year (kilograms)

f_i = measured flow volume during each sampled storm event that occurred during the water year (liters).

Loads measured during each sampling storm event (l) were calculated using the following equation:

$$l_i = C_i \times f_i$$

where: C_i = pollutant concentration for each sampled storm event determined from flow-proportioned composite samples or grab samples (kilograms per liter).

The load measured at the Curb and Gutter station for the water year was subsequently scaled to estimate influent loads for each pilot filter strip using the following equation:

$$L_{IN} = L_{C\&G} \times \left(\frac{B_{FS}}{B_{C\&G}} \right)$$

where: L_{IN} = filter strip influent pollutant load for water year (kilograms)

$L_{C\&G}$ = Curb and Gutter station load for water year (kilograms)

B_{FS} = impervious basin area for pilot filter strip (square feet) from Table 1.

$B_{C\&G}$= impervious basin area for Curb and Gutter Control (square feet) from Table 1.

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The influent and effluent pollutant loading estimates for each pilot filter strip were then used to calculate pollutant removal efficiencies using the following equation:

$$R = \left[\frac{(L_i - L_e)}{L_i} \right] \times 100$$

where: R = removal efficiency for pilot treatment system (percent)

L_i = influent pollutant load for the water year (kilograms)

L_e = effluent pollutant load measured in effluent over the study period of interest (kilograms).

Measured loads and pollutant removal efficiencies for each station were then compared to provide a general assessment of filter strip water quality treatment performance and to specifically examine the potential benefits of compost amendment for improving performance.

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Results and Discussion

Monitoring results for water year 2006 are presented and discussed herein. This section begins with a summary of the precipitation data that were collected over this period. Discharge data from each station are then summarized along with results from analyses that were performed to characterize filter strip hydrologic treatment performance. Finally, water quality data from each station are summarized along with results from analyses that were performed to characterize filter strip water quality treatment performance.

Precipitation Monitoring Results

Precipitation data collected over water year 2006 are presented in Figure 3. Table C1 in Appendix C also displays data compiled for individual storm events during both water years 2005 and 2005, including the date and time for the storm's start and end, the storm's duration, antecedent dry period, precipitation depth, average intensity, and peak intensity. Finally, summary statistics for runoff-producing storms are shown in Table 4 for water year 2006.

Table 4. Summary statistics for precipitation data measured during runoff-producing storm events in water year 2006.

	Minimum	Median	Maximum
Precipitation depth (inches)	0.01	0.19	2.39
Duration (hours)	0.25	7.75	59.8
Antecedent dry period (hours)	6.00	19.0	716
Average intensity (inches/hour)	0.00	0.03	0.21
Peak intensity (inches/15 minutes)	0.01	0.03	0.17

A total of 161 storm events occurred during water year 2006, with 102 producing runoff and 59 producing no runoff. The median, minimum, and maximum precipitation depth for runoff-producing storms were 0.19, 0.01, and 2.39 inches, respectively. The maximum precipitation depth (2.39 inches) was observed during a storm event that started on January 29, 2006 and lasted 23.25 hours. The runoff-producing storm with the highest average intensity (0.21 inches/hour) started on January 25, 2006 and lasted 1 hour. The runoff-producing storm with the highest peak intensity (0.17 inches/15 minutes) started on February 3, 2006 and lasted 19.25 hours.

Based on precipitation records from Sea-Tac International Airport, the cumulative precipitation total over water year 2006 was 39.3 inches (National Weather Service 2006); or slightly above the historical annual average of 38.09 inches for the period from 1931 through 2005 (Western Regional Climate Center 2006). However, the precipitation total for water year 2006 was substantially higher than the total (30.19 inches) for water year 2005. Based on this consideration, the data from the current monitoring year may provide a better indication of typical filter strip performance relative to the data collected over water year 2005 when the systems may have been saturated less frequently due to the lower than normal precipitation totals.

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Discharge Monitoring Results

This section presents discharge monitoring results for each station from monitoring conducted over water year 2006. Graphical summaries of these data are provided in Figures 4, 5, 6, and 7 for the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations, respectively. Tables C2, C3, and C4 in Appendix C also present the raw runoff volumes, peak discharge rates, and runoff durations, respectively, that were measured at these stations during individual storm events over both the 2005 and 2006 water years. Similarly, Tables C5, C6, and C7 in Appendix C present the normalized data for runoff volumes, peak discharge rates, and runoff durations, respectively.

This section begins with an overview of the data that were collected at each station during water year 2006, including the number of storms that were captured and statistics to summarize measured discharge volumes and rates. Separate subsections then evaluate the performance of the filter strips for reducing flow volumes, peak discharge rates, and flow durations. Where applicable, the analyses presented in these latter sections also include data from monitoring conducted in water year 2005 to show year-to-year trends and provide greater statistical power for detecting patterns in the monitoring results.

Monitoring Data Overview

A total of 101 runoff-producing storm events were observed at the Curb and Gutter station. This represents 64 percent of the storms out of a total of 157 storm events that were captured through monitoring at the station. As shown in Figure 4, the combined volume from these runoff-producing storms was 6,935 cubic feet (cf). (Note: data from 1 runoff-producing storm that occurred during the monitoring period is not captured in this combined volume). The maximum raw and normalized discharge rates of 0.105 cfs and 0.551 cfs/acre, respectively, were measured during the storm event that initiated on May 27, 2006 and produced 1.01 inches of precipitation over a 6.25-hour period.

A total of 101 runoff-producing storm events were observed at the VFS station. This represents 64 percent of the storms out of a total of 159 events that were captured through monitoring at the station. The combined volume from these runoff-producing storms was 4,367 cf (Figure 5). (Note: data from 1 runoff-producing storm that occurred during the monitoring period is not captured in this combined volume). The maximum raw and normalized discharge rates of 0.082 cfs and 0.174 cfs/acre, respectively, were measured during the storm event that initiated on February 3, 2006 and produced 0.74 inches of precipitation over a 19.25-hour period. As noted in the Precipitation Monitoring Results section above, this storm had the highest peak intensity of any storm during the monitoring period.

A total of 82 runoff-producing storm events were observed at the CAVFS1 station. This represents 60 percent of the storms out of a total of 136 events that were captured at the station. The combined volume from these runoff-producing storms was 294 cf (Figure 6). (Note: data from 20 runoff-producing storms that occurred during the monitoring period are not captured in this combined volume). The maximum raw and normalized discharge rates of 0.002 cfs and

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0.005 cfs/acre, respectively, were measured during the storm event that initiated on February 27, 2006 and produced 0.46 inches of precipitation over a 14.5-hour period.

A total of 99 runoff-producing storm events were observed at the CAVFS2 station. This represents 63 percent of the storms out of a total of 156 events that were captured at the station. The combined volume from these runoff-producing storms was 2,298 cf (Figure 7). (Note: data from 3 runoff-producing storms that occurred during the monitoring period are not captured in this combined volume.) The maximum raw and normalized discharge rates for the CAVFS2 station of 0.115 cfs and 0.258 cfs/acre were also measured during the storm event that initiated on February 3, 2006.

Evaluation Filter Strip Performance for Reducing Runoff Volumes

Figure 8 presents "box and whisker" plots comparing normalized runoff volumes measured at each station during runoff-producing storm events that occurred over water year 2006. To facilitate the evaluation of year-to-year trends in the data, Figure 8 also presents separate box and whisker plots for normalized runoff volumes that were measured in water year 2005. Each box and whisker plot presented in Figure 8 (and all subsequent figures) summarize following information from the data: 10th and 90th percentiles as the lower and upper whiskers, respectively; the 25th and 75th percentiles as the lower and upper boundaries of the box, respectively; and the median as the point in the box.

As described in the Methods section, a Freidman test was used to compare the normalized runoff volumes measured at the Curb and Gutter station to those at the three filter strip stations in order to provide a general assessment of treatment performance. To increase statistical power for detecting differences between these groups, this test was performed using data from both water years 2005 and 2006. Results from the Friedman test showed there were significant differences in the normalized runoff volumes between these stations ($p < 0.0001$). The follow-up multiple comparison test indicated that the normalized runoff volumes measured at all three filter strip stations were significantly lower than those at the Curb and Gutter station. Considering the combined data from all three filter strips, highway runoff volumes during individual storm events were reduced on average by 93 percent through treatment within these systems. Water losses within the filter strips are likely occurring due to both infiltration and evapotranspiration; however, the monitoring data obtained through this study cannot be used to determine which of these two processes dominates at any given time.

In order to examine the potential benefits of compost amendment for improving filter strip performance, Figure 9 shows scatter plots and linear regression analysis results that compare normalized runoff volumes measured at the CAVFS1 and CAVFS2 stations to those measured at the VFS station during runoff-producing storm events in water years 2005 and 2006. Results from a one-tailed sign test that was applied to these data indicated that normalized runoff volumes measured at the CAVFS1 station were significantly lower ($p < 0.0001$) than those measured at the VFS station. Likewise, a one-tailed sign test also indicated that normalized runoff volumes measured at the CAVFS2 station were significantly lower ($p = 0.0002$) than

those measured at the VFS station. These differences in runoff volumes between the monitoring stations are clearly evident in the scatter plots presented in Figure 9, although the differences between the CAVFS2 and VFS stations are less pronounced. Based on the slopes from the linear regression lines shown in Figure 9, runoff volumes at the CAVFS1 station were between 90 and 99 percent less than those at the VFS station. Similarly, runoff volumes at the CAVFS2 station were between 45 and 50 percent less than those at the VFS station.

These results are generally consistent with other studies that have measured lower runoff volumes from highway embankments with compost amendment (e.g., Glanville et al. 2004). However, it should also be noted that runoff volumes from the CAVFS1 filter strip were markedly lower than those for both the VFS and CAVFS2 filter strips. After similar observations were made during monitoring for water year 2005, Herrera coordinated with the ESO to implement additional subsurface soil assessments in June 2006 to determine if there were areas of high permeability and/or preferential pathways for water beneath the filter strips that might explain these performance differences. These investigations specifically involved the development of geologic cross-sections for the study site based on subsurface soil samples that were collected at 13 locations (i.e., 4 locations in the VFS filter strip, 5 locations in the CAVFS1 filter strip, and 4 locations in the CAVFS2 filter strip) using a push probe drilling method. Results from this assessment indicated that most of the site is underlain by glacial till; however, a historic surface depression was identified in the southern portion of the CAVFS1 filter strip. Soils within this depression consisted of permeable advance outwash sand with an organic silt layer that was interpreted to be the original ground surface for the depression prior to its being filled with the construction of the highway. This depression occupies approximately 40 percent of the CAVFS1 filter strip's total length and likely explains its superior performance relative to the VFS and CAVFS2 filter strips. Appendix D documents the sampling methodology and results from these subsurface soil assessments in more detail.

Figure 10 shows how normalized runoff volumes measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations vary with increasing precipitation depths and average precipitation intensities during runoff-producing storm events in water years 2005 and 2006. The plot for precipitation depth suggests there are distinct thresholds for initiating runoff in each filter strip. Once this threshold has been crossed, runoff volumes will steadily increase as precipitation depths increase. The threshold for the VFS filter strip was lowest at approximately 0.2 inches, followed by the CAVFS2 filter strip at approximately 0.3 to 0.4 inches. The threshold for the CAVFS1 filter strip was markedly higher in comparison at approximately 0.5 inches. The pattern of increasing runoff volumes with increasing precipitation depth was also much less pronounced for the CAVFS1 filter strip; whereas this pattern was most obvious for the VFS filter strip. These data indicate that the benefits of compost amendment in filter strips are generally realized most when storm precipitation depths exceed 0.2 inches. There was no clear pattern evident in plots comparing normalized runoff volumes for each station to average precipitation intensities (Figure 10).

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Evaluation Filter Strip Performance for Reducing Peak Discharge Rates

Figure 11 presents box and whisker plots comparing normalized peak discharge rates measured at each station during runoff-producing storm events that occurred over water years 2005 and 2006. Results from a Friedman test that was applied to these data showed there were significant differences in the normalized peak discharge rates between these stations ($p < 0.0001$). The follow-up multiple comparison test indicated that the normalized peak discharge rates measured at all three filter strip stations were significantly lower than those for the Curb and Gutter station. Considering the combined data from all three filter strips, peak discharge rates during individual storm events were reduced on average by 91 percent through treatment within these systems.

Figure 12 shows scatter plots and regression analysis results that compare normalized peak discharge rates measured at the CAVFS1 and CAVFS2 stations to those measured at the VFS station during runoff-producing storm events in 2005 and 2006. Results from a one-tailed sign test that was applied to these data indicated that normalized peak discharge rates measured at the CAVFS1 station were significantly lower ($p < 0.0001$) than those measured at the VFS station. Based on the slopes from the linear regression lines shown in Figure 12, peak discharge rates at the CAVFS1 station were between 77 and 98 percent lower than those at the VFS station. These large differences in peak discharge rates between the CAVFS1 and VFS stations are clearly evident in the upper scatter plot presented in Figure 12 and are probably related to the unique subsurface soil characteristics for the CAVFS1 filter strip that were discussed in the previous section.

A one-tailed sign test also indicated that normalized peak discharge rates measured at the CAVFS2 station were significantly lower ($p = 0.0413$) than those measured at the VFS station. As shown in the associated scatter plot for these data (see Figure 12), this pattern is generally evident over the lower end of the data range (i.e., 0 to 0.10 cf/acre): however, the scatter plot also shows that peak discharge rates tended to be higher at the CAVFS2 station relative to the VFS station in the upper end of the range (i.e., > 0.10 cf/acre). In general, these high values occurred coincident with very large storm events (the associated precipitation amounts ranged from 0.62 to 2.39 inches) when the CAVFS2 filter strip was likely saturated. Under saturated conditions, other factors such as the CAVFS2 filter strip's steeper longitudinal slope (see Table 1) are likely contributing to its inferior performance relative to the VFS filter strip.

Figure 13 shows how normalized peak discharge rates measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations vary with increasing precipitation depths and average precipitation intensities for runoff-producing storms in water years 2005 and 2006. The plot for precipitation depth suggests there is a threshold at approximately 0.6 inches over which normalized peak discharge rates increase markedly at all stations. This may be an indication that the filter strips are becoming saturated above this threshold; hence, infiltration rates are falling off while discharge rates are increasing. However, due to the unique subsurface soil characteristics for the CAVFS1 filter strip that increase its infiltration capacity, this pattern was generally more pronounced in the data for the VFS and CAVF2 stations. There was no clear pattern evident in plots comparing peak discharge rates for each station to average precipitation intensities (Figure 13).

Evaluation Filter Strip Performance for Reducing Flow Durations

Figure 14 presents box and whisker plots comparing normalized flow durations measured at each station during runoff-producing storm events that occurred over water years 2005 and 2006. Results from a Friedman test that was applied to these data showed there were significant differences in the normalized flow durations between these stations ($p < 0.0001$). The follow-up multiple comparison test indicated that the normalized peak discharge rates measured at all three filter strip stations were significantly lower than those at the Curb and Gutter station. Considering the combined data from all three filter strips, flow durations during individual storm events were reduced on average by 86 percent through treatment within these systems.

Figure 15 shows normalized flow durations measured at the CAVFS1 and CAVFS2 stations in comparison to those measured at the VFS station during runoff-producing storm events in water years 2005 and 2006. Results from a one-tailed sign test that was applied to these data indicate that normalized flow durations measured at the CAVFS1 station were significantly lower ($p < 0.0288$) than those measured at the VFS station; however, the test also indicated there were no significant differences ($p = 0.0509$) in normalized flow durations between the CAVFS2 and VFS stations. Again, the mixed results between the CAVFS1 and CAVFS2 stations for this measure of performance is probably related to the unique subsurface soil characteristics of the CAVFS1 filter strip. The scatter plots presented in Figure 16 also show there are no clear relationships between the normalized flow durations for each station and the measured storm precipitation depths and/or average precipitation intensities (Figure 16). In general, these results from these analyses suggest that compost amendment in the filter strips does not provide substantial benefit for reducing flow durations. However, this conclusion may change once more data is collected and analyzed in the remaining year of the project.

Water Quality Monitoring Results

This section summarizes water quality data that were collected at each station through water year 2006. It begins with an evaluation of summary data from this monitoring relative to guidelines for defining the acceptability of sampled storm events. This section then evaluates filter strip performance with regard to water quality treatment based on the data that were obtained from these events.

Storm Event Acceptability Evaluation

As described in the QAPP for the project (Herrera 2004) and Methods section for this document, guidelines were established for defining the acceptability of specific storm events for sampling based on:

- Precipitation depth
- Antecedent conditions
- Sampling coverage over storm hydrograph
- Total number of composite samples collected.

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These guidelines were established to ensure that representative data will be collected for the target conditions of this study. Summary data related to these guidelines are presented in Table 5 for each of the storm events that were sampled in water year 2006. Bold face values in this table indicate where a particular guideline for defining storm event acceptability was not met. Based on the data presented in Table 5, the guideline established for storm antecedent dry period was not met for the event number 3 that initiated on December 20, 2005. However, it should be noted that the antecedent dry period for this storm (5.25 hours) was very close to the established guideline of 6 hours.

It should also be noted that the precipitation depth (0.21 inches in 9.5 hours) for event number 2 that initiated on December 19, 2005 was below the guideline of 0.25 inches over a 24-hour period established pursuant to the QAPP. However, the QAPP also indicates that samples from storms as small as 0.15 inches over 24-hours may be accepted as long as the other specified criteria are met. In this case, all other criteria were met for this storm so the data have been accepted without qualification.

Finally, the sampling coverage at the Curb and Gutter, VFS, and CAVFS2 stations during event number 3 were all below the target goal of sampling at least 75 percent of the storm hydrograph. However, pursuant to the QAPP for the project, sampling only the rising limb of the hydrograph is considered acceptable for very long storms (>24 hours). The actual duration of the storm in this instance was 45.23 hours; therefore, the associated data have been accepted without qualification.

Evaluation of Filter Strip Water Quality Treatment Performance

This section evaluates the water quality treatment performance of the filter strips based on monitoring data collected over water year 2006. Included are comparisons of influent and effluent concentrations and loads that were measured for each filter strip. To facilitate these comparisons, summary statistics for pollutant concentrations and associated removal efficiency estimates are presented in Table 6 for each of the filter strips. Similarly, Table 7 presents annual pollutant load and removal efficiency estimates that were calculated in association with each filter strip. Additional graphical representations of these data are provided as necessary throughout this section. Finally, supporting information for this section is also provided in Appendices B and E. For example, Appendix B contains the Water Quality Data Quality Assurance Memorandum while Appendix E contains the associated laboratory reports, chain-of-custody records, and data quality assurance worksheets. The presentation and discussion of these results is organized under separate subsections for each of the primary monitoring parameters.

Because water quality sampling was only conducted on one occasion at the CAVFS1 station due to a lack of adequate runoff volumes, there are limited data available for characterizing the performance of this filter strip in relation to the others. Therefore, the available data from this station have been included in summary figures and tables within the following sections for informational purposes only; however, these data are generally not discussed in detail in any of the following subsections.

Table 5. Evaluation of storm event acceptability guidelines for water quality sampling in water year 2006.

Event No.	Storm Start Time	Storm Stop Time	Precipitation Depth[a] (inches)	Storm Antecedant Dry Period[b] (hours)	Sampling Coverage[c] (% of storm hydrograph)				Number of Composites[d]			
					Curb and Gutter Station	VFS Station	CAVFS1 Station	CAVFS2 Station	Curb and Gutter Station	VFS Station	CAVFS1 Station	CAVFS2 Station
1	11/2/05 17:30	11/3/05 20:00	0.77	7.75	74.1	100	NS	100	22	31	NS	10
2	12/19/05 22:15	12/20/05 7:45	0.21	11.50	100	100	NS	NS	16	19	NS	NS
3	12/20/05 13:00	12/22/05 10:00	1.19	**5.25**	33.6	19.1	NS	23.0	24	12	NS	72
4	12/28/05 3:30	12/28/05 12:00	0.46	19.25	100	77.8	NS	82.9	26	36	NS	10
5	1/5/06 7:30	1/6/06 0:00	1.06	32.00	100	98.6	NS	100.0	18	22	NS	24
6	1/8/06 15:45	1/11/06 0:15	1.45	24.00	89.7	95.6	33.9	87.0	15	28	13	36
7	1/16/06 2:30	1/16/06 22:45	0.61	9.75	100	98.4	NS	79.7	12	13	NS	28

[a] The storm acceptability guideline established precipitation depth is a minimum of 0.25 inches over a 24-hour period. However, samples from storms as small as 0.15 inches over 24-hours may be accepted as long as the other specified criteria are met.
[b] The storm acceptability guideline established antecedent dry period is a minimum 6 hours period preceding the each event with less than 0.04 inches of precipitation.
[c] Sampler pacing at each station is targeted at a goal of sampling through at least 75 percent of the storm hydrograph. However, pursuant to the QAPP for the project, sampling only the rising limb of the hydrograph is considered acceptable for very long storms (>24 hours).
[d] The minimum number of composites that constitutes an acceptable sample is ten.
Values in **bold** face do not meet the associated guideline for defining storm event acceptability.

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Table 6. Summary statistics for pollutant concentrations and associated filter strip removal efficiency estimates from water quality sampling conducted in water year 2006.

	Curb and Gutter Station			VFS Station/Filter Strip				CAVFS1 Station/Filter Strip				CAVFS2 Station/Filter Strip			
Parameter	N	Median Concentration (mg/L)	Maximum Concentration (mg/L)	N	Median Concentration (mg/L)	Maximum Concentration (mg/L)	Median Removal Efficiency[a] (%)	N	Median Concentration (mg/L)	Maximum Concentration (mg/L)	Median Removal Efficiency[a] (%)	N	Median Concentration (mg/L)	Maximum Concentration (mg/L)	Median Removal Efficiency[a] (%)
TSS	7	257	744	7	4.8	7.5	97.9	1	47	47	93.7	6	14	41	93.9
TP	7	0.368	0.601	7	0.070	0.261	81.0	1	0.138	0.138	77.0	6	0.056	0.096	84.1
SRP	7	0.002	0.015	7	0.021	0.109	-800	1	0.015	0.004	-650	6	0.003	0.015	-75.0
Total Copper	7	0.0417	0.0814	7	0.0059	0.0083	85.8	1	0.0092	0.0092	83.6	6	0.0085	0.0107	80.1
Dissolved Copper	7	0.0050	0.0077	7	0.0045	0.0076	-1.47	1	0.0027	0.0027	-42.1	6	0.0046	0.0076	3.88
Total Zinc	7	0.261	0.469	7	0.020	0.028	92.5	1	0.038	0.038	89.5	6	0.025	0.074	86.5
Dissolved Zinc	7	0.041	0.061	7	0.012	0.025	68.4	1	0.078	0.078	-129	6	0.012	0.019	73.5
TPH - Motor Oil Fraction	7	2.36	5.08	7	0.10	6.88	91.9	0	--	--	--	6	0.45	1.50	79.0
TPH - Diesel Fraction[b]	7	0.05	0.08	7	0.05	0.06	NA	0	--	--	--	6	0.05	0.05	NA

[a] Removal efficiency (RE) calculated based on measured concentrations at the Curb and Gutter station and filter strip stations during each storm event using the following equation:

$$RE = \frac{(C_{CG} - C_{FS})}{C_{CG}}$$

where:

C_{CG} = Concentration measured at Curb and Gutter station
C_{FS} = Concentration measured at filter strip station

[b] Concentrations of the diesel fraction of total petroleum hydrocarbons (TPH) were below detection limits in all samples.
TSS: Total suspended solids
TP: Total phosphorus
SRP: Soluble reactive phosphorus
mg/L: milligrams/liter
NA: not applicable

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Table 7. Filter strip influent and effluent pollutant loading and removal efficiency estimates from water quality sampling conducted in water year 2006.

	CVS Filter Strip			CAVFS1 Filter Strip			CAVFS2 Filter Strip		
Parameter	Influent Load (g)	Effluent Load (g)	Removal Efficiency (%)	Influent Load (g)	Effluent Load (g)	Removal Efficiency (%)	Influent Load (g)	Effluent Load (g)	Removal Efficiency (%)
TSS	75,961	660	99.1	67,980	379	99.4	71,952	1,345	98.1
TP	123	9.45	92.3	110	1.11	99.0	117	4.43	96.2
SRP	1.05	2.77	-163	0.94	0.12	87.2	1.00	0.21	79.2
Total Copper	15.5	0.68	95.6	14.7	0.07	99.5	13.9	0.55	96.0
Dissolved Copper	4.37	0.06	64.4	0.28	0.10	98.5	2.32	0.08	77.3
Total Zinc	96.6	2.19	97.7	91.5	0.31	99.7	86.7	2.47	97.2
Dissolved Zinc	13.9	1.57	88.7	13.2	0.63	95.2	12.5	0.91	92.7
TPH - Motor Oil Fraction	877	122	86.1	831	5	99.5	788	25	96.9
TPH - Diesel Fraction[a]	NA	NA	NA	NA	NA	NA	NA	NA	NA

[a] Concentrations of the diesel fraction of total petroleum hydrocarbons (TPH) were below detection limits in all samples.
TSS: Total suspended solids
TP: Total phosphorus
SRP: Soluble reactive phosphorus
g: grams
NA: not applicable

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Total Suspended Solids

Figure 17 presents box and whisker plots comparing total suspended solids concentrations measured at each station during storm event sampling that occurred over water year 2006. As shown in Table 6, median concentrations from these sampling events were 257, 4.8, and 14 milligrams/liter (mg/L) for the Curb and Gutter, VFS, and CAVFS2 stations, respectively. As described in the Methods section, a Freidman test was used to compare the total suspended solids concentrations from the Curb and Gutter station to those from the VFS and CAVFS2 stations in order to provide a general assessment of filter strip treatment performance. Results from the Friedman test showed there were significant differences in the total suspended solids concentrations between these stations ($p < 0.0025$). The follow-up multiple comparison test indicated that total suspended solids concentrations measured at the VFS station were significantly lower than those at the Curb and Gutter station; however, the test also indicated there were no significant differences in concentrations measured at the CAVFS2 and Curb and Gutter stations. However, it should be noted that these analyses are being performed using a relatively low number of samples ($n = 6$) and this latter conclusion may change once more data is collected and analyzed in the remaining year of the project.

Pollutant removal efficiency estimates calculated based on measured total suspended solids concentrations (see Table 6) were 97.9 and 93.9 percent for the VFS and CAVFS2 filter strips, respectively. Similarly, pollutant removal efficiency estimates calculated based on annual pollutant loads (see Table 7) were 99.1 and 98.1 percent for the VFS and CAVFS2 filter strips, respectively. The higher pollutant removal estimates derived using the annual loading data reflect water losses that are occurring within the filter strips through infiltration and evapotranspiration (see Discharge Monitoring Results section).

In order to examine the potential benefits of compost amendment for improving filter strip performance, Figure 18 presents a scatter plot comparing total suspended solids concentrations measured at the CAVFS2 station to those at the VFS station. Results from a two-tailed sign test that was applied to these data indicated that concentrations measured at the CAVFS2 station were significantly higher ($p < 0.0412$) than those measured at the VFS station. These higher concentrations for the CAVFS2 station are clearly evident in the scatter plot presented in Figure 18. Several factors could be influencing this increase in total suspended solids concentrations within the compost amended filter strip. For example, it is possible that fines present within the compost mix are being mobilized during storm events. Alternatively, the process of tilling in the compost amendment may have reduced surface compaction on the CAVFS2 filter strip thereby making it potentially more erosive relative to the surface of the VFS filter strip. These data appear to suggest that compost amendment does not provide any water quality treatment benefits for this parameter. However, as noted above, the removal efficiency estimates for the VFS and CAVFS2 filter strips are nearly equivalent when evaluated based on the annual loading data (see Table 7). These data suggest that sufficient water losses are occurring within the CAVFS2 filter strip to offset any negative affect from the observed increase in total suspended solids concentrations.

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Total Phosphorus

Figure 19 presents box and whisker plots comparing total phosphorus concentrations measured at each station during storm event sampling that occurred over water year 2006. As shown in Table 6, median concentrations from these sampling events were 0.368, 0.070, and 0.056 mg/L for the Curb and Gutter, VFS, and CAVFS2 stations, respectively. Results from the Friedman test that was applied to the data from these stations showed there were significant differences in the total phosphorus concentrations between these stations ($p < 0.0057$). The follow-up multiple comparison test indicated that total phosphorus concentrations measured at both the VFS and CAVFS2 stations were significantly lower than those at the Curb and Gutter station.

Figure 20 presents a scatter plot comparing total phosphorus concentrations measured at the CAVFS2 station to those from the VFS station. Results from a two-tailed sign test that was applied to these data indicate that concentrations measured at the CAVFS2 station were not significantly different ($p < 0.2207$) from those measured at the VFS station. These results are reflected in the similar removal efficiency estimates for the VFS and CAVFS2 filter strips (81.0 and 84.1 percent, respectively) that were derived for this parameter using concentration data (see Table 6). However, the CAVFS2 filter strip had slightly better treatment performance for this parameter when the higher water losses within the system are factored in. For example, the pollutant removal efficiency estimates calculated based on annual loads were 92.3 and 96.2 percent for the VFS and CAVFS2 filter strips, respectively (see Table 7).

Soluble Reactive Phosphorus

Figure 21 presents box and whisker plots comparing soluble reactive phosphorus concentrations measured at each station during storm event sampling that occurred over water year 2006. These data indicate that soluble reactive phosphorus concentrations were markedly higher at the VFS station relative to the Curb and Gutter and CAVFS2 stations. For example, median concentrations for this parameter were 0.002, 0.021, and 0.003 mg/L for the Curb and Gutter, VFS, and CAVFS2 stations, respectively (see Table 6). The maximum concentrations measured at the VFS station (0.109 mg/L) showed an even greater divergence from the maximum concentration (0.015 mg/L) measured at both the Curb and Gutter and CAVFS2 stations. Figure 22 presents a scatter plot comparing soluble reactive phosphorus concentrations measured at the CAVFS2 station to those from the VFS station. Results from a two-tailed sign test that was applied to these data also confirm that concentrations measured at the VFS station were significantly higher ($p < 0.0412$) than those measured at the CAVFS2 station.

The high soluble reactive phosphorus concentrations measured at the VFS station are reflected in the calculated removal efficiency estimates for this parameter (see Tables 6 and 7). For example, pollutant removal efficiency estimates calculated based on measured concentrations were -800 and -75 percent for the VFS and CAVFS2 filter strips, respectively. Similarly, pollutant removal efficiency estimates calculated based on annual pollutant loads were -163 and 79.2 percent for the VFS and CAVFS2 filter strips, respectively. These latter data indicate that the VFS filter strip is exporting soluble reactive phosphorus as opposed to trapping it.

The specific source for the high soluble reactive phosphorus concentrations in the effluent from the VFS filter strip has not been identified; however, potential sources include decaying vegetation, fertilizers and/or phosphorus based pesticides that were present on the ground surface prior to the construction of the test filters strips. During construction of the CAVFS1 and CAVFS2 filters strips, these sources would have been tilled into the ground with the compost where they would be less likely to influence surface water quality. In contrast, any of these sources that were present in the VFS filter strip would have remained on the ground surface where they could potentially be mobilized with greater ease by highway runoff.

Despite the relatively high concentrations of this parameter in filter strip effluent, it should be noted that soluble reactive phosphorus represents only a very small fraction of the total amount of phosphorus that is being removed by these systems. For example, the average ratio of soluble reactive phosphorus to total phosphorus at the Curb and Gutter station was only 0.02. As described in the previous section, filter strip removal efficiency estimates for total phosphorus range from approximately 81 to 96 percent. Based on these considerations, filter strips should still be considered a highly effective treatment option for phosphorus removal.

Total Copper

Figure 23 presents box and whisker plots comparing total copper concentrations measured at each station during storm event sampling that occurred over water year 2006. As shown in Table 5, median concentrations from these sampling events were 0.0417, 0.0059, and 0.0085 mg/L for the Curb and Gutter, VFS, and CAVFS2 stations, respectively. Results from the Friedman test that was applied to the data from these stations showed there were significant differences in the total copper concentrations between these stations ($p < 0.0025$). The follow-up multiple comparison test indicated that total copper concentrations measured at both the VFS and CAVFS2 stations were significantly lower than those at the Curb and Gutter station.

Pollutant removal efficiency estimates calculated based on measured total copper concentrations (see Table 6) were 85.8 and 80.1 percent for the VFS and CAVFS2 filter strips, respectively. Similarly, pollutant removal efficiency estimates calculated based on annual pollutant loads (see Table 7) were 95.6 and 96.0 percent for the VFS and CAVFS2 filter strips, respectively.

Figure 24 presents a scatter plot comparing total copper concentrations measured at the CAVFS2 station to those at the VFS station. Results from a two-tailed sign test that was applied to these data indicated that concentrations measured at the CAVFS2 station were significantly higher ($p < 0.0412$) than those measured at the VFS station. These higher concentrations for the CAVFS2 station are clearly evident in the scatter plot presented in Figure 24. The source of the higher total copper concentrations in the CAVFS2 filter strip has not been definitely identified; however, it is possible that the compost used in the construction of the filter strips may have contained some trace amounts of copper that is now leaching into runoff at the ground surface. (Documentation obtained from the contractor that installed the filter strips does not include any laboratory test results for copper concentrations in the compost. Herrera is currently coordinating with the ESO to determine if soil testing should be performed to address this question.) Like the results obtained for total suspended solids, these results might suggest that

compost amendment does not provide any water quality treatment benefits for this parameter. However, as noted above, the removal efficiency estimates for the VFS and CAVFS2 filter strips are nearly equivalent when evaluated based on the annual loading data (see Table 7). These data also suggest that sufficient water losses are occurring within the CAVFS2 filter strip to offset any negative affect from the observed increase in total copper concentrations.

Dissolved Copper

Figure 25 presents box and whisker plots comparing dissolved copper concentrations measured at each station during storm event sampling that occurred over water year 2006. As shown in Table 5, median concentrations from these sampling events were 0.0050, 0.0045, and 0.0046 mg/L for the Curb and Gutter, VFS, and CAVFS2 stations, respectively. Results from the Friedman test that was applied to these data showed there were no significant differences in total copper concentrations between these stations ($p = 0.5134$).

Pollutant removal efficiency estimates calculated based on measured dissolved copper concentrations (see Table 6) were relatively low at -1.1 and 3.9 percent for the VFS and CAVFS2 filter strips, respectively. In general, these low removal efficiencies are to be expected for this parameter given that the median concentration reported above for the Curb and Gutter station is at a low enough level as to be considered "irreducible" using conventional stormwater treatment processes such as filtration and sedimentation (Schueler 1996; Winer 2000; Minton 2002). In contrast, pollutant removal efficiency estimates calculated based on annual pollutant loads (see Table 7) were substantially higher for the VFS and CAVFS2 filter strips (64.4 and 77.3 percent, respectively) because they reflect water losses within these systems due to infiltration and evapotranspiration.

Figure 26 presents a scatter plot comparing dissolved copper concentrations measured at the CAVFS2 station to those at the VFS station. Results from a two-tailed sign test that was applied to these data indicated that there were no significant ($p = 0.6831$) differences in the concentrations for this parameter between the VFS and CAVFS2 stations.

Washington state surface water quality standards (WAC 173 201A) for dissolved copper vary depending on water hardness. Figure 27 presents dissolved copper and hardness concentrations measured at each station in relation to the acute water quality standard for this parameter. These data show that this standard was exceeded in 100, 85, and 67 percent of the samples collected from the Curb and Gutter, VFS, and CAVFS2 stations, respectively.

Total Zinc

Figure 28 presents box and whisker plots comparing total zinc concentrations measured at each station during storm event sampling that occurred over water year 2006. As shown in Table 6, median concentrations from these sampling events were 0.469, 0.020, and 0.025 mg/L for the Curb and Gutter, VFS, and CAVFS2 stations, respectively. Results from the Friedman test that was applied to the data from these stations showed there were significant differences in the total zinc concentrations between these stations ($p < 0.0036$). The follow-up multiple comparison test

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indicated that total zinc concentrations measured at both the VFS and CAVFS2 stations were significantly lower than those at the Curb and Gutter station.

Pollutant removal efficiencies for total zinc were relatively high. For example, pollutant removal efficiency estimates calculated based on measured total zinc concentrations (see Table 6) were 92.5 and 86.5 percent for the VFS and CAVFS2 filter strips, respectively. Similarly, pollutant removal efficiency estimates calculated based on annual pollutant loads (see Table 7) were 97.7 and 97.2 percent for the VFS and CAVFS2 filter strips, respectively.

Figure 29 presents a scatter plot comparing total zinc concentrations measured at the CAVFS2 station to those at the VFS station. Results from a two-tailed sign test that was applied to these data indicated that there were no significant ($p = 0.1336$) differences in the concentrations for this parameter between the VFS and CAVFS2 stations. However, the data presented in Figure 29 suggest that total zinc concentrations are generally trending higher at the CAVFS2 station relative to the VFS station. As noted above, a similar pattern was also observed for total copper concentrations and shown to be statistically significant. Like total copper, the higher total zinc concentrations in the CAVFS2 filter strip may be related to trace amounts of this metal that are present in the compost used in the filter strip construction.

Dissolved Zinc

Figure 30 presents box and whisker plots comparing dissolved zinc concentrations measured at each station during storm event sampling that occurred over water year 2006. As shown in Table 5, median concentrations from these sampling events were 0.041, 0.012, and 0.012 mg/L for the Curb and Gutter, VFS, and CAVFS2 stations, respectively. Results from the Friedman test that was applied to the data from these stations showed there were significant differences in the dissolved zinc concentrations between these stations ($p < 0.0088$). The follow-up multiple comparison test indicated that dissolved zinc concentrations measured at both the VFS and CAVFS2 stations were significantly lower than those at the Curb and Gutter station.

Pollutant removal efficiency estimates calculated based on measured dissolved zinc concentrations (see Table 6) were 68.4 and 73.5 percent for the VFS and CAVFS2 filter strips, respectively. Similarly, pollutant removal efficiency estimates calculated based on annual pollutant loads (see Table 7) were 88.7 and 92.7 percent for the VFS and CAVFS2 filter strips, respectively.

Figure 31 presents a scatter plot comparing dissolved zinc concentrations measured at the CAVFS2 station to those at the VFS station. Results from a two-tailed sign test that was applied to these data indicated that there were no significant ($p = 1.000$) differences in the concentrations for this parameter between the VFS and CAVFS2 stations.

Like dissolved copper, state surface water quality standards (WAC 173 201A) for dissolved zinc vary depending on water hardness. Figure 32 presents dissolved zinc and hardness concentrations measured at each station in relation to the acute water quality standard for this parameter. These data show that this standard was exceeded in all of the samples collected from

the Curb and Gutter station. However, the standard was not exceeded in any of the samples collected from the VFS and CAVFS2 stations.

Total Petroleum Hydrocarbons

Figure 33 presents box and whisker plots comparing concentrations of the motor oil fraction of TPH that were measured at each station during storm event sampling that occurred over water year 2006. As shown in Table 6, median concentrations from these sampling events were 2.36, 0.10, and 0.45 mg/L for the Curb and Gutter, VFS, and CAVFS2 stations, respectively. However, due to their high variability and the relatively low sample size, results from the Friedman test that was applied to these data showed there were no significant differences in the concentrations of this parameter between these stations ($p = 0.1146$).

Figure 34 presents a scatter plot comparing concentrations of the motor oil fraction of TPH that were measured at the CAVFS2 station to those at the VFS station. Results from a two-tailed sign test that was applied to these data also indicated that there were no significant ($p = 0.6831$) differences in the concentrations for this parameter between these stations.

Concentrations of the diesel fraction of TPH were below detection limits in all the collected samples.

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Conclusions

As noted in the introduction, this document summarizes data from the project that were collected from the inception of monitoring through the end of water year 2006 (i.e., December 2005 through September 2006). It specifically evaluates and compares the hydrologic and water quality treatment performance of filter strips with and without compost amendment. The key conclusions from the monitoring data collected thus far are summarized below under separate subheadings for hydrologic and water quality treatment performance, respectively.

Hydrologic Treatment Performance

- In general, filter strips appear to be highly effective treatment systems for mitigating hydrologic impacts from highway runoff with the associated volumes, peak discharge rates, and durations reduced on average by 93, 91, and 86 percent, respectively.

- Compost amendment appears to improve filter strip performance for reducing runoff volumes. More specifically, runoff volumes in filter strips with compost amendment are between 45 and 50 percent lower than those in filter strips without similar amendment.

- The benefits of compost amendment in filter strips for reducing flow volumes are generally realized most when storm precipitation depths exceed 0.2 inches.

- Compost amendment appears to improve filter strip performance for reducing peak discharge rates through the low end of the data range; however, other factors (e.g., slope) are likely influencing performance under saturated conditions at the high end of range.

- Peak discharge rates increase markedly at all stations once storm precipitation depth crosses a threshold of approximately 0.6 inches. This may be an indication that the filter strips are becoming saturated above this threshold; hence, infiltration rates are falling off while discharge rates are increasing.

- Data collected thus far do not provide any strong indication that compost amendment improves filter strip performance for reducing flow durations.

- Observed performance differences between the Compost 1 and Compost 2 filter strips are related to subsurface soil characteristics that are unique to the CAVFS1 filter strip. Specifically, a substantial portion of the CAVFS1 filter strip is underlain by a historic surface depression with deposits of permeable

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advance outwash sand. In contrast, the other filter strips are underlain by relatively impermeable till.

Water Quality Treatment Performance

- When evaluated based on pollutant concentrations, filter strips appear to be highly effective treatment systems for mitigating water quality impacts from highway runoff for all parameters examined except soluble reactive phosphorus, dissolved copper, and the motor oil fraction of TPH. High treatment performance is generally not expected for dissolved copper given that influent concentrations of this parameter were at low enough levels to be considered irreducible using conventional stormwater treatment processes.

- When evaluated based on annual pollutant load removal, filter strips appear to be highly effective treatment systems for mitigating water quality impacts from highway runoff for all the parameters examined in this study.

- In comparisons between filter strips with and without compost amendment, concentrations of total suspended solids and total copper were significantly higher in the effluent from the filter strip with compost amendment. However, these concentration increases were offset by higher water losses within the filter strip with compost amendment so that it generally achieved equivalent treatment performance to that of the filter strip without amendment.

- Effluent concentrations of soluble reactive phosphorus measured for the VFS filter strip were markedly higher than the associated influent concentrations. Loading analyses performed using these data also showed the VFS filter strip is exporting soluble reactive phosphorus as opposed to trapping it. However, soluble reactive phosphorus represents a very small fraction of the total amount of phosphorus that is present in the influent water. Given that filter strip removal efficiency estimates for total phosphorus range from approximately 81 to 96 percent, these systems should still be considered a highly effective treatment option for phosphorus removal.

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FIGURES

Figure 1. Vicinity map showing pilot filter strip locations along Interstate 5 in Snohomish County, Washington.

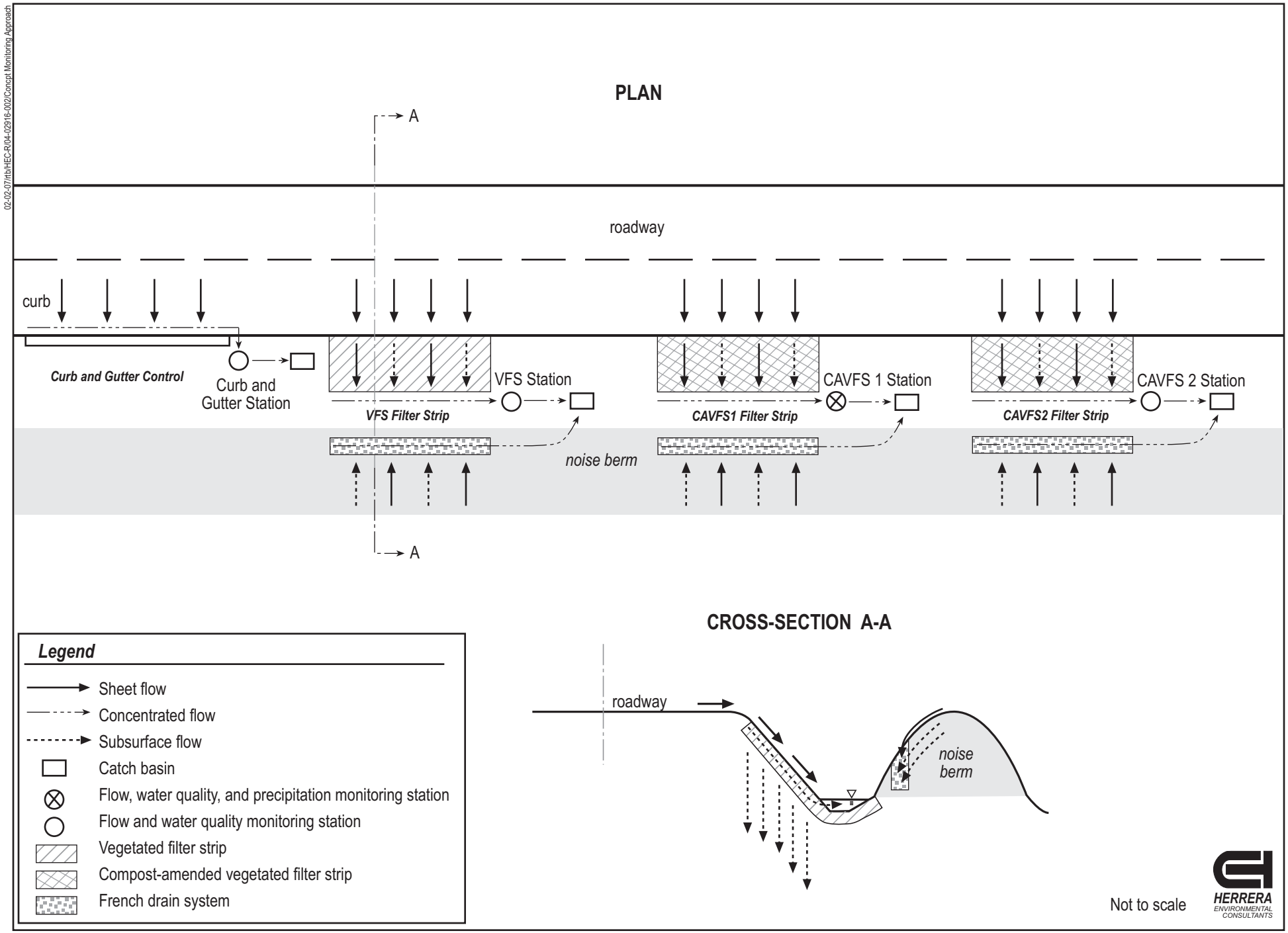


Figure 2. Schematic diagram of pilot filter strips and associated monitoring stations.

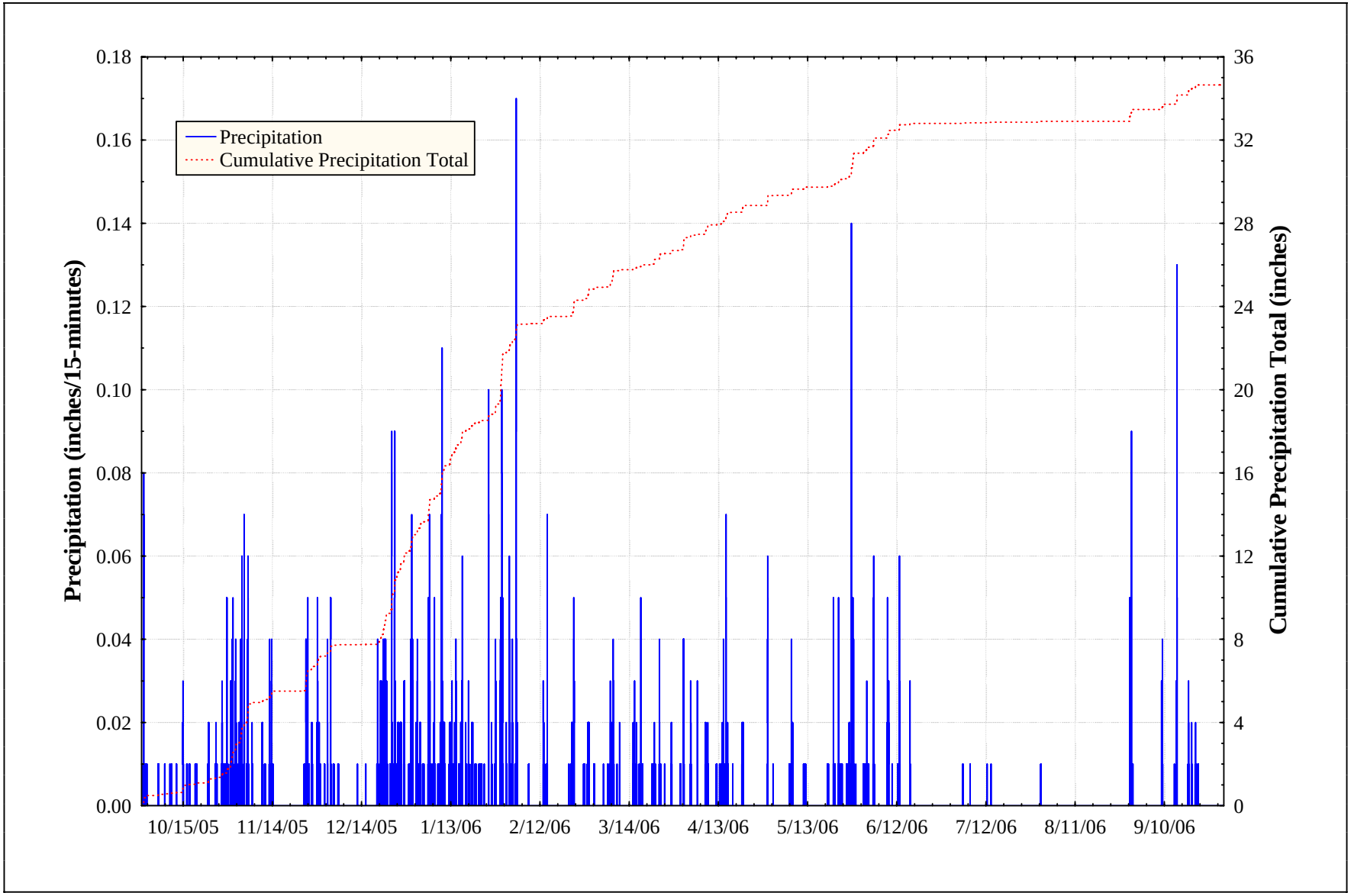


Figure 3. Fifteen-minute and cumulative precipitation totals measured at the CAVFS1 station over water year 2006.

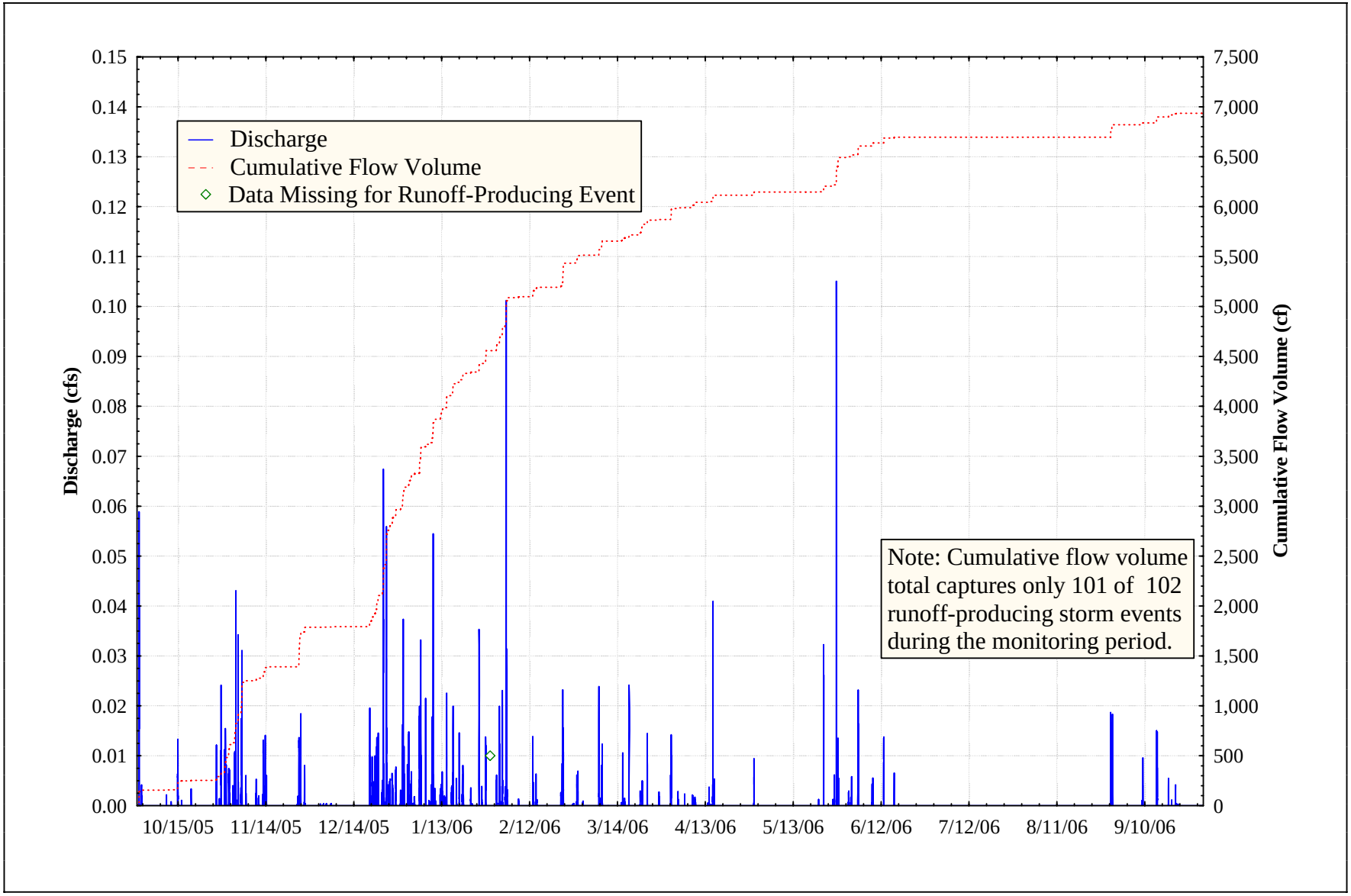


Figure 4. Discharge and cumulative flow volumes measured at the Curb and Gutter station over water year 2006.

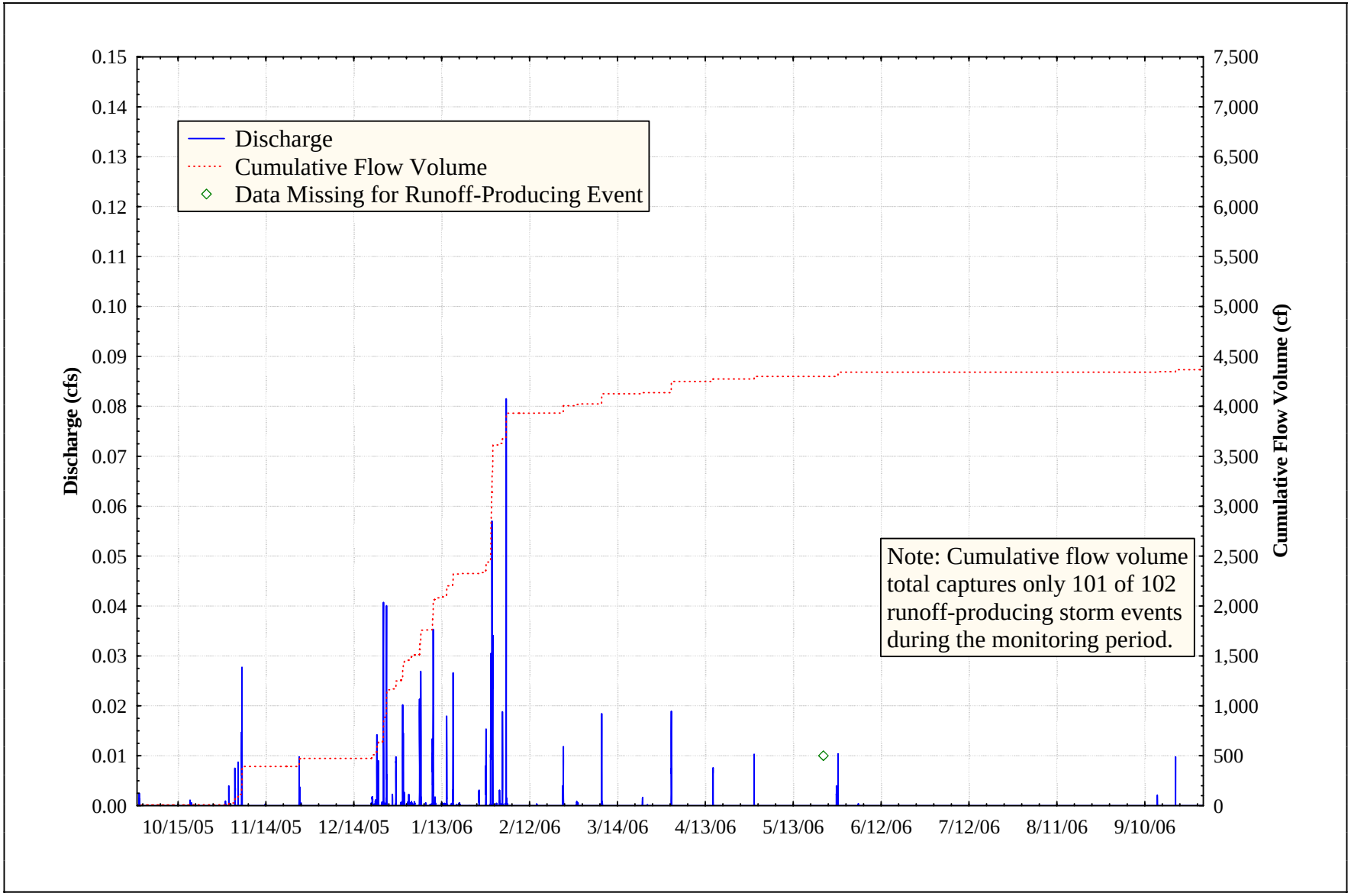


Figure 5. Discharge and cumulative flow volumes measured at the VFS station over water year 2006.

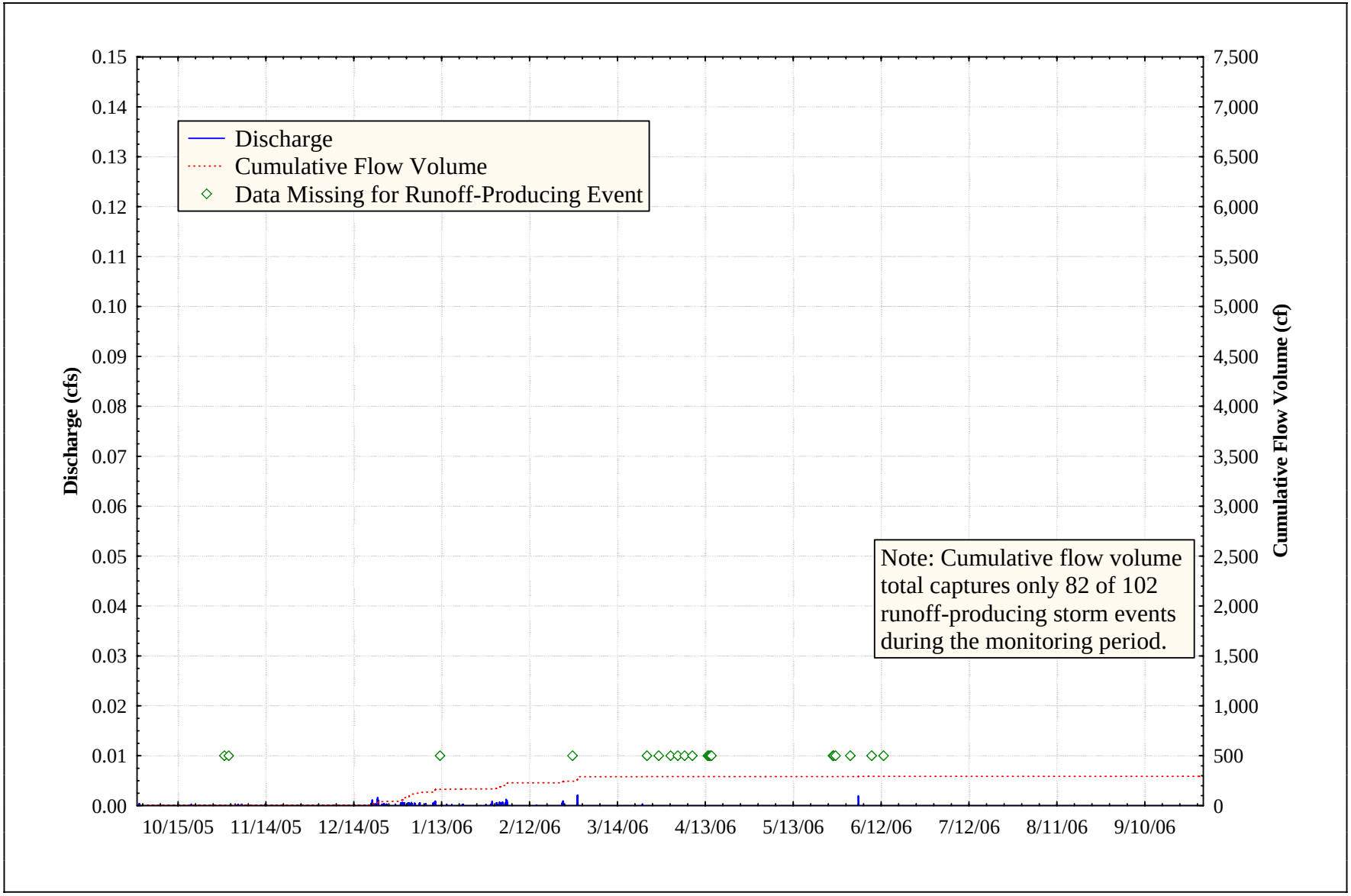


Figure 6. Discharge and cumulative flow volumes measured at the CAVFS1 station over water year 2006.

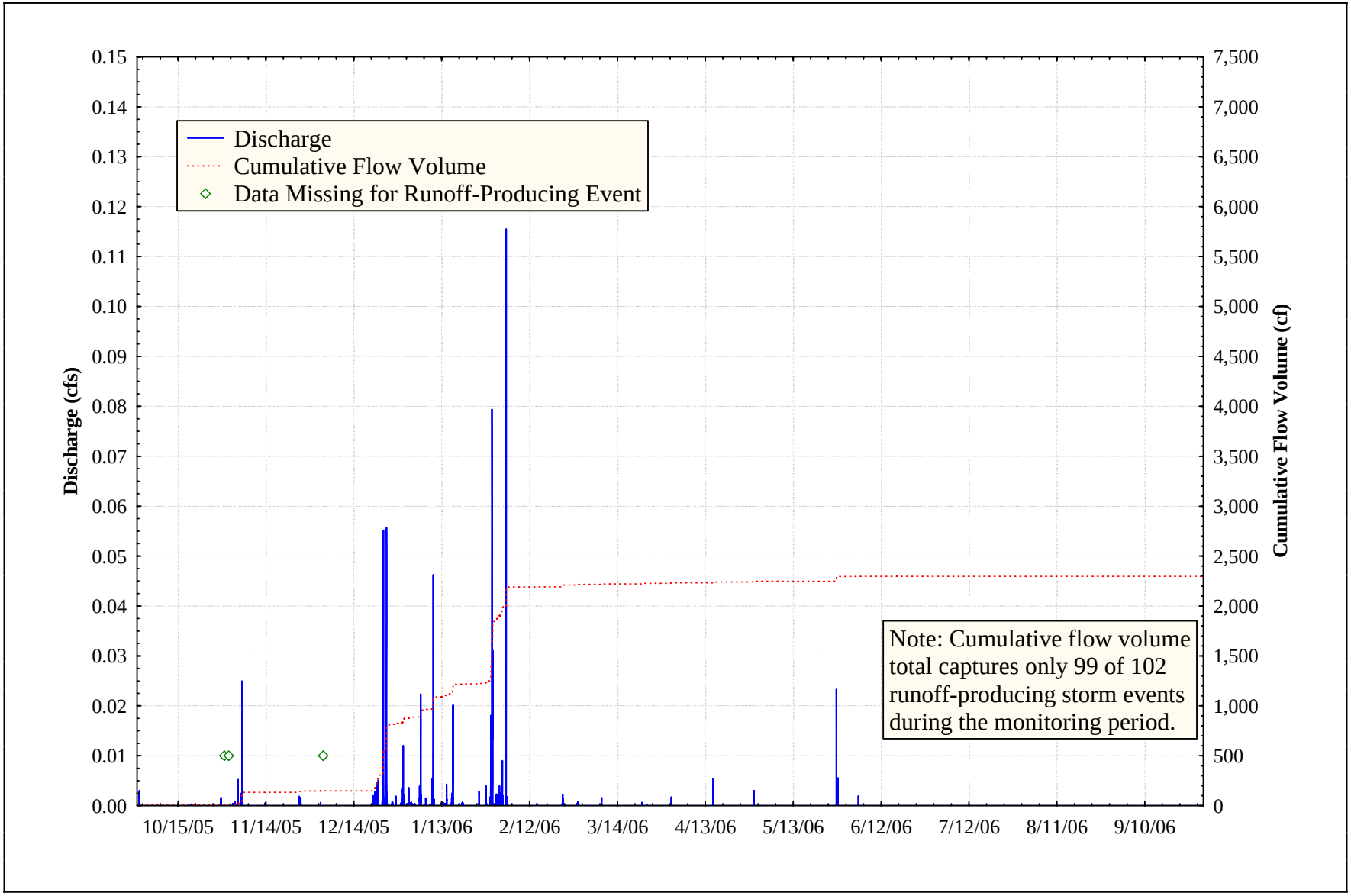


Figure 7. Discharge and cumulative flow volumes measured at the CAVFS2 station over water year 2006.

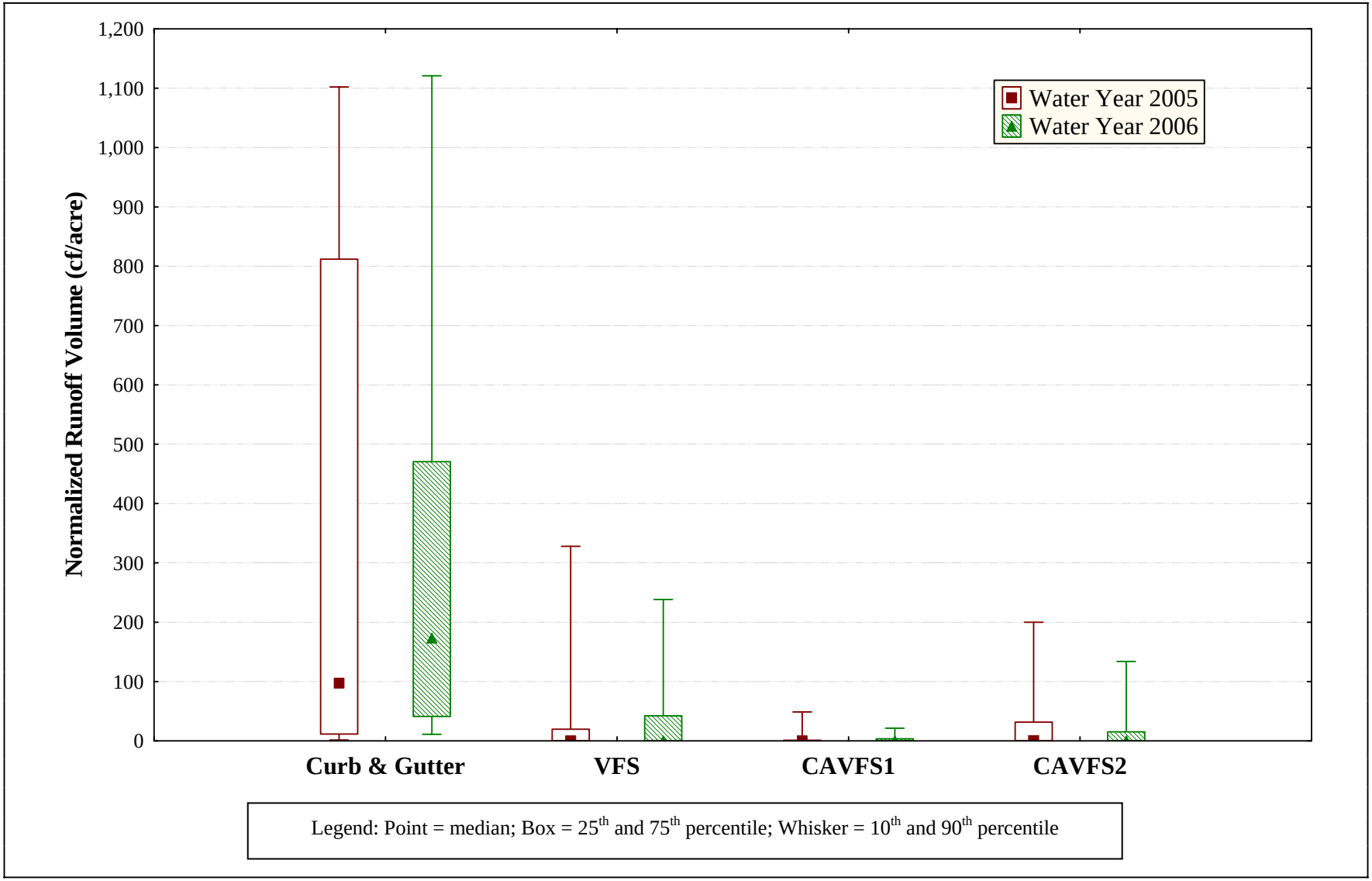


Figure 8. Comparison of normalized runoff volumes measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations during runoff-producing storm events in water years 2005 and 2006.

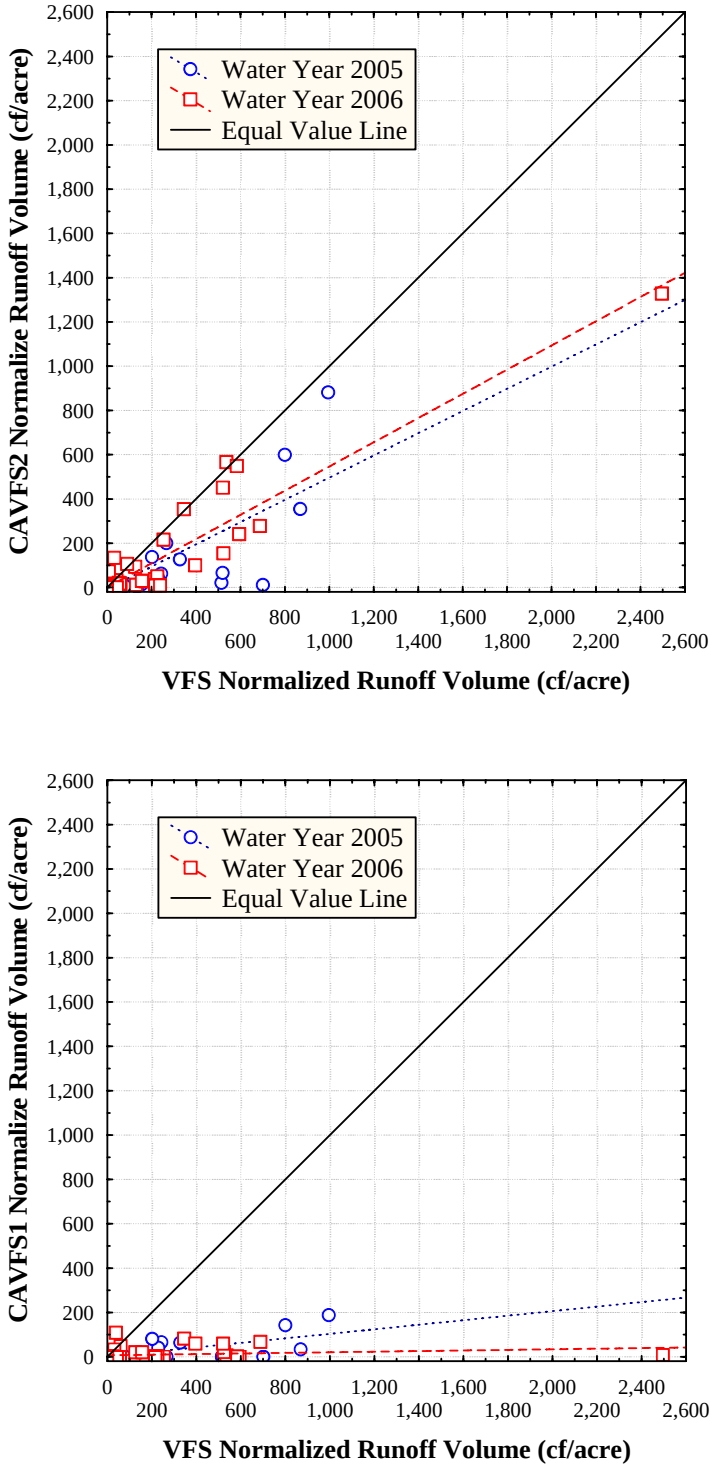
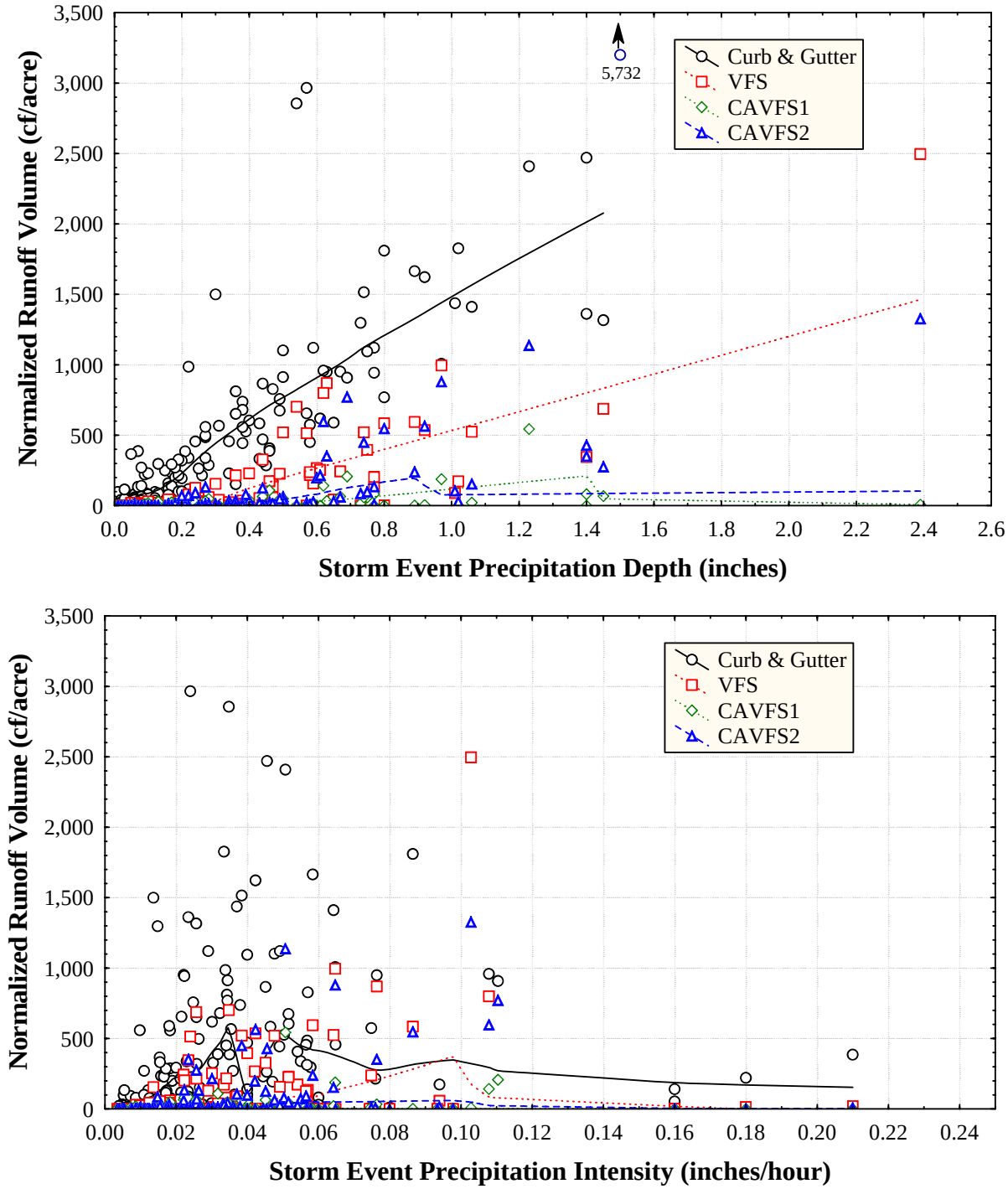


Figure 9. Comparison of normalized runoff volumes at the CAVFS1 and CAVFS2 stations versus the VFS station for runoff-producing storm events in water years 2005 and 2006.



Note: Lines in plots represent a Locally Weighted Scatterplot Smooth (LOWESS) that is fitted to the corresponding data points

Figure 10. Plot of normalized runoff volumes at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations versus precipitation totals and intensities for runoff-producing storm events in water years 2005 and 2006.

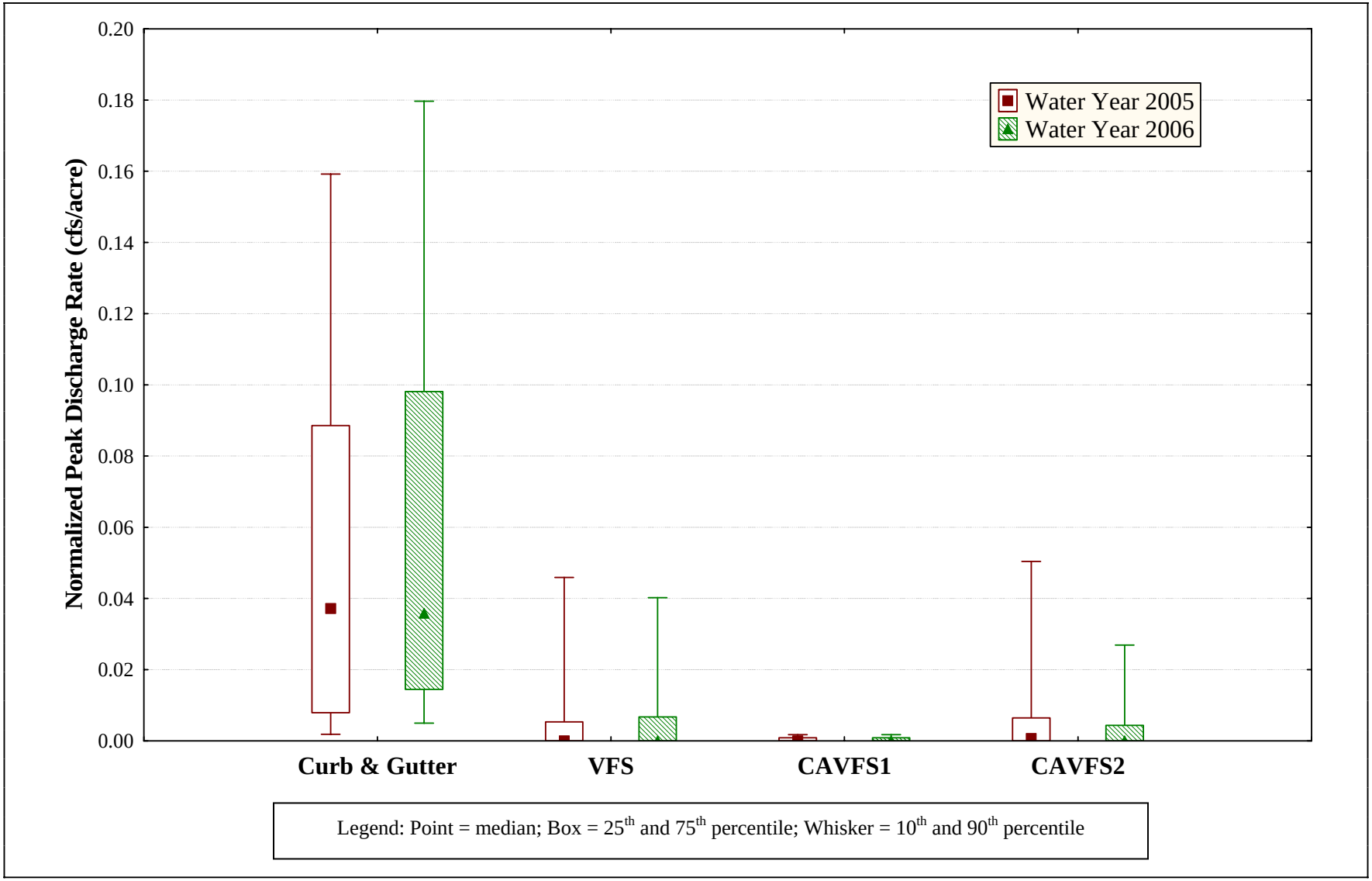


Figure 11. Comparison of normalized peak discharge rates measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations during runoff-producing storm events in water years 2005 and 2006.

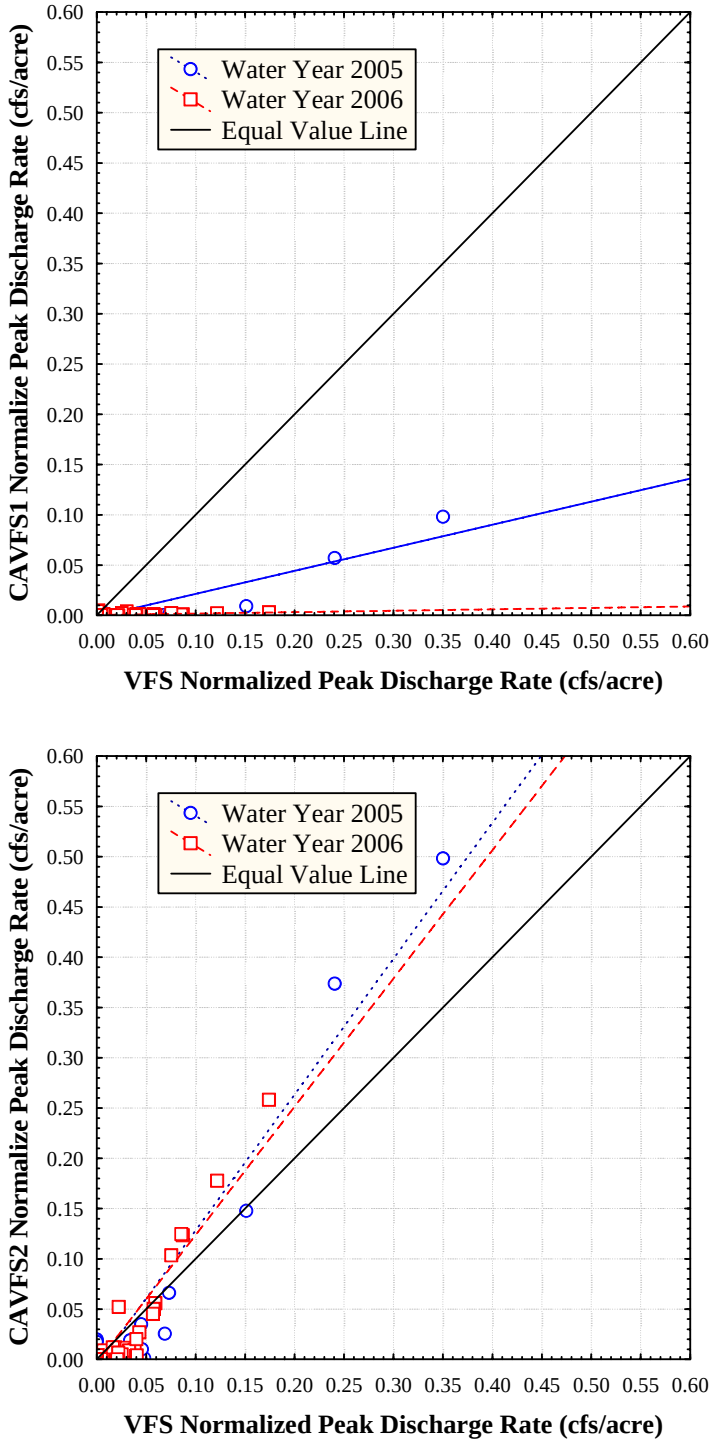
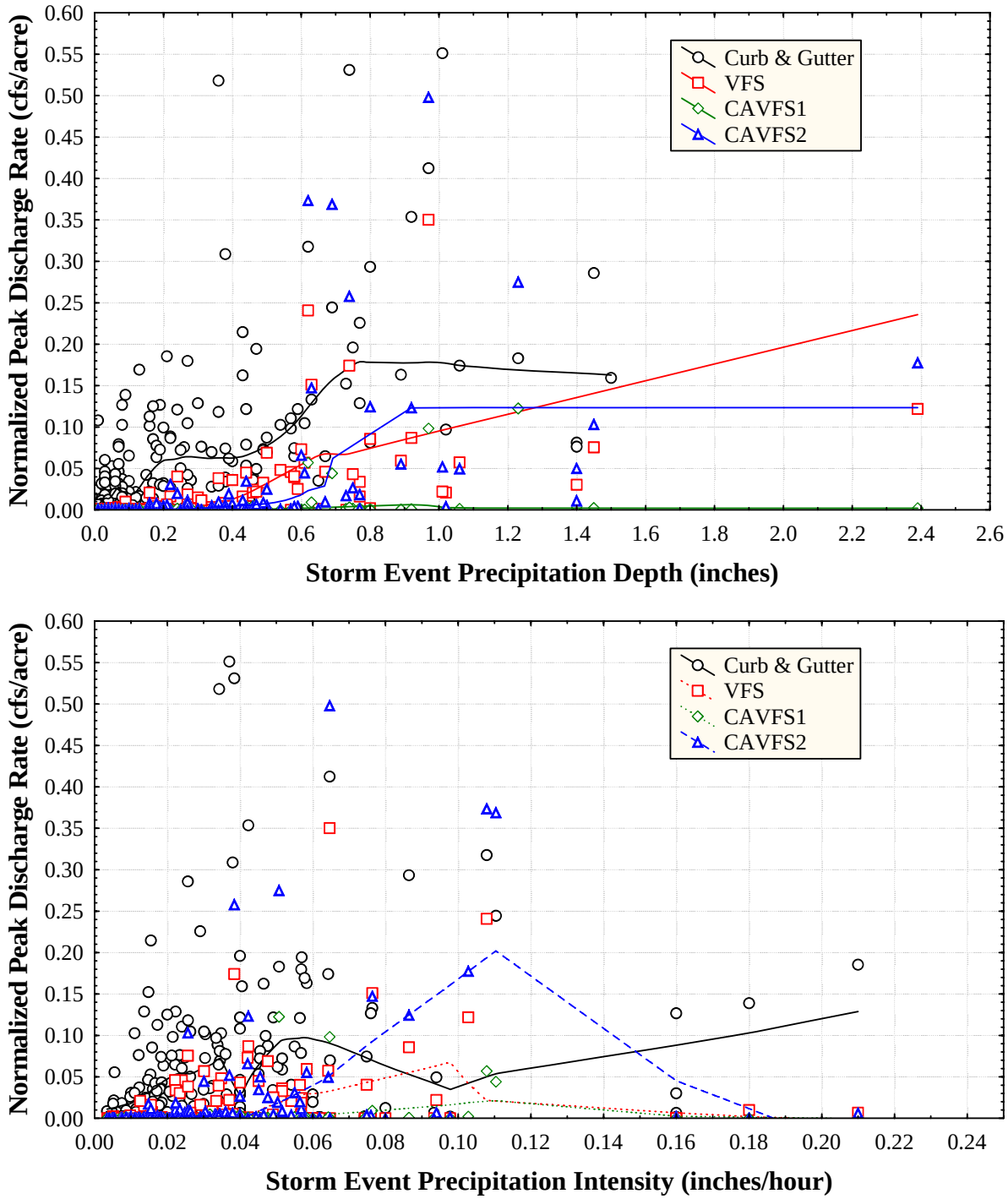


Figure 12. Comparison of normalized peak discharge rates at the CAVFS1 and CAVFS2 stations versus the VFS station for runoff-producing storm events in water years 2005 and 2006.



Note: Lines in plots represent a Locally Weighted Scatterplot Smooth (LOWESS) that is fitted to the corresponding data points

Figure 13. Plot of normalized peak discharge rates at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations versus precipitation totals and intensities for runoff-producing storm events in water years 2005 and 2006.

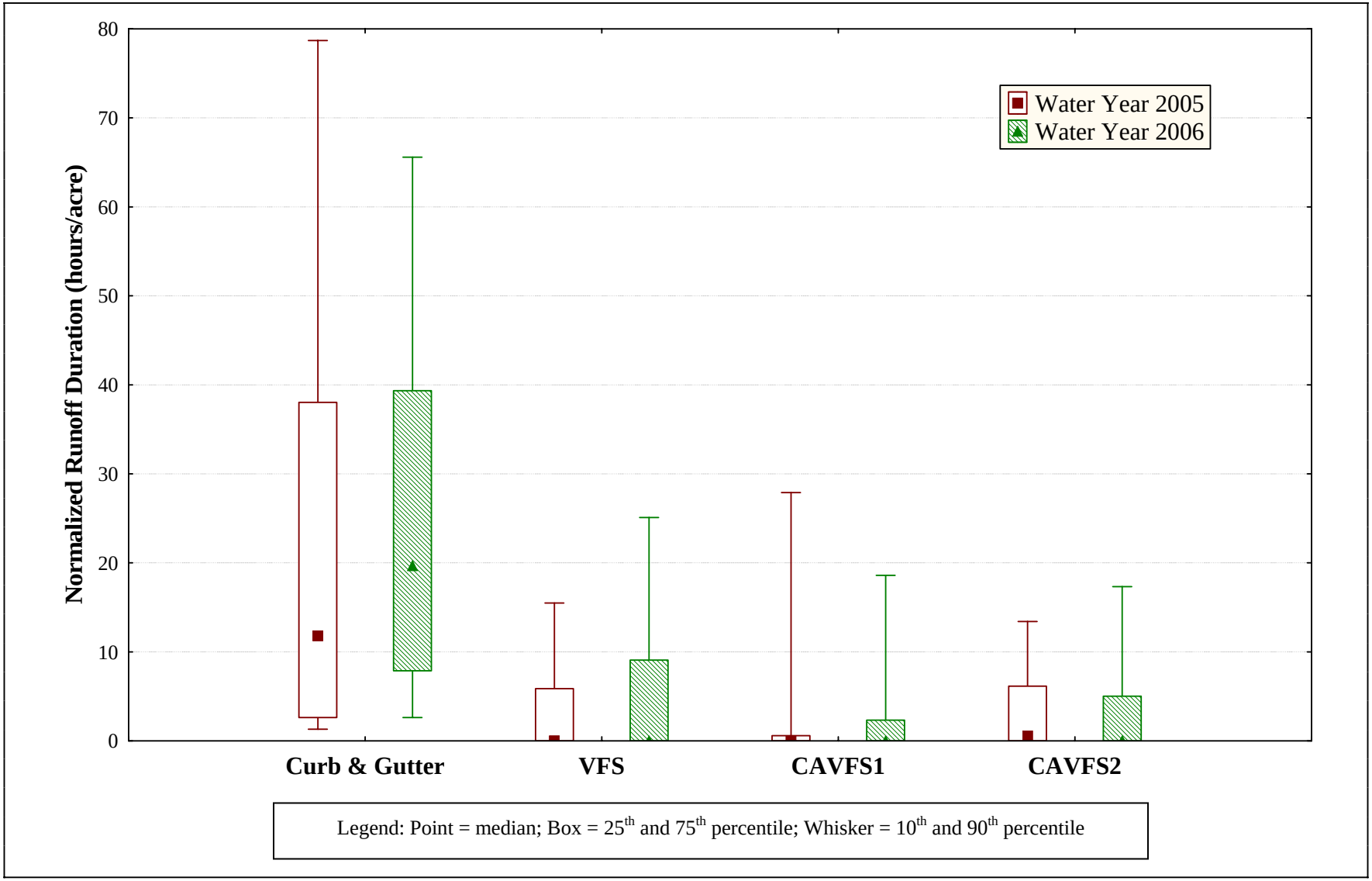


Figure 14. Comparison of normalized flow durations measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations during runoff-producing storm events in water years 2005 and 2006.

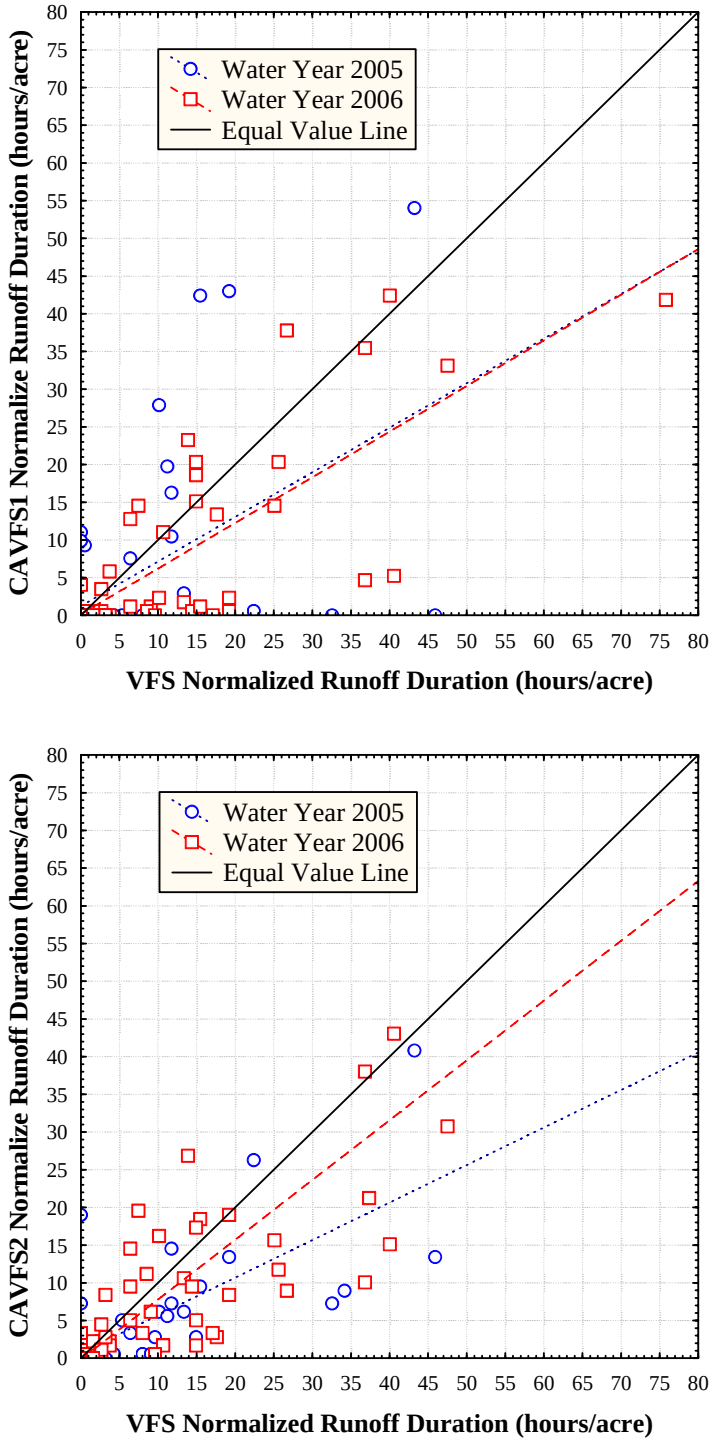
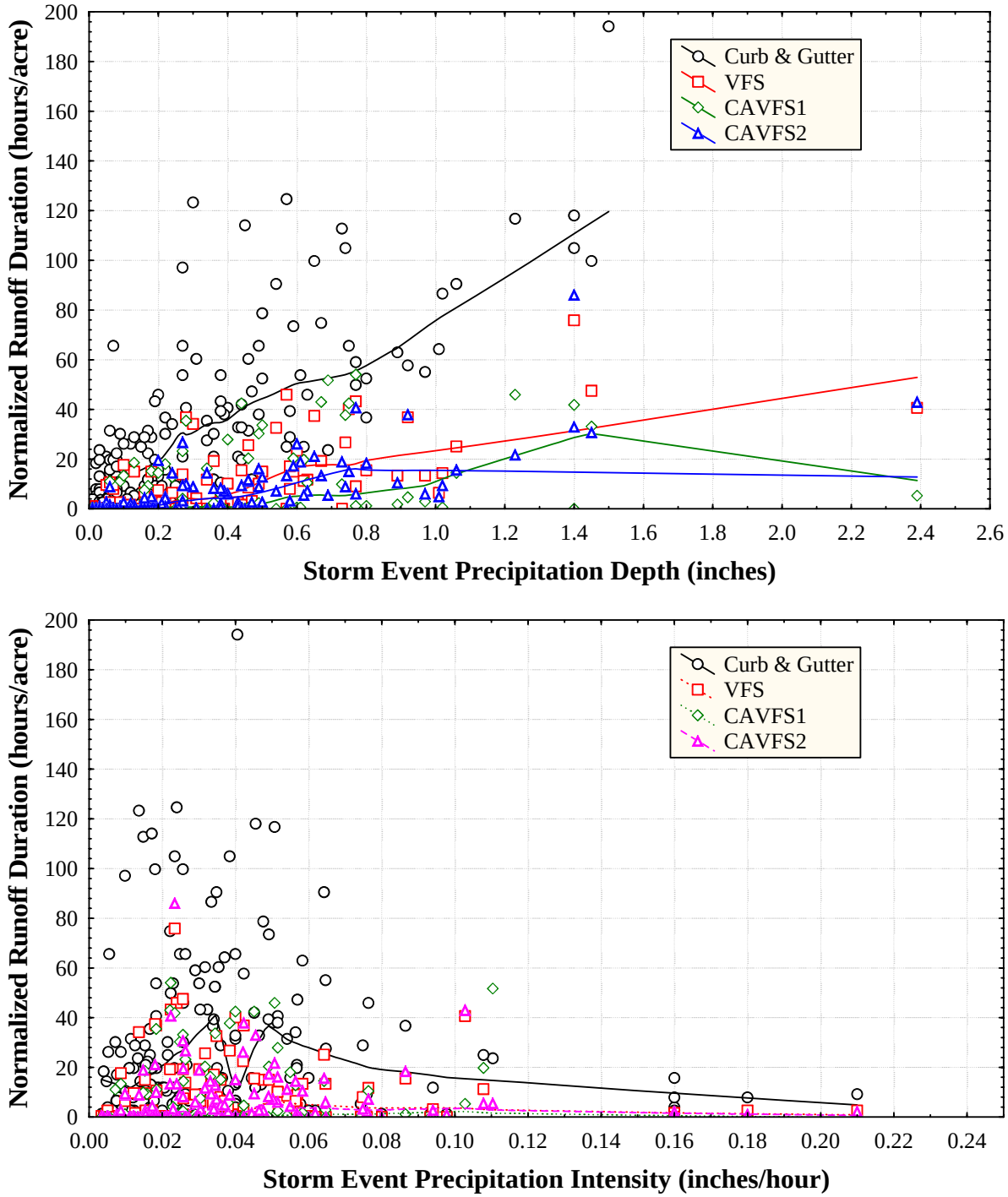


Figure 15. Comparison of normalized runoff durations at the CAVFS1 and CAVFS2 stations versus the VFS station for runoff-producing storm events in water years 2005 and 2006.



Note: Lines in plots represent a Locally Weighted Scatterplot Smooth (LOWESS) that is fitted to the corresponding data points

Figure 16. Plot of normalized runoff durations at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations versus precipitation totals and intensities for runoff-producing storm events in water years 2005 and 2006.

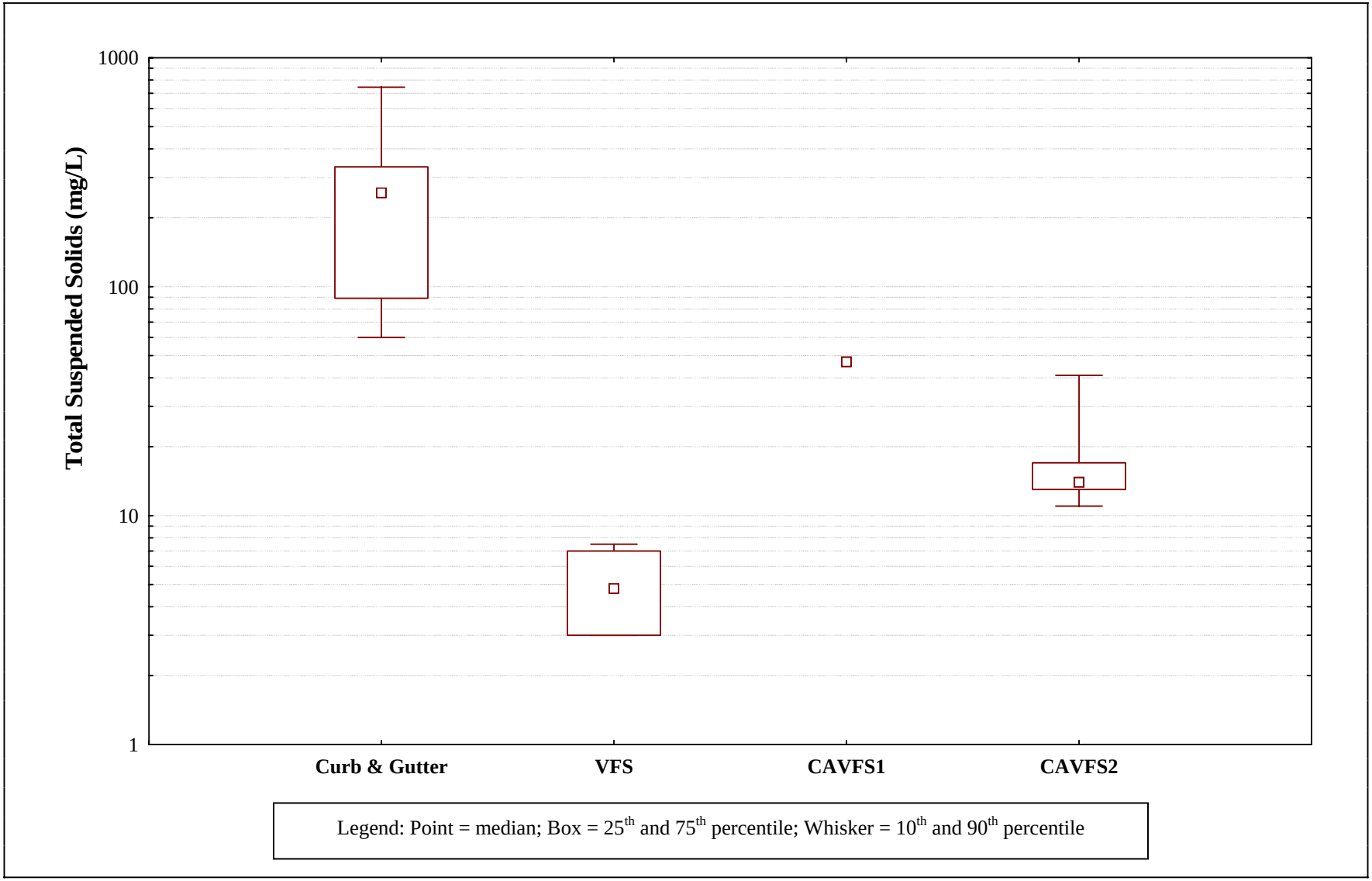


Figure 17. Comparison of total suspended solids concentrations measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations during storm events in water year 2006.

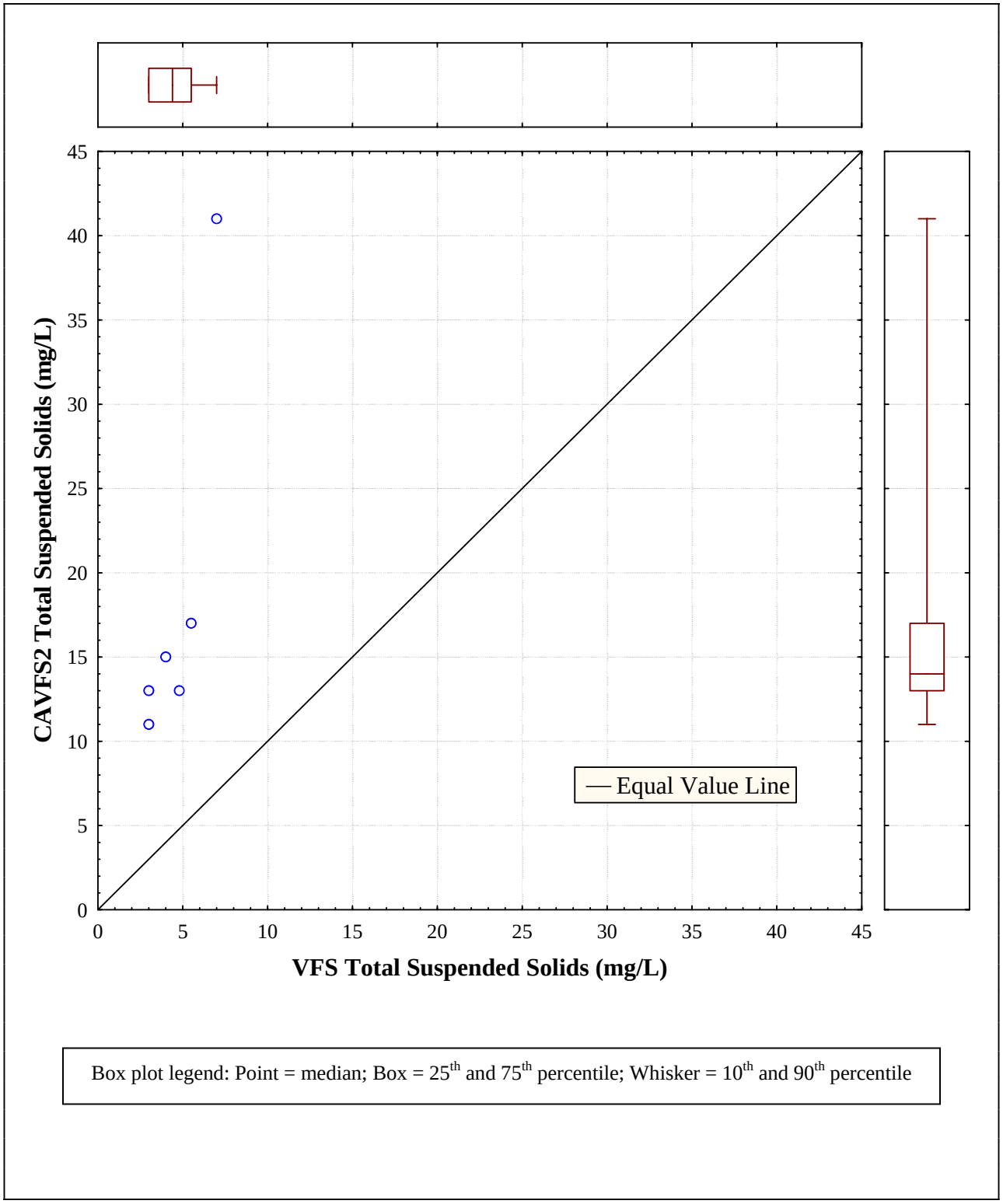


Figure 18. Comparison of total suspended solids concentrations measured at the CAVFS2 station versus the VFS station during storm events in water year 2006.

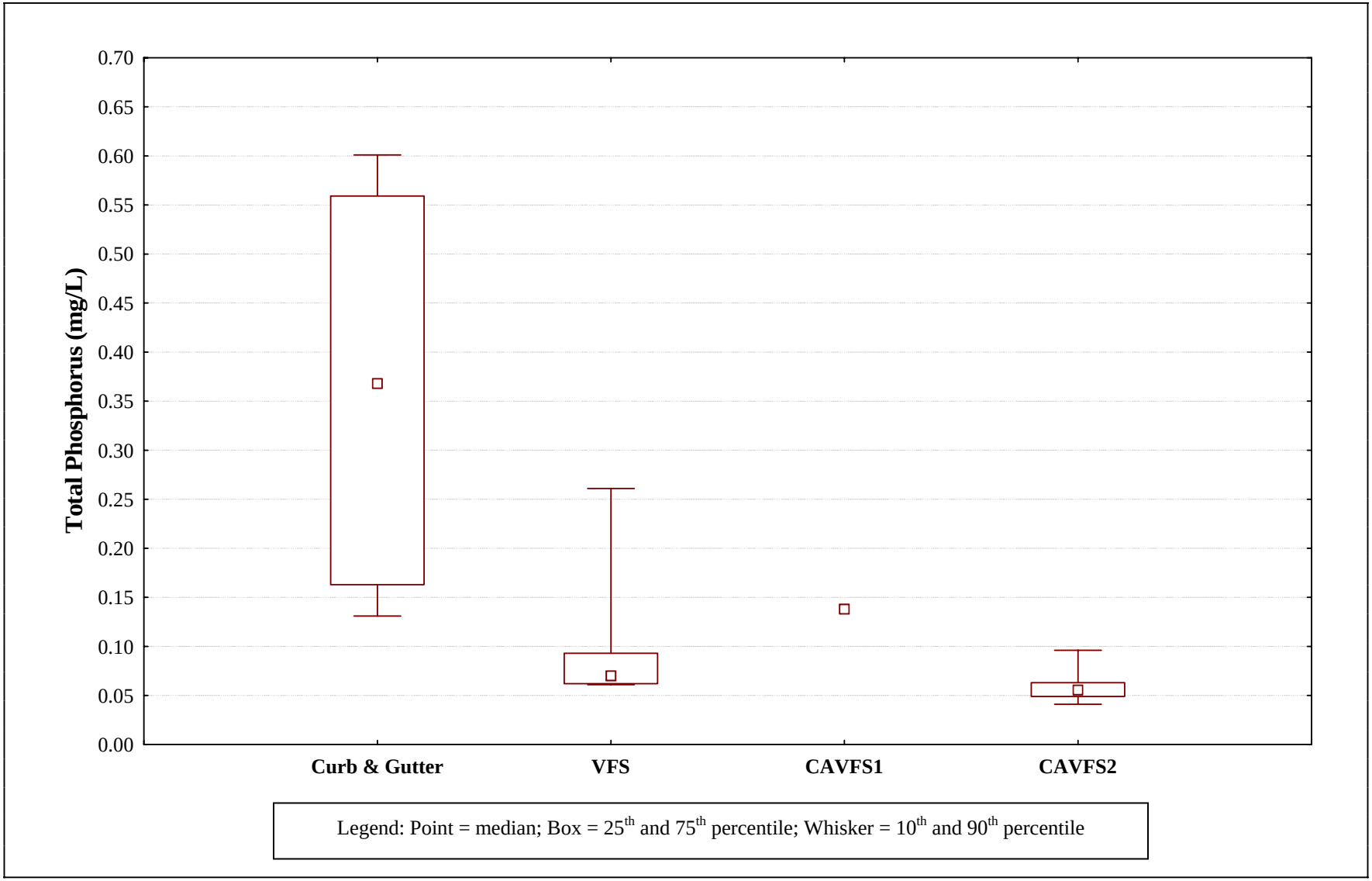


Figure 19. Comparison of total phosphorus concentrations measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations during storm events in water year 2006.

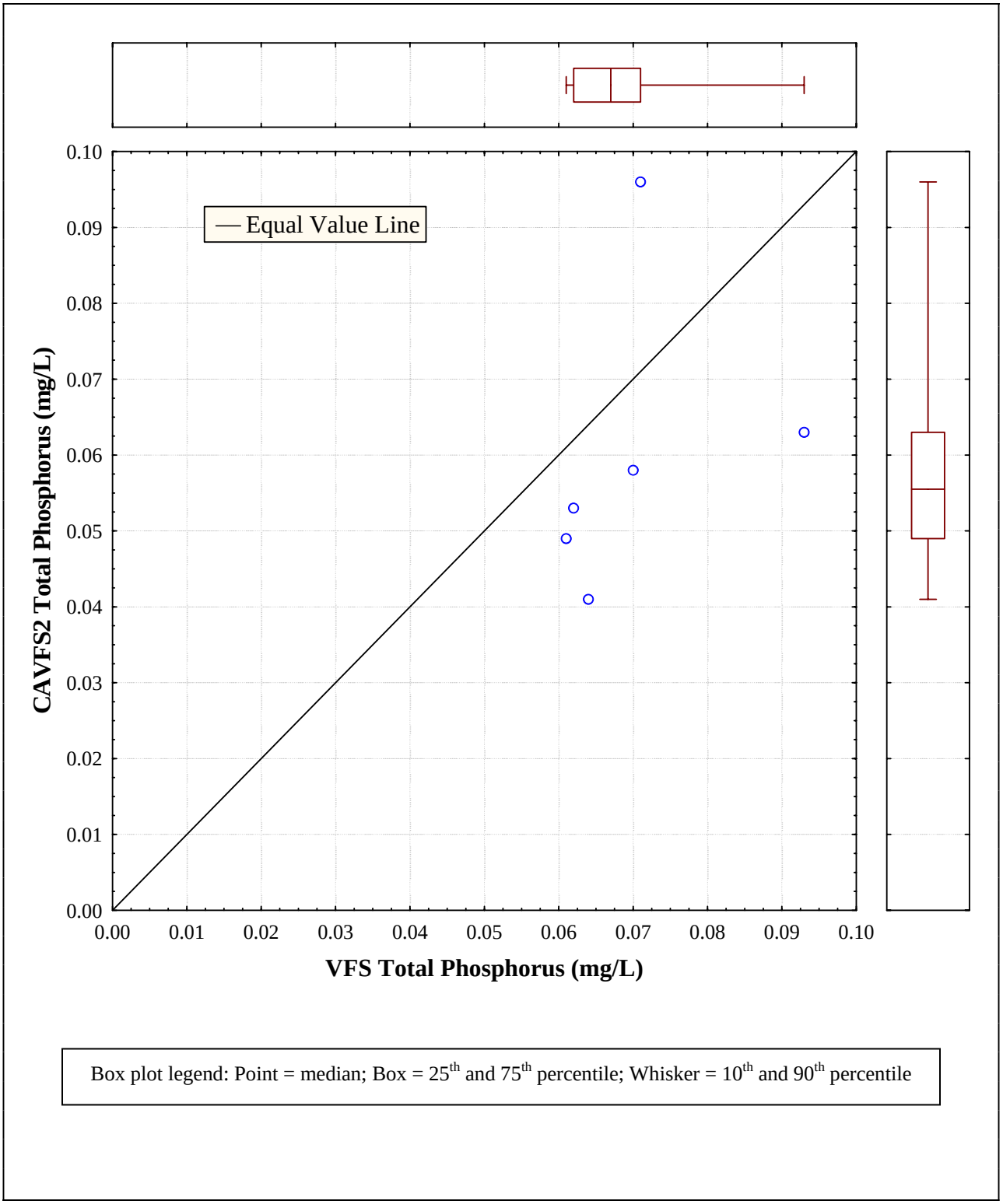


Figure 20. Comparison of total phosphorus concentrations measured at the CAVFS2 station versus the VFS station during storm events in water year 2006.

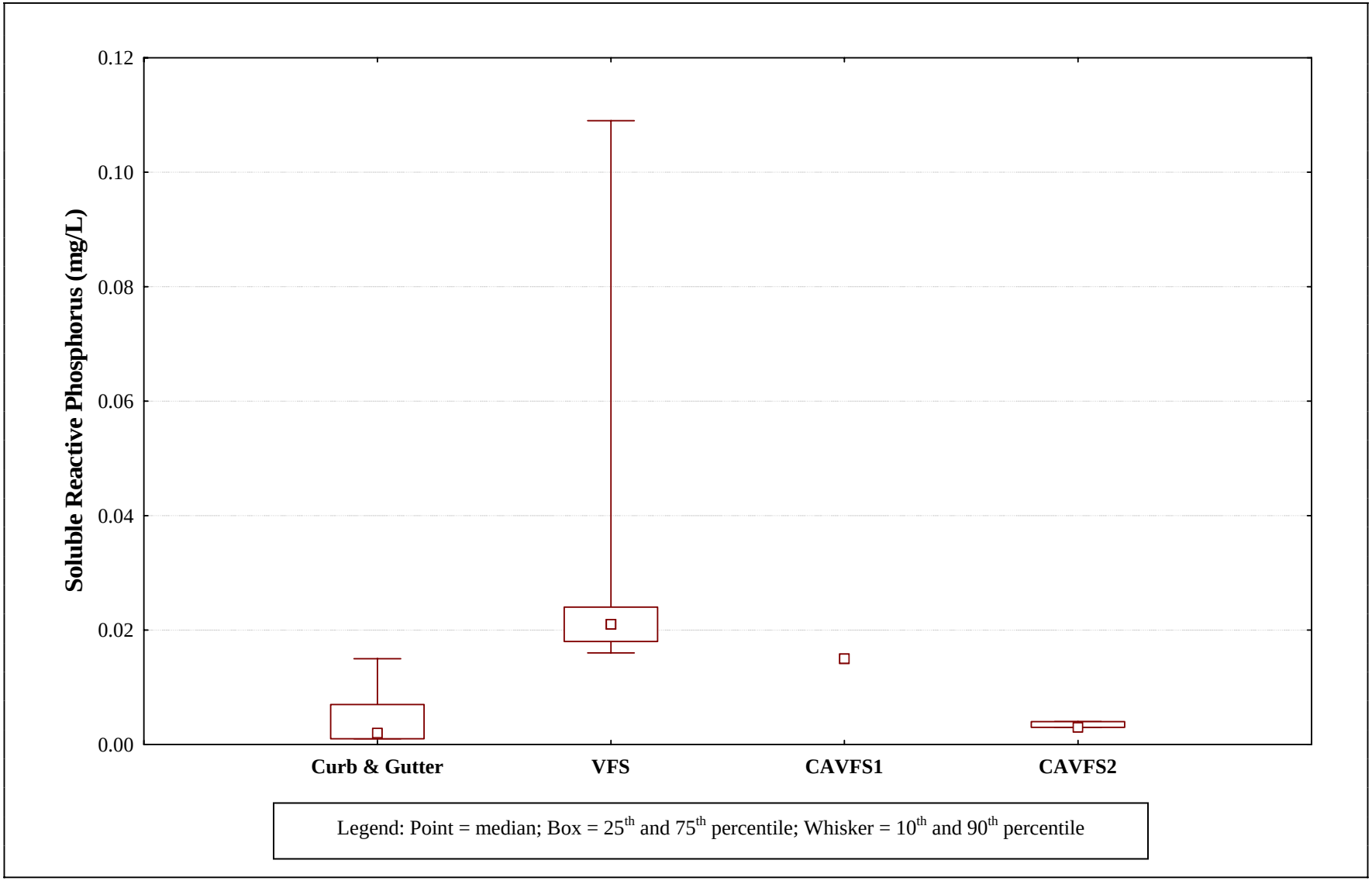


Figure 21 Comparison of soluble reactive phosphorus concentrations measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations during storm events in water year 2006.

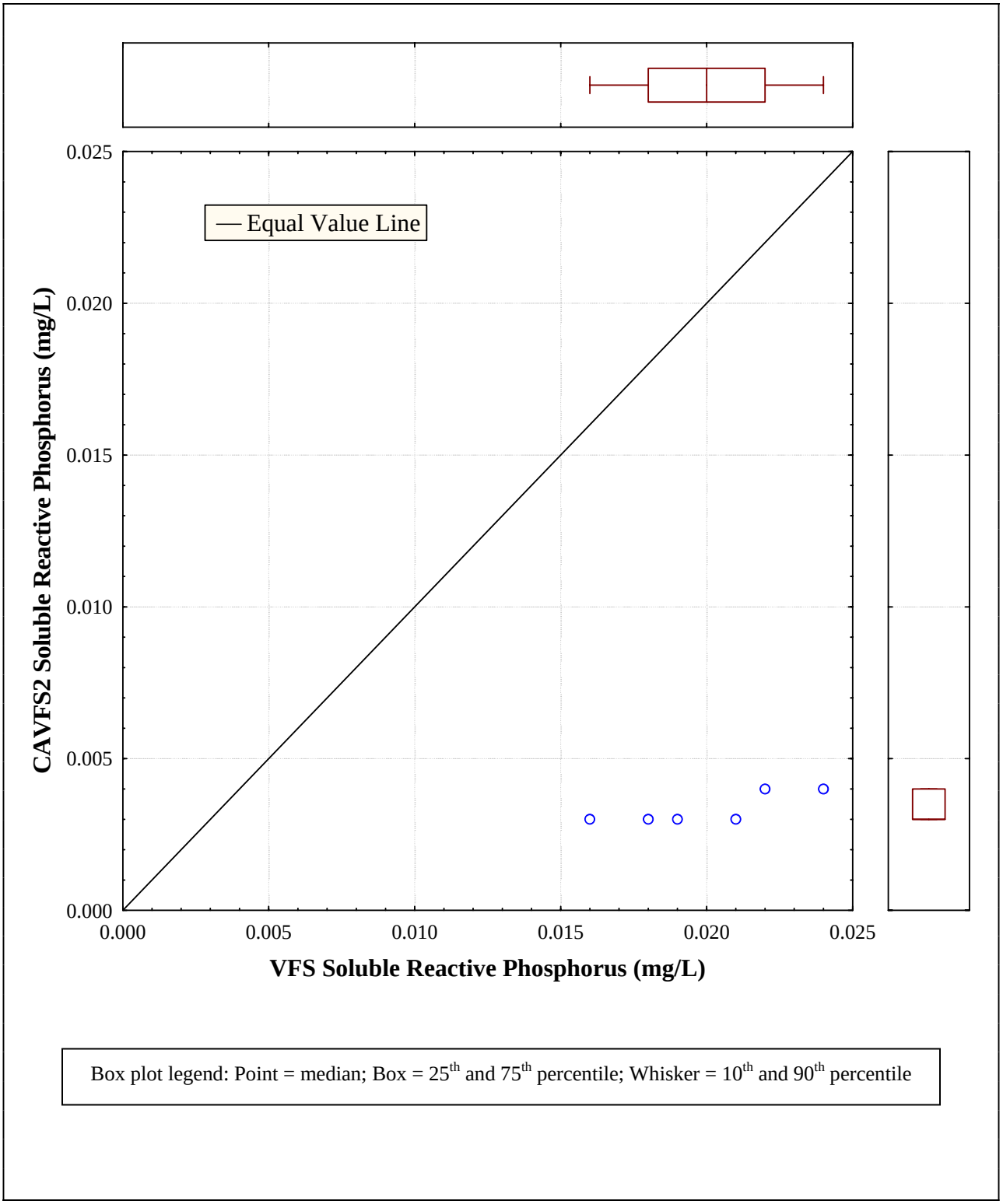


Figure 22. Comparison of soluble reactive phosphorus concentrations measured at the CAVFS2 station versus the VFS station during storm events in water year 2006.

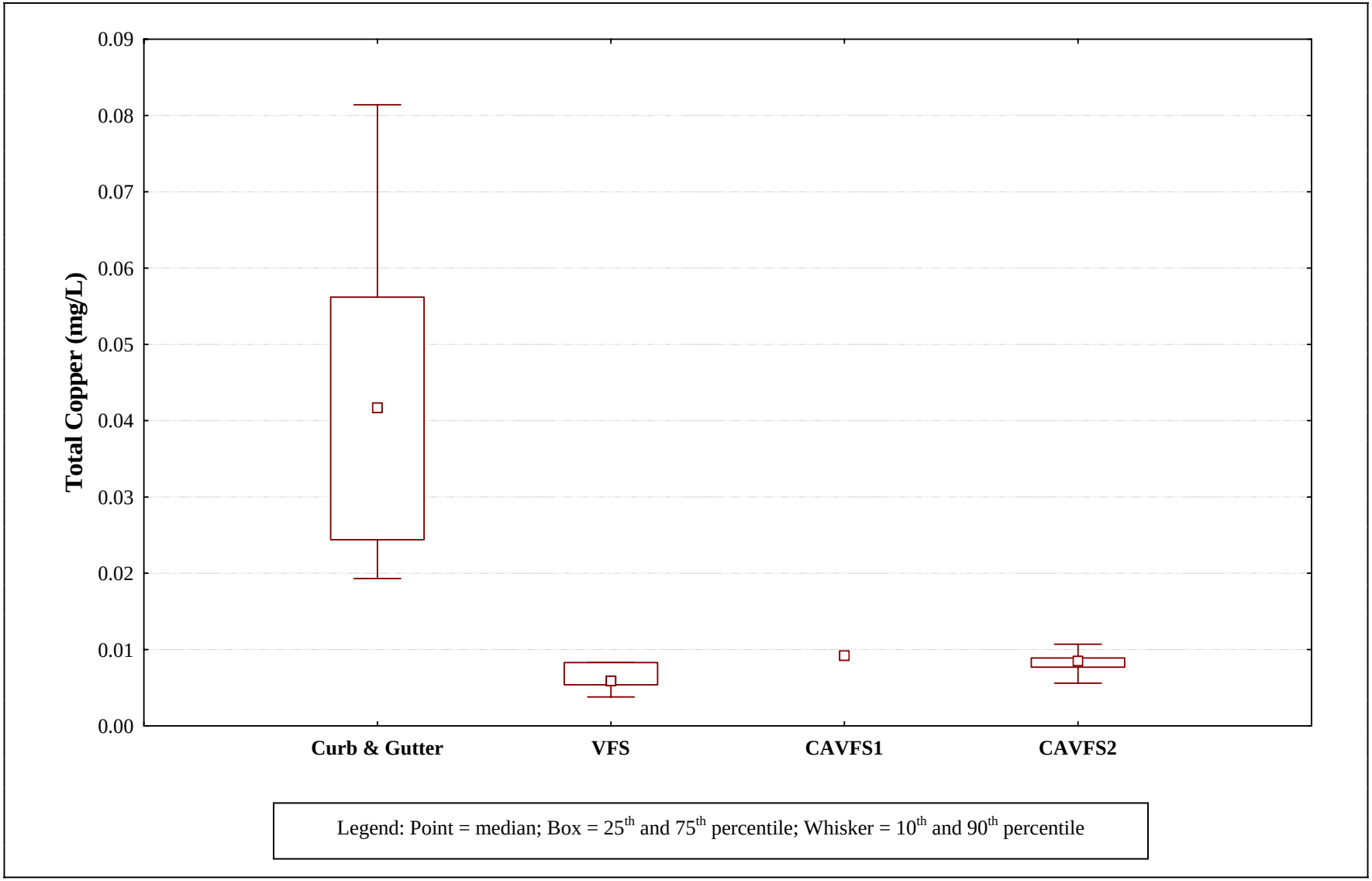


Figure 23. Comparison of total copper concentrations measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations during storm events in water year 2006.

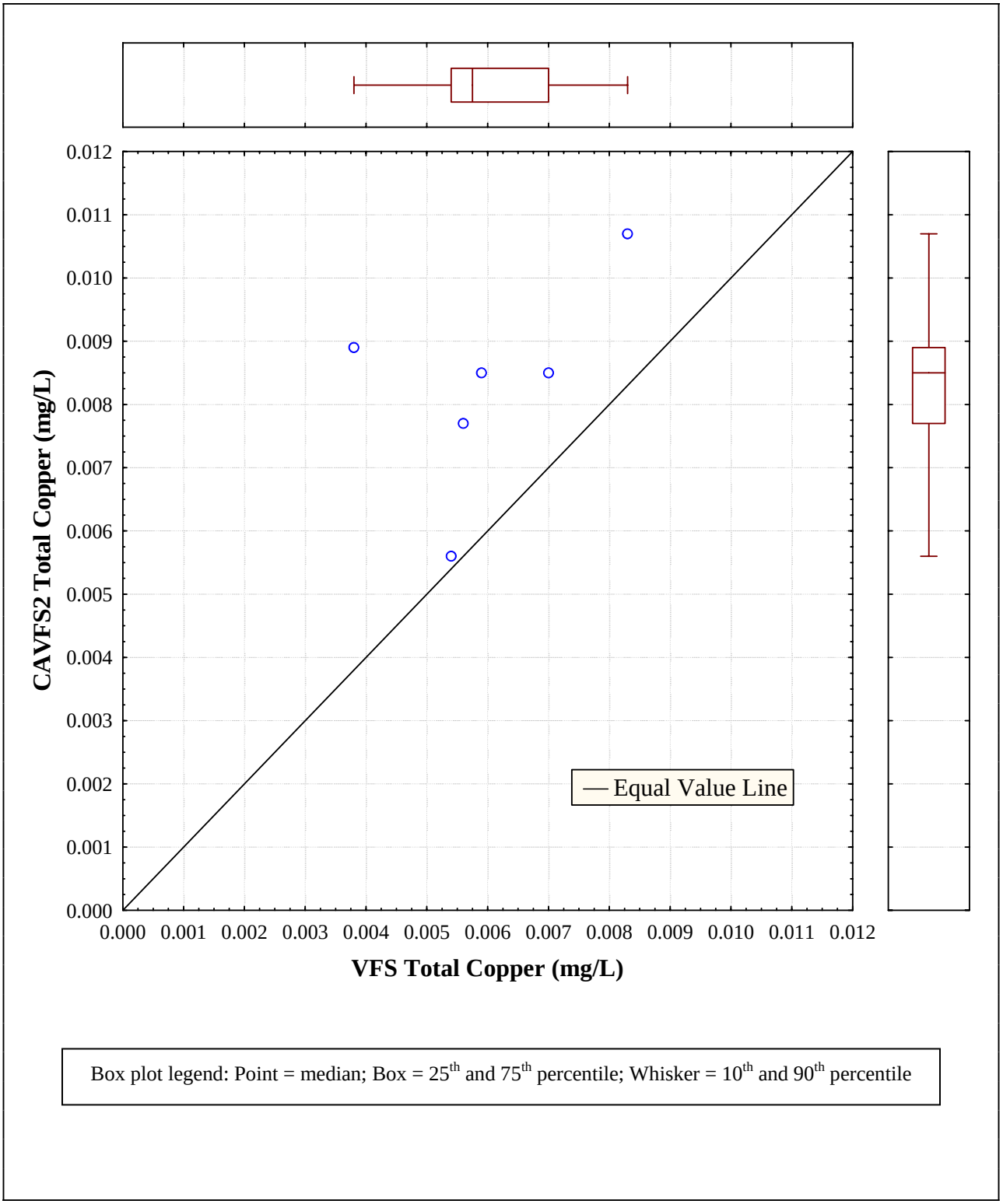


Figure 24. Comparison of total copper concentrations measured at the CAVFS2 station versus the VFS station during storm events in water year 2006.

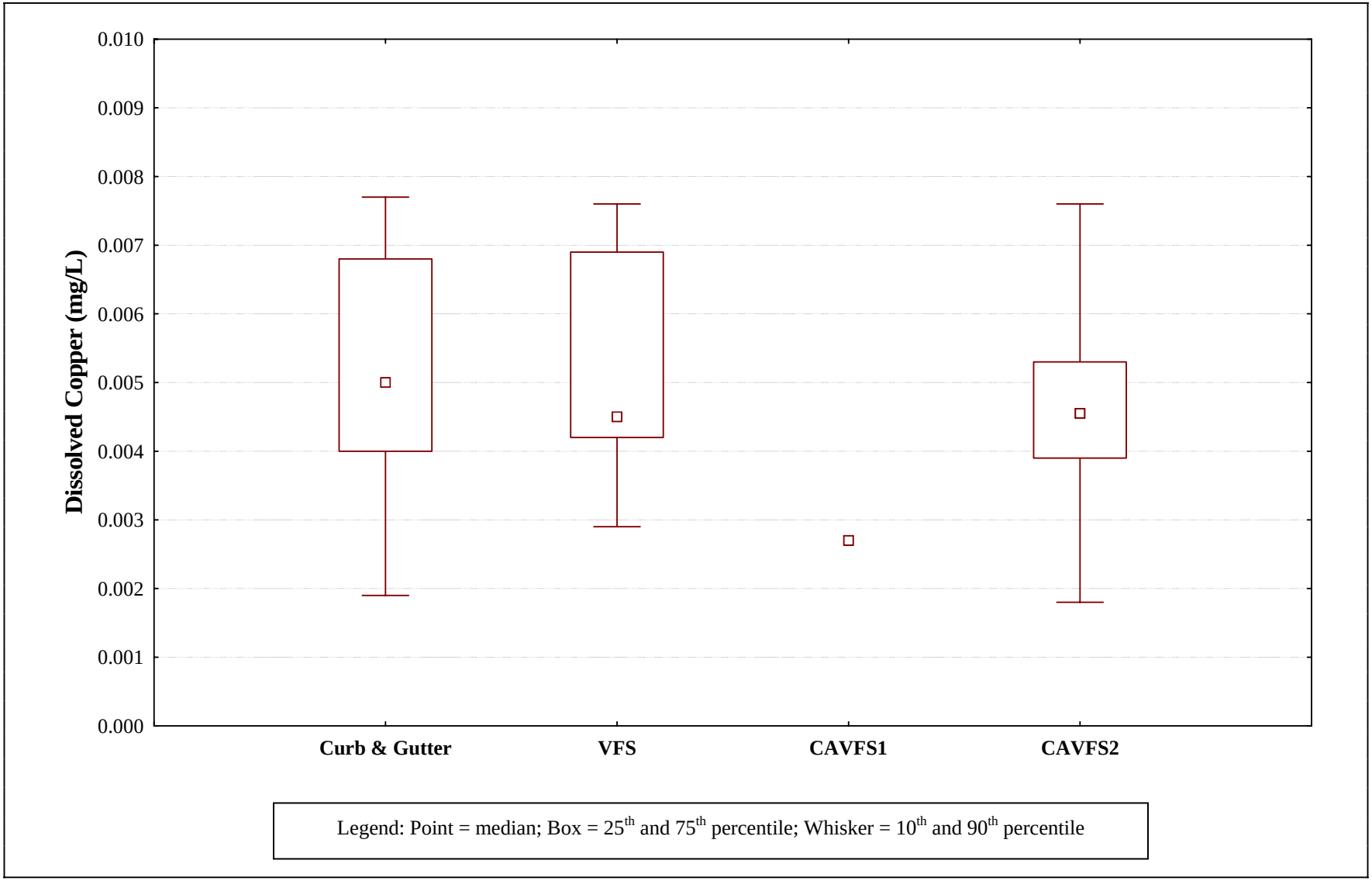


Figure 25. Comparison of dissolved copper concentrations measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations during storm events in water year 2006.

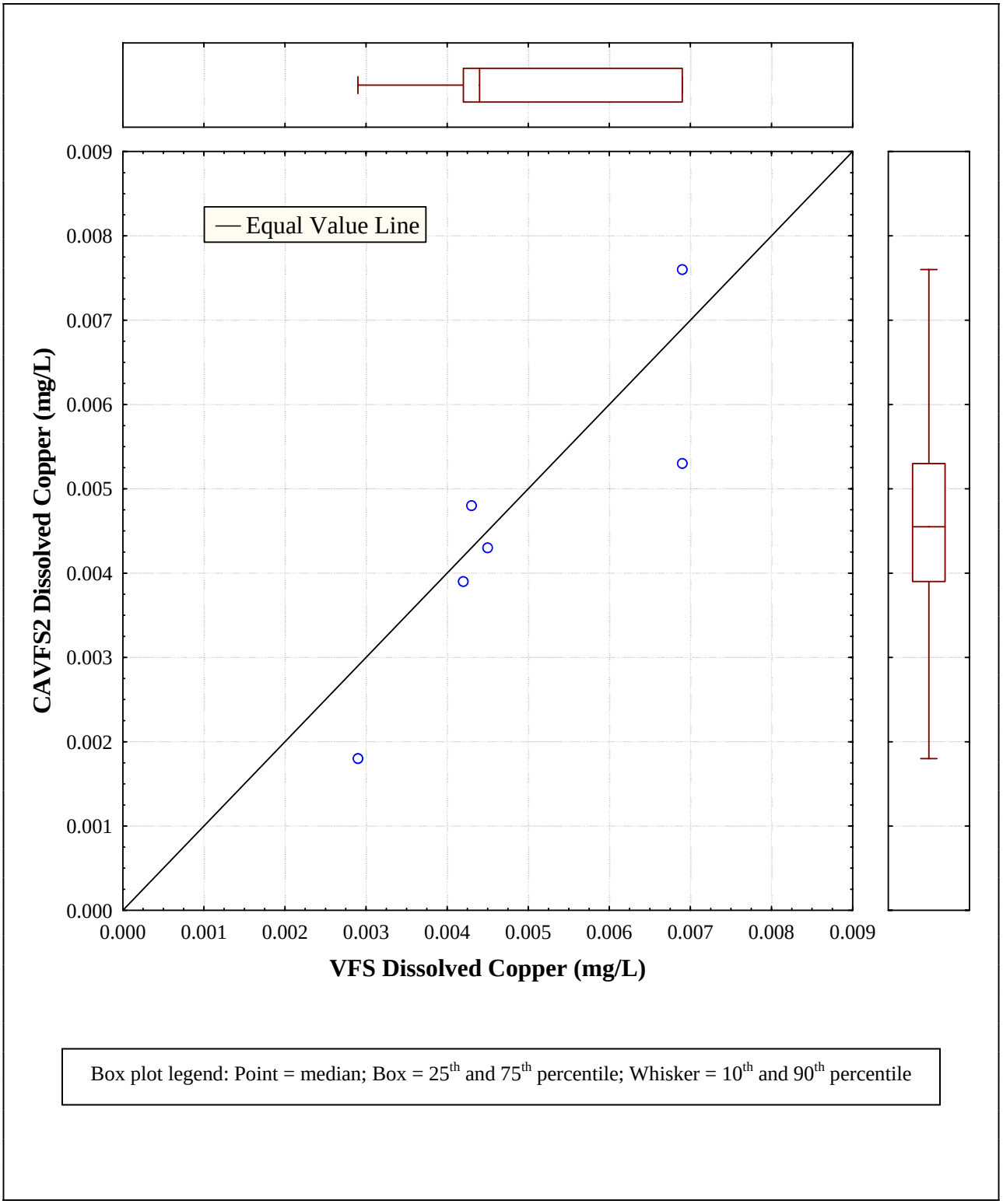


Figure 26. Comparison of dissolved copper concentrations measured at the CAVFS2 station versus the VFS station during storm events in water year 2006.

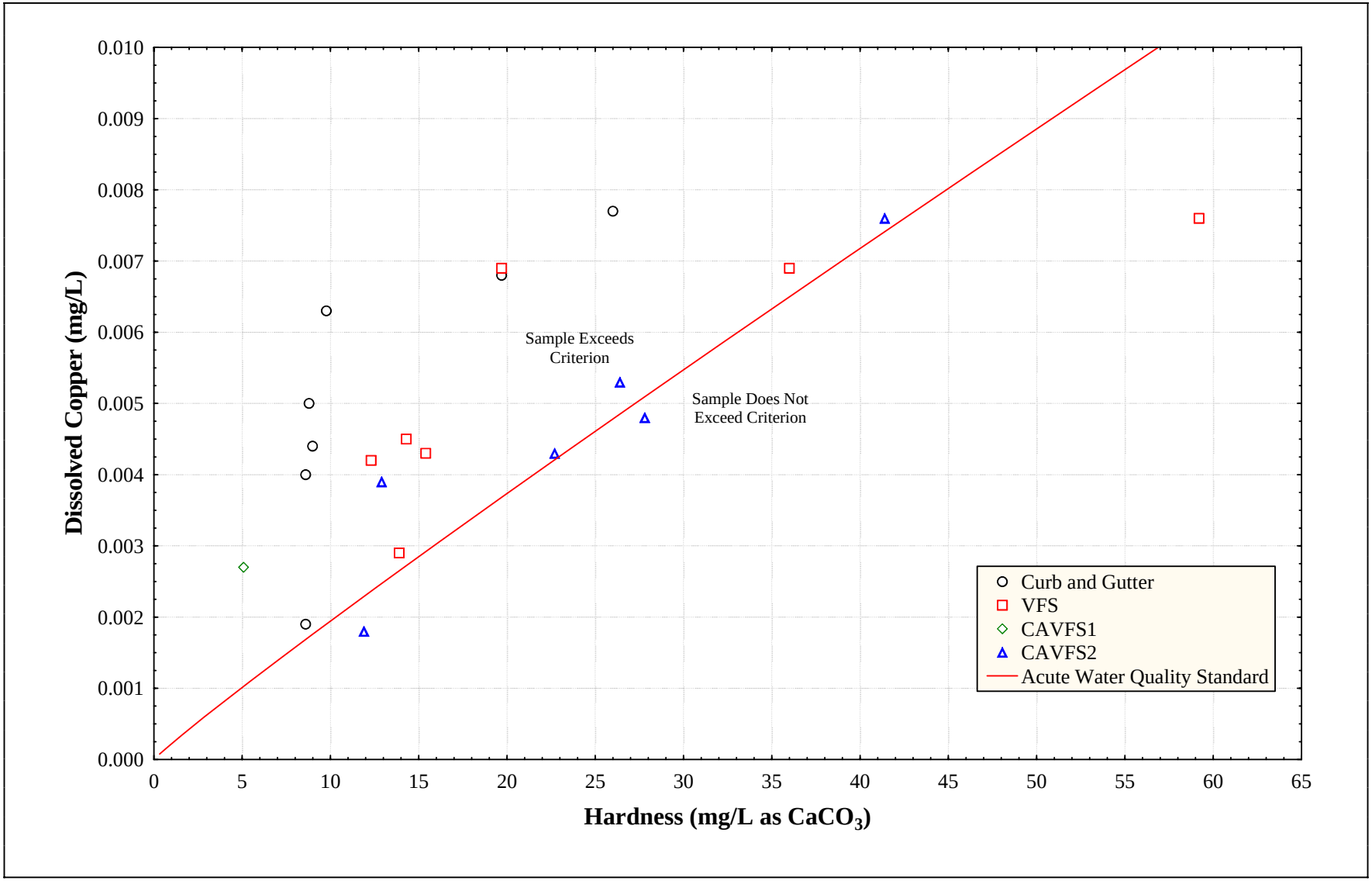


Figure 27. Dissolved copper and hardness concentrations measured at each station during storm events in water year 2006 with the associated acute water quality standard for dissolved copper.

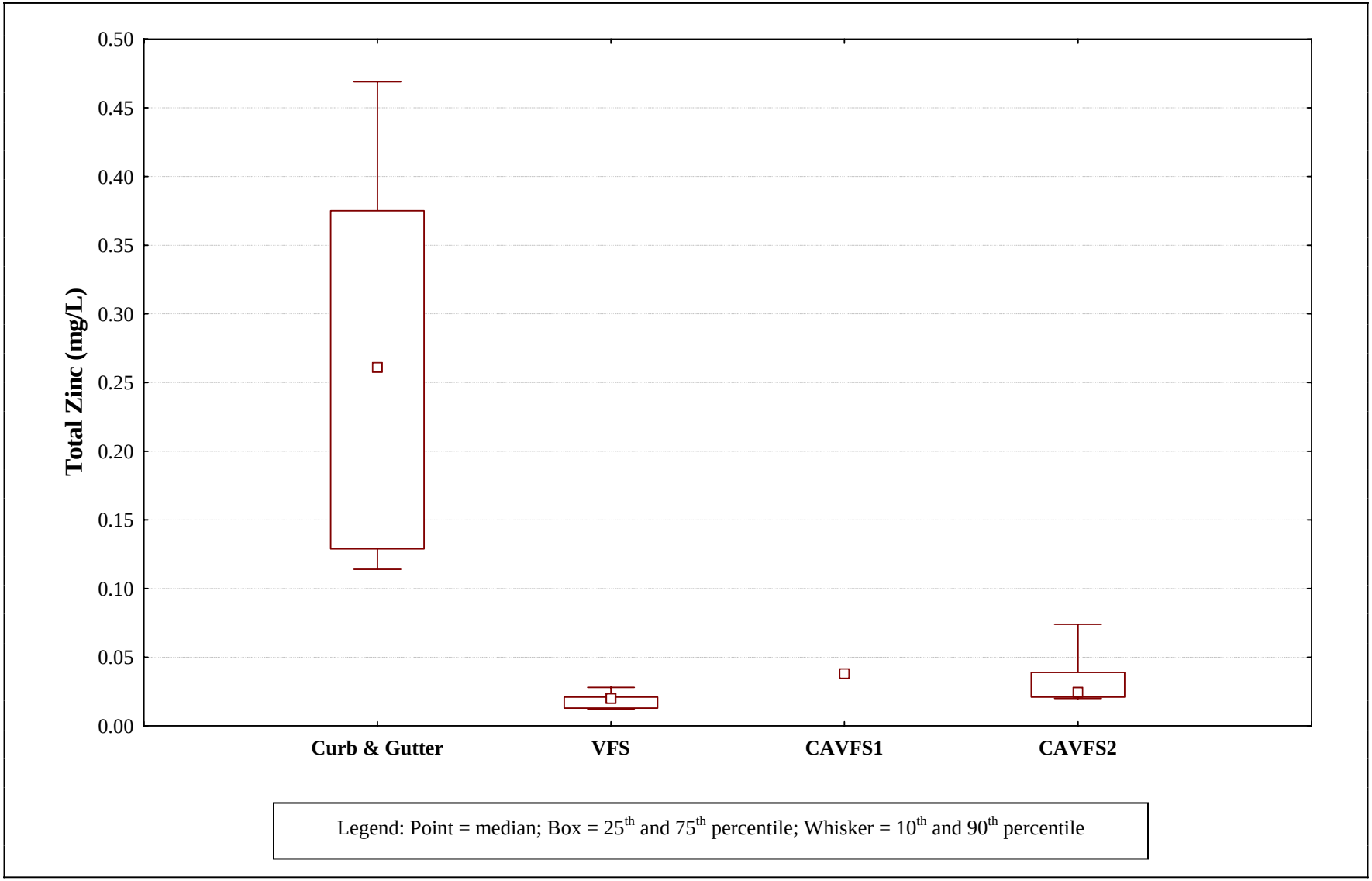


Figure 28. Comparison of total zinc concentrations measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations during storm events in water year 2006.

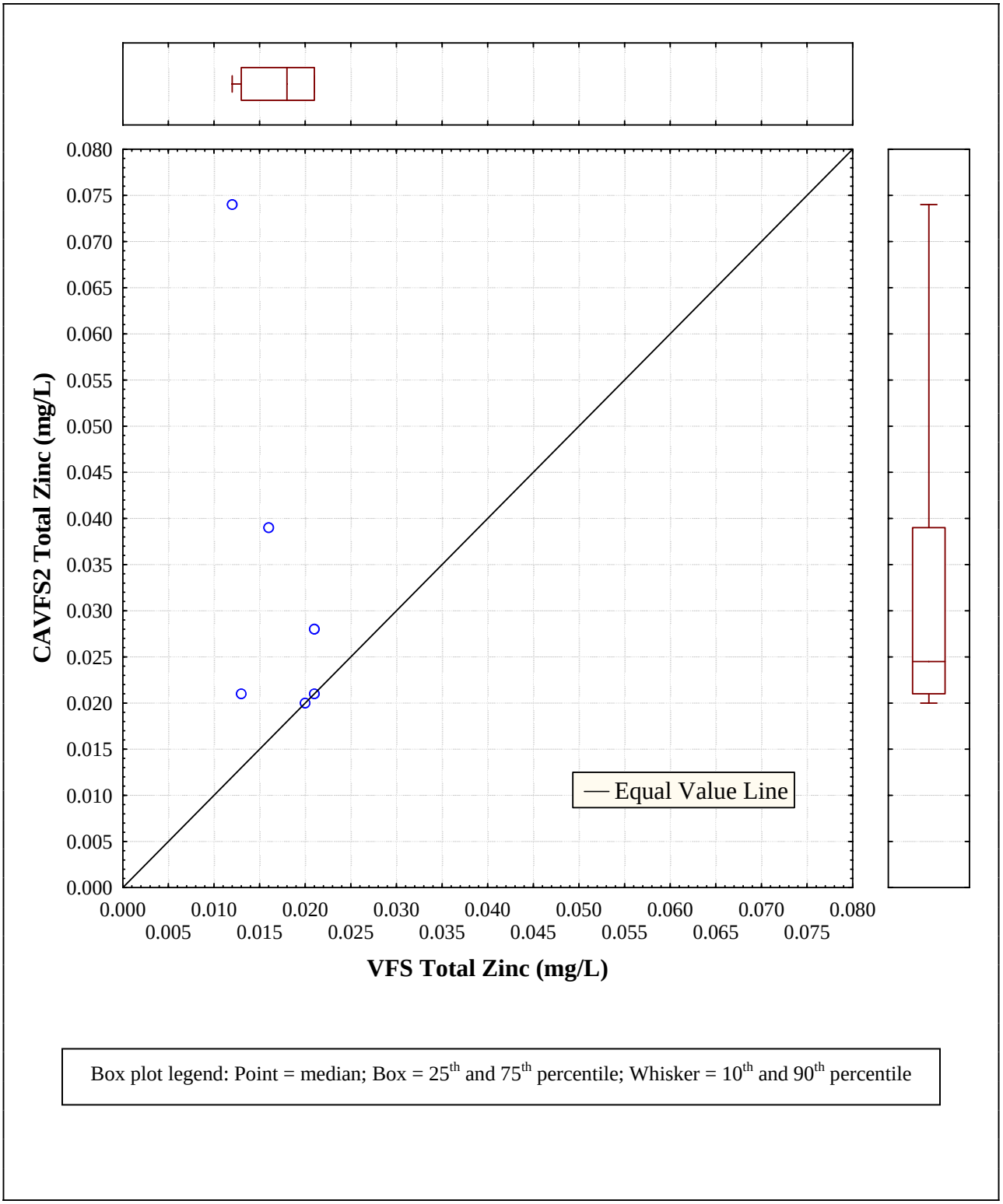


Figure 29. Comparison of total zinc concentrations measured at the CAVFS2 station versus the VFS station during storm events in water year 2006.

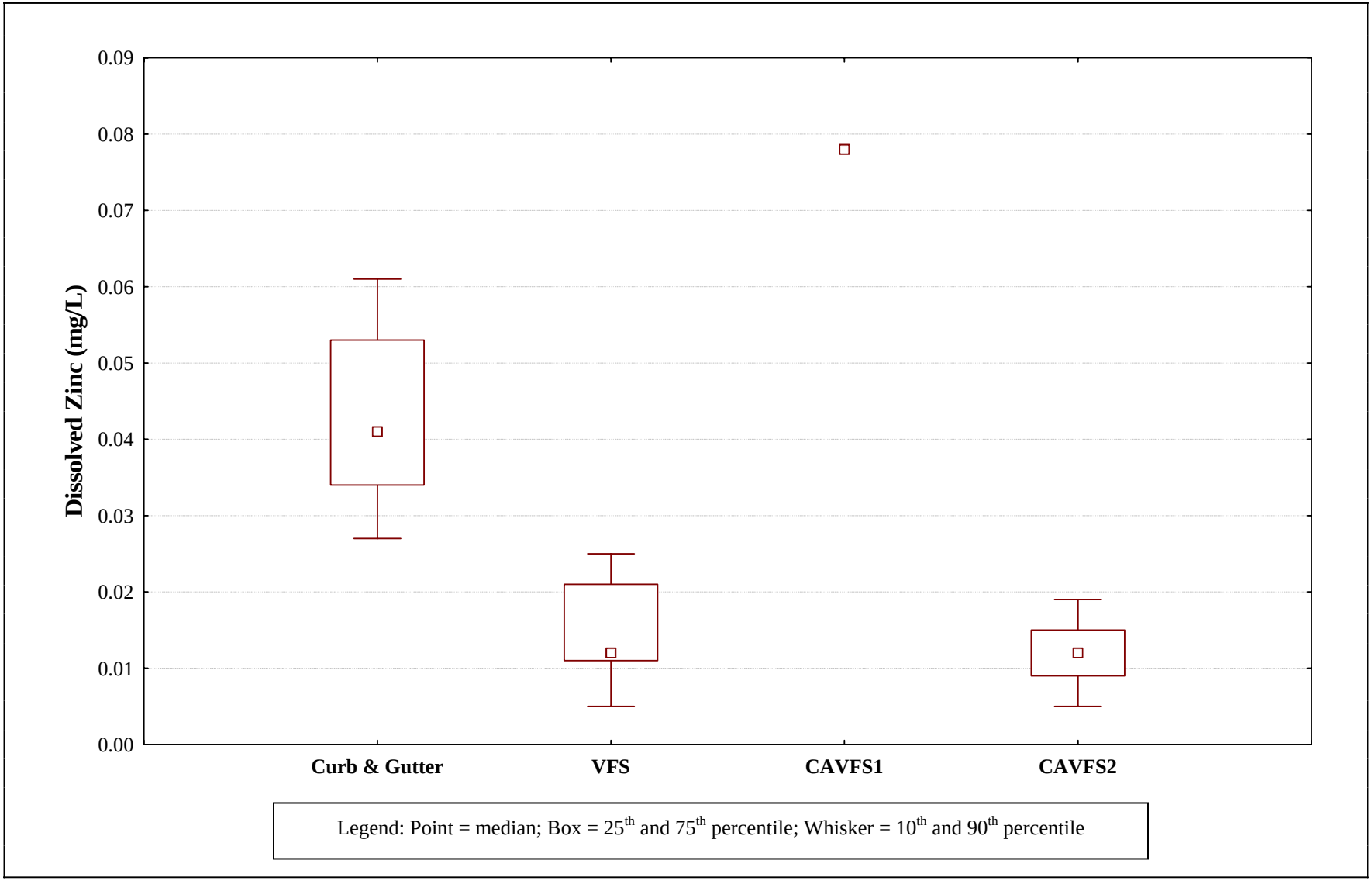


Figure 30. Comparison of dissolved zinc concentrations measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations during storm events in water year 2006.

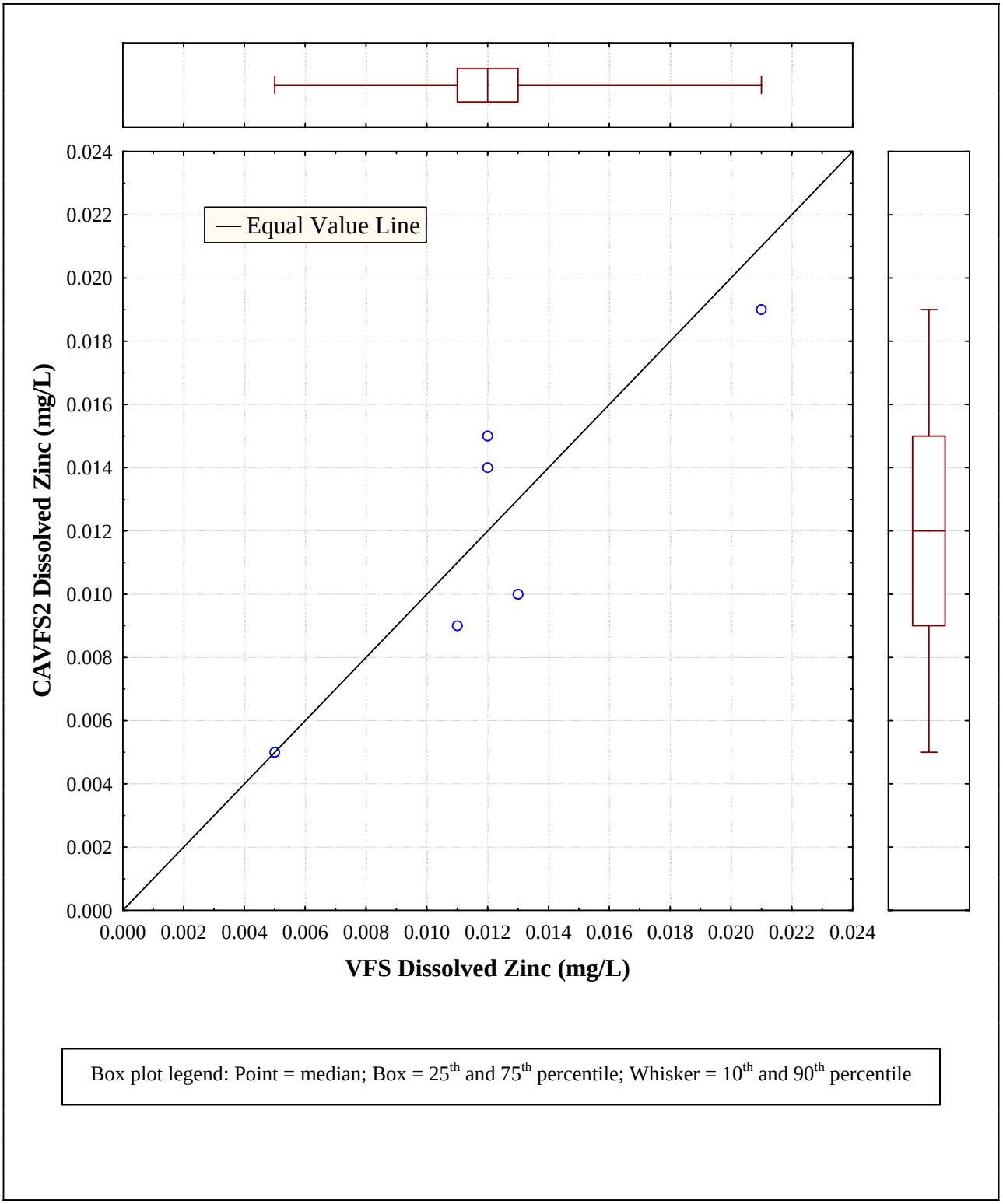


Figure 31. Comparison of dissolved zinc concentrations measured at the CAVFS2 station versus the VFS station during storm events in water year 2006.

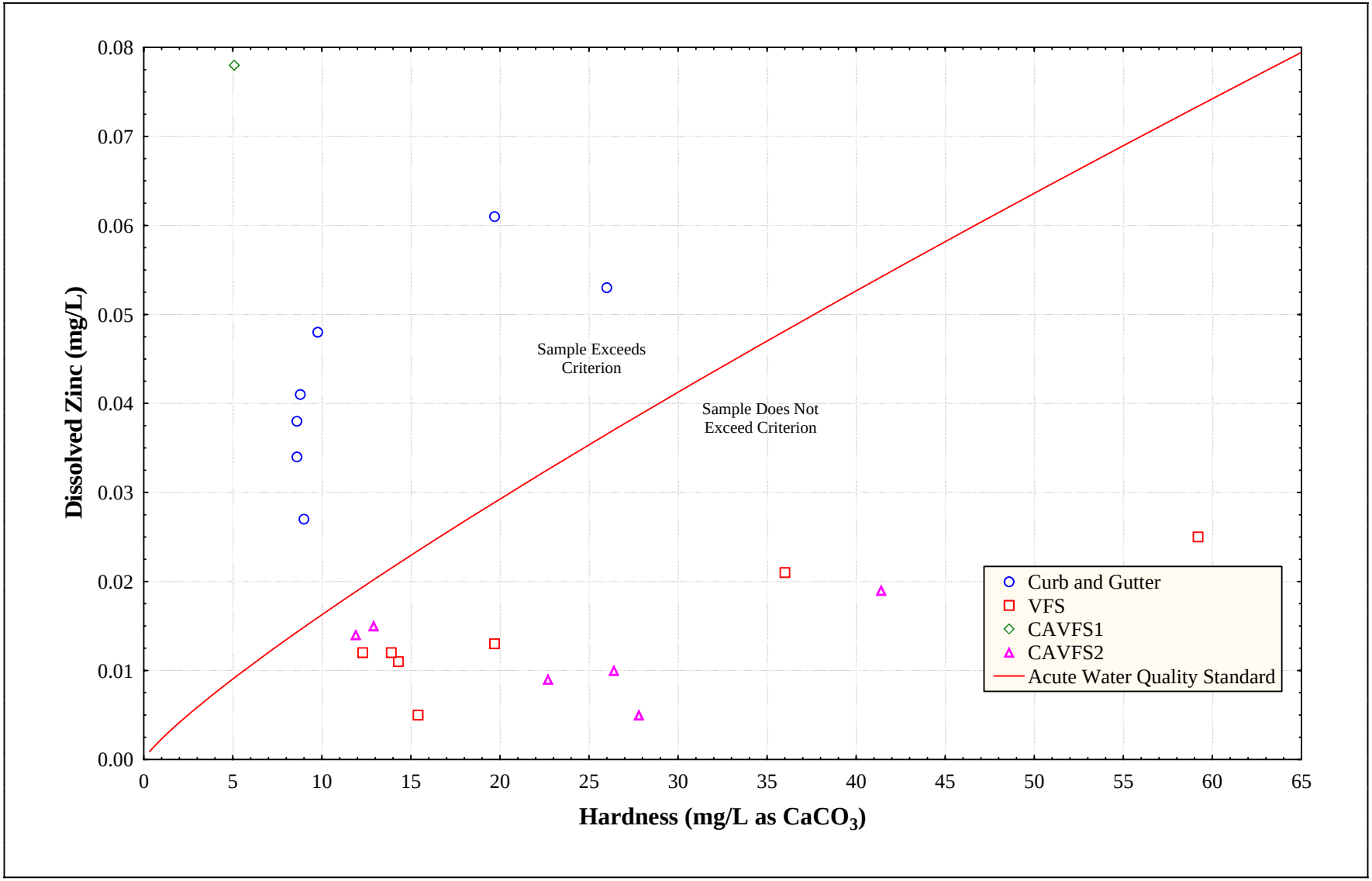


Figure 32. Dissolved zinc and hardness concentrations measured at each station during storm events in water year 2006 with the associated acute water quality standard for dissolved copper.

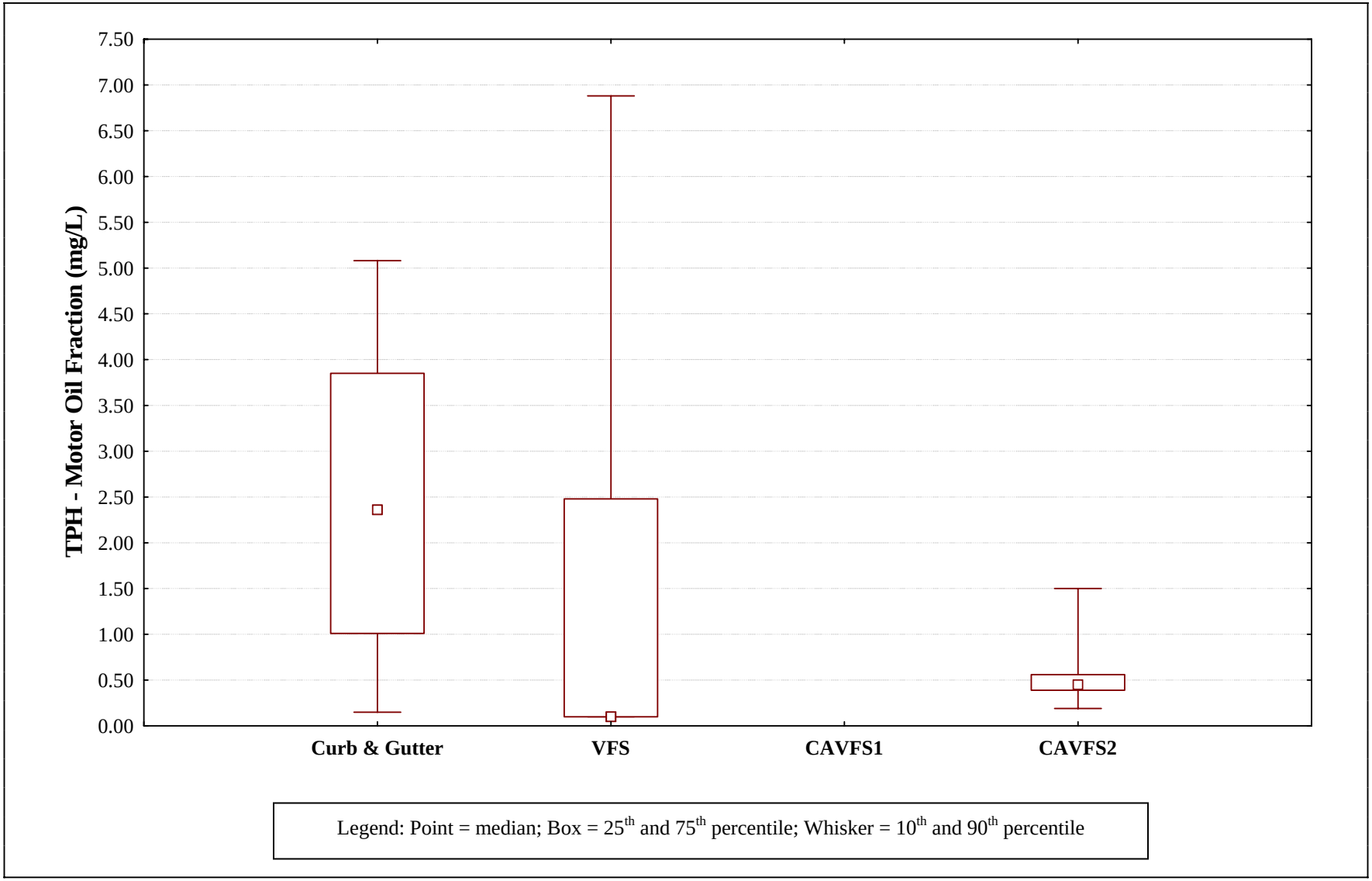


Figure 33. Comparison of total petroleum hydrocarbon (motor oil fraction) concentrations measured at the Curb and Gutter, VFS, CAVFS1, and CAVFS2 stations during storm events in water year 2006.

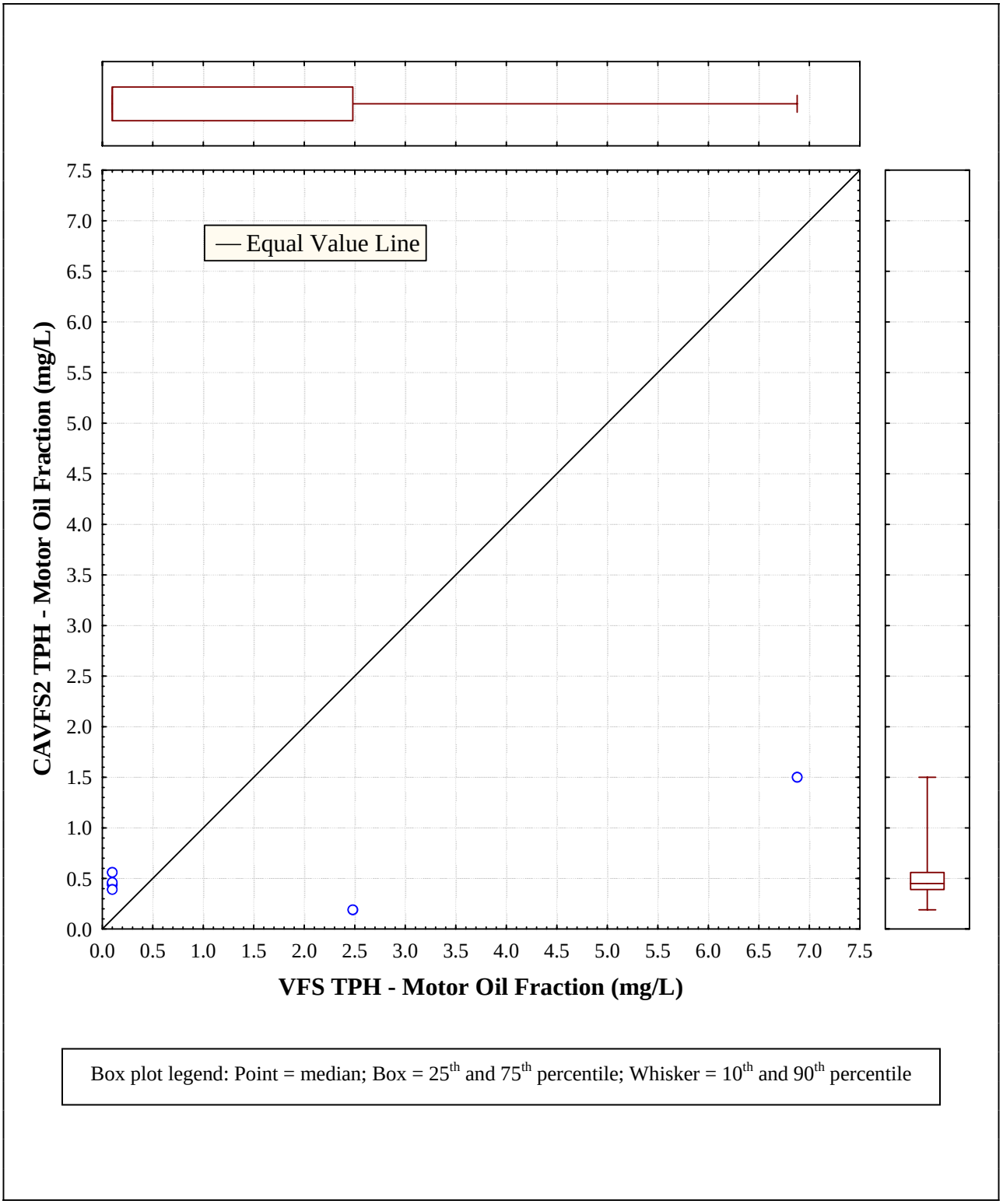


Figure 34. Comparison of total petroleum hydrocarbon (motor oil fraction) concentrations measured at the CAVFS2 station versus the VFS station during storm events in water year 2006.

APPENDIX A

Hydrologic Data Quality Assurance Review Memorandum

Herrera Environmental Consultants, Inc.

Memorandum

To	Project file 04-02916-002
From	Rebecca Dugopolski and John Lenth
Date	February 9, 2007
Subject	Water Year 2006 Hydrologic Data Validation Review for the Compost-Amended Vegetated Filter Strip Performance Monitoring Project

This memorandum presents the results from a quality assurance review of hydrologic monitoring data collected at monitoring stations for the compost-amended vegetated filter strip (CAVFS) monitoring project over water year 2006 (i.e., from October 1, 2005 through September 30, 2006). Included in this review were water level and associated discharge data from the Curb and Gutter, VFS, CAVFS1, and CAVFS2 monitoring stations. Also included were precipitation data from the CAVFS1 station. Detailed descriptions of these stations and their associated monitoring equipment are provided in the Quality Assurance Project Plan (Herrera 2004) for the project.

This memorandum initially describes the procedures that were used in this data quality assurance review. Specific quality assurance issues that were identified through this review are then documented in the concluding section along with any associated limitations on the use and interpretation of the data.

Data Quality Review Procedures

The following procedures were used in the hydrologic data quality assurance review for the monitoring stations and data described above:

1. Precipitation data from each study were reviewed to identify any significant data gaps. These gaps were then filled using data obtained from a rain gauge in Lynwood, WA that is operated by King County (2006). This gauge is located approximately 3 miles from the project site.

2. The precipitation record was then analyzed to identify every individual storm that occurred during the monitoring period. The individual storms were defined based on a minimum 6-hour dry period separating each event. Once defined, these storms were sequentially numbered starting with the first storm in the monitoring period and progressing through the last.

3. The available discharge and water level data from each monitoring station were then verified based on comparisons of the associated hydrographs to the hyetographs for individual storm events defined above in Step 2. Gross anomalies (e.g., data spikes), gaps, or inconsistencies that were identified through this review were investigated to determine if there are QA issues associated with the data that limit their usability.

4. If minor quality assurance issues were identified in any portion of the discharge record or in the water level data from a particular station and storm event, the data from that station and event were considered estimates and assigned a *J* qualifier. If major quality assurance issues are identified in any portion of the data from a particular station and /or storm event, the data from that station and event were rejected and assigned an R qualifier. Finally, *ND* qualifiers were assigned to the data from a particular station and event when no data were collected due to equipment malfunctions or other operational problems.

Data Quality Assurance Review Results

Results from this quality assurance review are summarized in Table A-1. More specifically, this table indicates where quality assurance issues were identified in the data including the associated station, storm event, nature of the problem and cause if known, and action taken in response. These results indicate that data from a total of 35 storms were rejected (*R*) due to severe quality assurance problems. In addition, data from a total of 8 storms were qualified as estimates (*J*) due to minor quality assurance problems. Finally, data from a total of two storms were assigned *ND* qualifiers to indicate no data were collected. Only estimated values were used in subsequent data analyses for this project.

References

Herrera. 2004. Quality Assurance Project Plan: Compost-Amended Vegetated Filter Strip Performance Monitoring Project. Prepared for Washington State Department of Transportation by Herrera Environmental Consultants, Inc., Seattle, Washington.

King County. 2006. Precipitation data from the LYNN rain gauge in Lynwood, Washington. Department of Natural Resources. Obtained October 17, 2006, from agency website: <http://dnr.metrokc.gov/wlr/waterres/hydrology/GaugeSelect.aspx>.

Table A-1 Results from quality assurance (QA) review of hydrologic monitoring data collected from the Curb and Gutter, VFS, CAVFS1, and CAVFS2 monitoring stations in water year 2006.

Station	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff producing	QA Issue	Cause	QA Action
CAVFS1	13	10/23/2005 6:45	10/23/2005 16:45	no	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	23	11/1/2005 8:00	11/1/2005 19:45	yes	No Data	Memory error	Rainfall data obtained from King County gauge LYNN. Flagged discharge data as nd.
CAVFS1	63	1/13/2006 4:15	1/13/2006 9:15	yes	Missing Data	Memory error	Rainfall data obtained from King County gauge LYNN. Discharge data rejected and assigned an R qualifier.
CAVFS1	92	2/26/2006 16:00	2/27/2006 2:30	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	107	3/24/2006 3:00	3/24/2006 15:15	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	109	3/28/2006 2:30	3/28/2006 8:00	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	111	4/1/2006 4:00	4/1/2006 11:45	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	112	4/3/2006 14:30	4/3/2006 19:30	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	113	4/5/2006 22:15	4/5/2006 22:45	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	114	4/8/2006 13:30	4/9/2006 15:45	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	117	4/13/2006 20:30	4/13/2006 23:30	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	118	4/14/2006 6:45	4/14/2006 7:45	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	119	4/14/2006 17:15	4/14/2006 17:30	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	120	4/15/2006 3:00	4/16/2006 6:45	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	121	4/17/2006 20:30	4/17/2006 20:45	no	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	134	5/23/2006 22:30	5/24/2006 15:30	no	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	136	5/26/2006 13:30	5/26/2006 13:45	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	137	5/26/2006 21:15	5/27/2006 5:30	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	138	5/27/2006 11:45	5/28/2006 15:00	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	139	5/29/2006 5:45	5/29/2006 6:00	no	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	141	6/1/2006 12:00	6/2/2006 5:15	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	142	6/2/2006 11:45	6/2/2006 14:30	no	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	144	6/8/2006 18:45	6/9/2006 8:15	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	147	6/12/2006 20:30	6/13/2006 2:00	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS1	22	10/31/2005 9:15	10/31/2005 19:00	yes	Missing Data	Memory error	Rainfall data obtained from King County gauge LYNN. Discharge data rejected and assigned an R qualifier.
CAVFS2	22	10/30/2005 19:45	10/31/2005 19:00	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS2	23	11/1/2005 8:00	11/1/2005 19:45	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS2	39	12/3/2005 13:30	12/3/2005 17:00	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS2	46	12/22/2005 18:15	12/22/2005 18:30	no	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS2	60	1/6/2006 23:00	1/6/2006 23:15	no	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
CAVFS2	63	1/13/2006 4:15	1/13/2006 9:15	yes	Missing Data	Memory error	Discharged data identified as estimated and assigned a J qualifier.
CAVFS2	72	1/22/2006 11:15	1/22/2006 11:30	no	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
Curb and Gutter	22	10/31/2005 9:15	10/31/2005 19:00	yes	Missing Data	Memory error	Discharged data identified as estimated and assigned a J qualifier.
Curb and Gutter	23	11/1/2005 8:00	11/1/2005 19:45	yes	No Data	Memory error	Discharged data identified as estimated and assigned a J qualifier.
Curb and Gutter	36	11/28/2005 22:00	11/30/2005 3:30	no	No Data	Memory error	Flagged as nd.
Curb and Gutter	37	12/1/2005 12:45	12/1/2005 13:30	no	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
Curb and Gutter	63	1/13/2006 4:15	1/13/2006 9:15	yes	Missing Data	Memory error	Discharged data identified as estimated and assigned a J qualifier.
Curb and Gutter	79	1/29/2006 21:00	1/30/2006 12:00	yes	Missing Data	Memory error	Discharge data rejected and assigned an R qualifier.
Curb and Gutter	83	1/29/2006 21:00	1/30/2006 12:00	yes	Missing Data	Memory error	Only a small amount of missing data. Discharged data identified as estimated and assigned a J qualifier.
Curb and Gutter	103	3/17/2006 8:15	3/17/2006 8:30	no	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
VFS	22	10/31/2005 9:15	10/31/2005 19:00	yes	Missing Data	Memory error	Discharged data identified as estimated and assigned a J qualifier.
VFS	23	11/1/2005 8:00	11/1/2005 19:45	yes	No Data	Memory error	Discharged data identified as estimated and assigned a J qualifier.
VFS	46	12/22/2005 18:15	12/22/2005 18:30	no	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.
VFS	63	1/13/2006 4:15	1/13/2006 9:15	yes	Missing Data	Memory error	Discharged data identified as estimated and assigned a J qualifier.
VFS	133	5/23/2006 8:15	5/23/2006 10:30	yes	Inaccurate water level measurements	Instrument drift.	Discharge data rejected and assigned an R qualifier.

APPENDIX B

Water Quality Data Quality Assurance Review Memorandum

Herrera Environmental Consultants, Inc.

Memorandum

To	Project File 04-02916-002
cc	John Lenth, Herrera Environmental Consultants
From	Gina Catarra and Rob Zisette, Herrera Environmental Consultants
Date	November 1, 2006
Subject	Data Quality Assurance Review of CAVFS Performance Monitoring Surface Water Data

This memorandum presents a review of data quality for surface water samples collected for performance monitoring of compost-amended vegetated filter strip (CAVFS) test plots from November 2005 to January 2006. Aquatic Research Incorporated of Seattle, Washington analyzed the samples for:

- Total suspended solids by EPA Method 160.2
- Total phosphorus by EPA Method 365.1
- Hardness by Standard Method 2340C
- Soluble reactive phosphorus (SRP) by Standard Method 4500P,F
- Total and dissolved copper by EPA Method 220.2
- Total and dissolved zinc by EPA Method 200.7
- Total petroleum hydrocarbons by NWTPH-Dx methodColiform bacteria by Standard Method 9222D

The laboratory's performance was reviewed in accordance with quality control (QC) criteria outlined in the *WSDOT Compost-Amended Vegetated Filter Strip Performance Monitoring Quality Assurance Project Plan* (QAPP) (WSDOT 2004).

Quality control data summaries submitted by the laboratories were reviewed; raw data were not submitted by the laboratories. Data quality assurance worksheets summarizing the quality assurance and quality control (QA/QC) review were completed for each sampling event and are included with the data. Data qualifiers (flags) were added to the sample results in the laboratory reports. Data validation results are summarized below, followed by definitions of data qualifiers.

Custody, Preservation, Holding Times, and Completeness—Acceptable with Qualification

The samples were properly preserved and sample custody was maintained from sample collection to receipt at the laboratories. All samples were analyzed within the required holding times (Table 1). With the exception noted below, the laboratory reports were complete and contained results for all samples and tests requested on the chain-of-custody (COC) forms.

Table 1. Summary of sample collection requirements.

Parameter	Analytical Method	Bottle	Preservative	Holding Time
Hardness	SM 2340B	500 mL poly	Nitric acid to pH<2, cool to 4°C	6 months
Total suspended solids	EPA 160.2	1 L poly	Cool to 4°C	7 days
Total phosphorus	EPA 365.1	250 mL poly	Sulfuric acid to pH<2, cool to 4°C	28 days
Soluble reactive phosphorus	EPA 365.1	250 mL poly	Cool to 4°C, filtration within 12 hours	48 hours
Dissolved metals	EPA 200.7/200.8	500 mL poly	Cool to 4°C	6 months
Total metals	EPA 200.7/200.8	500 mL poly	Nitric acid to pH<2, cool to 4°C	6 months
Total petroleum hydrocarbons	NWTPH-Dx	500 mL amber glass	Hydrochloric acid to pH<2, cool to 4°C	14 days to extraction; 40 days to analysis

Analytical method modifications from the QAPP included the following parameters:

- Total and dissolved copper by graphite furnace using EPA method 220.2 rather than by ICP using EPA Method 200.7 to achieve a lower detection limit.

No data were qualified based on analytical method changes.

The dissolved zinc result (0.078 mg/L) was greater than the total zinc result (0.038 mg/L) for sample COMPOST 1 collected on 1/10/06. The dissolved zinc result for sample COMPOST 1 was qualified as estimated (J) to indicate a potentially elevated result due to contamination of the sample (see Table 2). The method blank for dissolved zinc did not contain zinc above the reporting limit so no other sample results were qualified.

Table 2. Summary of sample results qualified due to potentially elevated results due to laboratory contamination.

Sample ID	Sample Date	Parameter	Qualifier
COMPOST 1	1/10/06	Dissolved copper	J

Laboratory Reporting Limits—Acceptable

The laboratory reporting limits and QAPP specified reporting limits are provided in Table 3. The laboratory reporting limits met the QAPP specified reporting limits for all analyses. No data were qualified based on laboratory reporting limits.

Table 3. Summary of QAPP and laboratory reporting limits.

Parameter	QAPP Reporting Limit	Laboratory Reporting Limit
Hardness	2 mg/L	2 mg/L
Total suspended solids	0.50 mg/L	0.50 mg/L
Total phosphorus	0.02 mg/L	0.02 mg/L
Soluble reactive phosphorus	0.001 mg/L	0.001 mg/L
Total and dissolved copper	0.001 mg/L	0.001 mg/L
Total and dissolved zinc	0.005 mg/L	0.005 mg/L
Total petroleum hydrocarbons	0.050 mg/L (diesel); 0.10 mg/L (motor oil)	0.050 mg/L (diesel); 0.10 mg/L (motor oil)

Blank Analysis—Acceptable with Discussion

Method Blanks

Method blanks were analyzed at the required frequency. Method blanks did not contain levels of target analytes above the laboratory reporting limits.

Rinsate Blanks

One equipment rinsate blank was collected and analyzed for metals in accordance with the QAPP. As shown in Table 4, results for copper (total) and zinc (dissolved and total) exceeded the criterion of metals values less than 2 times the reporting limit. No data were qualified because the exceedances were marginal. The QAPP specified that additional testing shall be conducted if metals results exceed the less than 2 times the reporting limit. No additional sampling was conducted, but the field procedures will be evaluated and modified, if needed, prior to the next sampling event.

Table 4. Summary of equipment rinsate blank criterion exceedances.

Sample Date	Parameter	Sample ID	Sample Result (mg/L)	Reporting Limit (mg/L)	Qualifier
3/2/06	Dissolved zinc	CURB&GUTTER 030206RB	0.011	0.005	None
3/2/06	Total copper	CURB&GUTTER 030206RB	0.0021	0.0010	None
3/2/06	Total zinc	CURB&GUTTER 030206RB	0.014	0.005	None

Laboratory Control Sample Analysis—Acceptable

Laboratory control samples were analyzed at the required frequency. The percent recovery values for all sampling events met the QAPP criteria (80 to 120 percent for petroleum hydrocarbon analyses and 90 to 110 percent for all other analyses).

Matrix Spike Analysis—Acceptable

Matrix spike (MS) samples were analyzed for total phosphorus, soluble reactive phosphorus, hardness, and metals at the required frequency. The percent recovery values for the MS analyses met the control limits (75 to 125 percent) established by the QAPP..

Laboratory Duplicate Analysis—Acceptable

Laboratory duplicates or laboratory control sample duplicates were analyzed at the required frequency. The relative percent difference (RPD) was calculated for each analyte where both duplicate values were greater than five times the reporting limit (RL). The difference between duplicate values was calculated if the detected compound concentration was less than five times the RL in either the sample or the field duplicate. A control limit of less than 20 percent RPD (25 percent for total suspended solids and 35 percent for petroleum hydrocarbons) was established in the QAPP and a control limit of two times the RL was used to evaluate difference values. The relative percent difference (RPD) values met the control limits established by the QAPP, and all difference values were less than two times the RL.

Field Duplicates—Acceptable with Qualification

Field duplicates were analyzed for all analyses. The QAPP specified that a field duplicate sample shall be collected at a frequency of one per every three sample events. As shown in Table 5, field duplicates were not collected at the required frequency. No data were qualified because of field duplicate sampling frequency.

Table 5. Frequency of field duplicate sample collection.

Number of Events	Number of Field Duplicates Collected	Percentage of Events Sampled
6	1	17

With the exception noted below, field duplicate precision met the QAPP specified criterion of less than 20 percent RPD (25 percent for total suspended solids and 35 percent for petroleum hydrocarbons). In addition, a criterion of less than 2 times the reporting limit was used if the sample concentration was less than 5 times the reporting limit. Table 6 presents the one sample value that was qualified as estimated (J) for field duplicate RPD exceedance. No other data associated with the sample batch were qualified due to field duplicate criteria exceedance because other quality control criteria were met.

Table 6. Summary of field duplicate criteria exceedances.

Sample Date	Parameter	Sample ID	Duplicate ID	RPD (%)	Qualifier
1/6/06	Total zinc	CURB&GUTTER	DUPE-010606	32	J

Data Quality Assessment Summary

In general, the data quality for all parameters was found to be acceptable based on holding time, reporting limit, method blank, control standard, matrix spike, laboratory duplicate, and field duplicate criteria. Field duplicate precision exceeded criteria for one total zinc value. In addition, one dissolved zinc result was qualified as estimated (J) due to potential high bias.

Usability of the data is based on the guidance documents previously noted. Upon consideration of the information presented here, the data are acceptable as qualified.

Definition of Data Qualifiers

The following data qualifier definitions are taken from *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (USEPA 2002).

U The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

J The associated value is an estimated quantity.

UJ The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

R The data are unusable. (Note: analyte may or may not be present.)

References

USEPA. 2002. Contract laboratory program national functional guidelines for inorganic data review. U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C. (EPA-540/R-01/008).

WSDOT. 2004. WSDOT Compost-Amended Vegetated Filter Strip Performance Monitoring, Quality Assurance Project Plan. Prepared for Washington State Department of Transportation, Environmental Affairs Office, Water Quality Program. December 2004.

APPENDIX C

Precipitation and Discharge Data for Individual Storm Events in Water Year 2005

Table C.1. Summary statistics for individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Storm Duration (hours)	Storm Antecedent Dry Period (hours)	Precipitation Amount (inches)	Max Precipitation Intensity (inches/15-minutes)	Ave. Precipitation Intensity (inches/hour)
2005	1	12/9/04 16:45	12/11/04 5:45	yes	37.00	--	1.50	0.05	0.04
2005	2	12/11/04 13:15	12/11/04 13:30	yes	0.25	7.50	0.01	0.01	0.04
2005	3	12/13/04 12:15	12/14/04 10:15	yes	22.00	46.75	0.30	0.04	0.01
2005	4	12/16/04 20:45	12/16/04 22:45	yes	2.00	58.50	0.07	0.02	0.04
2005	5	12/17/04 9:15	12/17/04 9:30	no	0.25	10.50	0.01	0.01	0.04
2005	6	12/18/04 3:15	12/18/04 3:30	yes	0.25	17.75	0.01	0.01	0.04
2005	7	12/19/04 12:15	12/19/04 12:45	yes	0.50	32.75	0.09	0.06	0.18
2005	8	12/21/04 8:45	12/21/04 15:15	yes	6.50	44.00	0.22	0.03	0.03
2005	9	12/25/04 11:45	12/26/04 11:30	yes	23.75	92.50	0.57	0.03	0.02
2005	10	12/29/04 8:45	12/30/04 0:15	yes	15.50	69.25	0.54	0.03	0.03
2005	11	1/1/05 3:30	1/1/05 6:45	yes	3.25	51.25	0.05	0.01	0.02
2005	12	1/2/05 13:30	1/2/05 13:45	yes	0.25	30.75	0.01	0.01	0.04
2005	13	1/5/05 15:15	1/5/05 15:30	no	0.25	73.50	0.02	0.02	0.08
2005	14	1/6/05 19:00	1/7/05 14:45	no	19.75	27.50	0.35	0.03	0.02
2005	15	1/8/05 17:00	1/8/05 19:45	yes	2.75	26.25	0.17	0.04	0.06
2005	16	1/10/05 13:30	1/10/05 13:45	no	0.25	41.75	0.01	0.01	0.04
2005	17	1/13/05 8:00	1/13/05 8:15	no	0.25	66.25	0.02	0.02	0.08
2005	18	1/16/05 2:45	1/16/05 14:00	undefined	11.25	66.50	0.21	0.02	0.02
2005	19	1/17/05 8:30	1/18/05 2:30	undefined	18.00	18.50	0.76	0.05	0.04
2005	20	1/18/05 10:00	1/18/05 15:00	undefined	5.00	7.50	0.19	0.03	0.04
2005	21	1/18/05 23:30	1/19/05 7:00	undefined	7.50	8.50	0.17	0.04	0.02
2005	22	1/20/05 11:15	1/20/05 13:45	yes	2.50	28.25	0.02	0.01	0.01
2005	23	1/22/05 20:15	1/22/05 20:30	yes	0.25	54.50	0.01	0.01	0.04
2005	24	1/26/05 23:00	1/26/05 23:15	yes	0.25	98.50	0.01	0.01	0.04
2005	25	1/28/05 21:30	1/28/05 21:45	yes	0.25	46.25	0.01	0.01	0.04
2005	26	1/30/05 8:45	1/30/05 9:30	yes	0.75	35.00	0.03	0.01	0.04
2005	27	1/31/05 3:30	1/31/05 3:45	no	0.25	18.00	0.01	0.01	0.04
2005	28	2/4/05 7:15	2/4/05 15:30	yes	8.25	99.50	0.47	0.12	0.06
2005	29	2/4/05 23:00	2/5/05 3:45	yes	4.75	7.50	0.07	0.02	0.01
2005	30	2/5/05 20:30	2/5/05 21:15	yes	0.75	16.75	0.03	0.01	0.04
2005	31	2/6/05 8:00	2/6/05 18:30	yes	10.50	10.75	0.50	0.04	0.05
2005	32	2/12/05 3:30	2/12/05 3:45	no	0.25	129.00	0.01	0.01	0.04
2005	33	2/12/05 10:00	2/12/05 18:45	yes	8.75	6.25	0.31	0.05	0.04
2005	34	2/13/05 6:00	2/13/05 8:30	yes	2.50	11.25	0.03	0.01	0.01
2005	35	2/14/05 9:00	2/14/05 9:15	no	0.25	24.50	0.02	0.02	0.08
2005	36	2/28/05 8:00	3/1/05 6:45	yes	22.75	334.75	0.12	0.01	0.01
2005	37	3/1/05 13:45	3/1/05 14:00	no	0.25	7.00	0.01	0.01	0.04

Table C.1. Summary statistics for individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Storm Duration (hours)	Storm Antecedent Dry Period (hours)	Precipitation Amount (inches)	Max Precipitation Intensity (inches/15-minutes)	Ave. Precipitation Intensity (inches/hour)
2005	38	3/9/05 9:15	3/9/05 9:30	no	0.25	187.25	0.01	0.01	0.04
2005	39	3/16/05 11:30	3/16/05 15:45	yes	4.25	170.00	0.20	0.08	0.05
2005	40	3/17/05 7:15	3/17/05 7:30	no	0.25	15.50	0.01	0.01	0.04
2005	41	3/18/05 3:30	3/18/05 5:15	yes	1.75	20.00	0.04	0.01	0.02
2005	42	3/19/05 13:15	3/20/05 19:30	yes	30.25	32.00	0.67	0.04	0.02
2005	43	3/26/05 3:00	3/27/05 9:45	yes	30.75	127.50	1.40	0.04	0.05
2005	44	3/27/05 23:45	3/28/05 0:00	no	0.25	14.00	0.01	0.01	0.04
2005	45	3/28/05 6:45	3/28/05 13:30	yes	6.75	6.75	0.05	0.02	0.01
2005	46	3/28/05 22:30	3/29/05 1:30	yes	3.00	9.00	0.07	0.01	0.02
2005	47	3/29/05 13:15	3/29/05 13:30	yes	0.25	11.75	0.04	0.04	0.16
2005	48	3/29/05 21:15	3/29/05 21:45	no	0.50	7.75	0.05	0.03	0.10
2005	49	3/30/05 21:00	3/30/05 21:15	no	0.25	23.25	0.01	0.01	0.04
2005	50	3/31/05 11:15	3/31/05 11:45	yes	0.50	14.00	0.02	0.01	0.04
2005	51	3/31/05 18:30	4/1/05 9:00	yes	14.50	6.75	0.50	0.03	0.03
2005	52	4/2/05 17:15	4/3/05 13:00	yes	19.75	32.25	0.49	0.04	0.02
2005	53	4/4/05 6:15	4/4/05 10:15	yes	4.00	17.25	0.22	0.04	0.05
2005	54	4/6/05 13:00	4/6/05 13:15	no	0.25	50.75	0.01	0.01	0.04
2005	55	4/7/05 10:00	4/7/05 18:15	yes	8.25	20.75	0.63	0.08	0.08
2005	56	4/8/05 10:15	4/8/05 10:30	yes	0.25	16.00	0.01	0.01	0.04
2005	57	4/10/05 19:15	4/11/05 3:00	yes	7.75	56.75	0.40	0.03	0.05
2005	58	4/12/05 11:45	4/12/05 14:15	yes	2.50	32.75	0.03	0.01	0.01
2005	59	4/13/05 13:30	4/13/05 13:45	no	0.25	23.25	0.01	0.01	0.04
2005	60	4/14/05 1:00	4/14/05 13:30	yes	12.50	11.25	0.09	0.03	0.01
2005	61	4/15/05 12:45	4/16/05 13:00	yes	24.25	23.25	1.23	0.13	0.05
2005	62	4/17/05 15:00	4/18/05 0:45	yes	9.75	26.00	0.44	0.05	0.05
2005	63	4/23/05 22:15	4/23/05 23:30	yes	1.25	141.50	0.03	0.02	0.02
2005	64	4/29/05 7:30	4/29/05 8:15	yes	0.75	128.00	0.03	0.01	0.04
2005	65	4/29/05 17:45	4/30/05 6:15	yes	12.50	9.50	0.06	0.01	0.00
2005	66	5/4/05 4:15	5/4/05 6:45	yes	2.50	94.00	0.03	0.01	0.01
2005	67	5/8/05 17:30	5/9/05 0:00	yes	6.50	106.75	0.08	0.02	0.01
2005	68	5/9/05 6:30	5/9/05 9:45	yes	3.25	6.50	0.04	0.02	0.01
2005	69	5/9/05 19:30	5/10/05 3:15	yes	7.75	9.75	0.39	0.04	0.05
2005	70	5/14/05 1:45	5/14/05 7:45	yes	6.00	94.50	0.06	0.02	0.01
2005	71	5/15/05 2:45	5/15/05 9:00	yes	6.25	19.00	0.69	0.16	0.11
2005	72	5/16/05 11:45	5/16/05 22:30	yes	10.75	26.75	0.17	0.06	0.02
2005	73	5/17/05 23:00	5/20/05 0:15	yes	49.25	24.50	0.73	0.06	0.01
2005	74	5/20/05 11:00	5/20/05 15:00	yes	4.00	10.75	0.03	0.02	0.01

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Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Storm Duration (hours)	Storm Antecedent Dry Period (hours)	Precipitation Amount (inches)	Max Precipitation Intensity (inches/15-minutes)	Ave. Precipitation Intensity (inches/hour)
2005	75	5/21/05 17:30	5/21/05 19:45	yes	2.25	26.50	0.10	0.02	0.04
2005	76	5/22/05 11:30	5/22/05 11:45	yes	0.25	15.75	0.01	0.01	0.04
2005	77	5/31/05 4:30	5/31/05 19:30	yes	15.00	208.75	0.97	0.39	0.06
2005	78	6/1/05 4:00	6/1/05 9:15	yes	5.25	8.50	0.16	0.05	0.03
2005	79	6/3/05 4:15	6/3/05 5:30	yes	1.25	43.00	0.02	0.01	0.02
2005	80	6/5/05 13:15	6/5/05 15:15	yes	2.00	55.75	0.06	0.01	0.03
2005	81	6/5/05 22:45	6/5/05 23:00	no	0.25	7.50	0.01	0.01	0.04
2005	82	6/6/05 15:45	6/6/05 16:00	no	0.25	16.75	0.01	0.01	0.04
2005	83	6/7/05 22:30	6/8/05 4:15	yes	5.75	30.50	0.62	0.16	0.11
2005	84	6/8/05 15:15	6/8/05 15:30	yes	0.25	11.00	0.01	0.01	0.04
2005	85	6/10/05 18:45	6/12/05 5:15	yes	34.50	51.25	0.77	0.07	0.02
2005	86	6/12/05 21:15	6/13/05 6:00	yes	8.75	16.00	0.03	0.01	0.00
2005	87	6/14/05 23:15	6/15/05 3:15	no	4.00	41.25	0.09	0.01	0.02
2005	88	6/16/05 20:45	6/17/05 7:00	yes	10.25	41.50	0.34	0.03	0.03
2005	89	6/21/05 15:30	6/21/05 17:00	no	1.50	104.50	0.03	0.01	0.02
2005	90	6/22/05 6:00	6/22/05 20:15	yes	14.25	13.00	0.60	0.08	0.04
2005	91	6/26/05 19:30	6/27/05 9:15	no	13.75	95.25	0.25	0.03	0.02
2005	92	7/2/05 1:15	7/2/05 6:15	yes	5.00	112.00	0.07	0.01	0.01
2005	93	7/5/05 18:00	7/6/05 0:15	yes	6.25	83.75	0.10	0.02	0.02
2005	94	7/8/05 5:15	7/8/05 15:30	yes	10.25	53.00	0.22	0.03	0.02
2005	95	7/15/05 12:45	7/15/05 15:45	yes	3.00	165.25	0.05	0.01	0.02
2005	96	7/16/05 0:45	7/16/05 9:00	yes	8.25	9.00	0.08	0.01	0.01
2005	97	7/22/05 6:00	7/22/05 8:30	yes	2.50	141.00	0.10	0.02	0.04
2005	98	8/1/05 7:30	8/1/05 7:45	no	0.25	239.00	0.01	0.01	0.04
2005	99	8/17/05 3:00	8/17/05 5:45	no	2.75	379.25	0.16	0.06	0.06
2005	100	8/28/05 19:00	8/28/05 23:30	yes	4.50	277.25	0.19	0.12	0.04
2005	101	8/29/05 19:15	8/29/05 19:45	no	0.50	19.75	0.02	0.01	0.04
2005	102	8/30/05 7:15	8/30/05 8:00	no	0.75	11.50	0.02	0.01	0.03
2005	103	9/4/05 8:15	9/4/05 8:30	yes	0.25	120.25	0.01	0.01	0.04
2005	104	9/5/05 8:00	9/5/05 8:15	no	0.25	23.50	0.01	0.01	0.04
2005	105	9/9/05 1:15	9/9/05 11:45	yes	10.50	89.00	0.36	0.21	0.03
2005	106	9/9/05 23:30	9/10/05 8:45	yes	9.25	11.75	0.43	0.05	0.05
2005	107	9/14/05 21:00	9/14/05 21:15	yes	0.25	108.25	0.01	0.01	0.04
2005	108	9/16/05 1:30	9/16/05 6:30	yes	5.00	28.25	0.09	0.01	0.02
2005	109	9/30/05 4:45	9/30/05 11:00	no	6.25	334.25	0.17	0.02	0.03
2006	1	10/1/05 9:00	10/1/05 19:00	yes	10.00	--	0.38	0.08	0.04

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2006	2	10/2/05 4:45	10/2/05 5:00	no	0.25	9.75	0.01	0.01	0.04
2006	3	10/2/05 11:30	10/2/05 19:30	yes	8.00	6.50	0.10	0.01	0.01
2006	4	10/6/05 13:30	10/6/05 19:15	no	5.75	90.00	0.06	0.01	0.01
2006	5	10/8/05 19:00	10/8/05 20:15	no	1.25	47.75	0.02	0.01	0.02
2006	6	10/10/05 12:45	10/10/05 13:00	no	0.25	40.50	0.01	0.01	0.04
2006	7	10/11/05 0:00	10/11/05 1:45	yes	1.75	11.00	0.02	0.01	0.01
2006	8	10/12/05 15:30	10/12/05 19:00	yes	3.50	37.75	0.04	0.01	0.01
2006	9	10/14/05 20:15	10/15/05 1:30	yes	5.25	49.25	0.34	0.03	0.06
2006	10	10/16/05 5:00	10/16/05 8:30	yes	3.50	27.50	0.03	0.01	0.01
2006	11	10/17/05 0:00	10/17/05 5:45	no	5.75	15.50	0.02	0.01	0.00
2006	12	10/19/05 1:00	10/19/05 12:45	yes	11.75	43.25	0.06	0.01	0.01
2006	13	10/23/05 6:45	10/23/05 16:45	no	10.00	90.00	0.20	0.02	0.02
2006	14	10/25/05 17:30	10/25/05 18:45	no	1.25	48.75	0.03	0.01	0.02
2006	15	10/26/05 1:30	10/26/05 2:00	no	0.50	6.75	0.03	0.02	0.06
2006	16	10/26/05 8:30	10/26/05 8:45	no	0.25	6.50	0.01	0.01	0.04
2006	17	10/27/05 21:30	10/28/05 7:00	yes	9.50	36.75	0.18	0.03	0.02
2006	18	10/28/05 18:15	10/28/05 18:30	no	0.25	11.25	0.01	0.01	0.04
2006	19	10/29/05 2:15	10/29/05 3:15	yes	1.00	7.75	0.02	0.01	0.02
2006	20	10/29/05 15:00	10/29/05 17:30	yes	2.50	11.75	0.19	0.05	0.08
2006	21	10/30/05 0:30	10/30/05 0:45	no	0.25	7.00	0.01	0.01	0.04
2006	22	10/30/05 19:45	10/31/05 19:00	yes	23.25 J	18.99 J	0.80 J	0.05 J	0.03 J
2006	23	11/1/05 8:00	11/1/05 19:45	yes	11.75 J	13.00 J	0.38 J	0.04 J	0.03 J
2006	24	11/2/05 9:30	11/2/05 9:45	no	0.25	13.75	0.01	0.01	0.04
2006	25	11/2/05 17:30	11/3/05 20:00	yes	26.50	7.75	0.77	0.06	0.03
2006	26	11/4/05 10:00	11/4/05 14:45	yes	4.75	14.00	0.27	0.07	0.06
2006	27	11/5/05 8:45	11/6/05 0:00	yes	15.25	18.00	0.89	0.06	0.06
2006	28	11/7/05 3:15	11/7/05 6:15	yes	3.00	27.25	0.07	0.02	0.02
2006	29	11/10/05 13:30	11/10/05 18:15	yes	4.75	79.25	0.08	0.02	0.02
2006	30	11/11/05 10:00	11/11/05 14:30	yes	4.50	15.75	0.07	0.01	0.02
2006	31	11/12/05 23:00	11/13/05 19:45	yes	20.75	32.50	0.38	0.04	0.02

Table C.1. Summary statistics for individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Storm Duration (hours)	Storm Antecedent Dry Period (hours)	Precipitation Amount (inches)	Max Precipitation Intensity (inches/15-minutes)	Ave. Precipitation Intensity (inches/hour)
2006	32	11/14/05 4:45	11/14/05 5:15	yes	0.50	9.00	0.02	0.01	0.04
2006	33	11/24/05 16:00	11/25/05 22:30	yes	30.50	250.75	1.02	0.05	0.03
2006	34	11/26/05 8:30	11/26/05 8:45	no	0.25	10.00	0.01	0.01	0.04
2006	35	11/27/05 2:15	11/27/05 11:15	yes	9.00	17.50	0.15	0.02	0.02
2006	36	11/28/05 22:00	11/30/05 3:30	no	29.50	34.75	0.48	0.05	0.02
2006	37	12/1/05 12:45	12/1/05 13:30	no	0.75	33.25	0.02	0.01	0.03
2006	38	12/2/05 12:30	12/2/05 14:45	yes	2.25	23.00	0.22	0.04	0.10
2006	39	12/3/05 13:30	12/3/05 17:00	yes	3.50	22.75	0.26	0.05	0.07
2006	40	12/4/05 11:30	12/4/05 17:00	yes	5.50	18.50	0.05	0.01	0.01
2006	41	12/6/05 1:00	12/6/05 6:00	yes	5.00	32.00	0.02	0.01	0.00
2006	42	12/12/05 14:30	12/12/05 14:45	no	0.25	152.50	0.01	0.01	0.04
2006	43	12/15/05 10:15	12/15/05 10:30	no	0.25	67.50	0.01	0.01	0.04
2006	44	12/19/05 3:30	12/19/05 10:45	yes	7.25	89.00	0.08	0.04	0.01
2006	45	12/19/05 22:15	12/22/05 10:00	yes	59.75	11.50	1.40	0.04	0.02
2006	46	12/22/05 18:15	12/22/05 18:30	no	0.25	8.25	0.01	0.01	0.04
2006	47	12/23/05 14:00	12/24/05 11:45	yes	21.75	19.50	0.92	0.09	0.04
2006	48	12/24/05 22:15	12/25/05 7:30	yes	9.25	10.50	0.80	0.09	0.09
2006	49	12/25/05 13:45	12/26/05 10:15	yes	20.50	6.25	0.34	0.02	0.02
2006	50	12/27/05 0:30	12/27/05 8:15	yes	7.75	14.25	0.38	0.02	0.05
2006	51	12/28/05 3:30	12/28/05 12:00	yes	8.50	19.25	0.46	0.03	0.05
2006	52	12/29/05 20:45	12/30/05 5:15	yes	8.50	32.75	0.13	0.01	0.02
2006	53	12/30/05 11:45	12/31/05 6:30	yes	18.75	6.50	0.75	0.07	0.04
2006	54	1/1/06 7:15	1/1/06 10:30	yes	3.25	24.75	0.06	0.02	0.02
2006	55	1/1/06 16:30	1/1/06 21:30	yes	5.00	6.00	0.18	0.04	0.04
2006	56	1/2/06 5:15	1/2/06 20:30	yes	15.25	7.75	0.28	0.02	0.02
2006	57	1/3/06 12:00	1/3/06 23:30	yes	11.50	15.50	0.10	0.01	0.01
2006	58	1/5/06 7:30	1/6/06 0:00	yes	16.50	32.00	1.06	0.07	0.06
2006	59	1/6/06 9:15	1/6/06 9:30	no	0.25	9.25	0.01	0.01	0.04
2006	60	1/6/06 23:00	1/6/06 23:15	no	0.25	13.50	0.01	0.01	0.04
2006	61	1/7/06 6:30	1/7/06 15:45	yes	9.25	7.25	0.16	0.05	0.02

Table C.1. Summary statistics for individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Storm Duration (hours)	Storm Antecedent Dry Period (hours)	Precipitation Amount (inches)	Max Precipitation Intensity (inches/15-minutes)	Ave. Precipitation Intensity (inches/hour)
2006	62	1/8/06 15:45	1/11/06 0:15	yes	56.50	24.00	1.45	0.11	0.03
2006	63	1/12/06 11:15	1/13/06 23:15	yes	36.00 J	35.00 J	0.65 J	0.03 J	0.02 J
2006	64	1/14/06 6:30	1/14/06 20:30	yes	14.00	7.25	0.36	0.04	0.03
2006	65	1/15/06 16:30	1/15/06 16:45	no	0.25	20.00	0.01	0.01	0.04
2006	66	1/16/06 2:30	1/16/06 22:45	yes	20.25	9.75	0.61	0.06	0.03
2006	67	1/18/06 0:15	1/18/06 1:15	yes	1.00	25.50	0.06	0.02	0.06
2006	68	1/18/06 8:00	1/18/06 8:15	no	0.25	6.75	0.01	0.01	0.04
2006	69	1/18/06 23:15	1/19/06 5:00	yes	5.75	15.00	0.07	0.03	0.01
2006	70	1/19/06 22:30	1/20/06 10:15	yes	11.75	17.50	0.27	0.02	0.02
2006	71	1/21/06 3:15	1/21/06 11:45	no	8.50	17.00	0.04	0.01	0.00
2006	72	1/22/06 11:15	1/22/06 11:30	no	0.25	23.50	0.01	0.01	0.04
2006	73	1/22/06 21:00	1/23/06 0:15	yes	3.25	9.50	0.06	0.01	0.02
2006	74	1/23/06 6:15	1/23/06 10:15	yes	4.00	6.00	0.03	0.01	0.01
2006	75	1/24/06 6:45	1/24/06 7:00	no	0.25	20.50	0.01	0.01	0.04
2006	76	1/25/06 18:00	1/25/06 19:00	yes	1.00	35.00	0.21	0.1	0.21
2006	77	1/26/06 16:00	1/26/06 21:00	yes	5.00	21.00	0.08	0.02	0.02
2006	78	1/27/06 20:00	1/28/06 5:30	yes	9.50	23.00	0.49	0.04	0.05
2006	79	1/29/06 12:45	1/30/06 12:00	yes	23.25	31.25	2.39	0.1	0.10
2006	80	1/31/06 13:45	1/31/06 21:30	yes	7.75	25.75	0.20	0.02	0.03
2006	81	2/1/06 16:15	2/2/06 2:30	yes	10.25	18.75	0.27	0.06	0.03
2006	82	2/2/06 15:45	2/2/06 20:00	yes	4.25	13.25	0.24	0.04	0.06
2006	83	2/3/06 14:30	2/4/06 9:45	yes	19.25	18.50	0.74	0.17	0.04
2006	84	2/8/06 4:30	2/8/06 6:45	yes	2.25	90.75	0.03	0.01	0.01
2006	85	2/13/06 2:00	2/13/06 8:15	yes	6.25	115.25	0.19	0.03	0.03
2006	86	2/14/06 2:00	2/14/06 3:45	yes	1.75	17.75	0.03	0.01	0.02
2006	87	2/14/06 10:45	2/14/06 11:30	yes	0.75	7.00	0.12	0.07	0.16
2006	88	2/21/06 16:45	2/21/06 17:00	no	0.25	173.25	0.01	0.01	0.04
2006	89	2/22/06 8:00	2/22/06 8:15	no	0.25	15.00	0.01	0.01	0.04
2006	90	2/22/06 15:30	2/22/06 19:45	yes	4.25	7.25	0.17	0.02	0.04
2006	91	2/23/06 2:00	2/23/06 14:00	yes	12.00	6.25	0.59	0.05	0.05

Table C.1. Summary statistics for individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Storm Duration (hours)	Storm Antecedent Dry Period (hours)	Precipitation Amount (inches)	Max Precipitation Intensity (inches/15-minutes)	Ave. Precipitation Intensity (inches/hour)
2006	92	2/26/06 16:00	2/27/06 2:30	yes	10.50	74.00	0.08	0.01	0.01
2006	93	2/27/06 22:15	2/28/06 12:45	yes	14.50	19.75	0.46	0.02	0.03
2006	94	3/2/06 3:45	3/2/06 7:00	yes	3.25	39.00	0.08	0.01	0.02
2006	95	3/5/06 8:15	3/5/06 8:45	no	0.50	73.25	0.02	0.01	0.04
2006	96	3/6/06 19:00	3/6/06 21:15	no	2.25	34.25	0.02	0.01	0.01
2006	97	3/7/06 10:00	3/7/06 18:30	yes	8.50	12.75	0.17	0.03	0.02
2006	98	3/8/06 3:45	3/8/06 20:45	yes	17.00	9.25	0.58	0.04	0.03
2006	99	3/9/06 22:45	3/9/06 23:00	no	0.25	26.00	0.01	0.01	0.04
2006	100	3/10/06 19:15	3/10/06 20:45	no	1.50	20.25	0.05	0.02	0.03
2006	101	3/15/06 6:45	3/15/06 19:30	yes	12.75	106.00	0.07	0.03	0.01
2006	102	3/16/06 8:30	3/16/06 13:45	yes	5.25	13.00	0.06	0.02	0.01
2006	103	3/17/06 8:15	3/17/06 8:30	no	0.25	18.50	0.01	0.01	0.04
2006	104	3/17/06 22:00	3/17/06 22:30	yes	0.50	13.50	0.08	0.05	0.16
2006	105	3/18/06 12:15	3/18/06 12:30	no	0.25	13.75	0.01	0.01	0.04
2006	106	3/21/06 15:30	3/22/06 19:00	yes	27.50	75.00	0.27	0.02	0.01
2006	107	3/24/06 3:00	3/24/06 15:15	yes	12.25	32.00	0.26	0.04	0.02
2006	108	3/25/06 22:15	3/25/06 22:30	no	0.25	31.00	0.01	0.01	0.04
2006	109	3/28/06 2:30	3/28/06 8:00	yes	5.50	52.00	0.15	0.02	0.03
2006	110	3/31/06 3:15	3/31/06 9:30	no	6.25	67.25	0.04	0.01	0.01
2006	111	4/1/06 4:00	4/1/06 11:45	yes	7.75	18.50	0.58	0.04	0.07
2006	112	4/3/06 14:30	4/3/06 19:30	yes	5.00	50.75	0.12	0.03	0.02
2006	113	4/5/06 22:15	4/5/06 22:45	yes	0.50	50.75	0.04	0.03	0.08
2006	114	4/8/06 13:30	4/9/06 15:45	yes	26.25	62.75	0.45	0.02	0.02
2006	115	4/12/06 7:15	4/12/06 12:15	no	5.00	63.50	0.02	0.01	0.00
2006	116	4/13/06 9:45	4/13/06 10:00	no	0.25	21.50	0.01	0.01	0.04
2006	117	4/13/06 20:30	4/13/06 23:30	yes	3.00	10.50	0.04	0.01	0.01
2006	118	4/14/06 6:45	4/14/06 7:45	yes	1.00	7.25	0.06	0.02	0.06
2006	119	4/14/06 17:15	4/14/06 17:30	yes	0.25	9.50	0.04	0.04	0.16
2006	120	4/15/06 3:00	4/16/06 6:45	yes	27.75	9.50	0.43	0.07	0.02
2006	121	4/17/06 20:30	4/17/06 20:45	no	0.25	37.75	0.01	0.01	0.04

Table C.1. Summary statistics for individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Storm Duration (hours)	Storm Antecedent Dry Period (hours)	Precipitation Amount (inches)	Max Precipitation Intensity (inches/15-minutes)	Ave. Precipitation Intensity (inches/hour)
2006	122	4/20/06 21:30	4/21/06 10:15	no	12.75	72.75	0.33	0.02	0.03
2006	123	4/29/06 11:30	4/29/06 16:30	yes	5.00	193.25	0.47	0.06	0.09
2006	124	5/1/06 9:45	5/1/06 10:00	no	0.25	41.25	0.01	0.01	0.04
2006	125	5/6/06 22:00	5/7/06 0:30	no	2.50	132.00	0.05	0.01	0.02
2006	126	5/7/06 13:30	5/8/06 0:45	no	11.25	13.00	0.25	0.04	0.02
2006	127	5/11/06 15:15	5/11/06 15:30	no	0.25	86.50	0.01	0.01	0.04
2006	128	5/11/06 23:00	5/12/06 9:15	no	10.25	7.50	0.09	0.01	0.01
2006	129	5/19/06 16:00	5/19/06 19:00	no	3.00	174.75	0.03	0.01	0.01
2006	130	5/20/06 1:30	5/20/06 1:45	no	0.25	6.50	0.01	0.01	0.04
2006	131	5/21/06 16:30	5/21/06 17:15	yes	0.75	38.75	0.07	0.05	0.09
2006	132	5/22/06 1:00	5/22/06 6:45	no	5.75	7.75	0.06	0.01	0.01
2006	133	5/23/06 8:15	5/23/06 10:30	yes	2.25	25.50	0.13	0.05	0.06
2006	134	5/23/06 22:30	5/24/06 15:30	no	17.00	12.00	0.10	0.01	0.01
2006	135	5/26/06 2:00	5/26/06 6:30	no	4.50	34.50	0.03	0.01	0.01
2006	136	5/26/06 13:30	5/26/06 13:45	yes	0.25	7.00	0.01	0.01	0.04
2006	137	5/26/06 21:15	5/27/06 5:30	yes	8.25	7.50	0.17	0.02	0.02
2006	138	5/27/06 11:45	5/28/06 15:00	yes	27.25	6.25	1.01	0.14	0.04
2006	139	5/29/06 5:45	5/29/06 6:00	no	0.25	14.75	0.01	0.01	0.04
2006	140	5/31/06 18:45	5/31/06 23:15	yes	4.50	60.75	0.08	0.01	0.02
2006	141	6/1/06 12:00	6/2/06 5:15	yes	17.25	12.75	0.19	0.03	0.01
2006	142	6/2/06 11:45	6/2/06 14:30	no	2.75	6.50	0.02	0.01	0.01
2006	143	6/4/06 0:30	6/4/06 11:30	yes	11.00	34.00	0.44	0.06	0.04
2006	144	6/8/06 18:45	6/9/06 8:15	yes	13.50	103.25	0.36	0.05	0.03
2006	145	6/10/06 10:45	6/10/06 11:00	no	0.25	26.50	0.01	0.01	0.04
2006	146	6/12/06 7:45	6/12/06 9:15	no	1.50	44.75	0.02	0.01	0.01
2006	147	6/12/06 20:30	6/13/06 2:00	yes	5.50	11.25	0.25	0.06	0.05
2006	148	6/16/06 10:45	6/16/06 12:45	yes	2.00	80.75	0.06	0.03	0.03
2006	149	7/4/06 5:15	7/4/06 6:15	no	1.00	424.50	0.02	0.01	0.02
2006	150	7/6/06 16:15	7/6/06 16:30	no	0.25	58.00	0.01	0.01	0.04
2006	151	7/12/06 9:30	7/12/06 10:00	no	0.50	137.00	0.02	0.01	0.04

Table C.1. Summary statistics for individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Storm Duration (hours)	Storm Antecedent Dry Period (hours)	Precipitation Amount (inches)	Max Precipitation Intensity (inches/15-minutes)	Ave. Precipitation Intensity (inches/hour)
2006	152	7/13/06 17:45	7/13/06 18:00	no	0.25	31.75	0.01	0.01	0.04
2006	153	7/30/06 11:00	7/30/06 12:30	no	1.50	401.00	0.04	0.01	0.03
2006	154	8/29/06 8:15	8/30/06 10:45	yes	26.50	715.75	0.57	0.09	0.02
2006	155	9/9/06 1:30	9/9/06 11:00	yes	9.50	230.75	0.25	0.04	0.03
2006	156	9/13/06 9:15	9/13/06 9:30	no	0.25	94.25	0.01	0.01	0.04
2006	157	9/14/06 0:00	9/14/06 7:45	yes	7.75	14.50	0.44	0.13	0.06
2006	158	9/18/06 0:15	9/18/06 5:45	yes	5.50	88.50	0.20	0.03	0.04
2006	159	9/19/06 2:45	9/19/06 6:30	yes	3.75	21.00	0.11	0.02	0.03
2006	160	9/20/06 8:45	9/20/06 21:30	yes	12.75	26.25	0.16	0.02	0.01
2006	161	9/21/06 10:15	9/21/06 10:30	yes	0.25	12.75	0.01	0.01	0.04

J: estimated value based on quality assurance review

R: data rejected based on quality assurance review

nd: no data are available for specified event

Table C.2. Raw runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Runoff Volume (cf)	VFS Runoff Volume (cf)	CAVFS1 Runoff Volume (cf)	CAVFS2 Runoff Volume (cf)
2005	1	12/9/04 16:45	12/11/04 5:45	yes	1,092.58	R	R	R
2005	2	12/11/04 13:15	12/11/04 13:30	yes	0.50	1.14	R	R
2005	3	12/13/04 12:15	12/14/04 10:15	yes	285.96	72.50	R	6.08
2005	4	12/16/04 20:45	12/16/04 22:45	yes	73.76	8.36	0.00	0.22
2005	5	12/17/04 9:15	12/17/04 9:30	no	0.00	0.00	0.00	0.00
2005	6	12/18/04 3:15	12/18/04 3:30	yes	2.21	0.56	0.00	0.00
2005	7	12/19/04 12:15	12/19/04 12:45	yes	41.99	7.35	0.00	0.48
2005	8	12/21/04 8:45	12/21/04 15:15	yes	188.02	37.72	0.00	2.57
2005	9	12/25/04 11:45	12/26/04 11:30	yes	565.27	240.89	0.00	9.51
2005	10	12/29/04 8:45	12/30/04 0:15	yes	544.23	328.12	0.00	4.89
2005	11	1/1/05 3:30	1/1/05 6:45	yes	69.85	9.95	0.00	2.09
2005	12	1/2/05 13:30	1/2/05 13:45	yes	1.36	0.00	0.03	0.26
2005	13	1/5/05 15:15	1/5/05 15:30	no	R	R	R	0.00
2005	14	1/6/05 19:00	1/7/05 14:45	no	R	0.00	R	R
2005	15	1/8/05 17:00	1/8/05 19:45	yes	0.58	0.00	R	0.86
2005	16	1/10/05 13:30	1/10/05 13:45	no	nd	nd	nd	nd
2005	17	1/13/05 8:00	1/13/05 8:15	no	nd	nd	nd	nd
2005	18	1/16/05 2:45	1/16/05 14:00	undefined	nd	nd	nd	nd
2005	19	1/17/05 8:30	1/18/05 2:30	undefined	nd	nd	nd	nd
2005	20	1/18/05 10:00	1/18/05 15:00	undefined	nd	nd	nd	nd
2005	21	1/18/05 23:30	1/19/05 7:00	undefined	nd	nd	nd	nd
2005	22	1/20/05 11:15	1/20/05 13:45	yes	5.43	0.03	0.00	nd
2005	23	1/22/05 20:15	1/22/05 20:30	yes	1.35	0.00	0.00	nd
2005	24	1/26/05 23:00	1/26/05 23:15	yes	0.01	0.00	0.00	nd
2005	25	1/28/05 21:30	1/28/05 21:45	yes	1.36	0.00	0.00	nd
2005	26	1/30/05 8:45	1/30/05 9:30	yes	11.10	0.00	0.00	nd
2005	27	1/31/05 3:30	1/31/05 3:45	no	0.00	0.00	0.00	nd
2005	28	2/4/05 7:15	2/4/05 15:30	yes	157.77	63.06	0.00	1.50
2005	29	2/4/05 23:00	2/5/05 3:45	yes	19.47	0.00	0.00	0.00
2005	30	2/5/05 20:30	2/5/05 21:15	yes	19.31	0.00	0.00	0.00
2005	31	2/6/05 8:00	2/6/05 18:30	yes	210.06	243.33	0.26	29.26
2005	32	2/12/05 3:30	2/12/05 3:45	no	0.00	0.00	0.00	0.00
2005	33	2/12/05 10:00	2/12/05 18:45	yes	108.06	19.26	0.00	0.24
2005	34	2/13/05 6:00	2/13/05 8:30	yes	0.41	0.00	0.00	0.00
2005	35	2/14/05 9:00	2/14/05 9:15	no	0.00	0.00	0.00	0.00
2005	36	2/28/05 8:00	3/1/05 6:45	yes	18.56	0.00	0.00	0.00
2005	37	3/1/05 13:45	3/1/05 14:00	no	0.00	0.00	0.00	0.00

Table C.2. Raw runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Runoff Volume (cf)	VFS Runoff Volume (cf)	CAVFS1 Runoff Volume (cf)	CAVFS2 Runoff Volume (cf)
2005	38	3/9/05 9:15	3/9/05 9:30	no	0.00	0.00	0.00	0.00
2005	39	3/16/05 11:30	3/16/05 15:45	yes	37.03	0.00	0.00	nd
2005	40	3/17/05 7:15	3/17/05 7:30	no	0.00	0.00	0.00	nd
2005	41	3/18/05 3:30	3/18/05 5:15	yes	4.08	0.00	0.00	nd
2005	42	3/19/05 13:15	3/20/05 19:30	yes	181.29	114.13	28.31	27.95
2005	43	3/26/05 3:00	3/27/05 9:45	yes	470.81	R	0.00	192.62
2005	44	3/27/05 23:45	3/28/05 0:00	no	0.00	0.00	0.00	0.00
2005	45	3/28/05 6:45	3/28/05 13:30	yes	4.37	0.00	0.00	0.00
2005	46	3/28/05 22:30	3/29/05 1:30	yes	23.68	0.00	0.00	0.00
2005	47	3/29/05 13:15	3/29/05 13:30	yes	7.51	0.00	nd	0.89
2005	48	3/29/05 21:15	3/29/05 21:45	no	0.00	nd	nd	0.00
2005	49	3/30/05 21:00	3/30/05 21:15	no	0.00	nd	nd	0.00
2005	50	3/31/05 11:15	3/31/05 11:45	yes	0.26	0.00	nd	0.05
2005	51	3/31/05 18:30	4/1/05 9:00	yes	173.99	R	20.96	20.30
2005	52	4/2/05 17:15	4/3/05 13:00	yes	144.18	nd	18.80	11.75
2005	53	4/4/05 6:15	4/4/05 10:15	yes	64.72	nd	12.25	33.42
2005	54	4/6/05 13:00	4/6/05 13:15	no	0.00	0.00	0.00	0.00
2005	55	4/7/05 10:00	4/7/05 18:15	yes	180.98	406.96	14.32	158.62
2005	56	4/8/05 10:15	4/8/05 10:30	yes	0.26	0.01	0.47	0.00
2005	57	4/10/05 19:15	4/11/05 3:00	yes	115.17	107.44	17.41	19.04
2005	58	4/12/05 11:45	4/12/05 14:15	yes	4.37	0.00	0.00	0.00
2005	59	4/13/05 13:30	4/13/05 13:45	no	0.00	0.00	0.00	0.00
2005	60	4/14/05 1:00	4/14/05 13:30	yes	17.61	0.00	5.46	0.00
2005	61	4/15/05 12:45	4/16/05 13:00	yes	459.17	R	233.79	509.67
2005	62	4/17/05 15:00	4/18/05 0:45	yes	165.08	153.53	27.62	56.82
2005	63	4/23/05 22:15	4/23/05 23:30	yes	15.35	0.00	0.00	0.00
2005	64	4/29/05 7:30	4/29/05 8:15	yes	14.48	0.00	0.00	0.00
2005	65	4/29/05 17:45	4/30/05 6:15	yes	6.35	0.00	0.00	0.00
2005	66	5/4/05 4:15	5/4/05 6:45	yes	0.22	0.00	0.00	0.00
2005	67	5/8/05 17:30	5/9/05 0:00	yes	17.06	0.00	0.00	0.00
2005	68	5/9/05 6:30	5/9/05 9:45	yes	1.44	0.00	0.00	0.00
2005	69	5/9/05 19:30	5/10/05 3:15	yes	100.38	0.00	0.00	36.28
2005	70	5/14/05 1:45	5/14/05 7:45	yes	15.22	R	0.00	7.20
2005	71	5/15/05 2:45	5/15/05 9:00	yes	173.21	R	89.06	345.55
2005	72	5/16/05 11:45	5/16/05 22:30	yes	44.76	3.08	10.06	1.22
2005	73	5/17/05 23:00	5/20/05 0:15	yes	247.40	0.00	6.47	38.78
2005	74	5/20/05 11:00	5/20/05 15:00	yes	4.86	0.00	0.00	0.67

Table C.2. Raw runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Runoff Volume (cf)	VFS Runoff Volume (cf)	CAVFS1 Runoff Volume (cf)	CAVFS2 Runoff Volume (cf)
2005	75	5/21/05 17:30	5/21/05 19:45	yes	44.03	0.00	0.00	1.26
2005	76	5/22/05 11:30	5/22/05 11:45	yes	0.11	0.00	0.00	0.03
2005	77	5/31/05 4:30	5/31/05 19:30	yes	191.87	465.92	80.87	394.31
2005	78	6/1/05 4:00	6/1/05 9:15	yes	30.37	6.90	4.31	6.14
2005	79	6/3/05 4:15	6/3/05 5:30	yes	0.29	0.00	0.00	0.00
2005	80	6/5/05 13:15	6/5/05 15:15	yes	4.86	0.00	0.00	0.00
2005	81	6/5/05 22:45	6/5/05 23:00	no	0.00	0.00	0.00	0.00
2005	82	6/6/05 15:45	6/6/05 16:00	no	0.00	0.00	0.00	0.00
2005	83	6/7/05 22:30	6/8/05 4:15	yes	182.87	374.46	61.13	268.08
2005	84	6/8/05 15:15	6/8/05 15:30	yes	0.15	0.34	0.34	0.41
2005	85	6/10/05 18:45	6/12/05 5:15	yes	179.99	94.59	34.82	61.34
2005	86	6/12/05 21:15	6/13/05 6:00	yes	1.45	0.05	0.00	0.02
2005	87	6/14/05 23:15	6/15/05 3:15	no	nd	0.00	0.00	0.00
2005	88	6/16/05 20:45	6/17/05 7:00	yes	nd	11.13	7.98	16.49
2005	89	6/21/05 15:30	6/21/05 17:00	no	nd	0.00	0.00	0.00
2005	90	6/22/05 6:00	6/22/05 20:15	yes	nd	124.68	0.26	89.48
2005	91	6/26/05 19:30	6/27/05 9:15	no	nd	0.00	0.00	0.00
2005	92	7/2/05 1:15	7/2/05 6:15	yes	18.84	0.00	0.00	0.00
2005	93	7/5/05 18:00	7/6/05 0:15	yes	15.37	0.00	0.00	0.00
2005	94	7/8/05 5:15	7/8/05 15:30	yes	22.31	0.00	0.00	0.00
2005	95	7/15/05 12:45	7/15/05 15:45	yes	2.20	0.00	0.00	0.00
2005	96	7/16/05 0:45	7/16/05 9:00	yes	1.03	0.00	0.00	0.00
2005	97	7/22/05 6:00	7/22/05 8:30	yes	5.09	0.00	0.00	0.00
2005	98	8/1/05 7:30	8/1/05 7:45	no	0.00	0.00	0.00	0.00
2005	99	8/17/05 3:00	8/17/05 5:45	no	nd	0.00	0.00	0.00
2005	100	8/28/05 19:00	8/28/05 23:30	yes	nd	1.91	0.00	0.00
2005	101	8/29/05 19:15	8/29/05 19:45	no	0.00	0.00	0.00	0.00
2005	102	8/30/05 7:15	8/30/05 8:00	no	0.00	0.00	0.00	0.00
2005	103	9/4/05 8:15	9/4/05 8:30	yes	18.53	0.00	0.00	0.00
2005	104	9/5/05 8:00	9/5/05 8:15	no	0.00	0.00	0.00	0.00
2005	105	9/9/05 1:15	9/9/05 11:45	yes	154.74	R	0.00	R
2005	106	9/9/05 23:30	9/10/05 8:45	yes	111.26	R	0.00	3.21
2005	107	9/14/05 21:00	9/14/05 21:15	yes	1.13	0.00	0.00	0.00
2005	108	9/16/05 1:30	9/16/05 6:30	yes	9.89	0.00	0.00	0.00
2005	109	9/30/05 4:45	9/30/05 11:00	no	0.00	0.00	nd	1.09
2006	1	10/1/05 9:00	10/1/05 19:00	yes	140.63	6.72	3.11	7.91

Table C.2. Raw runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Runoff Volume (cf)	VFS Runoff Volume (cf)	CAVFS1 Runoff Volume (cf)	CAVFS2 Runoff Volume (cf)
2006	2	10/2/05 4:45	10/2/05 5:00	no	0.00	0.00	0.00	0.00
2006	3	10/2/05 11:30	10/2/05 19:30	yes	15.69	0.00	0.00	0.00
2006	4	10/6/05 13:30	10/6/05 19:15	no	0.00	0.00	0.00	0.00
2006	5	10/8/05 19:00	10/8/05 20:15	no	0.00	0.00	0.00	0.00
2006	6	10/10/05 12:45	10/10/05 13:00	no	0.00	0.00	0.00	0.00
2006	7	10/11/05 0:00	10/11/05 1:45	yes	2.21	0.00	0.00	0.00
2006	8	10/12/05 15:30	10/12/05 19:00	yes	1.05	0.00	0.00	0.00
2006	9	10/14/05 20:15	10/15/05 1:30	yes	87.14	0.00	0.00	0.00
2006	10	10/16/05 5:00	10/16/05 8:30	yes	2.21	0.00	0.00	0.00
2006	11	10/17/05 0:00	10/17/05 5:45	no	0.00	0.00	0.00	0.00
2006	12	10/19/05 1:00	10/19/05 12:45	yes	4.95	2.43	0.29	0.29
2006	13	10/23/05 6:45	10/23/05 16:45	no	0.00	0.00	R	0.00
2006	14	10/25/05 17:30	10/25/05 18:45	no	0.00	0.00	0.00	0.00
2006	15	10/26/05 1:30	10/26/05 2:00	no	0.00	0.00	0.00	0.00
2006	16	10/26/05 8:30	10/26/05 8:45	no	0.00	0.00	0.00	0.00
2006	17	10/27/05 21:30	10/28/05 7:00	yes	38.08	0.00	0.00	0.00
2006	18	10/28/05 18:15	10/28/05 18:30	no	0.00	0.00	0.00	0.00
2006	19	10/29/05 2:15	10/29/05 3:15	yes	2.32	0.00	0.00	0.00
2006	20	10/29/05 15:00	10/29/05 17:30	yes	41.00	0.00	0.00	4.21
2006	21	10/30/05 0:30	10/30/05 0:45	no	0.00	0.00	0.00	0.00
2006	22	10/30/05 19:45	10/31/05 19:00	yes	146.66 J	1.17 J	R	R
2006	23	11/1/05 8:00	11/1/05 19:45	yes	129.75 J	16.77 J	nd	R
2006	24	11/2/05 9:30	11/2/05 9:45	no	0.00	0.00	0.00	0.00
2006	25	11/2/05 17:30	11/3/05 20:00	yes	213.65	60.87	0.50	5.21
2006	26	11/4/05 10:00	11/4/05 14:45	yes	92.57	26.76	0.00	6.89
2006	27	11/5/05 8:45	11/6/05 0:00	yes	317.27	278.24	0.43	107.93
2006	28	11/7/05 3:15	11/7/05 6:15	yes	16.86	0.00	0.00	0.00
2006	29	11/10/05 13:30	11/10/05 18:15	yes	18.45	0.00	0.00	0.00
2006	30	11/11/05 10:00	11/11/05 14:30	yes	6.39	0.00	0.00	0.00
2006	31	11/12/05 23:00	11/13/05 19:45	yes	106.36	0.26	0.24	0.50

Table C.2. Raw runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Runoff Volume (cf)	VFS Runoff Volume (cf)	CAVFS1 Runoff Volume (cf)	CAVFS2 Runoff Volume (cf)
2006	32	11/14/05 4:45	11/14/05 5:15	yes	7.78	0.00	0.00	0.00
2006	33	11/24/05 16:00	11/25/05 22:30	yes	348.13	80.55	0.22	13.56
2006	34	11/26/05 8:30	11/26/05 8:45	no	0.00	0.00	0.00	0.00
2006	35	11/27/05 2:15	11/27/05 11:15	yes	47.62	0.00	0.00	0.00
2006	36	11/28/05 22:00	11/30/05 3:30	no	nd	0.00	0.00	0.00
2006	37	12/1/05 12:45	12/1/05 13:30	no	R	0.00	0.00	0.00
2006	38	12/2/05 12:30	12/2/05 14:45	yes	0.34	0.00	0.00	0.56
2006	39	12/3/05 13:30	12/3/05 17:00	yes	1.12	0.00	0.00	R
2006	40	12/4/05 11:30	12/4/05 17:00	yes	0.95	0.00	0.00	0.00
2006	41	12/6/05 1:00	12/6/05 6:00	yes	4.35	0.00	0.00	0.00
2006	42	12/12/05 14:30	12/12/05 14:45	no	0.00	0.00	0.00	0.00
2006	43	12/15/05 10:15	12/15/05 10:30	no	0.00	0.00	0.00	0.00
2006	44	12/19/05 3:30	12/19/05 10:45	yes	51.50	0.00	0.00	0.00
2006	45	12/19/05 22:15	12/22/05 10:00	yes	259.59	161.69	35.20	157.91
2006	46	12/22/05 18:15	12/22/05 18:30	no	0.00	R	0.00	R
2006	47	12/23/05 14:00	12/24/05 11:45	yes	309.26	251.15	2.28	253.15
2006	48	12/24/05 22:15	12/25/05 7:30	yes	344.96	273.50	0.50	245.58
2006	49	12/25/05 13:45	12/26/05 10:15	yes	43.74	0.00	0.00	0.00
2006	50	12/27/05 0:30	12/27/05 8:15	yes	84.58	7.52	0.00	0.94
2006	51	12/28/05 3:30	12/28/05 12:00	yes	77.57	80.96	0.26	12.06
2006	52	12/29/05 20:45	12/30/05 5:15	yes	16.79	10.70	12.01	1.07
2006	53	12/30/05 11:45	12/31/05 6:30	yes	208.59	185.50	25.63	44.74
2006	54	1/1/06 7:15	1/1/06 10:30	yes	14.50	9.40	5.92	0.91
2006	55	1/1/06 16:30	1/1/06 21:30	yes	51.51	14.66	8.90	6.74
2006	56	1/2/06 5:15	1/2/06 20:30	yes	55.05	28.33	20.60	6.38
2006	57	1/3/06 12:00	1/3/06 23:30	yes	14.99	13.86	8.15	1.65
2006	58	1/5/06 7:30	1/6/06 0:00	yes	268.92	245.35	9.22	69.01
2006	59	1/6/06 9:15	1/6/06 9:30	no	0.00	0.00	0.00	0.00
2006	60	1/6/06 23:00	1/6/06 23:15	no	0.00	0.00	0.00	R
2006	61	1/7/06 6:30	1/7/06 15:45	yes	24.55	1.91	1.75	6.80

Table C.2. Raw runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Runoff Volume (cf)	VFS Runoff Volume (cf)	CAVFS1 Runoff Volume (cf)	CAVFS2 Runoff Volume (cf)
2006	62	1/8/06 15:45	1/11/06 0:15	yes	250.97	322.07	28.73	124.16
2006	63	1/12/06 11:15	1/13/06 23:15	yes	112.33 J	19.76 J	R	14.30 J
2006	64	1/14/06 6:30	1/14/06 20:30	yes	124.25	100.51	0.92	17.20
2006	65	1/15/06 16:30	1/15/06 16:45	no	0.00	0.00	0.00	0.00
2006	66	1/16/06 2:30	1/16/06 22:45	yes	117.84	118.92	0.24	96.55
2006	67	1/18/06 0:15	1/18/06 1:15	yes	15.59	0.22	0.00	0.00
2006	68	1/18/06 8:00	1/18/06 8:15	no	0.00	0.00	0.00	0.00
2006	69	1/18/06 23:15	1/19/06 5:00	yes	25.29	4.93	0.00	0.41
2006	70	1/19/06 22:30	1/20/06 10:15	yes	64.54	0.00	1.51	2.62
2006	71	1/21/06 3:15	1/21/06 11:45	no	0.00	0.00	0.00	0.00
2006	72	1/22/06 11:15	1/22/06 11:30	no	0.00	0.00	0.00	R
2006	73	1/22/06 21:00	1/23/06 0:15	yes	11.23	0.00	0.00	0.00
2006	74	1/23/06 6:15	1/23/06 10:15	yes	1.40	0.00	0.00	0.00
2006	75	1/24/06 6:45	1/24/06 7:00	no	0.00	0.00	0.00	0.00
2006	76	1/25/06 18:00	1/25/06 19:00	yes	73.45	9.12	0.00	4.28
2006	77	1/26/06 16:00	1/26/06 21:00	yes	12.22	0.00	0.00	0.00
2006	78	1/27/06 20:00	1/28/06 5:30	yes	128.64	105.99	0.86	22.30
2006	79	1/29/06 12:45	1/30/06 12:00	yes	R	1,168.69	3.06	594.00
2006	80	1/31/06 13:45	1/31/06 21:30	yes	60.89	3.71	8.63	32.09
2006	81	2/1/06 16:15	2/2/06 2:30	yes	94.85	15.14	13.99	59.86
2006	82	2/2/06 15:45	2/2/06 20:00	yes	86.90	59.11	8.62	41.79
2006	83	2/3/06 14:30	2/4/06 9:45	yes	288.80 J	243.68	25.40	201.82
2006	84	2/8/06 4:30	2/8/06 6:45	yes	8.96	0.00	0.00	0.00
2006	85	2/13/06 2:00	2/13/06 8:15	yes	62.40	0.00	0.00	0.00
2006	86	2/14/06 2:00	2/14/06 3:45	yes	21.88	0.00	0.00	0.00
2006	87	2/14/06 10:45	2/14/06 11:30	yes	10.09	0.75	0.07	1.13
2006	88	2/21/06 16:45	2/21/06 17:00	no	0.00	0.00	0.00	0.00
2006	89	2/22/06 8:00	2/22/06 8:15	no	0.00	0.00	0.00	0.00
2006	90	2/22/06 15:30	2/22/06 19:45	yes	26.59	0.00	0.00	0.00
2006	91	2/23/06 2:00	2/23/06 14:00	yes	213.76	73.44	8.63	13.09

Table C.2. Raw runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Runoff Volume (cf)	VFS Runoff Volume (cf)	CAVFS1 Runoff Volume (cf)	CAVFS2 Runoff Volume (cf)
2006	92	2/26/06 16:00	2/27/06 2:30	yes	3.46	0.00	R	0.00
2006	93	2/27/06 22:15	2/28/06 12:45	yes	74.12	18.41	46.59	6.53
2006	94	3/2/06 3:45	3/2/06 7:00	yes	3.02	0.00	0.00	0.00
2006	95	3/5/06 8:15	3/5/06 8:45	no	0.00	0.00	0.00	0.00
2006	96	3/6/06 19:00	3/6/06 21:15	no	0.00	0.00	0.00	0.00
2006	97	3/7/06 10:00	3/7/06 18:30	yes	55.93	0.00	0.00	0.00
2006	98	3/8/06 3:45	3/8/06 20:45	yes	85.91	101.57	0.00	3.72
2006	99	3/9/06 22:45	3/9/06 23:00	no	0.00	0.00	0.00	0.00
2006	100	3/10/06 19:15	3/10/06 20:45	no	0.00	0.00	0.00	0.00
2006	101	3/15/06 6:45	3/15/06 19:30	yes	25.38	0.00	0.00	0.00
2006	102	3/16/06 8:30	3/16/06 13:45	yes	9.62	0.00	0.00	0.00
2006	103	3/17/06 8:15	3/17/06 8:30	no	R	0.00	0.00	0.00
2006	104	3/17/06 22:00	3/17/06 22:30	yes	26.77	0.00	0.00	0.00
2006	105	3/18/06 12:15	3/18/06 12:30	no	0.00	0.00	0.00	0.00
2006	106	3/21/06 15:30	3/22/06 19:00	yes	106.54	11.30	0.68	3.37
2006	107	3/24/06 3:00	3/24/06 15:15	yes	40.91	0.22	R	0.22
2006	108	3/25/06 22:15	3/25/06 22:30	no	0.00	0.00	0.00	0.00
2006	109	3/28/06 2:30	3/28/06 8:00	yes	6.88	0.00	R	0.00
2006	110	3/31/06 3:15	3/31/06 9:30	no	0.00	0.00	0.00	0.00
2006	111	4/1/06 4:00	4/1/06 11:45	yes	109.40	111.55	R	3.84
2006	112	4/3/06 14:30	4/3/06 19:30	yes	6.92	0.00	R	0.00
2006	113	4/5/06 22:15	4/5/06 22:45	yes	2.11	0.00	R	0.00
2006	114	4/8/06 13:30	4/9/06 15:45	yes	54.41	0.00	R	0.00
2006	115	4/12/06 7:15	4/12/06 12:15	no	0.00	0.00	0.00	0.00
2006	116	4/13/06 9:45	4/13/06 10:00	no	0.00	0.00	0.00	0.00
2006	117	4/13/06 20:30	4/13/06 23:30	yes	0.50	0.00	R	0.00
2006	118	4/14/06 6:45	4/14/06 7:45	yes	5.71	0.00	R	0.00
2006	119	4/14/06 17:15	4/14/06 17:30	yes	0.48	0.00	R	0.00
2006	120	4/15/06 3:00	4/16/06 6:45	yes	63.37	24.60	R	9.18
2006	121	4/17/06 20:30	4/17/06 20:45	no	0.00	0.00	R	0.00

Table C.2. Raw runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Runoff Volume (cf)	VFS Runoff Volume (cf)	CAVFS1 Runoff Volume (cf)	CAVFS2 Runoff Volume (cf)
2006	122	4/20/06 21:30	4/21/06 10:15	no	0.00	0.00	0.00	0.00
2006	123	4/29/06 11:30	4/29/06 16:30	yes	33.03	27.01	0.00	7.54
2006	124	5/1/06 9:45	5/1/06 10:00	no	0.00	0.00	0.00	0.00
2006	125	5/6/06 22:00	5/7/06 0:30	no	0.00	0.00	0.00	0.00
2006	126	5/7/06 13:30	5/8/06 0:45	no	0.00	0.00	0.00	0.00
2006	127	5/11/06 15:15	5/11/06 15:30	no	0.00	0.00	0.00	0.00
2006	128	5/11/06 23:00	5/12/06 9:15	no	0.00	0.00	0.00	0.00
2006	129	5/19/06 16:00	5/19/06 19:00	no	0.00	0.00	0.00	0.00
2006	130	5/20/06 1:30	5/20/06 1:45	no	0.00	0.00	0.00	0.00
2006	131	5/21/06 16:30	5/21/06 17:15	yes	1.13	0.00	0.00	0.00
2006	132	5/22/06 1:00	5/22/06 6:45	no	0.00	0.00	0.00	0.00
2006	133	5/23/06 8:15	5/23/06 10:30	yes	56.51	R	0.00	0.00
2006	134	5/23/06 22:30	5/24/06 15:30	no	0.00	0.00	R	0.00
2006	135	5/26/06 2:00	5/26/06 6:30	no	0.00	0.00	0.00	0.00
2006	136	5/26/06 13:30	5/26/06 13:45	yes	1.13	0.00	R	0.00
2006	137	5/26/06 21:15	5/27/06 5:30	yes	12.59	0.00	R	0.00
2006	138	5/27/06 11:45	5/28/06 15:00	yes	273.95	42.23	R	47.53
2006	139	5/29/06 5:45	5/29/06 6:00	no	0.00	0.00	R	0.00
2006	140	5/31/06 18:45	5/31/06 23:15	yes	7.05	0.00	0.00	0.00
2006	141	6/1/06 12:00	6/2/06 5:15	yes	19.12	0.00	R	0.00
2006	142	6/2/06 11:45	6/2/06 14:30	no	0.00	0.00	R	0.00
2006	143	6/4/06 0:30	6/4/06 11:30	yes	89.67	0.38	1.79	1.79
2006	144	6/8/06 18:45	6/9/06 8:15	yes	29.12	0.00	R	0.00
2006	145	6/10/06 10:45	6/10/06 11:00	no	0.00	0.00	0.00	0.00
2006	146	6/12/06 7:45	6/12/06 9:15	no	0.00	0.00	0.00	0.00
2006	147	6/12/06 20:30	6/13/06 2:00	yes	50.12	0.00	R	0.00
2006	148	6/16/06 10:45	6/16/06 12:45	yes	7.86	0.00	0.00	0.00
2006	149	7/4/06 5:15	7/4/06 6:15	no	0.00	0.00	0.00	0.00
2006	150	7/6/06 16:15	7/6/06 16:30	no	0.00	0.00	0.00	0.00
2006	151	7/12/06 9:30	7/12/06 10:00	no	0.00	0.00	0.00	0.00

Table C.2. Raw runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Runoff Volume (cf)	VFS Runoff Volume (cf)	CAVFS1 Runoff Volume (cf)	CAVFS2 Runoff Volume (cf)
2006	152	7/13/06 17:45	7/13/06 18:00	no	0.00	0.00	0.00	0.00
2006	153	7/30/06 11:00	7/30/06 12:30	no	0.00	0.00	0.00	0.00
2006	154	8/29/06 8:15	8/30/06 10:45	yes	124.82	0.00	0.00	0.00
2006	155	9/9/06 1:30	9/9/06 11:00	yes	17.87	0.00	0.00	0.00
2006	156	9/13/06 9:15	9/13/06 9:30	no	0.00	0.00	0.00	0.00
2006	157	9/14/06 0:00	9/14/06 7:45	yes	59.62	3.26	0.00	0.00
2006	158	9/18/06 0:15	9/18/06 5:45	yes	19.35	0.00	0.00	0.00
2006	159	9/19/06 2:45	9/19/06 6:30	yes	2.53	0.00	0.00	0.00
2006	160	9/20/06 8:45	9/20/06 21:30	yes	14.80	20.74	0.00	0.00
2006	161	9/21/06 10:15	9/21/06 10:30	yes	0.74	0.00	0.00	0.00

J: estimated value based on quality assurance review

R: data rejected based on quality assurance review

nd: no data are available for specified event

cf: cubic feet

Table C.3. Raw peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Peak Discharge Rate (cfs)	VFS Peak Discharge Rate (cfs)	CAVFS 1 Peak Discharge Rate (cfs)	CAVFS 2 Peak Discharge Rate (cfs)
2005	1	12/9/04 16:45	12/11/04 5:45	yes	0.030	R	R	R
2005	2	12/11/04 13:15	12/11/04 13:30	yes	0.001	0.001	R	R
2005	3	12/13/04 12:15	12/14/04 10:15	yes	0.025	0.007	R	0.001
2005	4	12/16/04 20:45	12/16/04 22:45	yes	0.015	0.002	0.000	0.000
2005	5	12/17/04 9:15	12/17/04 9:30	no	0.000	0.000	0.000	0.000
2005	6	12/18/04 3:15	12/18/04 3:30	yes	0.002	0.001	0.000	0.000
2005	7	12/19/04 12:15	12/19/04 12:45	yes	0.026	0.005	0.000	0.000
2005	8	12/21/04 8:45	12/21/04 15:15	yes	0.017	0.008	0.000	0.000
2005	9	12/25/04 11:45	12/26/04 11:30	yes	0.021	0.021	0.000	0.001
2005	10	12/29/04 8:45	12/30/04 0:15	yes	0.020	0.023	0.000	0.001
2005	11	1/1/05 3:30	1/1/05 6:45	yes	0.010	0.001	0.000	0.001
2005	12	1/2/05 13:30	1/2/05 13:45	yes	0.002	0.000	0.000	0.000
2005	13	1/5/05 15:15	1/5/05 15:30	no	R	R	R	0.000
2005	14	1/6/05 19:00	1/7/05 14:45	no	R	0.000	R	R
2005	15	1/8/05 17:00	1/8/05 19:45	yes	0.000	0.000	R	0.000
2005	16	1/10/05 13:30	1/10/05 13:45	no	nd	nd	nd	nd
2005	17	1/13/05 8:00	1/13/05 8:15	no	nd	nd	nd	nd
2005	18	1/16/05 2:45	1/16/05 14:00	undefined	nd	nd	nd	nd
2005	19	1/17/05 8:30	1/18/05 2:30	undefined	nd	nd	nd	nd
2005	20	1/18/05 10:00	1/18/05 15:00	undefined	nd	nd	nd	nd
2005	21	1/18/05 23:30	1/19/05 7:00	undefined	nd	nd	nd	nd
2005	22	1/20/05 11:15	1/20/05 13:45	yes	0.003	0.000	0.000	nd
2005	23	1/22/05 20:15	1/22/05 20:30	yes	0.001	0.000	0.000	nd
2005	24	1/26/05 23:00	1/26/05 23:15	yes	0.000	0.000	0.000	nd
2005	25	1/28/05 21:30	1/28/05 21:45	yes	0.001	0.000	0.000	nd
2005	26	1/30/05 8:45	1/30/05 9:30	yes	0.005	0.000	0.000	nd
2005	27	1/31/05 3:30	1/31/05 3:45	no	0.000	0.000	0.000	nd
2005	28	2/4/05 7:15	2/4/05 15:30	yes	0.037	0.011	0.000	0.002
2005	29	2/4/05 23:00	2/5/05 3:45	yes	0.009	0.000	0.000	0.000
2005	30	2/5/05 20:30	2/5/05 21:15	yes	0.009	0.000	0.000	0.000
2005	31	2/6/05 8:00	2/6/05 18:30	yes	0.017	0.032	0.000	0.011
2005	32	2/12/05 3:30	2/12/05 3:45	no	0.000	0.000	0.000	0.000
2005	33	2/12/05 10:00	2/12/05 18:45	yes	0.015	0.005	0.000	0.000
2005	34	2/13/05 6:00	2/13/05 8:30	yes	0.000	0.000	0.000	0.000
2005	35	2/14/05 9:00	2/14/05 9:15	no	0.000	0.000	0.000	0.000
2005	36	2/28/05 8:00	3/1/05 6:45	yes	0.004	0.000	0.000	0.000
2005	37	3/1/05 13:45	3/1/05 14:00	no	0.000	0.000	0.000	0.000

Table C.3. Raw peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Peak Discharge Rate (cfs)	VFS Peak Discharge Rate (cfs)	CAVFS 1 Peak Discharge Rate (cfs)	CAVFS 2 Peak Discharge Rate (cfs)
2005	38	3/9/05 9:15	3/9/05 9:30	no	0.000	0.000	0.000	0.000
2005	39	3/16/05 11:30	3/16/05 15:45	yes	0.019	0.000	0.000	nd
2005	40	3/17/05 7:15	3/17/05 7:30	no	0.000	0.000	0.000	nd
2005	41	3/18/05 3:30	3/18/05 5:15	yes	0.003	0.000	0.000	nd
2005	42	3/19/05 13:15	3/20/05 19:30	yes	0.012	0.021	0.001	0.005
2005	43	3/26/05 3:00	3/27/05 9:45	yes	0.015	R	0.000	0.023
2005	44	3/27/05 23:45	3/28/05 0:00	no	0.000	0.000	0.000	0.000
2005	45	3/28/05 6:45	3/28/05 13:30	yes	0.002	0.000	0.000	0.000
2005	46	3/28/05 22:30	3/29/05 1:30	yes	0.004	0.000	0.000	0.000
2005	47	3/29/05 13:15	3/29/05 13:30	yes	0.006	0.000	nd	0.001
2005	48	3/29/05 21:15	3/29/05 21:45	no	0.000	nd	nd	0.000
2005	49	3/30/05 21:00	3/30/05 21:15	no	0.000	nd	nd	0.000
2005	50	3/31/05 11:15	3/31/05 11:45	yes	0.000	0.000	nd	0.000
2005	51	3/31/05 18:30	4/1/05 9:00	yes	0.013	R	0.001	0.003
2005	52	4/2/05 17:15	4/3/05 13:00	yes	0.014	nd	0.001	0.003
2005	53	4/4/05 6:15	4/4/05 10:15	yes	0.017	nd	0.001	0.014
2005	54	4/6/05 13:00	4/6/05 13:15	no	0.000	0.000	0.000	0.000
2005	55	4/7/05 10:00	4/7/05 18:15	yes	0.025	0.071	0.004	0.066
2005	56	4/8/05 10:15	4/8/05 10:30	yes	0.000	0.000	0.001	0.000
2005	57	4/10/05 19:15	4/11/05 3:00	yes	0.011	0.017	0.001	0.003
2005	58	4/12/05 11:45	4/12/05 14:15	yes	0.001	0.000	0.000	0.000
2005	59	4/13/05 13:30	4/13/05 13:45	no	0.000	0.000	0.000	0.000
2005	60	4/14/05 1:00	4/14/05 13:30	yes	0.002	0.000	0.000	0.000
2005	61	4/15/05 12:45	4/16/05 13:00	yes	0.035	R	0.053	0.123
2005	62	4/17/05 15:00	4/18/05 0:45	yes	0.010	0.021	0.001	0.016
2005	63	4/23/05 22:15	4/23/05 23:30	yes	0.012	0.000	0.000	0.000
2005	64	4/29/05 7:30	4/29/05 8:15	yes	0.008	0.000	0.000	0.000
2005	65	4/29/05 17:45	4/30/05 6:15	yes	0.002	0.000	0.000	0.000
2005	66	5/4/05 4:15	5/4/05 6:45	yes	0.000	0.000	0.000	0.000
2005	67	5/8/05 17:30	5/9/05 0:00	yes	0.007	0.000	0.000	0.000
2005	68	5/9/05 6:30	5/9/05 9:45	yes	0.001	0.000	0.000	0.000
2005	69	5/9/05 19:30	5/10/05 3:15	yes	0.012	0.000	0.000	0.009
2005	70	5/14/05 1:45	5/14/05 7:45	yes	0.006	R	0.000	0.001
2005	71	5/15/05 2:45	5/15/05 9:00	yes	0.047	R	0.019	0.165
2005	72	5/16/05 11:45	5/16/05 22:30	yes	0.016	0.003	0.001	0.001
2005	73	5/17/05 23:00	5/20/05 0:15	yes	0.029	0.000	0.001	0.008
2005	74	5/20/05 11:00	5/20/05 15:00	yes	0.003	0.000	0.000	0.000

Table C.3. Raw peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Peak Discharge Rate (cfs)	VFS Peak Discharge Rate (cfs)	CAVFS 1 Peak Discharge Rate (cfs)	CAVFS 2 Peak Discharge Rate (cfs)
2005	75	5/21/05 17:30	5/21/05 19:45	yes	0.012	0.000	0.000	0.001
2005	76	5/22/05 11:30	5/22/05 11:45	yes	0.000	0.000	0.000	0.000
2005	77	5/31/05 4:30	5/31/05 19:30	yes	0.079	0.164	0.042	0.223
2005	78	6/1/05 4:00	6/1/05 9:15	yes	0.019	0.001	0.001	0.004
2005	79	6/3/05 4:15	6/3/05 5:30	yes	0.000	0.000	0.000	0.000
2005	80	6/5/05 13:15	6/5/05 15:15	yes	0.003	0.000	0.000	0.000
2005	81	6/5/05 22:45	6/5/05 23:00	no	0.000	0.000	0.000	0.000
2005	82	6/6/05 15:45	6/6/05 16:00	no	0.000	0.000	0.000	0.000
2005	83	6/7/05 22:30	6/8/05 4:15	yes	0.061	0.113	0.025	0.167
2005	84	6/8/05 15:15	6/8/05 15:30	yes	0.000	0.000	0.000	0.000
2005	85	6/10/05 18:45	6/12/05 5:15	yes	0.025	0.016	0.001	0.008
2005	86	6/12/05 21:15	6/13/05 6:00	yes	0.002	0.000	0.000	0.000
2005	87	6/14/05 23:15	6/15/05 3:15	no	nd	0.000	0.000	0.000
2005	88	6/16/05 20:45	6/17/05 7:00	yes	nd	0.002	0.001	0.002
2005	89	6/21/05 15:30	6/21/05 17:00	no	nd	0.000	0.000	0.000
2005	90	6/22/05 6:00	6/22/05 20:15	yes	nd	0.034	0.000	0.030
2005	91	6/26/05 19:30	6/27/05 9:15	no	nd	0.000	0.000	0.000
2005	92	7/2/05 1:15	7/2/05 6:15	yes	0.005	0.000	0.000	0.000
2005	93	7/5/05 18:00	7/6/05 0:15	yes	0.007	0.000	0.000	0.000
2005	94	7/8/05 5:15	7/8/05 15:30	yes	0.005	0.000	0.000	0.000
2005	95	7/15/05 12:45	7/15/05 15:45	yes	0.001	0.000	0.000	0.000
2005	96	7/16/05 0:45	7/16/05 9:00	yes	0.001	0.000	0.000	0.000
2005	97	7/22/05 6:00	7/22/05 8:30	yes	0.003	0.000	0.000	0.000
2005	98	8/1/05 7:30	8/1/05 7:45	no	0.000	0.000	0.000	0.000
2005	99	8/17/05 3:00	8/17/05 5:45	no	nd	0.000	0.000	0.000
2005	100	8/28/05 19:00	8/28/05 23:30	yes	nd	0.000	0.000	0.000
2005	101	8/29/05 19:15	8/29/05 19:45	no	0.000	0.000	0.000	0.000
2005	102	8/30/05 7:15	8/30/05 8:00	no	0.000	0.000	0.000	0.000
2005	103	9/4/05 8:15	9/4/05 8:30	yes	0.021	0.000	0.000	0.000
2005	104	9/5/05 8:00	9/5/05 8:15	no	0.000	0.000	0.000	0.000
2005	105	9/9/05 1:15	9/9/05 11:45	yes	0.099	R	0.000	R
2005	106	9/9/05 23:30	9/10/05 8:45	yes	0.031	R	0.000	0.002
2005	107	9/14/05 21:00	9/14/05 21:15	yes	0.001	0.000	0.000	0.000
2005	108	9/16/05 1:30	9/16/05 6:30	yes	0.003	0.000	0.000	0.000
2005	109	9/30/05 4:45	9/30/05 11:00	no	0.000	0.000	nd	0.001
2006	1	10/1/05 9:00	10/1/05 19:00	yes	0.059	0.003	0.000	0.003

Table C.3. Raw peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Peak Discharge Rate (cfs)	VFS Peak Discharge Rate (cfs)	CAVFS 1 Peak Discharge Rate (cfs)	CAVFS 2 Peak Discharge Rate (cfs)
2006	2	10/2/05 4:45	10/2/05 5:00	no	0.000	0.000	0.000	0.000
2006	3	10/2/05 11:30	10/2/05 19:30	yes	0.004	0.000	0.000	0.000
2006	4	10/6/05 13:30	10/6/05 19:15	no	0.000	0.000	0.000	0.000
2006	5	10/8/05 19:00	10/8/05 20:15	no	0.000	0.000	0.000	0.000
2006	6	10/10/05 12:45	10/10/05 13:00	no	0.000	0.000	0.000	0.000
2006	7	10/11/05 0:00	10/11/05 1:45	yes	0.002	0.000	0.000	0.000
2006	8	10/12/05 15:30	10/12/05 19:00	yes	0.001	0.000	0.000	0.000
2006	9	10/14/05 20:15	10/15/05 1:30	yes	0.013	0.000	0.000	0.000
2006	10	10/16/05 5:00	10/16/05 8:30	yes	0.001	0.000	0.000	0.000
2006	11	10/17/05 0:00	10/17/05 5:45	no	0.000	0.000	0.000	0.000
2006	12	10/19/05 1:00	10/19/05 12:45	yes	0.003	0.001	0.000	0.000
2006	13	10/23/05 6:45	10/23/05 16:45	no	0.000	0.000	R	0.000
2006	14	10/25/05 17:30	10/25/05 18:45	no	0.000	0.000	0.000	0.000
2006	15	10/26/05 1:30	10/26/05 2:00	no	0.000	0.000	0.000	0.000
2006	16	10/26/05 8:30	10/26/05 8:45	no	0.000	0.000	0.000	0.000
2006	17	10/27/05 21:30	10/28/05 7:00	yes	0.012	0.000	0.000	0.000
2006	18	10/28/05 18:15	10/28/05 18:30	no	0.000	0.000	0.000	0.000
2006	19	10/29/05 2:15	10/29/05 3:15	yes	0.001	0.000	0.000	0.000
2006	20	10/29/05 15:00	10/29/05 17:30	yes	0.024	0.000	0.000	0.002
2006	21	10/30/05 0:30	10/30/05 0:45	no	0.000	0.000	0.000	0.000
2006	22	10/30/05 19:45	10/31/05 19:00	yes	0.015 J	0.001 J	R	R
2006	23	11/1/05 8:00	11/1/05 19:45	yes	0.007 J	0.004 J	nd	R
2006	24	11/2/05 9:30	11/2/05 9:45	no	0.000	0.000	0.000	0.000
2006	25	11/2/05 17:30	11/3/05 20:00	yes	0.043	0.008	0.000	0.001
2006	26	11/4/05 10:00	11/4/05 14:45	yes	0.034	0.009	0.000	0.005
2006	27	11/5/05 8:45	11/6/05 0:00	yes	0.031	0.028	0.000	0.025
2006	28	11/7/05 3:15	11/7/05 6:15	yes	0.006	0.000	0.000	0.000
2006	29	11/10/05 13:30	11/10/05 18:15	yes	0.005	0.000	0.000	0.000
2006	30	11/11/05 10:00	11/11/05 14:30	yes	0.002	0.000	0.000	0.000
2006	31	11/12/05 23:00	11/13/05 19:45	yes	0.014	0.000	0.000	0.001

Table C.3. Raw peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Peak Discharge Rate (cfs)	VFS Peak Discharge Rate (cfs)	CAVFS 1 Peak Discharge Rate (cfs)	CAVFS 2 Peak Discharge Rate (cfs)
2006	32	11/14/05 4:45	11/14/05 5:15	yes	0.006	0.000	0.000	0.000
2006	33	11/24/05 16:00	11/25/05 22:30	yes	0.018	0.010	0.000	0.002
2006	34	11/26/05 8:30	11/26/05 8:45	no	0.000	0.000	0.000	0.000
2006	35	11/27/05 2:15	11/27/05 11:15	yes	0.008	0.000	0.000	0.000
2006	36	11/28/05 22:00	11/30/05 3:30	no	nd	0.000	0.000	0.000
2006	37	12/1/05 12:45	12/1/05 13:30	no	R	0.000	0.000	0.000
2006	38	12/2/05 12:30	12/2/05 14:45	yes	0.000	0.000	0.000	0.001
2006	39	12/3/05 13:30	12/3/05 17:00	yes	0.000	0.000	0.000	R
2006	40	12/4/05 11:30	12/4/05 17:00	yes	0.000	0.000	0.000	0.000
2006	41	12/6/05 1:00	12/6/05 6:00	yes	0.000	0.000	0.000	0.000
2006	42	12/12/05 14:30	12/12/05 14:45	no	0.000	0.000	0.000	0.000
2006	43	12/15/05 10:15	12/15/05 10:30	no	0.000	0.000	0.000	0.000
2006	44	12/19/05 3:30	12/19/05 10:45	yes	0.020	0.000	0.000	0.000
2006	45	12/19/05 22:15	12/22/05 10:00	yes	0.015	0.014	0.002	0.005
2006	46	12/22/05 18:15	12/22/05 18:30	no	0.000	R	0.000	R
2006	47	12/23/05 14:00	12/24/05 11:45	yes	0.067	0.041	0.000	0.055
2006	48	12/24/05 22:15	12/25/05 7:30	yes	0.056	0.040	0.000	0.056
2006	49	12/25/05 13:45	12/26/05 10:15	yes	0.005	0.000	0.000	0.000
2006	50	12/27/05 0:30	12/27/05 8:15	yes	0.006	0.002	0.000	0.001
2006	51	12/28/05 3:30	12/28/05 12:00	yes	0.008	0.010	0.000	0.002
2006	52	12/29/05 20:45	12/30/05 5:15	yes	0.003	0.001	0.001	0.001
2006	53	12/30/05 11:45	12/31/05 6:30	yes	0.037	0.020	0.001	0.012
2006	54	1/1/06 7:15	1/1/06 10:30	yes	0.008	0.001	0.001	0.000
2006	55	1/1/06 16:30	1/1/06 21:30	yes	0.015	0.002	0.001	0.004
2006	56	1/2/06 5:15	1/2/06 20:30	yes	0.007	0.001	0.001	0.001
2006	57	1/3/06 12:00	1/3/06 23:30	yes	0.002	0.001	0.001	0.000
2006	58	1/5/06 7:30	1/6/06 0:00	yes	0.033	0.027	0.001	0.022
2006	59	1/6/06 9:15	1/6/06 9:30	no	0.000	0.000	0.000	0.000
2006	60	1/6/06 23:00	1/6/06 23:15	no	0.000	0.000	0.000	R
2006	61	1/7/06 6:30	1/7/06 15:45	yes	0.021	0.001	0.000	0.002

Table C.3. Raw peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Peak Discharge Rate (cfs)	VFS Peak Discharge Rate (cfs)	CAVFS 1 Peak Discharge Rate (cfs)	CAVFS 2 Peak Discharge Rate (cfs)
2006	62	1/8/06 15:45	1/11/06 0:15	yes	0.054	0.035	0.001	0.046
2006	63	1/12/06 11:15	1/13/06 23:15	yes	0.007 J	0.001 J	R	0.001 J
2006	64	1/14/06 6:30	1/14/06 20:30	yes	0.023	0.018	0.000	0.004
2006	65	1/15/06 16:30	1/15/06 16:45	no	0.000	0.000	0.000	0.000
2006	66	1/16/06 2:30	1/16/06 22:45	yes	0.020	0.027	0.000	0.020
2006	67	1/18/06 0:15	1/18/06 1:15	yes	0.005	0.000	0.000	0.000
2006	68	1/18/06 8:00	1/18/06 8:15	no	0.000	0.000	0.000	0.000
2006	69	1/18/06 23:15	1/19/06 5:00	yes	0.015	0.001	0.000	0.000
2006	70	1/19/06 22:30	1/20/06 10:15	yes	0.008	0.000	0.000	0.001
2006	71	1/21/06 3:15	1/21/06 11:45	no	0.000	0.000	0.000	0.000
2006	72	1/22/06 11:15	1/22/06 11:30	no	0.000	0.000	0.000	R
2006	73	1/22/06 21:00	1/23/06 0:15	yes	0.004	0.000	0.000	0.000
2006	74	1/23/06 6:15	1/23/06 10:15	yes	0.000	0.000	0.000	0.000
2006	75	1/24/06 6:45	1/24/06 7:00	no	0.000	0.000	0.000	0.000
2006	76	1/25/06 18:00	1/25/06 19:00	yes	0.035	0.003	0.000	0.003
2006	77	1/26/06 16:00	1/26/06 21:00	yes	0.004	0.000	0.000	0.000
2006	78	1/27/06 20:00	1/28/06 5:30	yes	0.014	0.015	0.000	0.004
2006	79	1/29/06 12:45	1/30/06 12:00	yes	R	0.057	0.001	0.079
2006	80	1/31/06 13:45	1/31/06 21:30	yes	0.006	0.000	0.001	0.002
2006	81	2/1/06 16:15	2/2/06 2:30	yes	0.020	0.003	0.001	0.004
2006	82	2/2/06 15:45	2/2/06 20:00	yes	0.023	0.019	0.001	0.009
2006	83	2/3/06 14:30	2/4/06 9:45	yes	0.101 J	0.082	0.001	0.115
2006	84	2/8/06 4:30	2/8/06 6:45	yes	0.001	0.000	0.000	0.000
2006	85	2/13/06 2:00	2/13/06 8:15	yes	0.014	0.000	0.000	0.000
2006	86	2/14/06 2:00	2/14/06 3:45	yes	0.006	0.000	0.000	0.000
2006	87	2/14/06 10:45	2/14/06 11:30	yes	0.001	0.000	0.000	0.000
2006	88	2/21/06 16:45	2/21/06 17:00	no	0.000	0.000	0.000	0.000
2006	89	2/22/06 8:00	2/22/06 8:15	no	0.000	0.000	0.000	0.000
2006	90	2/22/06 15:30	2/22/06 19:45	yes	0.003	0.000	0.000	0.000
2006	91	2/23/06 2:00	2/23/06 14:00	yes	0.023	0.012	0.001	0.002

Table C.3. Raw peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Peak Discharge Rate (cfs)	VFS Peak Discharge Rate (cfs)	CAVFS 1 Peak Discharge Rate (cfs)	CAVFS 2 Peak Discharge Rate (cfs)
2006	92	2/26/06 16:00	2/27/06 2:30	yes	0.000	0.000	R	0.000
2006	93	2/27/06 22:15	2/28/06 12:45	yes	0.007	0.001	0.002	0.001
2006	94	3/2/06 3:45	3/2/06 7:00	yes	0.001	0.000	0.000	0.000
2006	95	3/5/06 8:15	3/5/06 8:45	no	0.000	0.000	0.000	0.000
2006	96	3/6/06 19:00	3/6/06 21:15	no	0.000	0.000	0.000	0.000
2006	97	3/7/06 10:00	3/7/06 18:30	yes	0.024	0.000	0.000	0.000
2006	98	3/8/06 3:45	3/8/06 20:45	yes	0.012	0.018	0.000	0.002
2006	99	3/9/06 22:45	3/9/06 23:00	no	0.000	0.000	0.000	0.000
2006	100	3/10/06 19:15	3/10/06 20:45	no	0.000	0.000	0.000	0.000
2006	101	3/15/06 6:45	3/15/06 19:30	yes	0.011	0.000	0.000	0.000
2006	102	3/16/06 8:30	3/16/06 13:45	yes	0.002	0.000	0.000	0.000
2006	103	3/17/06 8:15	3/17/06 8:30	no	R	0.000	0.000	0.000
2006	104	3/17/06 22:00	3/17/06 22:30	yes	0.024	0.000	0.000	0.000
2006	105	3/18/06 12:15	3/18/06 12:30	no	0.000	0.000	0.000	0.000
2006	106	3/21/06 15:30	3/22/06 19:00	yes	0.005	0.002	0.000	0.000
2006	107	3/24/06 3:00	3/24/06 15:15	yes	0.014	0.000	R	0.000
2006	108	3/25/06 22:15	3/25/06 22:30	no	0.000	0.000	0.000	0.000
2006	109	3/28/06 2:30	3/28/06 8:00	yes	0.003	0.000	R	0.000
2006	110	3/31/06 3:15	3/31/06 9:30	no	0.000	0.000	0.000	0.000
2006	111	4/1/06 4:00	4/1/06 11:45	yes	0.014	0.019	R	0.002
2006	112	4/3/06 14:30	4/3/06 19:30	yes	0.003	0.000	R	0.000
2006	113	4/5/06 22:15	4/5/06 22:45	yes	0.002	0.000	R	0.000
2006	114	4/8/06 13:30	4/9/06 15:45	yes	0.002	0.000	R	0.000
2006	115	4/12/06 7:15	4/12/06 12:15	no	0.000	0.000	0.000	0.000
2006	116	4/13/06 9:45	4/13/06 10:00	no	0.000	0.000	0.000	0.000
2006	117	4/13/06 20:30	4/13/06 23:30	yes	0.001	0.000	R	0.000
2006	118	4/14/06 6:45	4/14/06 7:45	yes	0.004	0.000	R	0.000
2006	119	4/14/06 17:15	4/14/06 17:30	yes	0.000	0.000	R	0.000
2006	120	4/15/06 3:00	4/16/06 6:45	yes	0.041	0.008	R	0.005
2006	121	4/17/06 20:30	4/17/06 20:45	no	0.000	0.000	R	0.000

Table C.3. Raw peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Peak Discharge Rate (cfs)	VFS Peak Discharge Rate (cfs)	CAVFS 1 Peak Discharge Rate (cfs)	CAVFS 2 Peak Discharge Rate (cfs)
2006	122	4/20/06 21:30	4/21/06 10:15	no	0.000	0.000	0.000	0.000
2006	123	4/29/06 11:30	4/29/06 16:30	yes	0.009	0.010	0.000	0.003
2006	124	5/1/06 9:45	5/1/06 10:00	no	0.000	0.000	0.000	0.000
2006	125	5/6/06 22:00	5/7/06 0:30	no	0.000	0.000	0.000	0.000
2006	126	5/7/06 13:30	5/8/06 0:45	no	0.000	0.000	0.000	0.000
2006	127	5/11/06 15:15	5/11/06 15:30	no	0.000	0.000	0.000	0.000
2006	128	5/11/06 23:00	5/12/06 9:15	no	0.000	0.000	0.000	0.000
2006	129	5/19/06 16:00	5/19/06 19:00	no	0.000	0.000	0.000	0.000
2006	130	5/20/06 1:30	5/20/06 1:45	no	0.000	0.000	0.000	0.000
2006	131	5/21/06 16:30	5/21/06 17:15	yes	0.001	0.000	0.000	0.000
2006	132	5/22/06 1:00	5/22/06 6:45	no	0.000	0.000	0.000	0.000
2006	133	5/23/06 8:15	5/23/06 10:30	yes	0.032	R	0.000	0.000
2006	134	5/23/06 22:30	5/24/06 15:30	no	0.000	0.000	R	0.000
2006	135	5/26/06 2:00	5/26/06 6:30	no	0.000	0.000	0.000	0.000
2006	136	5/26/06 13:30	5/26/06 13:45	yes	0.001	0.000	R	0.000
2006	137	5/26/06 21:15	5/27/06 5:30	yes	0.006	0.000	R	0.000
2006	138	5/27/06 11:45	5/28/06 15:00	yes	0.105	0.010	R	0.023
2006	139	5/29/06 5:45	5/29/06 6:00	no	0.000	0.000	R	0.000
2006	140	5/31/06 18:45	5/31/06 23:15	yes	0.003	0.000	0.000	0.000
2006	141	6/1/06 12:00	6/2/06 5:15	yes	0.006	0.000	R	0.000
2006	142	6/2/06 11:45	6/2/06 14:30	no	0.000	0.000	R	0.000
2006	143	6/4/06 0:30	6/4/06 11:30	yes	0.023	0.000	0.002	0.002
2006	144	6/8/06 18:45	6/9/06 8:15	yes	0.006	0.000	R	0.000
2006	145	6/10/06 10:45	6/10/06 11:00	no	0.000	0.000	0.000	0.000
2006	146	6/12/06 7:45	6/12/06 9:15	no	0.000	0.000	0.000	0.000
2006	147	6/12/06 20:30	6/13/06 2:00	yes	0.014	0.000	R	0.000
2006	148	6/16/06 10:45	6/16/06 12:45	yes	0.007	0.000	0.000	0.000
2006	149	7/4/06 5:15	7/4/06 6:15	no	0.000	0.000	0.000	0.000
2006	150	7/6/06 16:15	7/6/06 16:30	no	0.000	0.000	0.000	0.000
2006	151	7/12/06 9:30	7/12/06 10:00	no	0.000	0.000	0.000	0.000

Table C.3. Raw peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Peak Discharge Rate (cfs)	VFS Peak Discharge Rate (cfs)	CAVFS 1 Peak Discharge Rate (cfs)	CAVFS 2 Peak Discharge Rate (cfs)
2006	152	7/13/06 17:45	7/13/06 18:00	no	0.000	0.000	0.000	0.000
2006	153	7/30/06 11:00	7/30/06 12:30	no	0.000	0.000	0.000	0.000
2006	154	8/29/06 8:15	8/30/06 10:45	yes	0.019	0.000	0.000	0.000
2006	155	9/9/06 1:30	9/9/06 11:00	yes	0.010	0.000	0.000	0.000
2006	156	9/13/06 9:15	9/13/06 9:30	no	0.000	0.000	0.000	0.000
2006	157	9/14/06 0:00	9/14/06 7:45	yes	0.015	0.002	0.000	0.000
2006	158	9/18/06 0:15	9/18/06 5:45	yes	0.005	0.000	0.000	0.000
2006	159	9/19/06 2:45	9/19/06 6:30	yes	0.001	0.000	0.000	0.000
2006	160	9/20/06 8:45	9/20/06 21:30	yes	0.004	0.010	0.000	0.000
2006	161	9/21/06 10:15	9/21/06 10:30	yes	0.000	0.000	0.000	0.000

J: estimated value based on quality assurance review

R: data rejected based on quality assurance review

nd: no data are available for specified event

cfs: cubic feet per second

Table C.4. Raw flow durations measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Flow Duration (hours)	VFS Flow Duration (hours)	CAVFS1 Flow Duration (hours)	CAVFS2 Flow Duration (hours)
2005	1	12/9/04 16:45	12/11/04 5:45	yes	37.00	R	R	R
2005	2	12/11/04 13:15	12/11/04 13:30	yes	0.25	0.50	R	R
2005	3	12/13/04 12:15	12/14/04 10:15	yes	23.50	16.00	R	4.00
2005	4	12/16/04 20:45	12/16/04 22:45	yes	3.75	3.75	0.00	0.25
2005	5	12/17/04 9:15	12/17/04 9:30	no	0.00	0.00	0.00	0.00
2005	6	12/18/04 3:15	12/18/04 3:30	yes	0.25	0.25	0.00	0.00
2005	7	12/19/04 12:15	12/19/04 12:45	yes	1.50	1.25	0.00	0.50
2005	8	12/21/04 8:45	12/21/04 15:15	yes	7.00	2.50	0.00	2.25
2005	9	12/25/04 11:45	12/26/04 11:30	yes	23.75	21.50	0.00	6.00
2005	10	12/29/04 8:45	12/30/04 0:15	yes	17.25	15.25	0.00	3.25
2005	11	1/1/05 3:30	1/1/05 6:45	yes	4.00	4.50	0.00	1.25
2005	12	1/2/05 13:30	1/2/05 13:45	yes	0.25	0.00	0.25	0.25
2005	13	1/5/05 15:15	1/5/05 15:30	no	R	R	R	0.00
2005	14	1/6/05 19:00	1/7/05 14:45	no	R	0.00	R	R
2005	15	1/8/05 17:00	1/8/05 19:45	yes	0.50	0.00	R	0.75
2005	16	1/10/05 13:30	1/10/05 13:45	no	nd	nd	nd	nd
2005	17	1/13/05 8:00	1/13/05 8:15	no	nd	nd	nd	nd
2005	18	1/16/05 2:45	1/16/05 14:00	undefined	nd	nd	nd	nd
2005	19	1/17/05 8:30	1/18/05 2:30	undefined	nd	nd	nd	nd
2005	20	1/18/05 10:00	1/18/05 15:00	undefined	nd	nd	nd	nd
2005	21	1/18/05 23:30	1/19/05 7:00	undefined	nd	nd	nd	nd
2005	22	1/20/05 11:15	1/20/05 13:45	yes	1.50	0.25	0.00	nd
2005	23	1/22/05 20:15	1/22/05 20:30	yes	0.50	0.00	0.00	nd
2005	24	1/26/05 23:00	1/26/05 23:15	yes	0.25	0.00	0.00	nd
2005	25	1/28/05 21:30	1/28/05 21:45	yes	0.50	0.00	0.00	nd
2005	26	1/30/05 8:45	1/30/05 9:30	yes	1.25	0.00	0.00	nd
2005	27	1/31/05 3:30	1/31/05 3:45	no	0.00	0.00	0.00	nd
2005	28	2/4/05 7:15	2/4/05 15:30	yes	9.00	4.25	0.00	0.25
2005	29	2/4/05 23:00	2/5/05 3:45	yes	2.75	0.00	0.00	0.00
2005	30	2/5/05 20:30	2/5/05 21:15	yes	2.50	0.00	0.00	0.00
2005	31	2/6/05 8:00	2/6/05 18:30	yes	15.00	7.00	0.25	1.25
2005	32	2/12/05 3:30	2/12/05 3:45	no	0.00	0.00	0.00	0.00
2005	33	2/12/05 10:00	2/12/05 18:45	yes	11.50	2.00	0.00	0.25
2005	34	2/13/05 6:00	2/13/05 8:30	yes	0.25	0.00	0.00	0.00
2005	35	2/14/05 9:00	2/14/05 9:15	no	0.00	0.00	0.00	0.00
2005	36	2/28/05 8:00	3/1/05 6:45	yes	5.00	0.00	0.00	0.00
2005	37	3/1/05 13:45	3/1/05 14:00	no	0.00	0.00	0.00	0.00

Table C.4. Raw flow durations measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Flow Duration (hours)	VFS Flow Duration (hours)	CAVFS1 Flow Duration (hours)	CAVFS2 Flow Duration (hours)
2005	38	3/9/05 9:15	3/9/05 9:30	no	0.00	0.00	0.00	0.00
2005	39	3/16/05 11:30	3/16/05 15:45	yes	2.50	0.00	0.00	nd
2005	40	3/17/05 7:15	3/17/05 7:30	no	0.00	0.00	0.00	nd
2005	41	3/18/05 3:30	3/18/05 5:15	yes	1.00	0.00	0.00	nd
2005	42	3/19/05 13:15	3/20/05 19:30	yes	14.25	9.00	18.50	6.00
2005	43	3/26/05 3:00	3/27/05 9:45	yes	22.50	R	0.00	14.75
2005	44	3/27/05 23:45	3/28/05 0:00	no	0.00	0.00	0.00	0.00
2005	45	3/28/05 6:45	3/28/05 13:30	yes	1.25	0.00	0.00	0.00
2005	46	3/28/05 22:30	3/29/05 1:30	yes	3.75	0.00	0.00	0.00
2005	47	3/29/05 13:15	3/29/05 13:30	yes	0.75	0.00	nd	0.25
2005	48	3/29/05 21:15	3/29/05 21:45	no	0.00	nd	nd	0.00
2005	49	3/30/05 21:00	3/30/05 21:15	no	0.00	nd	nd	0.00
2005	50	3/31/05 11:15	3/31/05 11:45	yes	0.25	0.00	nd	0.25
2005	51	3/31/05 18:30	4/1/05 9:00	yes	10.00	R	14.50	5.75
2005	52	4/2/05 17:15	4/3/05 13:00	yes	12.50	nd	13.00	4.00
2005	53	4/4/05 6:15	4/4/05 10:15	yes	3.00	nd	7.75	2.00
2005	54	4/6/05 13:00	4/6/05 13:15	no	0.00	0.00	0.00	0.00
2005	55	4/7/05 10:00	4/7/05 18:15	yes	8.75	5.50	4.50	3.25
2005	56	4/8/05 10:15	4/8/05 10:30	yes	0.25	0.25	0.25	0.00
2005	57	4/10/05 19:15	4/11/05 3:00	yes	7.75	4.75	12.00	2.75
2005	58	4/12/05 11:45	4/12/05 14:15	yes	1.50	0.00	0.00	0.00
2005	59	4/13/05 13:30	4/13/05 13:45	no	0.00	0.00	0.00	0.00
2005	60	4/14/05 1:00	4/14/05 13:30	yes	5.75	0.00	4.75	0.00
2005	61	4/15/05 12:45	4/16/05 13:00	yes	22.25	R	19.75	9.75
2005	62	4/17/05 15:00	4/18/05 0:45	yes	8.00	7.25	18.25	4.25
2005	63	4/23/05 22:15	4/23/05 23:30	yes	1.00	0.00	0.00	0.00
2005	64	4/29/05 7:30	4/29/05 8:15	yes	1.25	0.00	0.00	0.00
2005	65	4/29/05 17:45	4/30/05 6:15	yes	2.75	0.00	0.00	0.00
2005	66	5/4/05 4:15	5/4/05 6:45	yes	0.25	0.00	0.00	0.00
2005	67	5/8/05 17:30	5/9/05 0:00	yes	1.75	0.00	0.00	0.00
2005	68	5/9/05 6:30	5/9/05 9:45	yes	0.50	0.00	0.00	0.00
2005	69	5/9/05 19:30	5/10/05 3:15	yes	7.25	0.00	0.00	3.25
2005	70	5/14/05 1:45	5/14/05 7:45	yes	2.00	R	0.00	4.00
2005	71	5/15/05 2:45	5/15/05 9:00	yes	4.50	R	22.25	2.50
2005	72	5/16/05 11:45	5/16/05 22:30	yes	4.25	0.25	4.00	0.75
2005	73	5/17/05 23:00	5/20/05 0:15	yes	21.50	0.00	4.25	8.50
2005	74	5/20/05 11:00	5/20/05 15:00	yes	0.75	0.00	0.00	0.50

Table C.4. Raw flow durations measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Flow Duration (hours)	VFS Flow Duration (hours)	CAVFS1 Flow Duration (hours)	CAVFS2 Flow Duration (hours)
2005	75	5/21/05 17:30	5/21/05 19:45	yes	3.00	0.00	0.00	0.75
2005	76	5/22/05 11:30	5/22/05 11:45	yes	0.25	0.00	0.00	0.25
2005	77	5/31/05 4:30	5/31/05 19:30	yes	10.50	6.25	1.25	2.75
2005	78	6/1/05 4:00	6/1/05 9:15	yes	1.75	3.00	3.25	1.50
2005	79	6/3/05 4:15	6/3/05 5:30	yes	0.25	0.00	0.00	0.00
2005	80	6/5/05 13:15	6/5/05 15:15	yes	1.00	0.00	0.00	0.00
2005	81	6/5/05 22:45	6/5/05 23:00	no	0.00	0.00	0.00	0.00
2005	82	6/6/05 15:45	6/6/05 16:00	no	0.00	0.00	0.00	0.00
2005	83	6/7/05 22:30	6/8/05 4:15	yes	4.75	5.25	8.50	2.50
2005	84	6/8/05 15:15	6/8/05 15:30	yes	0.25	0.25	0.25	0.25
2005	85	6/10/05 18:45	6/12/05 5:15	yes	9.50	20.25	23.25	18.25
2005	86	6/12/05 21:15	6/13/05 6:00	yes	0.25	0.25	0.00	0.25
2005	87	6/14/05 23:15	6/15/05 3:15	no	nd	0.00	0.00	0.00
2005	88	6/16/05 20:45	6/17/05 7:00	yes	nd	5.50	7.00	6.50
2005	89	6/21/05 15:30	6/21/05 17:00	no	nd	0.00	0.00	0.00
2005	90	6/22/05 6:00	6/22/05 20:15	yes	nd	10.50	0.25	11.75
2005	91	6/26/05 19:30	6/27/05 9:15	no	nd	0.00	0.00	0.00
2005	92	7/2/05 1:15	7/2/05 6:15	yes	2.75	0.00	0.00	0.00
2005	93	7/5/05 18:00	7/6/05 0:15	yes	1.75	0.00	0.00	0.00
2005	94	7/8/05 5:15	7/8/05 15:30	yes	5.75	0.00	0.00	0.00
2005	95	7/15/05 12:45	7/15/05 15:45	yes	0.75	0.00	0.00	0.00
2005	96	7/16/05 0:45	7/16/05 9:00	yes	0.50	0.00	0.00	0.00
2005	97	7/22/05 6:00	7/22/05 8:30	yes	1.00	0.00	0.00	0.00
2005	98	8/1/05 7:30	8/1/05 7:45	no	0.00	0.00	0.00	0.00
2005	99	8/17/05 3:00	8/17/05 5:45	no	nd	0.00	0.00	0.00
2005	100	8/28/05 19:00	8/28/05 23:30	yes	nd	1.50	0.00	0.00
2005	101	8/29/05 19:15	8/29/05 19:45	no	0.00	0.00	0.00	0.00
2005	102	8/30/05 7:15	8/30/05 8:00	no	0.00	0.00	0.00	0.00
2005	103	9/4/05 8:15	9/4/05 8:30	yes	0.25	0.00	0.00	0.00
2005	104	9/5/05 8:00	9/5/05 8:15	no	0.00	0.00	0.00	0.00
2005	105	9/9/05 1:15	9/9/05 11:45	yes	2.25	R	0.00	R
2005	106	9/9/05 23:30	9/10/05 8:45	yes	6.25	R	0.00	1.25
2005	107	9/14/05 21:00	9/14/05 21:15	yes	0.25	0.00	0.00	0.00
2005	108	9/16/05 1:30	9/16/05 6:30	yes	2.25	0.00	0.00	0.00
2005	109	9/30/05 4:45	9/30/05 11:00	no	0.00	0.00	nd	0.75
2006	1	10/1/05 9:00	10/1/05 19:00	yes	2.00	1.75	2.50	1.00

Table C.4. Raw flow durations measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Flow Duration (hours)	VFS Flow Duration (hours)	CAVFS1 Flow Duration (hours)	CAVFS2 Flow Duration (hours)
2006	2	10/2/05 4:45	10/2/05 5:00	no	0.00	0.00	0.00	0.00
2006	3	10/2/05 11:30	10/2/05 19:30	yes	1.75	0.00	0.00	0.00
2006	4	10/6/05 13:30	10/6/05 19:15	no	0.00	0.00	0.00	0.00
2006	5	10/8/05 19:00	10/8/05 20:15	no	0.00	0.00	0.00	0.00
2006	6	10/10/05 12:45	10/10/05 13:00	no	0.00	0.00	0.00	0.00
2006	7	10/11/05 0:00	10/11/05 1:45	yes	0.50	0.00	0.00	0.00
2006	8	10/12/05 15:30	10/12/05 19:00	yes	0.50	0.00	0.00	0.00
2006	9	10/14/05 20:15	10/15/05 1:30	yes	5.25	0.00	0.00	0.00
2006	10	10/16/05 5:00	10/16/05 8:30	yes	1.00	0.00	0.00	0.00
2006	11	10/17/05 0:00	10/17/05 5:45	no	0.00	0.00	0.00	0.00
2006	12	10/19/05 1:00	10/19/05 12:45	yes	0.75	1.25	0.25	0.25
2006	13	10/23/05 6:45	10/23/05 16:45	no	0.00	0.00	R	0.00
2006	14	10/25/05 17:30	10/25/05 18:45	no	0.00	0.00	0.00	0.00
2006	15	10/26/05 1:30	10/26/05 2:00	no	0.00	0.00	0.00	0.00
2006	16	10/26/05 8:30	10/26/05 8:45	no	0.00	0.00	0.00	0.00
2006	17	10/27/05 21:30	10/28/05 7:00	yes	2.25	0.00	0.00	0.00
2006	18	10/28/05 18:15	10/28/05 18:30	no	0.00	0.00	0.00	0.00
2006	19	10/29/05 2:15	10/29/05 3:15	yes	0.50	0.00	0.00	0.00
2006	20	10/29/05 15:00	10/29/05 17:30	yes	1.75	0.00	0.00	1.00
2006	21	10/30/05 0:30	10/30/05 0:45	no	0.00	0.00	0.00	0.00
2006	22	10/30/05 19:45	10/31/05 19:00	yes	10.00 J	0.50 J	R	R
2006	23	11/1/05 8:00	11/1/05 19:45	yes	8.25 J	2.50 J	nd	R
2006	24	11/2/05 9:30	11/2/05 9:45	no	0.00	0.00	0.00	0.00
2006	25	11/2/05 17:30	11/3/05 20:00	yes	11.25	4.25	0.50	2.75
2006	26	11/4/05 10:00	11/4/05 14:45	yes	4.00	1.75	0.00	0.75
2006	27	11/5/05 8:45	11/6/05 0:00	yes	12.00	6.25	0.75	4.75
2006	28	11/7/05 3:15	11/7/05 6:15	yes	2.25	0.00	0.00	0.00
2006	29	11/10/05 13:30	11/10/05 18:15	yes	2.50	0.00	0.00	0.00
2006	30	11/11/05 10:00	11/11/05 14:30	yes	2.00	0.00	0.00	0.00
2006	31	11/12/05 23:00	11/13/05 19:45	yes	10.25	0.25	0.25	0.25

Table C.4. Raw flow durations measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Flow Duration (hours)	VFS Flow Duration (hours)	CAVFS1 Flow Duration (hours)	CAVFS2 Flow Duration (hours)
2006	32	11/14/05 4:45	11/14/05 5:15	yes	1.00	0.00	0.00	0.00
2006	33	11/24/05 16:00	11/25/05 22:30	yes	16.50	6.75	0.25	4.25
2006	34	11/26/05 8:30	11/26/05 8:45	no	0.00	0.00	0.00	0.00
2006	35	11/27/05 2:15	11/27/05 11:15	yes	4.75	0.00	0.00	0.00
2006	36	11/28/05 22:00	11/30/05 3:30	no	nd	0.00	0.00	0.00
2006	37	12/1/05 12:45	12/1/05 13:30	no	R	0.00	0.00	0.00
2006	38	12/2/05 12:30	12/2/05 14:45	yes	0.25	0.00	0.00	0.50
2006	39	12/3/05 13:30	12/3/05 17:00	yes	1.00	0.00	0.00	R
2006	40	12/4/05 11:30	12/4/05 17:00	yes	0.75	0.00	0.00	0.00
2006	41	12/6/05 1:00	12/6/05 6:00	yes	3.50	0.00	0.00	0.00
2006	42	12/12/05 14:30	12/12/05 14:45	no	0.00	0.00	0.00	0.00
2006	43	12/15/05 10:15	12/15/05 10:30	no	0.00	0.00	0.00	0.00
2006	44	12/19/05 3:30	12/19/05 10:45	yes	3.75	0.00	0.00	0.00
2006	45	12/19/05 22:15	12/22/05 10:00	yes	20.00	35.50	18.00	38.50
2006	46	12/22/05 18:15	12/22/05 18:30	no	0.00	R	0.00	R
2006	47	12/23/05 14:00	12/24/05 11:45	yes	11.00	17.25	2.00	17.00
2006	48	12/24/05 22:15	12/25/05 7:30	yes	7.00	7.25	0.50	8.25
2006	49	12/25/05 13:45	12/26/05 10:15	yes	6.75	0.00	0.00	0.00
2006	50	12/27/05 0:30	12/27/05 8:15	yes	7.50	1.50	0.00	3.75
2006	51	12/28/05 3:30	12/28/05 12:00	yes	6.00	4.00	0.25	5.00
2006	52	12/29/05 20:45	12/30/05 5:15	yes	5.50	7.00	8.00	0.75
2006	53	12/30/05 11:45	12/31/05 6:30	yes	12.50	18.75	18.25	6.75
2006	54	1/1/06 7:15	1/1/06 10:30	yes	3.75	5.00	4.75	0.75
2006	55	1/1/06 16:30	1/1/06 21:30	yes	5.50	7.00	6.50	2.25
2006	56	1/2/06 5:15	1/2/06 20:30	yes	7.75	17.25	15.25	4.50
2006	57	1/3/06 12:00	1/3/06 23:30	yes	5.00	8.25	5.75	1.25
2006	58	1/5/06 7:30	1/6/06 0:00	yes	17.25	11.75	6.25	7.00
2006	59	1/6/06 9:15	1/6/06 9:30	no	0.00	0.00	0.00	0.00
2006	60	1/6/06 23:00	1/6/06 23:15	no	0.00	0.00	0.00	R
2006	61	1/7/06 6:30	1/7/06 15:45	yes	0.75	1.25	1.50	2.00

Table C.4. Raw flow durations measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Flow Duration (hours)	VFS Flow Duration (hours)	CAVFS1 Flow Duration (hours)	CAVFS2 Flow Duration (hours)
2006	62	1/8/06 15:45	1/11/06 0:15	yes	19.00	22.25	14.25	13.75
2006	63	1/12/06 11:15	1/13/06 23:15	yes	19.00 J	17.50 J	R	9.50 J
2006	64	1/14/06 6:30	1/14/06 20:30	yes	5.75	9.00	1.00	3.75
2006	65	1/15/06 16:30	1/15/06 16:45	no	0.00	0.00	0.00	0.00
2006	66	1/16/06 2:30	1/16/06 22:45	yes	10.25	9.00	0.25	8.50
2006	67	1/18/06 0:15	1/18/06 1:15	yes	3.00	0.25	0.00	0.00
2006	68	1/18/06 8:00	1/18/06 8:15	no	0.00	0.00	0.00	0.00
2006	69	1/18/06 23:15	1/19/06 5:00	yes	3.75	4.50	0.00	0.25
2006	70	1/19/06 22:30	1/20/06 10:15	yes	10.25	0.00	1.75	1.50
2006	71	1/21/06 3:15	1/21/06 11:45	no	0.00	0.00	0.00	0.00
2006	72	1/22/06 11:15	1/22/06 11:30	no	0.00	0.00	0.00	R
2006	73	1/22/06 21:00	1/23/06 0:15	yes	2.00	0.00	0.00	0.00
2006	74	1/23/06 6:15	1/23/06 10:15	yes	1.25	0.00	0.00	0.00
2006	75	1/24/06 6:45	1/24/06 7:00	no	0.00	0.00	0.00	0.00
2006	76	1/25/06 18:00	1/25/06 19:00	yes	1.75	1.25	0.00	1.00
2006	77	1/26/06 16:00	1/26/06 21:00	yes	4.25	0.00	0.00	0.00
2006	78	1/27/06 20:00	1/28/06 5:30	yes	7.25	4.75	1.00	7.25
2006	79	1/29/06 12:45	1/30/06 12:00	yes	R	19.00	2.25	19.25
2006	80	1/31/06 13:45	1/31/06 21:30	yes	8.75	3.50	6.25	8.75
2006	81	2/1/06 16:15	2/2/06 2:30	yes	12.50	6.50	10.00	12.00
2006	82	2/2/06 15:45	2/2/06 20:00	yes	6.50	3.00	5.50	6.50
2006	83	2/3/06 14:30	2/4/06 9:45	yes	20.00 J	12.50	16.25	4.00
2006	84	2/8/06 4:30	2/8/06 6:45	yes	4.50	0.00	0.00	0.00
2006	85	2/13/06 2:00	2/13/06 8:15	yes	8.25	0.00	0.00	0.00
2006	86	2/14/06 2:00	2/14/06 3:45	yes	3.75	0.00	0.00	0.00
2006	87	2/14/06 10:45	2/14/06 11:30	yes	3.00	0.75	0.25	1.00
2006	88	2/21/06 16:45	2/21/06 17:00	no	0.00	0.00	0.00	0.00
2006	89	2/22/06 8:00	2/22/06 8:15	no	0.00	0.00	0.00	0.00
2006	90	2/22/06 15:30	2/22/06 19:45	yes	6.00	0.00	0.00	0.00
2006	91	2/23/06 2:00	2/23/06 14:00	yes	14.00	7.00	8.75	7.75

Table C.4. Raw flow durations measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Flow Duration (hours)	VFS Flow Duration (hours)	CAVFS1 Flow Duration (hours)	CAVFS2 Flow Duration (hours)
2006	92	2/26/06 16:00	2/27/06 2:30	yes	3.25	0.00	R	0.00
2006	93	2/27/06 22:15	2/28/06 12:45	yes	11.50	12.00	8.75	5.25
2006	94	3/2/06 3:45	3/2/06 7:00	yes	1.50	0.00	0.00	0.00
2006	95	3/5/06 8:15	3/5/06 8:45	no	0.00	0.00	0.00	0.00
2006	96	3/6/06 19:00	3/6/06 21:15	no	0.00	0.00	0.00	0.00
2006	97	3/7/06 10:00	3/7/06 18:30	yes	2.25	0.00	0.00	0.00
2006	98	3/8/06 3:45	3/8/06 20:45	yes	7.50	8.00	0.00	1.50
2006	99	3/9/06 22:45	3/9/06 23:00	no	0.00	0.00	0.00	0.00
2006	100	3/10/06 19:15	3/10/06 20:45	no	0.00	0.00	0.00	0.00
2006	101	3/15/06 6:45	3/15/06 19:30	yes	12.50	0.00	0.00	0.00
2006	102	3/16/06 8:30	3/16/06 13:45	yes	6.00	0.00	0.00	0.00
2006	103	3/17/06 8:15	3/17/06 8:30	no	R	0.00	0.00	0.00
2006	104	3/17/06 22:00	3/17/06 22:30	yes	1.50	0.00	0.00	0.00
2006	105	3/18/06 12:15	3/18/06 12:30	no	0.00	0.00	0.00	0.00
2006	106	3/21/06 15:30	3/22/06 19:00	yes	18.50	3.00	0.50	4.25
2006	107	3/24/06 3:00	3/24/06 15:15	yes	2.00	0.25	R	0.25
2006	108	3/25/06 22:15	3/25/06 22:30	no	0.00	0.00	0.00	0.00
2006	109	3/28/06 2:30	3/28/06 8:00	yes	1.25	0.00	R	0.00
2006	110	3/31/06 3:15	3/31/06 9:30	no	0.00	0.00	0.00	0.00
2006	111	4/1/06 4:00	4/1/06 11:45	yes	5.50	3.75	R	1.50
2006	112	4/3/06 14:30	4/3/06 19:30	yes	1.25	0.00	R	0.00
2006	113	4/5/06 22:15	4/5/06 22:45	yes	0.25	0.00	R	0.00
2006	114	4/8/06 13:30	4/9/06 15:45	yes	21.75	0.00	R	0.00
2006	115	4/12/06 7:15	4/12/06 12:15	no	0.00	0.00	0.00	0.00
2006	116	4/13/06 9:45	4/13/06 10:00	no	0.00	0.00	0.00	0.00
2006	117	4/13/06 20:30	4/13/06 23:30	yes	0.25	0.00	R	0.00
2006	118	4/14/06 6:45	4/14/06 7:45	yes	0.50	0.00	R	0.00
2006	119	4/14/06 17:15	4/14/06 17:30	yes	0.50	0.00	R	0.00
2006	120	4/15/06 3:00	4/16/06 6:45	yes	4.00	1.25	R	0.50
2006	121	4/17/06 20:30	4/17/06 20:45	no	0.00	0.00	R	0.00

Table C.4. Raw flow durations measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Flow Duration (hours)	VFS Flow Duration (hours)	CAVFS1 Flow Duration (hours)	CAVFS2 Flow Duration (hours)
2006	122	4/20/06 21:30	4/21/06 10:15	no	0.00	0.00	0.00	0.00
2006	123	4/29/06 11:30	4/29/06 16:30	yes	2.25	1.50	0.00	1.25
2006	124	5/1/06 9:45	5/1/06 10:00	no	0.00	0.00	0.00	0.00
2006	125	5/6/06 22:00	5/7/06 0:30	no	0.00	0.00	0.00	0.00
2006	126	5/7/06 13:30	5/8/06 0:45	no	0.00	0.00	0.00	0.00
2006	127	5/11/06 15:15	5/11/06 15:30	no	0.00	0.00	0.00	0.00
2006	128	5/11/06 23:00	5/12/06 9:15	no	0.00	0.00	0.00	0.00
2006	129	5/19/06 16:00	5/19/06 19:00	no	0.00	0.00	0.00	0.00
2006	130	5/20/06 1:30	5/20/06 1:45	no	0.00	0.00	0.00	0.00
2006	131	5/21/06 16:30	5/21/06 17:15	yes	0.25	0.00	0.00	0.00
2006	132	5/22/06 1:00	5/22/06 6:45	no	0.00	0.00	0.00	0.00
2006	133	5/23/06 8:15	5/23/06 10:30	yes	1.00	R	0.00	0.00
2006	134	5/23/06 22:30	5/24/06 15:30	no	0.00	0.00	R	0.00
2006	135	5/26/06 2:00	5/26/06 6:30	no	0.00	0.00	0.00	0.00
2006	136	5/26/06 13:30	5/26/06 13:45	yes	0.25	0.00	R	0.00
2006	137	5/26/06 21:15	5/27/06 5:30	yes	2.25	0.00	R	0.00
2006	138	5/27/06 11:45	5/28/06 15:00	yes	12.25	3.00	R	2.25
2006	139	5/29/06 5:45	5/29/06 6:00	no	0.00	0.00	R	0.00
2006	140	5/31/06 18:45	5/31/06 23:15	yes	1.25	0.00	0.00	0.00
2006	141	6/1/06 12:00	6/2/06 5:15	yes	3.75	0.00	R	0.00
2006	142	6/2/06 11:45	6/2/06 14:30	no	0.00	0.00	R	0.00
2006	143	6/4/06 0:30	6/4/06 11:30	yes	6.25	0.25	0.25	0.25
2006	144	6/8/06 18:45	6/9/06 8:15	yes	4.00	0.00	R	0.00
2006	145	6/10/06 10:45	6/10/06 11:00	no	0.00	0.00	0.00	0.00
2006	146	6/12/06 7:45	6/12/06 9:15	no	0.00	0.00	0.00	0.00
2006	147	6/12/06 20:30	6/13/06 2:00	yes	2.25	0.00	R	0.00
2006	148	6/16/06 10:45	6/16/06 12:45	yes	0.50	0.00	0.00	0.00
2006	149	7/4/06 5:15	7/4/06 6:15	no	0.00	0.00	0.00	0.00
2006	150	7/6/06 16:15	7/6/06 16:30	no	0.00	0.00	0.00	0.00
2006	151	7/12/06 9:30	7/12/06 10:00	no	0.00	0.00	0.00	0.00

Table C.4. Raw flow durations measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Flow Duration (hours)	VFS Flow Duration (hours)	CAVFS1 Flow Duration (hours)	CAVFS2 Flow Duration (hours)
2006	152	7/13/06 17:45	7/13/06 18:00	no	0.00	0.00	0.00	0.00
2006	153	7/30/06 11:00	7/30/06 12:30	no	0.00	0.00	0.00	0.00
2006	154	8/29/06 8:15	8/30/06 10:45	yes	4.75	0.00	0.00	0.00
2006	155	9/9/06 1:30	9/9/06 11:00	yes	1.75	0.00	0.00	0.00
2006	156	9/13/06 9:15	9/13/06 9:30	no	0.00	0.00	0.00	0.00
2006	157	9/14/06 0:00	9/14/06 7:45	yes	3.75	0.75	0.00	0.00
2006	158	9/18/06 0:15	9/18/06 5:45	yes	3.00	0.00	0.00	0.00
2006	159	9/19/06 2:45	9/19/06 6:30	yes	0.75	0.00	0.00	0.00
2006	160	9/20/06 8:45	9/20/06 21:30	yes	5.50	0.75	0.00	0.00
2006	161	9/21/06 10:15	9/21/06 10:30	yes	0.75	0.00	0.00	0.00

J: estimated value based on quality assurance review

R: data rejected based on quality assurance review

nd: no data are available for specified event

Table C.5. Normalized runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Runoff Volume (cf/acre)	VFS Normalized Runoff Volume (cf/acre)	CAVFS1 Normalized Runoff Volume (cf/acre)	CAVFS2 Normalized Runoff Volume (cf/acre)
2005	1	12/9/04 16:45	12/11/04 5:45	yes	5,732.17	R	R	R
2005	2	12/11/04 13:15	12/11/04 13:30	yes	2.60	2.44	R	R
2005	3	12/13/04 12:15	12/14/04 10:15	yes	1,500.26	154.84	R	13.58
2005	4	12/16/04 20:45	12/16/04 22:45	yes	386.95	17.86	0.00	0.48
2005	5	12/17/04 9:15	12/17/04 9:30	no	0.00	0.00	0.00	0.00
2005	6	12/18/04 3:15	12/18/04 3:30	yes	11.62	1.19	0.00	0.00
2005	7	12/19/04 12:15	12/19/04 12:45	yes	220.27	15.71	0.00	1.07
2005	8	12/21/04 8:45	12/21/04 15:15	yes	986.43	80.56	0.00	5.76
2005	9	12/25/04 11:45	12/26/04 11:30	yes	2,965.67	514.53	0.00	21.27
2005	10	12/29/04 8:45	12/30/04 0:15	yes	2,855.27	700.84	0.00	10.93
2005	11	1/1/05 3:30	1/1/05 6:45	yes	366.46	21.26	0.00	4.67
2005	12	1/2/05 13:30	1/2/05 13:45	yes	7.13	0.00	0.06	0.58
2005	13	1/5/05 15:15	1/5/05 15:30	no	R	R	R	0.00
2005	14	1/6/05 19:00	1/7/05 14:45	no	R	0.00	R	R
2005	15	1/8/05 17:00	1/8/05 19:45	yes	3.02	0.00	R	1.93
2005	16	1/10/05 13:30	1/10/05 13:45	no	nd	nd	nd	nd
2005	17	1/13/05 8:00	1/13/05 8:15	no	nd	nd	nd	nd
2005	18	1/16/05 2:45	1/16/05 14:00	undefined	nd	nd	nd	nd
2005	19	1/17/05 8:30	1/18/05 2:30	undefined	nd	nd	nd	nd
2005	20	1/18/05 10:00	1/18/05 15:00	undefined	nd	nd	nd	nd
2005	21	1/18/05 23:30	1/19/05 7:00	undefined	nd	nd	nd	nd
2005	22	1/20/05 11:15	1/20/05 13:45	yes	28.47	0.06	0.00	nd
2005	23	1/22/05 20:15	1/22/05 20:30	yes	7.08	0.00	0.00	nd
2005	24	1/26/05 23:00	1/26/05 23:15	yes	0.05	0.00	0.00	nd
2005	25	1/28/05 21:30	1/28/05 21:45	yes	7.13	0.00	0.00	nd
2005	26	1/30/05 8:45	1/30/05 9:30	yes	58.22	0.00	0.00	nd
2005	27	1/31/05 3:30	1/31/05 3:45	no	0.00	0.00	0.00	nd
2005	28	2/4/05 7:15	2/4/05 15:30	yes	827.73	134.70	0.00	3.36
2005	29	2/4/05 23:00	2/5/05 3:45	yes	102.13	0.00	0.00	0.00
2005	30	2/5/05 20:30	2/5/05 21:15	yes	101.28	0.00	0.00	0.00
2005	31	2/6/05 8:00	2/6/05 18:30	yes	1,102.07	519.74	0.61	65.42
2005	32	2/12/05 3:30	2/12/05 3:45	no	0.00	0.00	0.00	0.00
2005	33	2/12/05 10:00	2/12/05 18:45	yes	566.95	41.14	0.00	0.54
2005	34	2/13/05 6:00	2/13/05 8:30	yes	2.12	0.00	0.00	0.00
2005	35	2/14/05 9:00	2/14/05 9:15	no	0.00	0.00	0.00	0.00
2005	36	2/28/05 8:00	3/1/05 6:45	yes	97.36	0.00	0.00	0.00

Table C.5. Normalized runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Runoff Volume (cf/acre)	VFS Normalized Runoff Volume (cf/acre)	CAVFS1 Normalized Runoff Volume (cf/acre)	CAVFS2 Normalized Runoff Volume (cf/acre)
2005	37	3/1/05 13:45	3/1/05 14:00	no	0.00	0.00	0.00	0.00
2005	38	3/9/05 9:15	3/9/05 9:30	no	0.00	0.00	0.00	0.00
2005	39	3/16/05 11:30	3/16/05 15:45	yes	194.25	0.00	0.00	nd
2005	40	3/17/05 7:15	3/17/05 7:30	no	0.00	0.00	0.00	nd
2005	41	3/18/05 3:30	3/18/05 5:15	yes	21.39	0.00	0.00	nd
2005	42	3/19/05 13:15	3/20/05 19:30	yes	951.11	243.77	65.80	62.49
2005	43	3/26/05 3:00	3/27/05 9:45	yes	2,470.07	R	0.00	430.70
2005	44	3/27/05 23:45	3/28/05 0:00	no	0.00	0.00	0.00	0.00
2005	45	3/28/05 6:45	3/28/05 13:30	yes	22.90	0.00	0.00	0.00
2005	46	3/28/05 22:30	3/29/05 1:30	yes	124.23	0.00	0.00	0.00
2005	47	3/29/05 13:15	3/29/05 13:30	yes	39.38	0.00	nd	1.99
2005	48	3/29/05 21:15	3/29/05 21:45	no	0.00	nd	nd	0.00
2005	49	3/30/05 21:00	3/30/05 21:15	no	0.00	nd	nd	0.00
2005	50	3/31/05 11:15	3/31/05 11:45	yes	1.37	0.00	nd	0.12
2005	51	3/31/05 18:30	4/1/05 9:00	yes	912.82	R	48.72	45.38
2005	52	4/2/05 17:15	4/3/05 13:00	yes	756.43	nd	43.70	26.26
2005	53	4/4/05 6:15	4/4/05 10:15	yes	339.54	nd	28.47	74.72
2005	54	4/6/05 13:00	4/6/05 13:15	no	0.00	0.00	0.00	0.00
2005	55	4/7/05 10:00	4/7/05 18:15	yes	949.51	869.24	33.28	354.67
2005	56	4/8/05 10:15	4/8/05 10:30	yes	1.37	0.02	1.09	0.00
2005	57	4/10/05 19:15	4/11/05 3:00	yes	604.25	229.49	40.45	42.58
2005	58	4/12/05 11:45	4/12/05 14:15	yes	22.90	0.00	0.00	0.00
2005	59	4/13/05 13:30	4/13/05 13:45	no	0.00	0.00	0.00	0.00
2005	60	4/14/05 1:00	4/14/05 13:30	yes	92.41	0.00	12.70	0.00
2005	61	4/15/05 12:45	4/16/05 13:00	yes	2,409.01	R	543.36	1,139.63
2005	62	4/17/05 15:00	4/18/05 0:45	yes	866.07	327.93	64.19	127.04
2005	63	4/23/05 22:15	4/23/05 23:30	yes	80.55	0.00	0.00	0.00
2005	64	4/29/05 7:30	4/29/05 8:15	yes	75.97	0.00	0.00	0.00
2005	65	4/29/05 17:45	4/30/05 6:15	yes	33.29	0.00	0.00	0.00
2005	66	5/4/05 4:15	5/4/05 6:45	yes	1.13	0.00	0.00	0.00
2005	67	5/8/05 17:30	5/9/05 0:00	yes	89.48	0.00	0.00	0.00
2005	68	5/9/05 6:30	5/9/05 9:45	yes	7.55	0.00	0.00	0.00
2005	69	5/9/05 19:30	5/10/05 3:15	yes	526.62	0.00	0.00	81.12
2005	70	5/14/05 1:45	5/14/05 7:45	yes	79.85	R	0.00	16.10
2005	71	5/15/05 2:45	5/15/05 9:00	yes	908.76	R	206.97	772.65
2005	72	5/16/05 11:45	5/16/05 22:30	yes	234.82	6.57	23.39	2.74

Table C.5. Normalized runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Runoff Volume (cf/acre)	VFS Normalized Runoff Volume (cf/acre)	CAVFS1 Normalized Runoff Volume (cf/acre)	CAVFS2 Normalized Runoff Volume (cf/acre)
2005	73	5/17/05 23:00	5/20/05 0:15	yes	1,297.98	0.00	15.04	86.72
2005	74	5/20/05 11:00	5/20/05 15:00	yes	25.50	0.00	0.00	1.49
2005	75	5/21/05 17:30	5/21/05 19:45	yes	230.99	0.00	0.00	2.82
2005	76	5/22/05 11:30	5/22/05 11:45	yes	0.57	0.00	0.00	0.06
2005	77	5/31/05 4:30	5/31/05 19:30	yes	1,006.64	995.17	187.94	881.68
2005	78	6/1/05 4:00	6/1/05 9:15	yes	159.31	14.74	10.02	13.72
2005	79	6/3/05 4:15	6/3/05 5:30	yes	1.51	0.00	0.00	0.00
2005	80	6/5/05 13:15	6/5/05 15:15	yes	25.50	0.00	0.00	0.00
2005	81	6/5/05 22:45	6/5/05 23:00	no	0.00	0.00	0.00	0.00
2005	82	6/6/05 15:45	6/6/05 16:00	no	0.00	0.00	0.00	0.00
2005	83	6/7/05 22:30	6/8/05 4:15	yes	959.42	799.82	142.07	599.44
2005	84	6/8/05 15:15	6/8/05 15:30	yes	0.80	0.73	0.79	0.91
2005	85	6/10/05 18:45	6/12/05 5:15	yes	944.31	202.04	80.93	137.17
2005	86	6/12/05 21:15	6/13/05 6:00	yes	7.60	0.12	0.00	0.04
2005	87	6/14/05 23:15	6/15/05 3:15	no	nd	0.00	0.00	0.00
2005	88	6/16/05 20:45	6/17/05 7:00	yes	nd	23.78	18.55	36.87
2005	89	6/21/05 15:30	6/21/05 17:00	no	nd	0.00	0.00	0.00
2005	90	6/22/05 6:00	6/22/05 20:15	yes	nd	266.30	0.61	200.07
2005	91	6/26/05 19:30	6/27/05 9:15	no	nd	0.00	0.00	0.00
2005	92	7/2/05 1:15	7/2/05 6:15	yes	98.83	0.00	0.00	0.00
2005	93	7/5/05 18:00	7/6/05 0:15	yes	80.65	0.00	0.00	0.00
2005	94	7/8/05 5:15	7/8/05 15:30	yes	117.05	0.00	0.00	0.00
2005	95	7/15/05 12:45	7/15/05 15:45	yes	11.52	0.00	0.00	0.00
2005	96	7/16/05 0:45	7/16/05 9:00	yes	5.38	0.00	0.00	0.00
2005	97	7/22/05 6:00	7/22/05 8:30	yes	26.73	0.00	0.00	0.00
2005	98	8/1/05 7:30	8/1/05 7:45	no	0.00	0.00	0.00	0.00
2005	99	8/17/05 3:00	8/17/05 5:45	no	nd	0.00	0.00	0.00
2005	100	8/28/05 19:00	8/28/05 23:30	yes	nd	4.08	0.00	0.00
2005	101	8/29/05 19:15	8/29/05 19:45	no	0.00	0.00	0.00	0.00
2005	102	8/30/05 7:15	8/30/05 8:00	no	0.00	0.00	0.00	0.00
2005	103	9/4/05 8:15	9/4/05 8:30	yes	97.22	0.00	0.00	0.00
2005	104	9/5/05 8:00	9/5/05 8:15	no	0.00	0.00	0.00	0.00
2005	105	9/9/05 1:15	9/9/05 11:45	yes	811.82	R	0.00	R
2005	106	9/9/05 23:30	9/10/05 8:45	yes	583.71	R	0.00	7.18
2005	107	9/14/05 21:00	9/14/05 21:15	yes	5.95	0.00	0.00	0.00
2005	108	9/16/05 1:30	9/16/05 6:30	yes	51.89	0.00	0.00	0.00

Table C.5. Normalized runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Runoff Volume (cf/acre)	VFS Normalized Runoff Volume (cf/acre)	CAVFS1 Normalized Runoff Volume (cf/acre)	CAVFS2 Normalized Runoff Volume (cf/acre)
2005	109	9/30/05 4:45	9/30/05 11:00	no	0.00	0.00	nd	2.44
2006	1	10/1/05 9:00	10/1/05 19:00	yes	737.78	14.36	7.24	17.69
2006	2	10/2/05 4:45	10/2/05 5:00	no	0.00	0.00	0.00	0.00
2006	3	10/2/05 11:30	10/2/05 19:30	yes	82.30	0.00	0.00	0.00
2006	4	10/6/05 13:30	10/6/05 19:15	no	0.00	0.00	0.00	0.00
2006	5	10/8/05 19:00	10/8/05 20:15	no	0.00	0.00	0.00	0.00
2006	6	10/10/05 12:45	10/10/05 13:00	no	0.00	0.00	0.00	0.00
2006	7	10/11/05 0:00	10/11/05 1:45	yes	11.57	0.00	0.00	0.00
2006	8	10/12/05 15:30	10/12/05 19:00	yes	5.52	0.00	0.00	0.00
2006	9	10/14/05 20:15	10/15/05 1:30	yes	457.16	0.00	0.00	0.00
2006	10	10/16/05 5:00	10/16/05 8:30	yes	11.62	0.00	0.00	0.00
2006	11	10/17/05 0:00	10/17/05 5:45	no	0.00	0.00	0.00	0.00
2006	12	10/19/05 1:00	10/19/05 12:45	yes	25.97	5.19	0.67	0.64
2006	13	10/23/05 6:45	10/23/05 16:45	no	0.00	0.00	R	0.00
2006	14	10/25/05 17:30	10/25/05 18:45	no	0.00	0.00	0.00	0.00
2006	15	10/26/05 1:30	10/26/05 2:00	no	0.00	0.00	0.00	0.00
2006	16	10/26/05 8:30	10/26/05 8:45	no	0.00	0.00	0.00	0.00
2006	17	10/27/05 21:30	10/28/05 7:00	yes	199.78	0.00	0.00	0.00
2006	18	10/28/05 18:15	10/28/05 18:30	no	0.00	0.00	0.00	0.00
2006	19	10/29/05 2:15	10/29/05 3:15	yes	12.18	0.00	0.00	0.00
2006	20	10/29/05 15:00	10/29/05 17:30	yes	215.13	0.00	0.00	9.42
2006	21	10/30/05 0:30	10/30/05 0:45	no	0.00	0.00	0.00	0.00
2006	22	10/30/05 19:45	10/31/05 19:00	yes	769.46 J	2.50 J	R	R
2006	23	11/1/05 8:00	11/1/05 19:45	yes	680.74 J	35.81 J	nd	R
2006	24	11/2/05 9:30	11/2/05 9:45	no	0.00	0.00	0.00	0.00
2006	25	11/2/05 17:30	11/3/05 20:00	yes	1,120.91	130.01	1.17	11.65
2006	26	11/4/05 10:00	11/4/05 14:45	yes	485.68	57.15	0.00	15.39
2006	27	11/5/05 8:45	11/6/05 0:00	yes	1,664.53	594.30	1.00	241.33
2006	28	11/7/05 3:15	11/7/05 6:15	yes	88.44	0.00	0.00	0.00
2006	29	11/10/05 13:30	11/10/05 18:15	yes	96.80	0.00	0.00	0.00

Table C.5. Normalized runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Runoff Volume (cf/acre)	VFS Normalized Runoff Volume (cf/acre)	CAVFS1 Normalized Runoff Volume (cf/acre)	CAVFS2 Normalized Runoff Volume (cf/acre)
2006	30	11/11/05 10:00	11/11/05 14:30	yes	33.52	0.00	0.00	0.00
2006	31	11/12/05 23:00	11/13/05 19:45	yes	558.02	0.56	0.56	1.11
2006	32	11/14/05 4:45	11/14/05 5:15	yes	40.80	0.00	0.00	0.00
2006	33	11/24/05 16:00	11/25/05 22:30	yes	1,826.44	172.05	0.50	30.33
2006	34	11/26/05 8:30	11/26/05 8:45	no	0.00	0.00	0.00	0.00
2006	35	11/27/05 2:15	11/27/05 11:15	yes	249.83	0.00	0.00	0.00
2006	36	11/28/05 22:00	11/30/05 3:30	no	nd	0.00	0.00	0.00
2006	37	12/1/05 12:45	12/1/05 13:30	no	R	0.00	0.00	0.00
2006	38	12/2/05 12:30	12/2/05 14:45	yes	1.79	0.00	0.00	1.25
2006	39	12/3/05 13:30	12/3/05 17:00	yes	5.86	0.00	0.00	R
2006	40	12/4/05 11:30	12/4/05 17:00	yes	4.96	0.00	0.00	0.00
2006	41	12/6/05 1:00	12/6/05 6:00	yes	22.81	0.00	0.00	0.00
2006	42	12/12/05 14:30	12/12/05 14:45	no	0.00	0.00	0.00	0.00
2006	43	12/15/05 10:15	12/15/05 10:30	no	0.00	0.00	0.00	0.00
2006	44	12/19/05 3:30	12/19/05 10:45	yes	270.18	0.00	0.00	0.00
2006	45	12/19/05 22:15	12/22/05 10:00	yes	1,361.91	345.34	81.81	353.08
2006	46	12/22/05 18:15	12/22/05 18:30	no	0.00	R	0.00	R
2006	47	12/23/05 14:00	12/24/05 11:45	yes	1,622.50	536.42	5.29	566.05
2006	48	12/24/05 22:15	12/25/05 7:30	yes	1,809.82	584.17	1.17	549.13
2006	49	12/25/05 13:45	12/26/05 10:15	yes	229.48	0.00	0.00	0.00
2006	50	12/27/05 0:30	12/27/05 8:15	yes	443.75	16.05	0.00	2.09
2006	51	12/28/05 3:30	12/28/05 12:00	yes	406.97	172.93	0.61	26.97
2006	52	12/29/05 20:45	12/30/05 5:15	yes	88.11	22.86	27.90	2.39
2006	53	12/30/05 11:45	12/31/05 6:30	yes	1,094.37	396.21	59.57	100.04
2006	54	1/1/06 7:15	1/1/06 10:30	yes	76.07	20.07	13.76	2.03
2006	55	1/1/06 16:30	1/1/06 21:30	yes	270.23	31.31	20.69	15.07
2006	56	1/2/06 5:15	1/2/06 20:30	yes	288.83	60.51	47.88	14.27
2006	57	1/3/06 12:00	1/3/06 23:30	yes	78.67	29.60	18.93	3.68
2006	58	1/5/06 7:30	1/6/06 0:00	yes	1,410.87	524.04	21.42	154.31

Table C.5. Normalized runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Runoff Volume (cf/acre)	VFS Normalized Runoff Volume (cf/acre)	CAVFS1 Normalized Runoff Volume (cf/acre)	CAVFS2 Normalized Runoff Volume (cf/acre)
2006	59	1/6/06 9:15	1/6/06 9:30	no	0.00	0.00	0.00	0.00
2006	60	1/6/06 23:00	1/6/06 23:15	no	0.00	0.00	0.00	R
2006	61	1/7/06 6:30	1/7/06 15:45	yes	128.81	4.08	4.06	15.21
2006	62	1/8/06 15:45	1/11/06 0:15	yes	1,316.72	687.90	66.77	277.63
2006	63	1/12/06 11:15	1/13/06 23:15	yes	589.33 J	42.19 J	R	31.98 J
2006	64	1/14/06 6:30	1/14/06 20:30	yes	651.84	214.68	2.13	38.46
2006	65	1/15/06 16:30	1/15/06 16:45	no	0.00	0.00	0.00	0.00
2006	66	1/16/06 2:30	1/16/06 22:45	yes	618.23	254.00	0.56	215.89
2006	67	1/18/06 0:15	1/18/06 1:15	yes	81.78	0.46	0.00	0.00
2006	68	1/18/06 8:00	1/18/06 8:15	no	0.00	0.00	0.00	0.00
2006	69	1/18/06 23:15	1/19/06 5:00	yes	132.68	10.53	0.00	0.91
2006	70	1/19/06 22:30	1/20/06 10:15	yes	338.60	0.00	3.51	5.86
2006	71	1/21/06 3:15	1/21/06 11:45	no	0.00	0.00	0.00	0.00
2006	72	1/22/06 11:15	1/22/06 11:30	no	0.00	0.00	0.00	R
2006	73	1/22/06 21:00	1/23/06 0:15	yes	58.93	0.00	0.00	0.00
2006	74	1/23/06 6:15	1/23/06 10:15	yes	7.32	0.00	0.00	0.00
2006	75	1/24/06 6:45	1/24/06 7:00	no	0.00	0.00	0.00	0.00
2006	76	1/25/06 18:00	1/25/06 19:00	yes	385.35	19.47	0.00	9.58
2006	77	1/26/06 16:00	1/26/06 21:00	yes	64.12	0.00	0.00	0.00
2006	78	1/27/06 20:00	1/28/06 5:30	yes	674.89	226.39	2.01	49.87
2006	79	1/29/06 12:45	1/30/06 12:00	yes	R	2,496.21	7.11	1,328.20
2006	80	1/31/06 13:45	1/31/06 21:30	yes	319.43	7.92	20.06	71.76
2006	81	2/1/06 16:15	2/2/06 2:30	yes	497.63	32.33	32.50	133.85
2006	82	2/2/06 15:45	2/2/06 20:00	yes	455.94	126.26	20.04	93.44
2006	83	2/3/06 14:30	2/4/06 9:45	yes	1515.18 J	520.49	59.03	451.26
2006	84	2/8/06 4:30	2/8/06 6:45	yes	47.03	0.00	0.00	0.00
2006	85	2/13/06 2:00	2/13/06 8:15	yes	327.36	0.00	0.00	0.00
2006	86	2/14/06 2:00	2/14/06 3:45	yes	114.79	0.00	0.00	0.00
2006	87	2/14/06 10:45	2/14/06 11:30	yes	52.93	1.60	0.17	2.52

Table C.5. Normalized runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Runoff Volume (cf/acre)	VFS Normalized Runoff Volume (cf/acre)	CAVFS1 Normalized Runoff Volume (cf/acre)	CAVFS2 Normalized Runoff Volume (cf/acre)
2006	88	2/21/06 16:45	2/21/06 17:00	no	0.00	0.00	0.00	0.00
2006	89	2/22/06 8:00	2/22/06 8:15	no	0.00	0.00	0.00	0.00
2006	90	2/22/06 15:30	2/22/06 19:45	yes	139.48	0.00	0.00	0.00
2006	91	2/23/06 2:00	2/23/06 14:00	yes	1,121.47	156.86	20.06	29.26
2006	92	2/26/06 16:00	2/27/06 2:30	yes	18.13	0.00	R	0.00
2006	93	2/27/06 22:15	2/28/06 12:45	yes	388.89	39.33	108.29	14.59
2006	94	3/2/06 3:45	3/2/06 7:00	yes	15.82	0.00	0.00	0.00
2006	95	3/5/06 8:15	3/5/06 8:45	no	0.00	0.00	0.00	0.00
2006	96	3/6/06 19:00	3/6/06 21:15	no	0.00	0.00	0.00	0.00
2006	97	3/7/06 10:00	3/7/06 18:30	yes	293.41	0.00	0.00	0.00
2006	98	3/8/06 3:45	3/8/06 20:45	yes	450.74	216.93	0.00	8.31
2006	99	3/9/06 22:45	3/9/06 23:00	no	0.00	0.00	0.00	0.00
2006	100	3/10/06 19:15	3/10/06 20:45	no	0.00	0.00	0.00	0.00
2006	101	3/15/06 6:45	3/15/06 19:30	yes	133.15	0.00	0.00	0.00
2006	102	3/16/06 8:30	3/16/06 13:45	yes	50.48	0.00	0.00	0.00
2006	103	3/17/06 8:15	3/17/06 8:30	no	R	0.00	0.00	0.00
2006	104	3/17/06 22:00	3/17/06 22:30	yes	140.43	0.00	0.00	0.00
2006	105	3/18/06 12:15	3/18/06 12:30	no	0.00	0.00	0.00	0.00
2006	106	3/21/06 15:30	3/22/06 19:00	yes	558.97	24.13	1.59	7.53
2006	107	3/24/06 3:00	3/24/06 15:15	yes	214.61	0.46	R	0.48
2006	108	3/25/06 22:15	3/25/06 22:30	no	0.00	0.00	0.00	0.00
2006	109	3/28/06 2:30	3/28/06 8:00	yes	36.07	0.00	R	0.00
2006	110	3/31/06 3:15	3/31/06 9:30	no	0.00	0.00	0.00	0.00
2006	111	4/1/06 4:00	4/1/06 11:45	yes	573.98	238.25	R	8.59
2006	112	4/3/06 14:30	4/3/06 19:30	yes	36.31	0.00	R	0.00
2006	113	4/5/06 22:15	4/5/06 22:45	yes	11.05	0.00	R	0.00
2006	114	4/8/06 13:30	4/9/06 15:45	yes	285.43	0.00	R	0.00
2006	115	4/12/06 7:15	4/12/06 12:15	no	0.00	0.00	0.00	0.00
2006	116	4/13/06 9:45	4/13/06 10:00	no	0.00	0.00	0.00	0.00

Table C.5. Normalized runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Runoff Volume (cf/acre)	VFS Normalized Runoff Volume (cf/acre)	CAVFS1 Normalized Runoff Volume (cf/acre)	CAVFS2 Normalized Runoff Volume (cf/acre)
2006	117	4/13/06 20:30	4/13/06 23:30	yes	2.60	0.00	R	0.00
2006	118	4/14/06 6:45	4/14/06 7:45	yes	29.94	0.00	R	0.00
2006	119	4/14/06 17:15	4/14/06 17:30	yes	2.50	0.00	R	0.00
2006	120	4/15/06 3:00	4/16/06 6:45	yes	332.46	52.54	R	20.53
2006	121	4/17/06 20:30	4/17/06 20:45	no	0.00	0.00	R	0.00
2006	122	4/20/06 21:30	4/21/06 10:15	no	0.00	0.00	0.00	0.00
2006	123	4/29/06 11:30	4/29/06 16:30	yes	173.29	57.69	0.00	16.86
2006	124	5/1/06 9:45	5/1/06 10:00	no	0.00	0.00	0.00	0.00
2006	125	5/6/06 22:00	5/7/06 0:30	no	0.00	0.00	0.00	0.00
2006	126	5/7/06 13:30	5/8/06 0:45	no	0.00	0.00	0.00	0.00
2006	127	5/11/06 15:15	5/11/06 15:30	no	0.00	0.00	0.00	0.00
2006	128	5/11/06 23:00	5/12/06 9:15	no	0.00	0.00	0.00	0.00
2006	129	5/19/06 16:00	5/19/06 19:00	no	0.00	0.00	0.00	0.00
2006	130	5/20/06 1:30	5/20/06 1:45	no	0.00	0.00	0.00	0.00
2006	131	5/21/06 16:30	5/21/06 17:15	yes	5.95	0.00	0.00	0.00
2006	132	5/22/06 1:00	5/22/06 6:45	no	0.00	0.00	0.00	0.00
2006	133	5/23/06 8:15	5/23/06 10:30	yes	296.48	R	0.00	0.00
2006	134	5/23/06 22:30	5/24/06 15:30	no	0.00	0.00	R	0.00
2006	135	5/26/06 2:00	5/26/06 6:30	no	0.00	0.00	0.00	0.00
2006	136	5/26/06 13:30	5/26/06 13:45	yes	5.95	0.00	R	0.00
2006	137	5/26/06 21:15	5/27/06 5:30	yes	66.06	0.00	R	0.00
2006	138	5/27/06 11:45	5/28/06 15:00	yes	1,437.27	90.20	R	106.28
2006	139	5/29/06 5:45	5/29/06 6:00	no	0.00	0.00	R	0.00
2006	140	5/31/06 18:45	5/31/06 23:15	yes	36.97	0.00	0.00	0.00
2006	141	6/1/06 12:00	6/2/06 5:15	yes	100.29	0.00	R	0.00
2006	142	6/2/06 11:45	6/2/06 14:30	no	0.00	0.00	R	0.00
2006	143	6/4/06 0:30	6/4/06 11:30	yes	470.43	0.81	4.16	4.00
2006	144	6/8/06 18:45	6/9/06 8:15	yes	152.75	0.00	R	0.00
2006	145	6/10/06 10:45	6/10/06 11:00	no	0.00	0.00	0.00	0.00

Table C.5. Normalized runoff volumes measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Runoff Volume (cf/acre)	VFS Normalized Runoff Volume (cf/acre)	CAVFS1 Normalized Runoff Volume (cf/acre)	CAVFS2 Normalized Runoff Volume (cf/acre)
2006	146	6/12/06 7:45	6/12/06 9:15	no	0.00	0.00	0.00	0.00
2006	147	6/12/06 20:30	6/13/06 2:00	yes	262.96	0.00	R	0.00
2006	148	6/16/06 10:45	6/16/06 12:45	yes	41.22	0.00	0.00	0.00
2006	149	7/4/06 5:15	7/4/06 6:15	no	0.00	0.00	0.00	0.00
2006	150	7/6/06 16:15	7/6/06 16:30	no	0.00	0.00	0.00	0.00
2006	151	7/12/06 9:30	7/12/06 10:00	no	0.00	0.00	0.00	0.00
2006	152	7/13/06 17:45	7/13/06 18:00	no	0.00	0.00	0.00	0.00
2006	153	7/30/06 11:00	7/30/06 12:30	no	0.00	0.00	0.00	0.00
2006	154	8/29/06 8:15	8/30/06 10:45	yes	654.87	0.00	0.00	0.00
2006	155	9/9/06 1:30	9/9/06 11:00	yes	93.73	0.00	0.00	0.00
2006	156	9/13/06 9:15	9/13/06 9:30	no	0.00	0.00	0.00	0.00
2006	157	9/14/06 0:00	9/14/06 7:45	yes	312.77	6.96	0.00	0.00
2006	158	9/18/06 0:15	9/18/06 5:45	yes	101.52	0.00	0.00	0.00
2006	159	9/19/06 2:45	9/19/06 6:30	yes	13.27	0.00	0.00	0.00
2006	160	9/20/06 8:45	9/20/06 21:30	yes	77.63	44.29	0.00	0.00
2006	161	9/21/06 10:15	9/21/06 10:30	yes	3.87	0.00	0.00	0.00

J: estimated value based on quality assurance review

R: data rejected based on quality assurance review

nd: no data are available for specified event

cf: cubic feet

Table C.6. Normalized peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Peak Discharge Rate (cfs/acre)	VFS Normalized Peak Discharge Rate (cfs/acre)	CAVFS1 Normalized Peak Discharge Rate (cfs/acre)	CAVFS2 Normalized Peak Discharge Rate (cfs/acre)
2005	1	12/9/04 16:45	12/11/04 5:45	yes	0.159	R	R	R
2005	2	12/11/04 13:15	12/11/04 13:30	yes	0.003	0.002	R	R
2005	3	12/13/04 12:15	12/14/04 10:15	yes	0.129	0.015	R	0.002
2005	4	12/16/04 20:45	12/16/04 22:45	yes	0.079	0.003	0.000	0.001
2005	5	12/17/04 9:15	12/17/04 9:30	no	0.000	0.000	0.000	0.000
2005	6	12/18/04 3:15	12/18/04 3:30	yes	0.013	0.001	0.000	0.000
2005	7	12/19/04 12:15	12/19/04 12:45	yes	0.139	0.010	0.000	0.001
2005	8	12/21/04 8:45	12/21/04 15:15	yes	0.089	0.016	0.000	0.001
2005	9	12/25/04 11:45	12/26/04 11:30	yes	0.111	0.046	0.000	0.002
2005	10	12/29/04 8:45	12/30/04 0:15	yes	0.103	0.048	0.000	0.001
2005	11	1/1/05 3:30	1/1/05 6:45	yes	0.053	0.002	0.000	0.001
2005	12	1/2/05 13:30	1/2/05 13:45	yes	0.008	0.000	0.000	0.001
2005	13	1/5/05 15:15	1/5/05 15:30	no	R	R	R	0.000
2005	14	1/6/05 19:00	1/7/05 14:45	no	R	0.000	R	R
2005	15	1/8/05 17:00	1/8/05 19:45	yes	0.002	0.000	R	0.001
2005	16	1/10/05 13:30	1/10/05 13:45	no	nd	nd	nd	nd
2005	17	1/13/05 8:00	1/13/05 8:15	no	nd	nd	nd	nd
2005	18	1/16/05 2:45	1/16/05 14:00	undefined	nd	nd	nd	nd
2005	19	1/17/05 8:30	1/18/05 2:30	undefined	nd	nd	nd	nd
2005	20	1/18/05 10:00	1/18/05 15:00	undefined	nd	nd	nd	nd
2005	21	1/18/05 23:30	1/19/05 7:00	undefined	nd	nd	nd	nd
2005	22	1/20/05 11:15	1/20/05 13:45	yes	0.014	0.000	0.000	nd
2005	23	1/22/05 20:15	1/22/05 20:30	yes	0.006	0.000	0.000	nd
2005	24	1/26/05 23:00	1/26/05 23:15	yes	0.000	0.000	0.000	nd
2005	25	1/28/05 21:30	1/28/05 21:45	yes	0.006	0.000	0.000	nd
2005	26	1/30/05 8:45	1/30/05 9:30	yes	0.028	0.000	0.000	nd
2005	27	1/31/05 3:30	1/31/05 3:45	no	0.000	0.000	0.000	nd
2005	28	2/4/05 7:15	2/4/05 15:30	yes	0.194	0.024	0.000	0.004
2005	29	2/4/05 23:00	2/5/05 3:45	yes	0.046	0.000	0.000	0.000
2005	30	2/5/05 20:30	2/5/05 21:15	yes	0.046	0.000	0.000	0.000
2005	31	2/6/05 8:00	2/6/05 18:30	yes	0.087	0.069	0.001	0.026
2005	32	2/12/05 3:30	2/12/05 3:45	no	0.000	0.000	0.000	0.000
2005	33	2/12/05 10:00	2/12/05 18:45	yes	0.076	0.012	0.000	0.001
2005	34	2/13/05 6:00	2/13/05 8:30	yes	0.002	0.000	0.000	0.000
2005	35	2/14/05 9:00	2/14/05 9:15	no	0.000	0.000	0.000	0.000
2005	36	2/28/05 8:00	3/1/05 6:45	yes	0.022	0.000	0.000	0.000

Table C.6. Normalized peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Peak Discharge Rate (cfs/acre)	VFS Normalized Peak Discharge Rate (cfs/acre)	CAVFS1 Normalized Peak Discharge Rate (cfs/acre)	CAVFS2 Normalized Peak Discharge Rate (cfs/acre)
2005	37	3/1/05 13:45	3/1/05 14:00	no	0.000	0.000	0.000	0.000
2005	38	3/9/05 9:15	3/9/05 9:30	no	0.000	0.000	0.000	0.000
2005	39	3/16/05 11:30	3/16/05 15:45	yes	0.099	0.000	0.000	nd
2005	40	3/17/05 7:15	3/17/05 7:30	no	0.000	0.000	0.000	nd
2005	41	3/18/05 3:30	3/18/05 5:15	yes	0.014	0.000	0.000	nd
2005	42	3/19/05 13:15	3/20/05 19:30	yes	0.065	0.046	0.002	0.010
2005	43	3/26/05 3:00	3/27/05 9:45	yes	0.081	R	0.000	0.050
2005	44	3/27/05 23:45	3/28/05 0:00	no	0.000	0.000	0.000	0.000
2005	45	3/28/05 6:45	3/28/05 13:30	yes	0.009	0.000	0.000	0.000
2005	46	3/28/05 22:30	3/29/05 1:30	yes	0.022	0.000	0.000	0.000
2005	47	3/29/05 13:15	3/29/05 13:30	yes	0.030	0.000	nd	0.002
2005	48	3/29/05 21:15	3/29/05 21:45	no	0.000	nd	nd	0.000
2005	49	3/30/05 21:00	3/30/05 21:15	no	0.000	nd	nd	0.000
2005	50	3/31/05 11:15	3/31/05 11:45	yes	0.002	0.000	nd	0.000
2005	51	3/31/05 18:30	4/1/05 9:00	yes	0.069	R	0.001	0.006
2005	52	4/2/05 17:15	4/3/05 13:00	yes	0.073	nd	0.001	0.007
2005	53	4/4/05 6:15	4/4/05 10:15	yes	0.087	nd	0.001	0.031
2005	54	4/6/05 13:00	4/6/05 13:15	no	0.000	0.000	0.000	0.000
2005	55	4/7/05 10:00	4/7/05 18:15	yes	0.133	0.151	0.009	0.148
2005	56	4/8/05 10:15	4/8/05 10:30	yes	0.002	0.000	0.001	0.000
2005	57	4/10/05 19:15	4/11/05 3:00	yes	0.059	0.036	0.001	0.008
2005	58	4/12/05 11:45	4/12/05 14:15	yes	0.007	0.000	0.000	0.000
2005	59	4/13/05 13:30	4/13/05 13:45	no	0.000	0.000	0.000	0.000
2005	60	4/14/05 1:00	4/14/05 13:30	yes	0.012	0.000	0.001	0.000
2005	61	4/15/05 12:45	4/16/05 13:00	yes	0.183	R	0.122	0.275
2005	62	4/17/05 15:00	4/18/05 0:45	yes	0.053	0.045	0.001	0.035
2005	63	4/23/05 22:15	4/23/05 23:30	yes	0.060	0.000	0.000	0.000
2005	64	4/29/05 7:30	4/29/05 8:15	yes	0.040	0.000	0.000	0.000
2005	65	4/29/05 17:45	4/30/05 6:15	yes	0.008	0.000	0.000	0.000
2005	66	5/4/05 4:15	5/4/05 6:45	yes	0.001	0.000	0.000	0.000
2005	67	5/8/05 17:30	5/9/05 0:00	yes	0.037	0.000	0.000	0.000
2005	68	5/9/05 6:30	5/9/05 9:45	yes	0.004	0.000	0.000	0.000
2005	69	5/9/05 19:30	5/10/05 3:15	yes	0.062	0.000	0.000	0.020
2005	70	5/14/05 1:45	5/14/05 7:45	yes	0.031	R	0.000	0.002
2005	71	5/15/05 2:45	5/15/05 9:00	yes	0.244	R	0.044	0.369
2005	72	5/16/05 11:45	5/16/05 22:30	yes	0.085	0.007	0.003	0.001

Table C.6. Normalized peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Peak Discharge Rate (cfs/acre)	VFS Normalized Peak Discharge Rate (cfs/acre)	CAVFS1 Normalized Peak Discharge Rate (cfs/acre)	CAVFS2 Normalized Peak Discharge Rate (cfs/acre)
2005	73	5/17/05 23:00	5/20/05 0:15	yes	0.152	0.000	0.001	0.017
2005	74	5/20/05 11:00	5/20/05 15:00	yes	0.018	0.000	0.000	0.001
2005	75	5/21/05 17:30	5/21/05 19:45	yes	0.065	0.000	0.000	0.002
2005	76	5/22/05 11:30	5/22/05 11:45	yes	0.001	0.000	0.000	0.000
2005	77	5/31/05 4:30	5/31/05 19:30	yes	0.412	0.350	0.098	0.498
2005	78	6/1/05 4:00	6/1/05 9:15	yes	0.101	0.002	0.001	0.009
2005	79	6/3/05 4:15	6/3/05 5:30	yes	0.002	0.000	0.000	0.000
2005	80	6/5/05 13:15	6/5/05 15:15	yes	0.017	0.000	0.000	0.000
2005	81	6/5/05 22:45	6/5/05 23:00	no	0.000	0.000	0.000	0.000
2005	82	6/6/05 15:45	6/6/05 16:00	no	0.000	0.000	0.000	0.000
2005	83	6/7/05 22:30	6/8/05 4:15	yes	0.318	0.241	0.057	0.374
2005	84	6/8/05 15:15	6/8/05 15:30	yes	0.001	0.001	0.001	0.001
2005	85	6/10/05 18:45	6/12/05 5:15	yes	0.129	0.034	0.002	0.019
2005	86	6/12/05 21:15	6/13/05 6:00	yes	0.008	0.000	0.000	0.000
2005	87	6/14/05 23:15	6/15/05 3:15	no	nd	0.000	0.000	0.000
2005	88	6/16/05 20:45	6/17/05 7:00	yes	nd	0.003	0.001	0.005
2005	89	6/21/05 15:30	6/21/05 17:00	no	nd	0.000	0.000	0.000
2005	90	6/22/05 6:00	6/22/05 20:15	yes	nd	0.073	0.001	0.066
2005	91	6/26/05 19:30	6/27/05 9:15	no	nd	0.000	0.000	0.000
2005	92	7/2/05 1:15	7/2/05 6:15	yes	0.025	0.000	0.000	0.000
2005	93	7/5/05 18:00	7/6/05 0:15	yes	0.035	0.000	0.000	0.000
2005	94	7/8/05 5:15	7/8/05 15:30	yes	0.027	0.000	0.000	0.000
2005	95	7/15/05 12:45	7/15/05 15:45	yes	0.005	0.000	0.000	0.000
2005	96	7/16/05 0:45	7/16/05 9:00	yes	0.003	0.000	0.000	0.000
2005	97	7/22/05 6:00	7/22/05 8:30	yes	0.013	0.000	0.000	0.000
2005	98	8/1/05 7:30	8/1/05 7:45	no	0.000	0.000	0.000	0.000
2005	99	8/17/05 3:00	8/17/05 5:45	no	nd	0.000	0.000	0.000
2005	100	8/28/05 19:00	8/28/05 23:30	yes	nd	0.001	0.000	0.000
2005	101	8/29/05 19:15	8/29/05 19:45	no	0.000	0.000	0.000	0.000
2005	102	8/30/05 7:15	8/30/05 8:00	no	0.000	0.000	0.000	0.000
2005	103	9/4/05 8:15	9/4/05 8:30	yes	0.108	0.000	0.000	0.000
2005	104	9/5/05 8:00	9/5/05 8:15	no	0.000	0.000	0.000	0.000
2005	105	9/9/05 1:15	9/9/05 11:45	yes	0.518	R	0.000	R
2005	106	9/9/05 23:30	9/10/05 8:45	yes	0.162	R	0.000	0.004
2005	107	9/14/05 21:00	9/14/05 21:15	yes	0.007	0.000	0.000	0.000
2005	108	9/16/05 1:30	9/16/05 6:30	yes	0.013	0.000	0.000	0.000

Table C.6. Normalized peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Peak Discharge Rate (cfs/acre)	VFS Normalized Peak Discharge Rate (cfs/acre)	CAVFS1 Normalized Peak Discharge Rate (cfs/acre)	CAVFS2 Normalized Peak Discharge Rate (cfs/acre)
2005	109	9/30/05 4:45	9/30/05 11:00	no	0.000	0.000	nd	0.001
2006	1	10/1/05 9:00	10/1/05 19:00	yes	737.781	14.360	7.237	17.689
2006	2	10/2/05 4:45	10/2/05 5:00	no	0.000	0.000	0.000	0.000
2006	3	10/2/05 11:30	10/2/05 19:30	yes	82.301	0.000	0.000	0.000
2006	4	10/6/05 13:30	10/6/05 19:15	no	0.000	0.000	0.000	0.000
2006	5	10/8/05 19:00	10/8/05 20:15	no	0.000	0.000	0.000	0.000
2006	6	10/10/05 12:45	10/10/05 13:00	no	0.000	0.000	0.000	0.000
2006	7	10/11/05 0:00	10/11/05 1:45	yes	11.568	0.000	0.000	0.000
2006	8	10/12/05 15:30	10/12/05 19:00	yes	5.525	0.000	0.000	0.000
2006	9	10/14/05 20:15	10/15/05 1:30	yes	457.165	0.000	0.000	0.000
2006	10	10/16/05 5:00	10/16/05 8:30	yes	11.616	0.000	0.000	0.000
2006	11	10/17/05 0:00	10/17/05 5:45	no	0.000	0.000	0.000	0.000
2006	12	10/19/05 1:00	10/19/05 12:45	yes	25.970	5.190	0.669	0.644
2006	13	10/23/05 6:45	10/23/05 16:45	no	0.000	0.000	R	0.000
2006	14	10/25/05 17:30	10/25/05 18:45	no	0.000	0.000	0.000	0.000
2006	15	10/26/05 1:30	10/26/05 2:00	no	0.000	0.000	0.000	0.000
2006	16	10/26/05 8:30	10/26/05 8:45	no	0.000	0.000	0.000	0.000
2006	17	10/27/05 21:30	10/28/05 7:00	yes	199.779	0.000	0.000	0.000
2006	18	10/28/05 18:15	10/28/05 18:30	no	0.000	0.000	0.000	0.000
2006	19	10/29/05 2:15	10/29/05 3:15	yes	12.182	0.000	0.000	0.000
2006	20	10/29/05 15:00	10/29/05 17:30	yes	215.125	0.000	0.000	9.418
2006	21	10/30/05 0:30	10/30/05 0:45	no	0.000	0.000	0.000	0.000
2006	22	10/30/05 19:45	10/31/05 19:00	yes	769.464 J	2.499 J	R	R
2006	23	11/1/05 8:00	11/1/05 19:45	yes	680.742 J	35.813 J	nd	R
2006	24	11/2/05 9:30	11/2/05 9:45	no	0.000	0.000	0.000	0.000
2006	25	11/2/05 17:30	11/3/05 20:00	yes	1120.908	130.007	1.171	11.652
2006	26	11/4/05 10:00	11/4/05 14:45	yes	485.684	57.151	0.000	15.395
2006	27	11/5/05 8:45	11/6/05 0:00	yes	1664.529	594.305	1.004	241.329
2006	28	11/7/05 3:15	11/7/05 6:15	yes	88.439	0.000	0.000	0.000
2006	29	11/10/05 13:30	11/10/05 18:15	yes	96.797	0.000	0.000	0.000

Table C.6. Normalized peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Peak Discharge Rate (cfs/acre)	VFS Normalized Peak Discharge Rate (cfs/acre)	CAVFS1 Normalized Peak Discharge Rate (cfs/acre)	CAVFS2 Normalized Peak Discharge Rate (cfs/acre)
2006	30	11/11/05 10:00	11/11/05 14:30	yes	33.525	0.000	0.000	0.000
2006	31	11/12/05 23:00	11/13/05 19:45	yes	558.022	0.557	0.565	1.107
2006	32	11/14/05 4:45	11/14/05 5:15	yes	40.796	0.000	0.000	0.000
2006	33	11/24/05 16:00	11/25/05 22:30	yes	1826.439	172.048	0.502	30.327
2006	34	11/26/05 8:30	11/26/05 8:45	no	0.000	0.000	0.000	0.000
2006	35	11/27/05 2:15	11/27/05 11:15	yes	249.830	0.000	0.000	0.000
2006	36	11/28/05 22:00	11/30/05 3:30	no	nd	0.000	0.000	0.000
2006	37	12/1/05 12:45	12/1/05 13:30	no	R	0.000	0.000	0.000
2006	38	12/2/05 12:30	12/2/05 14:45	yes	1.794	0.000	0.000	1.248
2006	39	12/3/05 13:30	12/3/05 17:00	yes	5.855	0.000	0.000	
2006	40	12/4/05 11:30	12/4/05 17:00	yes	4.958	0.000	0.000	0.000
2006	41	12/6/05 1:00	12/6/05 6:00	yes	22.806	0.000	0.000	0.000
2006	42	12/12/05 14:30	12/12/05 14:45	no	0.000	0.000	0.000	0.000
2006	43	12/15/05 10:15	12/15/05 10:30	no	0.000	0.000	0.000	0.000
2006	44	12/19/05 3:30	12/19/05 10:45	yes	270.181	0.000	0.000	0.000
2006	45	12/19/05 22:15	12/22/05 10:00	yes	1361.908	345.345	81.806	353.079
2006	46	12/22/05 18:15	12/22/05 18:30	no	0.000	R	0.000	R
2006	47	12/23/05 14:00	12/24/05 11:45	yes	1622.505	536.424	5.292	566.053
2006	48	12/24/05 22:15	12/25/05 7:30	yes	1809.818	584.174	1.171	549.129
2006	49	12/25/05 13:45	12/26/05 10:15	yes	229.479	0.000	0.000	0.000
2006	50	12/27/05 0:30	12/27/05 8:15	yes	443.755	16.051	0.000	2.093
2006	51	12/28/05 3:30	12/28/05 12:00	yes	406.972	172.932	0.607	26.966
2006	52	12/29/05 20:45	12/30/05 5:15	yes	88.109	22.856	27.903	2.395
2006	53	12/30/05 11:45	12/31/05 6:30	yes	1094.371	396.210	59.571	100.037
2006	54	1/1/06 7:15	1/1/06 10:30	yes	76.068	20.069	13.763	2.033
2006	55	1/1/06 16:30	1/1/06 21:30	yes	270.229	31.315	20.687	15.073
2006	56	1/2/06 5:15	1/2/06 20:30	yes	288.832	60.515	47.879	14.268
2006	57	1/3/06 12:00	1/3/06 23:30	yes	78.665	29.604	18.930	3.683
2006	58	1/5/06 7:30	1/6/06 0:00	yes	1410.874	524.044	21.419	154.312

Table C.6. Normalized peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Peak Discharge Rate (cfs/acre)	VFS Normalized Peak Discharge Rate (cfs/acre)	CAVFS1 Normalized Peak Discharge Rate (cfs/acre)	CAVFS2 Normalized Peak Discharge Rate (cfs/acre)
2006	59	1/6/06 9:15	1/6/06 9:30	no	0.000	0.000	0.000	0.000
2006	60	1/6/06 23:00	1/6/06 23:15	no	0.000	0.000	0.000	R
2006	61	1/7/06 6:30	1/7/06 15:45	yes	128.811	4.075	4.058	15.214
2006	62	1/8/06 15:45	1/11/06 0:15	yes	1316.721	687.903	66.767	277.633
2006	63	1/12/06 11:15	1/13/06 23:15	yes	589.328 J	42.195 J	R	31.977 J
2006	64	1/14/06 6:30	1/14/06 20:30	yes	651.844	214.685	2.134	38.457
2006	65	1/15/06 16:30	1/15/06 16:45	no	0.000	0.000	0.000	0.000
2006	66	1/16/06 2:30	1/16/06 22:45	yes	618.225	253.996	0.565	215.892
2006	67	1/18/06 0:15	1/18/06 1:15	yes	81.782	0.461	0.000	0.000
2006	68	1/18/06 8:00	1/18/06 8:15	no	0.000	0.000	0.000	0.000
2006	69	1/18/06 23:15	1/19/06 5:00	yes	132.683	10.534	0.000	0.906
2006	70	1/19/06 22:30	1/20/06 10:15	yes	338.600	0.000	3.514	5.856
2006	71	1/21/06 3:15	1/21/06 11:45	no	0.000	0.000	0.000	0.000
2006	72	1/22/06 11:15	1/22/06 11:30	no	0.000	0.000	0.000	R
2006	73	1/22/06 21:00	1/23/06 0:15	yes	58.928	0.000	0.000	0.000
2006	74	1/23/06 6:15	1/23/06 10:15	yes	7.319	0.000	0.000	0.000
2006	75	1/24/06 6:45	1/24/06 7:00	no	0.000	0.000	0.000	0.000
2006	76	1/25/06 18:00	1/25/06 19:00	yes	385.346	19.473	0.000	9.579
2006	77	1/26/06 16:00	1/26/06 21:00	yes	64.122	0.000	0.000	0.000
2006	78	1/27/06 20:00	1/28/06 5:30	yes	674.887	226.392	2.008	49.868
2006	79	1/29/06 12:45	1/30/06 12:00	yes	R	2496.211	7.112	1328.196
2006	80	1/31/06 13:45	1/31/06 21:30	yes	319.430	7.920	20.059	71.763
2006	81	2/1/06 16:15	2/2/06 2:30	yes	497.630	32.333	32.505	133.846
2006	82	2/2/06 15:45	2/2/06 20:00	yes	455.937	126.258	20.038	93.437
2006	83	2/3/06 14:30	2/4/06 9:45	yes	1515.178 J	520.488	59.027	451.265
2006	84	2/8/06 4:30	2/8/06 6:45	yes	47.029	0.000	0.000	0.000
2006	85	2/13/06 2:00	2/13/06 8:15	yes	327.362	0.000	0.000	0.000
2006	86	2/14/06 2:00	2/14/06 3:45	yes	114.787	0.000	0.000	0.000
2006	87	2/14/06 10:45	2/14/06 11:30	yes	52.931	1.596	0.167	2.516

Table C.6. Normalized peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Peak Discharge Rate (cfs/acre)	VFS Normalized Peak Discharge Rate (cfs/acre)	CAVFS1 Normalized Peak Discharge Rate (cfs/acre)	CAVFS2 Normalized Peak Discharge Rate (cfs/acre)
2006	88	2/21/06 16:45	2/21/06 17:00	no	0.000	0.000	0.000	0.000
2006	89	2/22/06 8:00	2/22/06 8:15	no	0.000	0.000	0.000	0.000
2006	90	2/22/06 15:30	2/22/06 19:45	yes	139.482	0.000	0.000	0.000
2006	91	2/23/06 2:00	2/23/06 14:00	yes	1121.474	156.861	20.059	29.261
2006	92	2/26/06 16:00	2/27/06 2:30	yes	18.132	0.000	R	0.000
2006	93	2/27/06 22:15	2/28/06 12:45	yes	388.887	39.331	108.287	14.590
2006	94	3/2/06 3:45	3/2/06 7:00	yes	15.818	0.000	0.000	0.000
2006	95	3/5/06 8:15	3/5/06 8:45	no	0.000	0.000	0.000	0.000
2006	96	3/6/06 19:00	3/6/06 21:15	no	0.000	0.000	0.000	0.000
2006	97	3/7/06 10:00	3/7/06 18:30	yes	293.413	0.000	0.000	0.000
2006	98	3/8/06 3:45	3/8/06 20:45	yes	450.743	216.934	0.000	8.311
2006	99	3/9/06 22:45	3/9/06 23:00	no	0.000	0.000	0.000	0.000
2006	100	3/10/06 19:15	3/10/06 20:45	no	0.000	0.000	0.000	0.000
2006	101	3/15/06 6:45	3/15/06 19:30	yes	133.155	0.000	0.000	0.000
2006	102	3/16/06 8:30	3/16/06 13:45	yes	50.476	0.000	0.000	0.000
2006	103	3/17/06 8:15	3/17/06 8:30	no	R	0.000	0.000	0.000
2006	104	3/17/06 22:00	3/17/06 22:30	yes	140.426	0.000	0.000	0.000
2006	105	3/18/06 12:15	3/18/06 12:30	no	0.000	0.000	0.000	0.000
2006	106	3/21/06 15:30	3/22/06 19:00	yes	558.967	24.125	1.590	7.526
2006	107	3/24/06 3:00	3/24/06 15:15	yes	214.606	0.461	R	0.483
2006	108	3/25/06 22:15	3/25/06 22:30	no	0.000	0.000	0.000	0.000
2006	109	3/28/06 2:30	3/28/06 8:00	yes	36.075	0.000	R	0.000
2006	110	3/31/06 3:15	3/31/06 9:30	no	0.000	0.000	0.000	0.000
2006	111	4/1/06 4:00	4/1/06 11:45	yes	573.982	238.252	R	8.593
2006	112	4/3/06 14:30	4/3/06 19:30	yes	36.311	0.000	R	0.000
2006	113	4/5/06 22:15	4/5/06 22:45	yes	11.049	0.000	R	0.000
2006	114	4/8/06 13:30	4/9/06 15:45	yes	285.433	0.000	R	0.000
2006	115	4/12/06 7:15	4/12/06 12:15	no	0.000	0.000	0.000	0.000
2006	116	4/13/06 9:45	4/13/06 10:00	no	0.000	0.000	0.000	0.000

Table C.6. Normalized peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Peak Discharge Rate (cfs/acre)	VFS Normalized Peak Discharge Rate (cfs/acre)	CAVFS1 Normalized Peak Discharge Rate (cfs/acre)	CAVFS2 Normalized Peak Discharge Rate (cfs/acre)
2006	117	4/13/06 20:30	4/13/06 23:30	yes	2.597	0.000	R	0.000
2006	118	4/14/06 6:45	4/14/06 7:45	yes	29.936	0.000	R	0.000
2006	119	4/14/06 17:15	4/14/06 17:30	yes	2.503	0.000	R	0.000
2006	120	4/15/06 3:00	4/16/06 6:45	yes	332.462	52.537	R	20.527
2006	121	4/17/06 20:30	4/17/06 20:45	no	0.000	0.000	R	0.000
2006	122	4/20/06 21:30	4/21/06 10:15	no	0.000	0.000	0.000	0.000
2006	123	4/29/06 11:30	4/29/06 16:30	yes	173.290	57.689	0.000	16.864
2006	124	5/1/06 9:45	5/1/06 10:00	no	0.000	0.000	0.000	0.000
2006	125	5/6/06 22:00	5/7/06 0:30	no	0.000	0.000	0.000	0.000
2006	126	5/7/06 13:30	5/8/06 0:45	no	0.000	0.000	0.000	0.000
2006	127	5/11/06 15:15	5/11/06 15:30	no	0.000	0.000	0.000	0.000
2006	128	5/11/06 23:00	5/12/06 9:15	no	0.000	0.000	0.000	0.000
2006	129	5/19/06 16:00	5/19/06 19:00	no	0.000	0.000	0.000	0.000
2006	130	5/20/06 1:30	5/20/06 1:45	no	0.000	0.000	0.000	0.000
2006	131	5/21/06 16:30	5/21/06 17:15	yes	5.949	0.000	0.000	0.000
2006	132	5/22/06 1:00	5/22/06 6:45	no	0.000	0.000	0.000	0.000
2006	133	5/23/06 8:15	5/23/06 10:30	yes	296.482	R	0.000	0.000
2006	134	5/23/06 22:30	5/24/06 15:30	no	0.000	0.000	R	0.000
2006	135	5/26/06 2:00	5/26/06 6:30	no	0.000	0.000	0.000	0.000
2006	136	5/26/06 13:30	5/26/06 13:45	yes	5.949	0.000	R	0.000
2006	137	5/26/06 21:15	5/27/06 5:30	yes	66.058	0.000	R	0.000
2006	138	5/27/06 11:45	5/28/06 15:00	yes	1437.268	90.195	R	106.276
2006	139	5/29/06 5:45	5/29/06 6:00	no	0.000	0.000	R	0.000
2006	140	5/31/06 18:45	5/31/06 23:15	yes	36.972	0.000	0.000	0.000
2006	141	6/1/06 12:00	6/2/06 5:15	yes	100.291	0.000	R	0.000
2006	142	6/2/06 11:45	6/2/06 14:30	no	0.000	0.000	R	0.000
2006	143	6/4/06 0:30	6/4/06 11:30	yes	470.433	0.807	4.162	4.005
2006	144	6/8/06 18:45	6/9/06 8:15	yes	152.750	0.000	R	0.000
2006	145	6/10/06 10:45	6/10/06 11:00	no	0.000	0.000	0.000	0.000

Table C.6. Normalized peak discharge rates measured during individual storm events that occurred in water years 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Peak Discharge Rate (cfs/acre)	VFS Normalized Peak Discharge Rate (cfs/acre)	CAVFS1 Normalized Peak Discharge Rate (cfs/acre)	CAVFS2 Normalized Peak Discharge Rate (cfs/acre)
2006	146	6/12/06 7:45	6/12/06 9:15	no	0.000	0.000	0.000	0.000
2006	147	6/12/06 20:30	6/13/06 2:00	yes	262.957	0.000	R	0.000
2006	148	6/16/06 10:45	6/16/06 12:45	yes	41.221	0.000	0.000	0.000
2006	149	7/4/06 5:15	7/4/06 6:15	no	0.000	0.000	0.000	0.000
2006	150	7/6/06 16:15	7/6/06 16:30	no	0.000	0.000	0.000	0.000
2006	151	7/12/06 9:30	7/12/06 10:00	no	0.000	0.000	0.000	0.000
2006	152	7/13/06 17:45	7/13/06 18:00	no	0.000	0.000	0.000	0.000
2006	153	7/30/06 11:00	7/30/06 12:30	no	0.000	0.000	0.000	0.000
2006	154	8/29/06 8:15	8/30/06 10:45	yes	654.866	0.000	0.000	0.000
2006	155	9/9/06 1:30	9/9/06 11:00	yes	93.728	0.000	0.000	0.000
2006	156	9/13/06 9:15	9/13/06 9:30	no	0.000	0.000	0.000	0.000
2006	157	9/14/06 0:00	9/14/06 7:45	yes	312.772	6.959	0.000	0.000
2006	158	9/18/06 0:15	9/18/06 5:45	yes	101.519	0.000	0.000	0.000
2006	159	9/19/06 2:45	9/19/06 6:30	yes	13.268	0.000	0.000	0.000
2006	160	9/20/06 8:45	9/20/06 21:30	yes	77.626	44.290	0.000	0.000
2006	161	9/21/06 10:15	9/21/06 10:30	yes	3.872	0.000	0.000	0.000

J: estimated value based on quality assurance review

R: data rejected based on quality assurance review

nd: no data are available for specified event

cfs: cubic feet per second

Table C.7. Normalized flow durations measured during individual storm events that occurred in water yearx 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Flow Duration (hours/acre)	VFS Normalized Flow Duration (hours/acre)	CAVFS1 Normalized Flow Duration (hours/acre)	CAVFS2 Normalized Flow Duration (hours/acre)
2005	1	12/9/04 16:45	12/11/04 5:45	yes	194.12	R	R	R
2005	2	12/11/04 13:15	12/11/04 13:30	yes	1.31	1.07	R	R
2005	3	12/13/04 12:15	12/14/04 10:15	yes	123.29	34.17	R	8.94
2005	4	12/16/04 20:45	12/16/04 22:45	yes	19.67	8.01	0.00	0.56
2005	5	12/17/04 9:15	12/17/04 9:30	no	0.00	0.00	0.00	0.00
2005	6	12/18/04 3:15	12/18/04 3:30	yes	1.31	0.53	0.00	0.00
2005	7	12/19/04 12:15	12/19/04 12:45	yes	7.87	2.67	0.00	1.12
2005	8	12/21/04 8:45	12/21/04 15:15	yes	36.73	5.34	0.00	5.03
2005	9	12/25/04 11:45	12/26/04 11:30	yes	124.60	45.92	0.00	13.42
2005	10	12/29/04 8:45	12/30/04 0:15	yes	90.50	32.57	0.00	7.27
2005	11	1/1/05 3:30	1/1/05 6:45	yes	20.99	9.61	0.00	2.80
2005	12	1/2/05 13:30	1/2/05 13:45	yes	1.31	0.00	0.58	0.56
2005	13	1/5/05 15:15	1/5/05 15:30	no	R	R	R	0.00
2005	14	1/6/05 19:00	1/7/05 14:45	no	R	0.00	R	R
2005	15	1/8/05 17:00	1/8/05 19:45	yes	2.62	0.00	R	1.68
2005	16	1/10/05 13:30	1/10/05 13:45	no	nd	nd	nd	nd
2005	17	1/13/05 8:00	1/13/05 8:15	no	nd	nd	nd	nd
2005	18	1/16/05 2:45	1/16/05 14:00	undefined	nd	nd	nd	nd
2005	19	1/17/05 8:30	1/18/05 2:30	undefined	nd	nd	nd	nd
2005	20	1/18/05 10:00	1/18/05 15:00	undefined	nd	nd	nd	nd
2005	21	1/18/05 23:30	1/19/05 7:00	undefined	nd	nd	nd	nd
2005	22	1/20/05 11:15	1/20/05 13:45	yes	7.87	0.53	0.00	nd
2005	23	1/22/05 20:15	1/22/05 20:30	yes	2.62	0.00	0.00	nd
2005	24	1/26/05 23:00	1/26/05 23:15	yes	1.31	0.00	0.00	nd
2005	25	1/28/05 21:30	1/28/05 21:45	yes	2.62	0.00	0.00	nd
2005	26	1/30/05 8:45	1/30/05 9:30	yes	6.56	0.00	0.00	nd
2005	27	1/31/05 3:30	1/31/05 3:45	no	0.00	0.00	0.00	nd
2005	28	2/4/05 7:15	2/4/05 15:30	yes	47.22	9.08	0.00	0.56
2005	29	2/4/05 23:00	2/5/05 3:45	yes	14.43	0.00	0.00	0.00
2005	30	2/5/05 20:30	2/5/05 21:15	yes	13.12	0.00	0.00	0.00
2005	31	2/6/05 8:00	2/6/05 18:30	yes	78.70	14.95	0.58	2.80
2005	32	2/12/05 3:30	2/12/05 3:45	no	0.00	0.00	0.00	0.00
2005	33	2/12/05 10:00	2/12/05 18:45	yes	60.33	4.27	0.00	0.56
2005	34	2/13/05 6:00	2/13/05 8:30	yes	1.31	0.00	0.00	0.00
2005	35	2/14/05 9:00	2/14/05 9:15	no	0.00	0.00	0.00	0.00
2005	36	2/28/05 8:00	3/1/05 6:45	yes	26.23	0.00	0.00	0.00

Table C.7. Normalized flow durations measured during individual storm events that occurred in water yearx 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Flow Duration (hours/acre)	VFS Normalized Flow Duration (hours/acre)	CAVFS1 Normalized Flow Duration (hours/acre)	CAVFS2 Normalized Flow Duration (hours/acre)
2005	37	3/1/05 13:45	3/1/05 14:00	no	0.00	0.00	0.00	0.00
2005	38	3/9/05 9:15	3/9/05 9:30	no	0.00	0.00	0.00	0.00
2005	39	3/16/05 11:30	3/16/05 15:45	yes	13.12	0.00	0.00	nd
2005	40	3/17/05 7:15	3/17/05 7:30	no	0.00	0.00	0.00	nd
2005	41	3/18/05 3:30	3/18/05 5:15	yes	5.25	0.00	0.00	nd
2005	42	3/19/05 13:15	3/20/05 19:30	yes	74.76	19.22	43.00	13.42
2005	43	3/26/05 3:00	3/27/05 9:45	yes	118.04	R	0.00	32.98
2005	44	3/27/05 23:45	3/28/05 0:00	no	0.00	0.00	0.00	0.00
2005	45	3/28/05 6:45	3/28/05 13:30	yes	6.56	0.00	0.00	0.00
2005	46	3/28/05 22:30	3/29/05 1:30	yes	19.67	0.00	0.00	0.00
2005	47	3/29/05 13:15	3/29/05 13:30	yes	3.93	0.00	nd	0.56
2005	48	3/29/05 21:15	3/29/05 21:45	no	0.00	nd	nd	0.00
2005	49	3/30/05 21:00	3/30/05 21:15	no	0.00	nd	nd	0.00
2005	50	3/31/05 11:15	3/31/05 11:45	yes	1.31	0.00	nd	0.56
2005	51	3/31/05 18:30	4/1/05 9:00	yes	52.46	R	33.70	12.86
2005	52	4/2/05 17:15	4/3/05 13:00	yes	65.58	nd	30.21	8.94
2005	53	4/4/05 6:15	4/4/05 10:15	yes	15.74	nd	18.01	4.47
2005	54	4/6/05 13:00	4/6/05 13:15	no	0.00	0.00	0.00	0.00
2005	55	4/7/05 10:00	4/7/05 18:15	yes	45.91	11.75	10.46	7.27
2005	56	4/8/05 10:15	4/8/05 10:30	yes	1.31	0.53	0.58	0.00
2005	57	4/10/05 19:15	4/11/05 3:00	yes	40.66	10.15	27.89	6.15
2005	58	4/12/05 11:45	4/12/05 14:15	yes	7.87	0.00	0.00	0.00
2005	59	4/13/05 13:30	4/13/05 13:45	no	0.00	0.00	0.00	0.00
2005	60	4/14/05 1:00	4/14/05 13:30	yes	30.17	0.00	11.04	0.00
2005	61	4/15/05 12:45	4/16/05 13:00	yes	116.73	R	45.90	21.80
2005	62	4/17/05 15:00	4/18/05 0:45	yes	41.97	15.49	42.41	9.50
2005	63	4/23/05 22:15	4/23/05 23:30	yes	5.25	0.00	0.00	0.00
2005	64	4/29/05 7:30	4/29/05 8:15	yes	6.56	0.00	0.00	0.00
2005	65	4/29/05 17:45	4/30/05 6:15	yes	14.43	0.00	0.00	0.00
2005	66	5/4/05 4:15	5/4/05 6:45	yes	1.31	0.00	0.00	0.00
2005	67	5/8/05 17:30	5/9/05 0:00	yes	9.18	0.00	0.00	0.00
2005	68	5/9/05 6:30	5/9/05 9:45	yes	2.62	0.00	0.00	0.00
2005	69	5/9/05 19:30	5/10/05 3:15	yes	38.04	0.00	0.00	7.27
2005	70	5/14/05 1:45	5/14/05 7:45	yes	10.49	R	0.00	8.94
2005	71	5/15/05 2:45	5/15/05 9:00	yes	23.61	R	51.71	5.59
2005	72	5/16/05 11:45	5/16/05 22:30	yes	22.30	0.53	9.30	1.68

Table C.7. Normalized flow durations measured during individual storm events that occurred in water yearx 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Flow Duration (hours/acre)	VFS Normalized Flow Duration (hours/acre)	CAVFS1 Normalized Flow Duration (hours/acre)	CAVFS2 Normalized Flow Duration (hours/acre)
2005	73	5/17/05 23:00	5/20/05 0:15	yes	112.80	0.00	9.88	19.01
2005	74	5/20/05 11:00	5/20/05 15:00	yes	3.93	0.00	0.00	1.12
2005	75	5/21/05 17:30	5/21/05 19:45	yes	15.74	0.00	0.00	1.68
2005	76	5/22/05 11:30	5/22/05 11:45	yes	1.31	0.00	0.00	0.56
2005	77	5/31/05 4:30	5/31/05 19:30	yes	55.09	13.35	2.91	6.15
2005	78	6/1/05 4:00	6/1/05 9:15	yes	9.18	6.41	7.55	3.35
2005	79	6/3/05 4:15	6/3/05 5:30	yes	1.31	0.00	0.00	0.00
2005	80	6/5/05 13:15	6/5/05 15:15	yes	5.25	0.00	0.00	0.00
2005	81	6/5/05 22:45	6/5/05 23:00	no	0.00	0.00	0.00	0.00
2005	82	6/6/05 15:45	6/6/05 16:00	no	0.00	0.00	0.00	0.00
2005	83	6/7/05 22:30	6/8/05 4:15	yes	24.92	11.21	19.75	5.59
2005	84	6/8/05 15:15	6/8/05 15:30	yes	1.31	0.53	0.58	0.56
2005	85	6/10/05 18:45	6/12/05 5:15	yes	49.84	43.25	54.04	40.81
2005	86	6/12/05 21:15	6/13/05 6:00	yes	1.31	0.53	0.00	0.56
2005	87	6/14/05 23:15	6/15/05 3:15	no	nd	0.00	0.00	0.00
2005	88	6/16/05 20:45	6/17/05 7:00	yes	nd	11.75	16.27	14.53
2005	89	6/21/05 15:30	6/21/05 17:00	no	nd	0.00	0.00	0.00
2005	90	6/22/05 6:00	6/22/05 20:15	yes	nd	22.43	0.58	26.27
2005	91	6/26/05 19:30	6/27/05 9:15	no	nd	0.00	0.00	0.00
2005	92	7/2/05 1:15	7/2/05 6:15	yes	14.43	0.00	0.00	0.00
2005	93	7/5/05 18:00	7/6/05 0:15	yes	9.18	0.00	0.00	0.00
2005	94	7/8/05 5:15	7/8/05 15:30	yes	30.17	0.00	0.00	0.00
2005	95	7/15/05 12:45	7/15/05 15:45	yes	3.93	0.00	0.00	0.00
2005	96	7/16/05 0:45	7/16/05 9:00	yes	2.62	0.00	0.00	0.00
2005	97	7/22/05 6:00	7/22/05 8:30	yes	5.25	0.00	0.00	0.00
2005	98	8/1/05 7:30	8/1/05 7:45	no	0.00	0.00	0.00	0.00
2005	99	8/17/05 3:00	8/17/05 5:45	no	nd	0.00	0.00	0.00
2005	100	8/28/05 19:00	8/28/05 23:30	yes	nd	3.20	0.00	0.00
2005	101	8/29/05 19:15	8/29/05 19:45	no	0.00	0.00	0.00	0.00
2005	102	8/30/05 7:15	8/30/05 8:00	no	0.00	0.00	0.00	0.00
2005	103	9/4/05 8:15	9/4/05 8:30	yes	1.31	0.00	0.00	0.00
2005	104	9/5/05 8:00	9/5/05 8:15	no	0.00	0.00	0.00	0.00
2005	105	9/9/05 1:15	9/9/05 11:45	yes	11.80	R	0.00	R
2005	106	9/9/05 23:30	9/10/05 8:45	yes	32.79	R	0.00	2.80
2005	107	9/14/05 21:00	9/14/05 21:15	yes	1.31	0.00	0.00	0.00
2005	108	9/16/05 1:30	9/16/05 6:30	yes	11.80	0.00	0.00	0.00

Table C.7. Normalized flow durations measured during individual storm events that occurred in water yearx 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Flow Duration (hours/acre)	VFS Normalized Flow Duration (hours/acre)	CAVFS1 Normalized Flow Duration (hours/acre)	CAVFS2 Normalized Flow Duration (hours/acre)
2005	109	9/30/05 4:45	9/30/05 11:00	no	0.00	0.00	nd	1.68
2006	1	10/1/05 9:00	10/1/05 19:00	yes	10.49	3.74	5.81	2.24
2006	2	10/2/05 4:45	10/2/05 5:00	no	0.00	0.00	0.00	0.00
2006	3	10/2/05 11:30	10/2/05 19:30	yes	9.18	0.00	0.00	0.00
2006	4	10/6/05 13:30	10/6/05 19:15	no	0.00	0.00	0.00	0.00
2006	5	10/8/05 19:00	10/8/05 20:15	no	0.00	0.00	0.00	0.00
2006	6	10/10/05 12:45	10/10/05 13:00	no	0.00	0.00	0.00	0.00
2006	7	10/11/05 0:00	10/11/05 1:45	yes	2.62	0.00	0.00	0.00
2006	8	10/12/05 15:30	10/12/05 19:00	yes	2.62	0.00	0.00	0.00
2006	9	10/14/05 20:15	10/15/05 1:30	yes	27.54	0.00	0.00	0.00
2006	10	10/16/05 5:00	10/16/05 8:30	yes	5.25	0.00	0.00	0.00
2006	11	10/17/05 0:00	10/17/05 5:45	no	0.00	0.00	0.00	0.00
2006	12	10/19/05 1:00	10/19/05 12:45	yes	3.93	2.67	0.58	0.56
2006	13	10/23/05 6:45	10/23/05 16:45	no	0.00	0.00	R	0.00
2006	14	10/25/05 17:30	10/25/05 18:45	no	0.00	0.00	0.00	0.00
2006	15	10/26/05 1:30	10/26/05 2:00	no	0.00	0.00	0.00	0.00
2006	16	10/26/05 8:30	10/26/05 8:45	no	0.00	0.00	0.00	0.00
2006	17	10/27/05 21:30	10/28/05 7:00	yes	11.80	0.00	0.00	0.00
2006	18	10/28/05 18:15	10/28/05 18:30	no	0.00	0.00	0.00	0.00
2006	19	10/29/05 2:15	10/29/05 3:15	yes	2.62	0.00	0.00	0.00
2006	20	10/29/05 15:00	10/29/05 17:30	yes	9.18	0.00	0.00	2.24
2006	21	10/30/05 0:30	10/30/05 0:45	no	0.00	0.00	0.00	0.00
2006	22	10/30/05 19:45	10/31/05 19:00	yes	52.46 J	1.07 J	R	R
2006	23	11/1/05 8:00	11/1/05 19:45	yes	43.28 J	5.34 J	nd	R
2006	24	11/2/05 9:30	11/2/05 9:45	no	0.00	0.00	0.00	0.00
2006	25	11/2/05 17:30	11/3/05 20:00	yes	59.02	9.08	1.16	6.15
2006	26	11/4/05 10:00	11/4/05 14:45	yes	20.99	3.74	0.00	1.68
2006	27	11/5/05 8:45	11/6/05 0:00	yes	62.96	13.35	1.74	10.62
2006	28	11/7/05 3:15	11/7/05 6:15	yes	11.80	0.00	0.00	0.00
2006	29	11/10/05 13:30	11/10/05 18:15	yes	13.12	0.00	0.00	0.00

Table C.7. Normalized flow durations measured during individual storm events that occurred in water yearx 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Flow Duration (hours/acre)	VFS Normalized Flow Duration (hours/acre)	CAVFS1 Normalized Flow Duration (hours/acre)	CAVFS2 Normalized Flow Duration (hours/acre)
2006	30	11/11/05 10:00	11/11/05 14:30	yes	10.49	0.00	0.00	0.00
2006	31	11/12/05 23:00	11/13/05 19:45	yes	53.78	0.53	0.58	0.56
2006	32	11/14/05 4:45	11/14/05 5:15	yes	5.25	0.00	0.00	0.00
2006	33	11/24/05 16:00	11/25/05 22:30	yes	86.57	14.42	0.58	9.50
2006	34	11/26/05 8:30	11/26/05 8:45	no	0.00	0.00	0.00	0.00
2006	35	11/27/05 2:15	11/27/05 11:15	yes	24.92	0.00	0.00	0.00
2006	36	11/28/05 22:00	11/30/05 3:30	no	nd	0.00	0.00	0.00
2006	37	12/1/05 12:45	12/1/05 13:30	no	R	0.00	0.00	0.00
2006	38	12/2/05 12:30	12/2/05 14:45	yes	1.31	0.00	0.00	1.12
2006	39	12/3/05 13:30	12/3/05 17:00	yes	5.25	0.00	0.00	R
2006	40	12/4/05 11:30	12/4/05 17:00	yes	3.93	0.00	0.00	0.00
2006	41	12/6/05 1:00	12/6/05 6:00	yes	18.36	0.00	0.00	0.00
2006	42	12/12/05 14:30	12/12/05 14:45	no	0.00	0.00	0.00	0.00
2006	43	12/15/05 10:15	12/15/05 10:30	no	0.00	0.00	0.00	0.00
2006	44	12/19/05 3:30	12/19/05 10:45	yes	19.67	0.00	0.00	0.00
2006	45	12/19/05 22:15	12/22/05 10:00	yes	104.93	75.82	41.83	86.09
2006	46	12/22/05 18:15	12/22/05 18:30	no	0.00	R	0.00	R
2006	47	12/23/05 14:00	12/24/05 11:45	yes	57.71	36.84	4.65	38.01
2006	48	12/24/05 22:15	12/25/05 7:30	yes	36.73	15.49	1.16	18.45
2006	49	12/25/05 13:45	12/26/05 10:15	yes	35.41	0.00	0.00	0.00
2006	50	12/27/05 0:30	12/27/05 8:15	yes	39.35	3.20	0.00	8.39
2006	51	12/28/05 3:30	12/28/05 12:00	yes	31.48	8.54	0.58	11.18
2006	52	12/29/05 20:45	12/30/05 5:15	yes	28.86	14.95	18.59	1.68
2006	53	12/30/05 11:45	12/31/05 6:30	yes	65.58	40.05	42.41	15.09
2006	54	1/1/06 7:15	1/1/06 10:30	yes	19.67	10.68	11.04	1.68
2006	55	1/1/06 16:30	1/1/06 21:30	yes	28.86	14.95	15.11	5.03
2006	56	1/2/06 5:15	1/2/06 20:30	yes	40.66	36.84	35.44	10.06
2006	57	1/3/06 12:00	1/3/06 23:30	yes	26.23	17.62	13.36	2.80
2006	58	1/5/06 7:30	1/6/06 0:00	yes	90.50	25.10	14.53	15.65

Table C.7. Normalized flow durations measured during individual storm events that occurred in water yearx 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Flow Duration (hours/acre)	VFS Normalized Flow Duration (hours/acre)	CAVFS1 Normalized Flow Duration (hours/acre)	CAVFS2 Normalized Flow Duration (hours/acre)
2006	59	1/6/06 9:15	1/6/06 9:30	no	0.00	0.00	0.00	0.00
2006	60	1/6/06 23:00	1/6/06 23:15	no	0.00	0.00	0.00	R
2006	61	1/7/06 6:30	1/7/06 15:45	yes	3.93	2.67	3.49	4.47
2006	62	1/8/06 15:45	1/11/06 0:15	yes	99.68	47.52	33.12	30.75
2006	63	1/12/06 11:15	1/13/06 23:15	yes	99.68 J	37.38 J	R	21.24 J
2006	64	1/14/06 6:30	1/14/06 20:30	yes	30.17	19.22	2.32	8.39
2006	65	1/15/06 16:30	1/15/06 16:45	no	0.00	0.00	0.00	0.00
2006	66	1/16/06 2:30	1/16/06 22:45	yes	53.78	19.22	0.58	19.01
2006	67	1/18/06 0:15	1/18/06 1:15	yes	15.74	0.53	0.00	0.00
2006	68	1/18/06 8:00	1/18/06 8:15	no	0.00	0.00	0.00	0.00
2006	69	1/18/06 23:15	1/19/06 5:00	yes	19.67	9.61	0.00	0.56
2006	70	1/19/06 22:30	1/20/06 10:15	yes	53.78	0.00	4.07	3.35
2006	71	1/21/06 3:15	1/21/06 11:45	no	0.00	0.00	0.00	0.00
2006	72	1/22/06 11:15	1/22/06 11:30	no	0.00	0.00	0.00	R
2006	73	1/22/06 21:00	1/23/06 0:15	yes	10.49	0.00	0.00	0.00
2006	74	1/23/06 6:15	1/23/06 10:15	yes	6.56	0.00	0.00	0.00
2006	75	1/24/06 6:45	1/24/06 7:00	no	0.00	0.00	0.00	0.00
2006	76	1/25/06 18:00	1/25/06 19:00	yes	9.18	2.67	0.00	2.24
2006	77	1/26/06 16:00	1/26/06 21:00	yes	22.30	0.00	0.00	0.00
2006	78	1/27/06 20:00	1/28/06 5:30	yes	38.04	10.15	2.32	16.21
2006	79	1/29/06 12:45	1/30/06 12:00	yes	R	40.58	5.23	43.04
2006	80	1/31/06 13:45	1/31/06 21:30	yes	45.91	7.48	14.53	19.57
2006	81	2/1/06 16:15	2/2/06 2:30	yes	65.58	13.88	23.24	26.83
2006	82	2/2/06 15:45	2/2/06 20:00	yes	34.10	6.41	12.78	14.53
2006	83	2/3/06 14:30	2/4/06 9:45	yes	104.93 J	26.70	37.77	8.94
2006	84	2/8/06 4:30	2/8/06 6:45	yes	23.61	0.00	0.00	0.00
2006	85	2/13/06 2:00	2/13/06 8:15	yes	43.28	0.00	0.00	0.00
2006	86	2/14/06 2:00	2/14/06 3:45	yes	19.67	0.00	0.00	0.00
2006	87	2/14/06 10:45	2/14/06 11:30	yes	15.74	1.60	0.58	2.24

Table C.7. Normalized flow durations measured during individual storm events that occurred in water yearx 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Flow Duration (hours/acre)	VFS Normalized Flow Duration (hours/acre)	CAVFS1 Normalized Flow Duration (hours/acre)	CAVFS2 Normalized Flow Duration (hours/acre)
2006	88	2/21/06 16:45	2/21/06 17:00	no	0.00	0.00	0.00	0.00
2006	89	2/22/06 8:00	2/22/06 8:15	no	0.00	0.00	0.00	0.00
2006	90	2/22/06 15:30	2/22/06 19:45	yes	31.48	0.00	0.00	0.00
2006	91	2/23/06 2:00	2/23/06 14:00	yes	73.45	14.95	20.34	17.33
2006	92	2/26/06 16:00	2/27/06 2:30	yes	17.05	0.00	R	0.00
2006	93	2/27/06 22:15	2/28/06 12:45	yes	60.33	25.63	20.34	11.74
2006	94	3/2/06 3:45	3/2/06 7:00	yes	7.87	0.00	0.00	0.00
2006	95	3/5/06 8:15	3/5/06 8:45	no	0.00	0.00	0.00	0.00
2006	96	3/6/06 19:00	3/6/06 21:15	no	0.00	0.00	0.00	0.00
2006	97	3/7/06 10:00	3/7/06 18:30	yes	11.80	0.00	0.00	0.00
2006	98	3/8/06 3:45	3/8/06 20:45	yes	39.35	17.09	0.00	3.35
2006	99	3/9/06 22:45	3/9/06 23:00	no	0.00	0.00	0.00	0.00
2006	100	3/10/06 19:15	3/10/06 20:45	no	0.00	0.00	0.00	0.00
2006	101	3/15/06 6:45	3/15/06 19:30	yes	65.58	0.00	0.00	0.00
2006	102	3/16/06 8:30	3/16/06 13:45	yes	31.48	0.00	0.00	0.00
2006	103	3/17/06 8:15	3/17/06 8:30	no	R	0.00	0.00	0.00
2006	104	3/17/06 22:00	3/17/06 22:30	yes	7.87	0.00	0.00	0.00
2006	105	3/18/06 12:15	3/18/06 12:30	no	0.00	0.00	0.00	0.00
2006	106	3/21/06 15:30	3/22/06 19:00	yes	97.06	6.41	1.16	9.50
2006	107	3/24/06 3:00	3/24/06 15:15	yes	10.49	0.53	R	0.56
2006	108	3/25/06 22:15	3/25/06 22:30	no	0.00	0.00	0.00	0.00
2006	109	3/28/06 2:30	3/28/06 8:00	yes	6.56	0.00	R	0.00
2006	110	3/31/06 3:15	3/31/06 9:30	no	0.00	0.00	0.00	0.00
2006	111	4/1/06 4:00	4/1/06 11:45	yes	28.86	8.01	R	3.35
2006	112	4/3/06 14:30	4/3/06 19:30	yes	6.56	0.00	R	0.00
2006	113	4/5/06 22:15	4/5/06 22:45	yes	1.31	0.00	R	0.00
2006	114	4/8/06 13:30	4/9/06 15:45	yes	114.11	0.00	R	0.00
2006	115	4/12/06 7:15	4/12/06 12:15	no	0.00	0.00	0.00	0.00
2006	116	4/13/06 9:45	4/13/06 10:00	no	0.00	0.00	0.00	0.00

Table C.7. Normalized flow durations measured during individual storm events that occurred in water yearx 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Flow Duration (hours/acre)	VFS Normalized Flow Duration (hours/acre)	CAVFS1 Normalized Flow Duration (hours/acre)	CAVFS2 Normalized Flow Duration (hours/acre)
2006	117	4/13/06 20:30	4/13/06 23:30	yes	1.31	0.00	R	0.00
2006	118	4/14/06 6:45	4/14/06 7:45	yes	2.62	0.00	R	0.00
2006	119	4/14/06 17:15	4/14/06 17:30	yes	2.62	0.00	R	0.00
2006	120	4/15/06 3:00	4/16/06 6:45	yes	20.99	2.67	R	1.12
2006	121	4/17/06 20:30	4/17/06 20:45	no	0.00	0.00	R	0.00
2006	122	4/20/06 21:30	4/21/06 10:15	no	0.00	0.00	0.00	0.00
2006	123	4/29/06 11:30	4/29/06 16:30	yes	11.80	3.20	0.00	2.80
2006	124	5/1/06 9:45	5/1/06 10:00	no	0.00	0.00	0.00	0.00
2006	125	5/6/06 22:00	5/7/06 0:30	no	0.00	0.00	0.00	0.00
2006	126	5/7/06 13:30	5/8/06 0:45	no	0.00	0.00	0.00	0.00
2006	127	5/11/06 15:15	5/11/06 15:30	no	0.00	0.00	0.00	0.00
2006	128	5/11/06 23:00	5/12/06 9:15	no	0.00	0.00	0.00	0.00
2006	129	5/19/06 16:00	5/19/06 19:00	no	0.00	0.00	0.00	0.00
2006	130	5/20/06 1:30	5/20/06 1:45	no	0.00	0.00	0.00	0.00
2006	131	5/21/06 16:30	5/21/06 17:15	yes	1.31	0.00	0.00	0.00
2006	132	5/22/06 1:00	5/22/06 6:45	no	0.00	0.00	0.00	0.00
2006	133	5/23/06 8:15	5/23/06 10:30	yes	5.25	R	0.00	0.00
2006	134	5/23/06 22:30	5/24/06 15:30	no	0.00	0.00	R	0.00
2006	135	5/26/06 2:00	5/26/06 6:30	no	0.00	0.00	0.00	0.00
2006	136	5/26/06 13:30	5/26/06 13:45	yes	1.31	0.00	R	0.00
2006	137	5/26/06 21:15	5/27/06 5:30	yes	11.80	0.00	R	0.00
2006	138	5/27/06 11:45	5/28/06 15:00	yes	64.27	6.41	R	5.03
2006	139	5/29/06 5:45	5/29/06 6:00	no	0.00	0.00	R	0.00
2006	140	5/31/06 18:45	5/31/06 23:15	yes	6.56	0.00	0.00	0.00
2006	141	6/1/06 12:00	6/2/06 5:15	yes	19.67	0.00	R	0.00
2006	142	6/2/06 11:45	6/2/06 14:30	no	0.00	0.00	R	0.00
2006	143	6/4/06 0:30	6/4/06 11:30	yes	32.79	0.53	0.58	0.56
2006	144	6/8/06 18:45	6/9/06 8:15	yes	20.99	0.00	R	0.00
2006	145	6/10/06 10:45	6/10/06 11:00	no	0.00	0.00	0.00	0.00

Table C.7. Normalized flow durations measured during individual storm events that occurred in water yearx 2005 and 2006.

Water Year	Storm ID	Storm Start Date & Time	Storm Stop Date & Time	Runoff Generating Event (yes/no/undefined)	Curb & Gutter Normalized Flow Duration (hours/acre)	VFS Normalized Flow Duration (hours/acre)	CAVFS1 Normalized Flow Duration (hours/acre)	CAVFS2 Normalized Flow Duration (hours/acre)
2006	146	6/12/06 7:45	6/12/06 9:15	no	0.00	0.00	0.00	0.00
2006	147	6/12/06 20:30	6/13/06 2:00	yes	11.80	0.00	R	0.00
2006	148	6/16/06 10:45	6/16/06 12:45	yes	2.62	0.00	0.00	0.00
2006	149	7/4/06 5:15	7/4/06 6:15	no	0.00	0.00	0.00	0.00
2006	150	7/6/06 16:15	7/6/06 16:30	no	0.00	0.00	0.00	0.00
2006	151	7/12/06 9:30	7/12/06 10:00	no	0.00	0.00	0.00	0.00
2006	152	7/13/06 17:45	7/13/06 18:00	no	0.00	0.00	0.00	0.00
2006	153	7/30/06 11:00	7/30/06 12:30	no	0.00	0.00	0.00	0.00
2006	154	8/29/06 8:15	8/30/06 10:45	yes	24.92	0.00	0.00	0.00
2006	155	9/9/06 1:30	9/9/06 11:00	yes	9.18	0.00	0.00	0.00
2006	156	9/13/06 9:15	9/13/06 9:30	no	0.00	0.00	0.00	0.00
2006	157	9/14/06 0:00	9/14/06 7:45	yes	19.67	1.60	0.00	0.00
2006	158	9/18/06 0:15	9/18/06 5:45	yes	15.74	0.00	0.00	0.00
2006	159	9/19/06 2:45	9/19/06 6:30	yes	3.93	0.00	0.00	0.00
2006	160	9/20/06 8:45	9/20/06 21:30	yes	28.86	1.60	0.00	0.00
2006	161	9/21/06 10:15	9/21/06 10:30	yes	3.93	0.00	0.00	0.00

J: estimated value based on quality assurance review

R: data rejected based on quality assurance review

nd: no data are available for specified event

APPENDIX D

Subsurface Soil Assessment Results

SUBSURFACE SOIL ASSESSMENT

Compost-Amended Vegetated Filter Strip Performance Monitoring Project Snohomish County, Washington

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Attachment 1 Soil Probe Boring Logs

Figures

Figure 1. Vicinity map showing pilot filter strip locations along Interstate 5 in Snohomish County, Washington 1

Figure 2. Geologic cross-section WSDOT Vegetated Filter Strip, north of Lynnwood, Washington. 2

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Introduction

Herrera Environmental Consultants, Inc. (Herrera) was retained by the Washington State Department of Transportation (WSDOT) to conduct a subsurface soil assessment across three compost-amended vegetated filter strips (CAVFS), located off the highway shoulder adjacent to the northbound lanes of Interstate 5 north of Lynnwood, in Snohomish County, Washington (Figure 1). The purpose of this assessment is to further characterize the local stratigraphy underlying the filter strips to determine whether areas of high permeability and preferential pathways for surface water runoff exist beneath the filter strips.

This report summarizes field observations and classification of subsurface soil samples collected from probe borings advanced along these filter strips at 13 locations using a push probe drilling method. Figure 2 shows the probe boring locations for the subsurface soil assessment. Boring logs are provided in Attachment 1.

Drilling and soil characterization activities were conducted on June 27, 2006. Cascade Drilling, Inc. of Woodinville, Washington provided push probe drilling services. All drilling and soil logging activities were conducted under the direction of a Washington state-licensed geologist. Brief descriptions of sampling procedures and results of this investigation are provided in the following sections.

General Site Geology

The subject site and surrounding area are situated on an extensive upland drift plain within the northern portion of the Puget Sound Lowland physiographic region. The drift plain originated from glacial and glaciofluvial processes associated with the latest and uppermost glacial episode, known as the Vashon Drift, which is represented in southwest Snohomish County area by three generally recognizable units (from oldest to youngest): Vashon advance outwash, Vashon Till, and Vashon recessional outwash. The glacial drift plain exhibits relatively level topography with a poorly developed surface drainage system and locally closed surface depressions occupied by lakes, wetlands, and peat bogs.

The geology of southwest Snohomish County, including the vicinity of the subject site, has been mapped as underlain by Pleistocene age Vashon glacial till consisting of a compact and unsorted mixture of cobbles and pebbles in a binder of silt and clay (Minard 1985). The till acts as a confining unit, although occasional sand and gravel lenses occur within this unit that can provide water to dug wells. The thickness of the Vashon Till in the area can vary from 10 to 60 feet (Minard 1985). The Vashon advance outwash deposits, consisting of well-sorted sand and gravel, is a major aquifer beneath the Vashon Till. Vashon recessional outwash alluvial deposits overlie the fill, consisting of well-sorted sand and gravel with variable amounts of silt.

Ground water developed in the project area generally occurs below the Vashon glacial till within the advance outwash sand and gravel deposits. Perched water zones may occur within the

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recessional outwash deposits overlying till and within the uppermost few feet of loose, weathered till, overlying dense till. Direct infiltration and seepage from precipitation and surface runoff primarily recharge ground water in the area.

Surface topography of the subject site slopes gently down from south to north. The elevation difference across the 1,325-foot-long project area from south to north is approximately 11 feet. The topography of each of the three filter test strips gently slopes down from the paved highway to the east toward the ditch invert and piping system.

Subsurface Soil Assessment Summary

Probe Boring Designations

Probe borings were designated by an alphanumeric system referencing the compost filter strip designation and a boring location number within each strip. Borings were denoted by a prefix "C" for control filter strip, "T1" for compost test filter strip 1, and "T2" for compost test filter strip 2, followed by a boring location number. For example:

- C-1 denotes soil samples collected from within control filter strip at location 1
- T1-2 denotes soil samples collected from within compost test filter strip 1 at location 2
- T2-3 denotes soil samples collected from within compost test filter strip 2 at location 3.

Probe Boring Locations

Four probe boring locations were placed within each of the three filter strips approximately 1 foot to 1.5 feet east of the highway shoulder gravel edge and laterally spaced approximately 100 feet apart of each other, including (from south to north; Figure 2):

- C-1 through C-4 within the control filter strip
- T1-1 through T1-4 within compost test filter strip 1
- T2-1 through T2-4 within compost test filter strip 2.

Boring T1-5 was advanced approximately 50 feet north of boring location T1-1 to determine whether subsurface soil conditions observed at T1-1 extended further to the north. No boring was advanced south of T1-1 because of the uncertain extent of catch basins and other subsurface equipment situated between the two filter strips.

Soil Classification and Collection from Push Probe Borings

Probe borings were advanced using a probe-drive sampler attached to driven probe rods. Probes were drilled to maximum depths ranging from 7 to 16 feet below ground surface; the maximum

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depths from 11 of the 13 borings were terminated when dense glacial till was encountered. During drilling, discrete soil samples for soil classification were collected continuously at 4-foot intervals using a probe-drive sampler 4 feet long by 2 inches outside diameter using dedicated clear Lexan® liners. The sampler was driven to obtain a soil sample at the desired sampling depth. Following retrieval, the soil-filled Lexan liner was removed from the sampler and cut open to expose the soil core. Soil encountered during drilling was visually inspected and classified in accordance with the Unified Soil Classification System (USCS; American Society for Testing and Materials [ASTM] D2488-90), and observed for soil coloration using the Munsell® Soil Color Charts (U.S. Department of Agriculture [USDA] Handbook 18—Soil Survey Manual). Pertinent geologic and hydrogeologic subsurface conditions were recorded on soil probe boring logs.

Soil cuttings generated during soil probe sampling (a total of less than a 5-gallon bucket was generated during the field investigation) were scattered across the ground surface. After soil sampling was completed, each probe borehole was backfilled from the bottom to the ground surface with bentonite chips and then capped at the surface with surrounding soil.

Survey elevations of the ground surface at each of the 12 boring locations (excluding boring T1-5) were field measured prior to drilling activities using an auto leveler, tripod, and a level rod with graduations in feet and decimals. Ground surface elevations were measured and calculated to the nearest 0.01 feet and recorded in the field notebook. The mid-point of compost test strip 1 was used as a temporary reference benchmark with an assumed elevation of zero feet.

Results

Figure 2 illustrates the general soil stratigraphy across all three compost filter strips. Filter strip material was encountered at all 13 locations from the ground surface extending to a depth of approximately 1 foot, and consisted of dark grayish brown, slightly silty fine- to medium-grained sand with variable amounts of gravel. Soils encountered underlying the filter strip material at 11 of 13 boring locations consisted of fill material or disturbed natural soil overlying glacial till; soils encountered at T1-1 and T1-5, both located at the south end of compost filter strip 1, consisted of fill overlying an organic silt layer overlying a permeable sand layer. Fill consisted of mottled dark grayish brown, dark yellowish brown, and/or dark brown fine- to medium-grained sand with variable amounts of silt, gravel, and organic material (i.e., roots, twigs, blades of grass). The thickness of fill across the site varied from 1 to 6 feet beneath the filter strips.

Underlying the fill at 11 of the 13 borings is dense, grayish brown silty fine- to medium-grained sand with variable amounts of gravel and clay. The dense sand unit is interpreted as Vashon glacial till, starting at depths ranging from 2 to 4.5 feet below ground surface. The upper portions of the till, ranging from 2 to 5 feet thick, was considered weathered based on content and color. The base of the glacial till was not reached at any of the 11 boring locations.

A black and dark brown organic silt layer, with roots, twigs, and other organic debris overlying silty fine-grained sand/sandy silt was encountered underlying the near-surface fill at boring

Draft

locations T1-1 and T1-5. Underlying the organic silt and silty sand layers from 8 feet below ground surface at T1-5 and 9.5 feet below ground surface at T1-1 is a permeable dark grayish brown fine- to medium-grained sand (with increasing amounts of gravel with depth at T1-1). The base of the permeable sand unit was not reached at either boring location. The organic silt layer is interpreted as the original ground surface within a surface depression. The permeable sand is similar in lithology to those described for Vashon advanced outwash sand deposits.

Ground water was encountered during drilling at boring locations T1-1 and T1-5 approximately 9 feet below ground surface. No ground water was encountered during drilling at the remaining 11 borings drilled to maximum depths ranging from 7 to 11.5 feet below ground surface. However, slightly wet zones up to 1 foot thick were encountered above the weathered/dense till interface in several of the borings.

Conclusion

Based on field observations, glacial till was encountered across most of the site, except for the southern portion of compost test strip 1, where till was absent and a historic surface depression, approximately 150 feet wide, exists beneath the test strip. The presence of the depression beneath compost test strip 1 most likely allowed surface water runoff to infiltrate down to ground water within the permeable advance outwash sand, rather than being intercepted by the test strip piping system. The organic silt layer encountered at borings T1-1 and T1-5 is interpreted as the original ground surface, and that the depression was filled in for the development of the highway.

References

Minard, James P. 1985. Geologic map of the Bothell quadrangle, Snohomish and King Counties, Washington. U.S. Geological Survey miscellaneous field studies, map MF-1747. Reston, Virginia.

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Figures

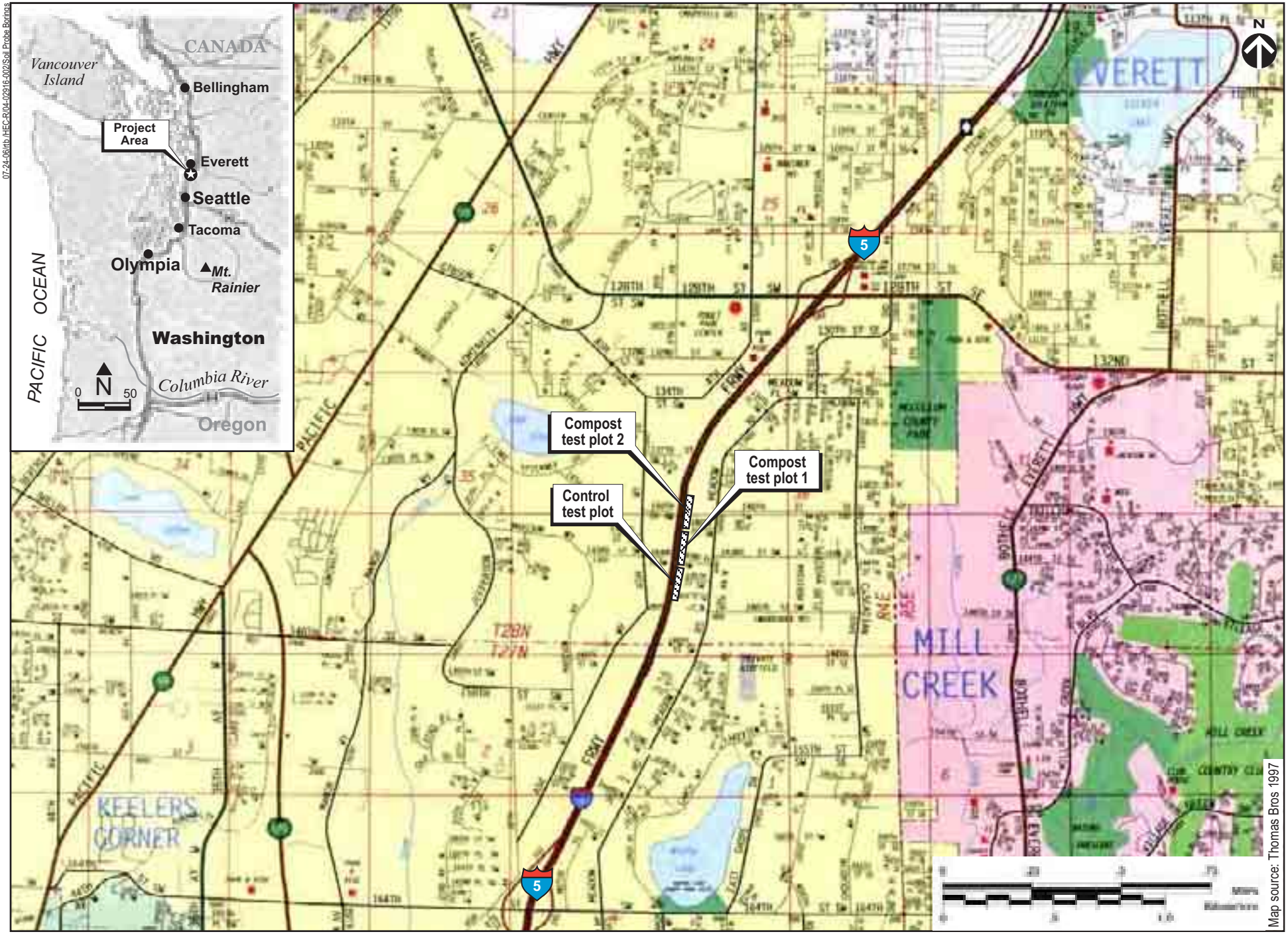

Figure 1. Vicinity map showing pilot filter strip locations along Interstate 5 in Snohomish County, Washington.

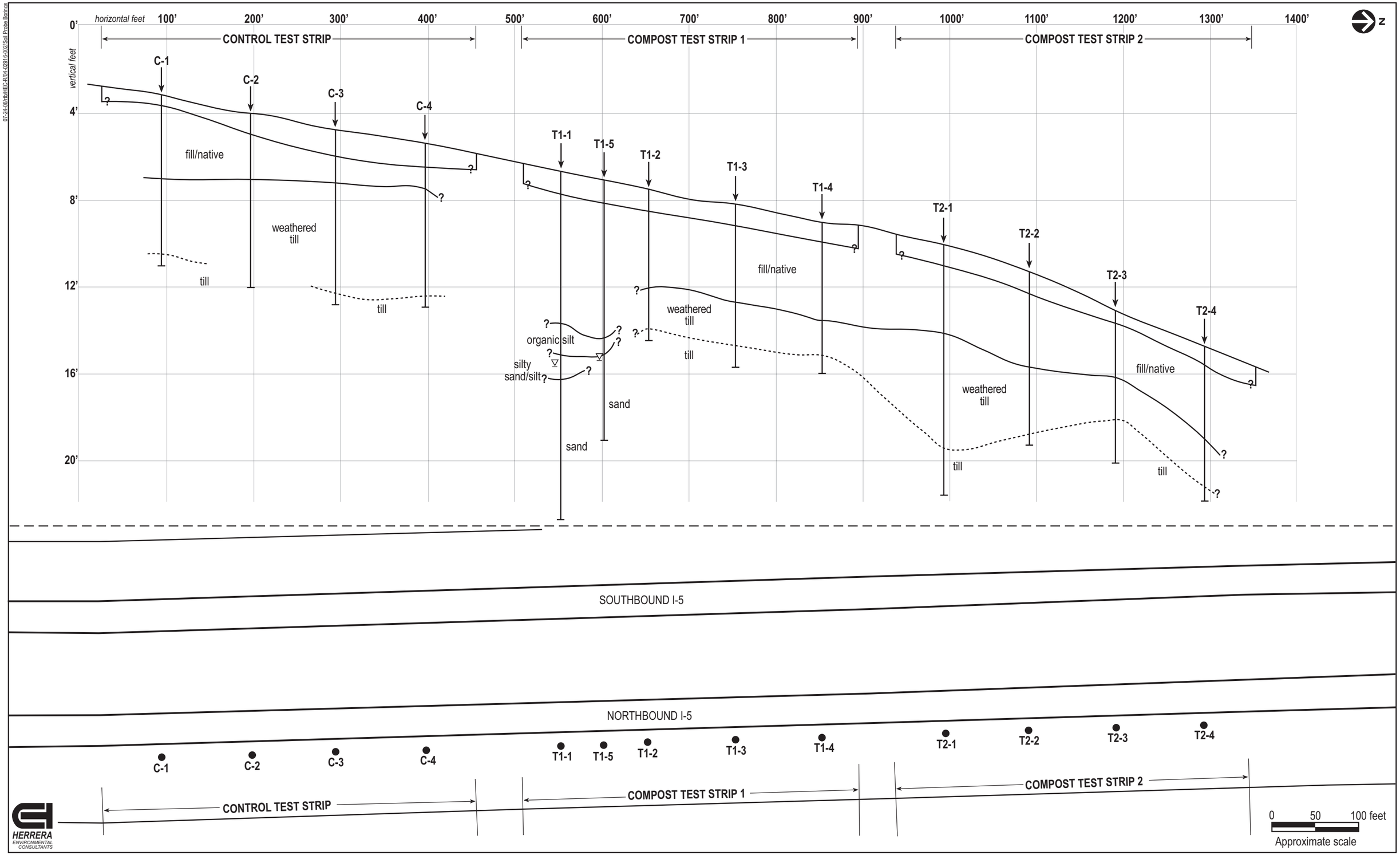

Figure 2. **Geologic cross-section WSDOT Vegetated Filter Strip, north of Lynnwood, Washington.**

ATTACHMENT 1

Soil Probe Boring Logs

SOIL PROBE BORING RECORD

Boring # [illegible]
Total Depth [illegible]
Sheet [illegible] of [illegible]

Project Name [illegible]
Project Number [illegible]
Client [illegible]
PPE No. [illegible]

Drilling Contractor [illegible]
Foreman [illegible]
Drill Rig [illegible]
Sampling Method [illegible]
Core Diameter [illegible]

Date Started [illegible]
Date Completed [illegible]
Groundwater Depth [illegible]
Auger Cutting Depth [illegible]
Backfill Material [illegible]

Sample Number (Depth)	Sample Type	Recovery	Auger Depth (feet)	Depth (feet BGS)	USCS Code	Soil Description
				0	SM	[illegible]
	[illegible]				SP-SM	[illegible]
	[illegible]	[illegible]		1	SP-SM	[illegible]
				2	SP-SM	[illegible]
				3		
				4		
	[illegible]			5	SM	[illegible]
				6		
				7		
				8	SM	[illegible]
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

SOIL PROBE BORING RECORD

Boring # [illegible]
Total Depth [illegible] feet
Sheet [illegible] of [illegible]

Project Name [illegible]	Drilling Contractor [illegible]	Drilling Method [illegible]
Project Number [illegible]	Location [illegible]	Drill Equipment [illegible]
Well [illegible]	[illegible]	Drilling Fluid [illegible]
[illegible]	Start Date [illegible]	Auger Diameter [illegible]
	Finish Date [illegible]	Borehole Depth [illegible]

Instrument Reading (ppm)	Sample Type	Recovery	Water Level Depth	Depth (ft BGS)	Soil Class.	Soil description
				0	[illegible]	[illegible]
	[illegible]	[illegible]		1	[illegible]	[illegible]
				2		
				3	[illegible]	[illegible]
				4		
	[illegible]	[illegible]		5	[illegible]	[illegible]
				6		
				7		[illegible]
				8		
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

SOIL PROBE BORING RECORD

Borehole: [illegible]
Total depth: [illegible]
Sheet: [illegible]

Project name: [illegible]	Drilling Contractor: [illegible]	Drilling method: [illegible]	
Project number: [illegible]	Driller: [illegible]	Completion method: [illegible]	
Date: [illegible]	Logged by: [illegible]	Soil sampling: [illegible]	
Borehole: [illegible]	Date/time: [illegible]	Water level: [illegible]	
Coordinates: [illegible]	Ground level: [illegible]	Total depth: [illegible]	

Sample number (depth)	Sample type	Recovery	Water level (date)	Depth (feet BGS)	Soil group	Soil description
					[illegible]	[illegible]
	[illegible]	[illegible]			[illegible]	[illegible]
					[illegible]	[illegible]
	[illegible]	[illegible]			[illegible]	[illegible]
					[illegible]	[illegible]
					[illegible]	[illegible]

SOIL PROBE BORING RECORD

Boring # _____
Total Depth _____ Feet
Sheet 1 of 1

Project Name	[illegible]	Drilling Contractor	[illegible]
Project Number	[illegible]	Drilling Method	[illegible]
Date	[illegible]	Sampling Method	[illegible]
Location	[illegible]	Boring Diameter	[illegible]
Elevation	[illegible]	Depth to Water	[illegible]
Coordinates	[illegible]	Logged by	[illegible]

Recovered Depth Interval	Sample Type and Number	% Recovery	Analytical Data	Depth Scale (Feet)	Soil Symbol	Soil Description
	[illegible]	[illegible]		1	[illegible]	[illegible]
	[illegible]	[illegible]		2	[illegible]	[illegible]
				3	[illegible]	[illegible]
				4		
				5		
	[illegible]	[illegible]		6	[illegible]	[illegible]
				7		
				8	[illegible]	[illegible]
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

HERRERA

SOIL PROBE BORING RECORD

Boring # T1-1
Total depth 16 feet
Sheet 1 of 1

Project name CAVI S
Project number C04-029-16-002
Client WSDOT
HFC rep. Dana Phelps

Drilling Contractor Cascade Drilling Inc
Location Filter test strip 1 – south end
Start date 6/27/06
Compl. date 6/27/06

Drilling method Push probe drilling
Sampling method 4-foot Lexan push probe sampler
Ground elevation NA
Air monitoring (Y/N) N
Instrument(s) NA

Instrument reading (ppm)	Sample type, interval	% recovery	Water level (feet)	Depth (feet, BGS)	Soil group	Soil description
				1	SP-SM/ SM	Very dark grayish brown, slightly silty to silty, fine-grained SAND, with some gravel, wood, rubber, moist (under stockpile)
	push probe sampler	80		2	SM	Grayish brown, silty fine- to medium-grained SAND, with gravel, moist
				3		
				4		
				5	SM	Mottled dark grayish brown, silty fine- to medium-grained SAND, with gravel, roots, moist
	push probe sampler	100		6		
				7		
				8	OL/ML	Very dark gray and very dark grayish brown, organic SILT, with some sand, occas. gravel, black organics (roots, twigs), moist
			12'	9	SM/ML	Dark brown, silty fine-grained SAND/s and SILT, with organics, moist to wet
	push probe sampler	100		10		
				11	SP/ SP-SM	Dark gray, fine- to medium-grained SAND, trace to slightly silty, wet
				12		
				13	SP/ SP-SM	Dark gray and dark grayish brown SAND, trace to slightly silty, some gravel, wet
	push probe sampler	100		14		
				15		
				16	SP-SM/ GP-GM	Same as above, coarser gravel, wet
				17		Boring terminated at 16 feet; encountered grounded water at 9 ft; borehole was backfilled from bottom to the ground surface with bentonite chips
				18		
				19		
				20		

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SOIL PROBE BORING RECORD

Boring # T1-5
Total depth 12 feet
Sheet 1 of 1

Project name CAVFS
Project number 004.0291.0.002
Client WSDOT
HSO rep Gene Phister

Drilling Contractor Cascade Drilling, Inc.
Location Filter test strip 1 - south end, approx. 20' north of T1-4 boring
Start date 5/27/05
Compl. date 5/27/05

Drilling method Push probe drilling
Sampling method 4-foot Lexan-lined probe sampler
Ground elevation NA
Air monitoring (Y/N) N
Instrument(s) NA

Instrument reading (ppm)	Sample type, interval	% recovery	Water level (feet)	Depth (feet BGS)	Soil group	Soil description
				1	SP-SM/ SM	Very dark grayish brown and dark brown, slightly silty to silty, fine-grained SAND, with some gravel, roots, dry (filter strip material)
	push probe sampler	100		2	SM	Mottled very dark grayish brown, gray, and black, silty fine- to medium-grained SAND, with some gravel, organic material, moist
				3		
				4		
				5	SM/ SP-SM	Dark gray, slightly silty to silty, fine- to medium-grained SAND, moist
	push probe sampler	80		6	SM	Very dark grayish brown and dark brown, silty SAND, with gravel, roots, moist
				7		
			V	8	OL/ML	Black and dark brown, organic SILT, wetter, roots, moist
				9	SM/ SP-SM	Dark olive brown, silty to slightly silty, fine- to medium-grained SAND, wet
	push probe sampler	75		10	SP	Very dark grayish brown, fine- to medium-grained SAND, trace amounts of silt, wet
				11		
				12		Boring terminated at 12 feet; encountered ground water at 8 feet. Borehole was backfilled from bottom to the ground surface with bentonite chip seal.
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

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SOIL PROBE BORING RECORD

Boring # T1-2
Total depth 7 feet
Sheet 1 of 1

Project name: CAVFS
Project number: CG-02916-002
Client: WSDOT
HFC rep: Diana Phelan

Drilling Contractor: Cascade Drilling, Inc.
Location: Filter test strip 1 - center-south
Start date: 6/27/06
Compl. date: 6/27/06

Drilling method: Push probe drilling
Sampling method: 4 foot Texas modified probe sampler
Ground elevation: NA
Air monitoring (V/A): N
Instrument(s): N/A

Instrument reading (ppm)	Sample type interval	% recovery	Water level (feet)	Depth (feet BGS)	Soil group	Soil description
				1	SM	Dark grayish brown, silty, fine grained SAND, with some crushed gravel, cons, dry (filter strip material)
	pass probe sampler	100		2	SM	Brown, silty fine grained SAND, with gravel, moist
				3	SM	Mottled very dark grayish brown and very dark gray, silty SAND, with some gravel, organics (black wood, roots, twigs), moist
				4		
				5	SM	Dark gray, silty fine- to medium gray SAND, with some gravel, moist to almost wet
	pass probe sampler	75		6		
				7	SM	Same as above, more gravel, slightly clayey (till-like)
				8		Boring terminated at 7 feet, no ground water was encountered. Borehole was backfilled from bottom to the ground surface with bentonite chip seal
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

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SOIL PROBE BORING RECORD

Boring # T-3
Total depth 7.5 feet
Sheet 1 of 1

Project name	CAVFS	Drilling Contractor	Cascade Drilling, Inc	Drilling method	Push probe drilling
Project number	C04.029.6.002	Location	Filter test strip 1 center	Sampling method	4 foot Lexan lined probe sampler
Client	WSDOT	(cm)		Ground elevation	NA
HEC rep	Dave Phelps	Start date	6/27/05	Air monitoring (Y/N)	N
		Comp. date	6/27/05	Instrument(s)	NA

Instrument reading (ppm)	Sample type, interval	% recovery	Water level (feet)	Depth (feet, BGS)	Soil group	Soil description
				1	SP-SM	Dark grayish brown, slightly silty fine- to medium-grained SAND, with some gravel, grass, roots, dry filter strip material
	push probe sampler	85		2	SM	Brown, silty fine- to medium-grained SAND with some fine gravel, roots, black organics, moist
				3	SM	Mottled dark grayish brown, silty fine- to medium-grained SAND, with some gravel, moist
				4		
				5		
	push probe sampler	85		6	SM	Dark gray and grayish brown, silty fine- to medium-grained SAND, with some gravel, moist
				7	SM	Same as above, dense, slightly clayey, moist (till-like)
				8		Boring terminated at 7.5 feet; no groundwater was encountered. Borehole was backfilled from bottom to the ground surface with bentonite chip seal.
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

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SOIL PROBE BORING RECORD

Boring # T1-4
Total depth 7 feet
Sheet 1 of 1

Project name: CAVFS
Project number: C04-02916-002
Client: WSDOT
RFC rec: Dave Phelan

Drilling Contractor: Cascade Drilling, Inc
Location: Fairchild Site 1 – northwest
Start date: 6/27/05
Compl date: 6/27/05

Drilling method: Push probe drilling
Sampling method: 4 foot Lexan-lined probe sampler
Ground elevation: NA
Air monitoring (Y/N): N
Instrument(s): NA

Instrument reading (ppm)	Sample type, interval	% recovery	Water level (feet)	Depth (feet, BGS)	Soil group	Soil description
				1	SP-SM	Very dark grayish brown slightly silty fine- to medium-grained SAND, with some gravel, grass roots, dry (filter strip material)
	push probe sampler	100		2	SM/ML	Mottled dark grayish brown and brown, silty fine- to medium-grained SAND/sandy SILT, with some gravel, black organics (roots), moist
				3		
				4	SM/ML	Same as above, brown, occas. large gravel, moist
				5	SM	Dark grayish brown, silty fine- to medium-grained SAND, with some gravel, moist
	push probe sampler	70		6		
				7	SM	Same as above, dense, slightly clayey, moist (till-like)
				8		Boring terminated at 7 feet; no ground water was encountered; borehole was backfilled from bottom to the ground surface with bentonite chip seal.
				9		
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

HERRERA

SOIL PROBE BORING RECORD

Boring # [illegible]
Total depth 11.5 feet
Sheet 1 of 1

Project name	DAVIS	Drilling Contractor	Cascade Drilling Inc	Drilling method	Push probe drilling
Project number	0054-025-16-002	Location	Filter test site 2 - south end	Sampling method	4-foot Lexan-lined probe sampler
Client	WSDOT			Ground elevation	NA
HFC rep	Diana Phelan	Start date	6.27.05	Air monitoring (Y/N)	N
		Compl date	6.27.05	Instrument(s)	NA

Instrument reading (ppm)	Sample type name	% recovery	Water level (feet)	Depth (feet BGS)	Soil group	Soil description
				1	SP-SM	Dark grayish brown, slightly silty fine- to medium-grained SAND, with some gravel, grass roots, dry (filter strip material)
	push probe sampler	100		2	SM	Mottled dark brown and grayish brown, silty fine- to medium-grained SAND, with fine gravel, moist
				3		
				4	ML	Mottled very dark grayish brown and dark brown, organic sandy SILT, with occas. gravel, roots, moist
				5	SM	Dark gray, silty fine- to medium-grained SAND, with some gravel, moist
	push probe sampler	90		6		
				7		
				8		
						moist to almost wet from 8 to 9 feet
				9		
	push probe sampler	90		10	SM	Dense, dark gray and olive gray, silty SAND with gravel, slightly clayey, moist (till like)
				11		
				12		Boring terminated at 11.5 feet, no ground water was encountered, borehole was backfilled from bottom to the ground surface with bentonite chip seal
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

SOIL PROBE BORING RECORD

Boring # [illegible]
Total depth [illegible]
Sheet [illegible]

Project name [illegible]
Project number [illegible]
Client [illegible]
Location [illegible]

Drilling contractor [illegible]
Driller [illegible]
Start [illegible]
Finish [illegible]
Completed [illegible]

Date started [illegible]
Date completed [illegible]
Drilling method [illegible]
Drilling equipment [illegible]
Logged by [illegible]

Elevation (ft MSL)	Sample type	Sample number	Sample recovery (ft)	Depth (feet BGS)	Soil group	Soil description
					SM, SW	[illegible]
				1	SM	[illegible]
	[illegible]				SM	[illegible]
	[illegible]	Bag		3		[illegible]
					SM	[illegible]
				5		[illegible]
				6	SM	[illegible]
				7	SM	[illegible]
	[illegible]	Bag		8		[illegible]
				9	SM	[illegible]
				10	SM	[illegible]
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

SOIL PROBE BORING RECORD

Boring # [illegible]
Hole Depth [illegible] feet
Sheet [illegible] of [illegible]

Project Name	[illegible]	Drilling Contractor	[illegible]	Drilling Method	[illegible]		
Project Number	[illegible]	Location	[illegible]	Sampling Method	[illegible]		
Client	[illegible]	Total		Groundwater Depth	[illegible]		
Drill Rig	[illegible]	Start Date	[illegible]	Auger Diameter	[illegible]		
Borehole Diameter	[illegible]	Finish Date	[illegible]	Total Number	[illegible]		

Borehole Reading (ppm)	Sample type/interval	Recovery	Well Construction	Depth (feet)	Soil Group	Soil description
					[illegible]	[illegible]
	[illegible]	[illegible]		1	[illegible]	[illegible]
				2	[illegible]	[illegible]
				3	[illegible]	[illegible]
				4	[illegible]	[illegible]
				5		
				6	[illegible]	[illegible]
				7		
	[illegible]	[illegible]		8	[illegible]	[illegible]
				9		[illegible]
				10		
				11		
				12		
				13		
				14		
				15		
				16		
				17		
				18		
				19		
				20		

SOIL PROBE BORING RECORD

Boring # [illegible]
Total Depth [illegible] ft
Sheet 1 of 1

Project [illegible]	Drilling Contractor [illegible]	Boring Method [illegible]	
Project Number [illegible]	Location [illegible]	Sampling Method [illegible]	
Client [illegible]		GW Elevation [illegible]	
PID Cap [illegible]	Start Date [illegible]	Water Level [illegible]	
	Completion Date [illegible]	Measuring Point [illegible]	

Interval Sampled	Sample Recovery	% Recovery	Water Level	Depth Feet	Soil Class	Soil Description
				0	[illegible]	[illegible]
	Post Push Sampler	100		1	[illegible]	[illegible]
				2	[illegible]	[illegible]
				3	[illegible]	[illegible]
	Post Push Sampler	75		4	[illegible]	[illegible]
				5	[illegible]	[illegible]
				6		
				7		
				8		
				9		
				10		
				11		
				12		
				13		
				14		
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				16		
				17		
				18		
				19		
				20		

APPENDIX E

Laboratory Reports, Chain-of-Custody Records, and Data Quality Assurance Worksheets

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] AURORA AVENUE NORTH, SEATTLE, WA 98[illegible]

PHONE: [illegible] FAX: [illegible]

CASE FILE NUMBER:	[illegible]	PAGE 1	
REPORT DATE:	[illegible]		
DATE SAMPLED:	[illegible]	DATE RECEIVED:	[illegible]

FINAL REPORT: LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM [illegible] ENVIRONMENTAL

CASE NARRATIVE

[illegible]

SAMPLE DATA

SAMPLE ID	[illegible] (mg/l)	[illegible] (mg/l)	[illegible] (mg/l)	[illegible] (mg/l)
EFFLUENT 2	[illegible]	[illegible]	[illegible]	[illegible]
CONTROL	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

SAMPLE ID	DISSOLVED SOLIDS COPPER (mg/l)	DISSOLVED SOLIDS ZINC (mg/l)	TOTAL VOLATILE COPPER (mg/l)	TOTAL VOLATILE ZINC (mg/l)
EFFLUENT 2	[illegible]	[illegible]	[illegible]	[illegible]
CONTROL	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] AVENUE NORTH, [illegible], WA [illegible]

PHONE: [illegible] FAX: [illegible]

CASE FILE NUMBER:	[illegible]	PAGE 2
REPORT DATE:	[illegible]	
DATE SAMPLED:	[illegible]	DATE RECEIVED: [illegible]

FINAL REPORT: LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES [illegible]

QA/QC DATA WATER

QC PARAMETER	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
METHOD	[illegible]	[illegible]	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]	[illegible]	[illegible]
DETECTION LIMIT	0.50	2.00	[illegible]	0.002

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	5.0	2.32	[illegible]	0.131
DUPLICATE	[illegible]	2.32	[illegible]	0.130
RPD	[illegible]	[illegible]	[illegible]	[illegible]

SPIKE SAMPLE

SAMPLE ID		[illegible]	[illegible]	[illegible]
ORIGINAL		2.32	[illegible]	0.131
SPIKED SAMPLE		[illegible]	[illegible]	[illegible]
SPIKE ADDED		[illegible]	[illegible]	[illegible]
% RECOVERY	N/A	[illegible]	[illegible]	[illegible]

QC CHECK

FOUND	[illegible]	[illegible]	[illegible]	[illegible]
TRUE	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

BLANK	<0.50	<2.00	<0.50	<0.002

[illegible]

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

1927 AURORA AVENUE NORTH SEATTLE, WA 98109

PHONE: (206) 285-2713 FAX: (206) 632-5017

CASE FILE NUMBER:	HL 9971-03	PAGE 3
REPORT DATE:	11/28/05	
DATE SAMPLED:	11/09/05	DATE RECEIVED: 11/9/05

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HARBOR ENVIRONMENTAL

QA/QC DATA WATER

QC PARAMETER	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
SOFTBRIDGE	[illegible]	[illegible]	[illegible]	[illegible]
DEIONIZED/DISTILLED	[illegible]	[illegible]	[illegible]	[illegible]
DILUTION TUBE	[illegible]	[illegible]	[illegible]	[illegible]

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
DUPLICATE	[illegible]	[illegible]	[illegible]	[illegible]
RPD	[illegible]	[illegible]	[illegible]	[illegible]

SPIKE SAMPLE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
SPIKED SAMPLE	[illegible]	[illegible]	[illegible]	[illegible]
SPIKE ADDED	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

QC CHECK

EPA 245	[illegible]	[illegible]	[illegible]	[illegible]
TBT'S	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]
BLANK	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

SUBMITTED BY

[illegible]

Laboratory Director

Aquatic Research Incorporated

2927 Aurora Ave. N / Seattle, WA 98103 / (206) 632-2715

CHAIN-OF CUSTODY RECORD

CLIENT: Weyerhaeuser Environmental

SAMPLING DATE: 10/3/05

SAMPLERS: [illegible]

SHEET 1 OF 1

PROJECT NO.:

CASE FILE NO.:

DATA RECORDED BY:

SAMPLE INFORMATION

PARAMETERS

| SAMPLE ID | DATE/TIME COLLECTED | [illegible] | [illegible] | [illegible]

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	HER071-44	PAGE 1	
REPORT DATE:	11/21/05		
DATE SAMPLED:	11/03/05	DATE RECEIVED:	11/04/05

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRERA ENVIRONMENTAL

CASE NARRATIVE

Three water samples were delivered to the laboratory in good condition. The samples were analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

	NWTPH-DX	
SAMPLE ID	DIESEL (mg/l)	MOTOR OIL (mg/l)
CURB & GUTTER	<0.05	2.2
CONTROL	<0.05	<0.10
COMPOST 2	<0.05	0.56

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] AVENUE, [illegible], WA 98[illegible]

PHONE: (206) 632-[illegible] FAX: (206) 632-[illegible]

CASE FILE NUMBER:	[illegible]	PAGE: 2
REPORT DATE:	11-21-05	
DATE SAMPLED:	11-06-05	DATE RECEIVED: 11-06-05

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRERA ENVIRONMENTAL.

QA/QC DATA WATER

QC PARAMETER	[illegible]	[illegible]
	mg/l	mg/l
METHOD	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]
DETECTION LIMIT	[illegible]	[illegible]

DUPLICATE

SAMPLE ID	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]
DUPLICATE	[illegible]	[illegible]
RPD	NC	NC

SPIKE SAMPLE

SAMPLE ID		
ORIGINAL		
[illegible] SAMPLE		
SPIKE ADDED		
% RECOVERY	NA	NA

QC CHECK

EQUAL	[illegible]	[illegible]
LIM	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]
BLANK	[illegible]	[illegible]

[illegible]

SUBMITTED BY

[illegible]

Aquatic Research Incorporated

3927 Aurora Ave. N. Seattle, WA 98103 (206) 632-2715

CHAIN OF-CUSTODY RECORD

CLIENT: [illegible]

SAMPLING DATE: [illegible]

SAMPLERS: [illegible]

SHEET [illegible] OF [illegible]

PROJECT ID:

CASE FILE NO.

DATA RECORDED BY:

SAMPLE INFORMATION

PARAMETERS

SAMPLE	DATE/TIME COLLECTED	[illegible]	NOTES
[illegible] Control Sample 2	[illegible]	[illegible]	

Relinquished By	Date/Time	Received By	Date/Time
[illegible]	[illegible]	[illegible]	[illegible]

Relinquished By	Date/Time	Received By	Date/Time

Data Quality Assurance Worksheet

By: [illegible]

Date: [illegible] Page 1 of [illegible]

Project Name/Job Number: [illegible]

Laboratory Procedure: [illegible]

Sample Date Sample ID: [illegible]

Checked: [illegible]

Date: [illegible]

Analyte	Initial Test	Check Standard	Method Blank Surrogate Recovery	Lab Duplicate	Matrix Spike	Laboratory Control Sample	Action
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Barium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cadmium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Chromium	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	OK	[illegible]	NA	NC	NA	[illegible]	None
[illegible]	OK	[illegible]	NA	NC	[illegible]	[illegible]	[illegible]

Comments: [illegible]

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] AVENUE, STREET, SEATTLE, WA 98101

PHONE: (206) 632-2715 FAX: (206) 632-2413

CASE FILE NUMBER:	[illegible]	PAGE 1
REPORT DATE:	[illegible]	
DATE SAMPLED:	[illegible]	DATE RECEIVED: [illegible]

FINAL REPORT, LABORATORY ANALYSIS OF SUBMITTED [illegible] WATER SAMPLES FROM [illegible] ENVIRONMENTAL.

CASE NARRATIVE

[illegible]

SAMPLE DATA

	TSS	[illegible]	[illegible]	[illegible]	NWTPH-DX DIESEL	[illegible]
SAMPLE ID	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	DISSOLVED METALS		TOTAL METALS	
	[illegible]	[illegible]	[illegible]	[illegible]
SAMPLE ID	(mg/L)	(mg/L)	(mg/L)	(mg/L)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] ALHAMBRA AVENUE, NORTH SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-3413

CASE FILE NUMBER: [illegible]-93 PAGE 2

REPORT DATE: 03-13-96

DATE SAMPLED: 12-20-95 DATE RECEIVED: 12-20-95

FINAL REPORT: LABORATORY ANALYSES OF SELECTED PARAMETERS ON WATER

SAMPLES SUBMITTED BY: [illegible]

QA/QC RAIN WATER

QC PARAMETER	TSS	HARDNESS	[illegible]	[illegible]	[illegible]	[illegible]
	(mg/L)	(mg/L CaCO3)	(mg/L)	(mg/L)	(mg/L)	(mg/L)
METHOD	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DETECTION LIMIT	0.50	2.00	0.021	0.02	0.05	[illegible]

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]		
ORIGINAL	10.	8.79	0.033	0.055		
DUPLICATE	10.	[illegible]	0.032	0.050		
RPD	[illegible]	[illegible]	[illegible]	0.43%	NA	NA

SPIKE SAMPLE

SAMPLE ID		[illegible]	[illegible]	[illegible]		
ORIGINAL		8.79	0.032	0.055		
SPIKED SAMPLE		[illegible]	[illegible]	[illegible]		
SPIKE ADDED		[illegible]	0.050	0.050		
% RECOVERY	NA	[illegible]	[illegible]	[illegible]	NA	NA

LCS STUDY

EPA 500	5.0	[illegible]	0.033	0.254	0.26	2.45
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BLANK	<0.50	<2.00	<0.02	<0.002	<0.05	<0.2

[illegible]

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LABORATORY & CONSULTING SERVICES

[illegible] AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2017

CASE FILE NUMBER: [illegible] PAGE: 3

REPORT DATE: [illegible]

DATE SAMPLED: 12/28/05 DATE RECEIVED: 12/29/05

FINAL RESULTS LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM WERNER ENVIRONMENTAL

QUALITY ASSURANCE

	DISSOLVED METALS		TOTAL METALS	
QC PARAMETER	[illegible]	[illegible]	[illegible]	[illegible]
	(mg/L)	(mg/L)	(mg/L)	(mg/L)
METHOD	[illegible]	[illegible]	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]	[illegible]	[illegible]
DETECTION LIMIT	[illegible]	[illegible]	[illegible]	[illegible]

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
DUPLICATE	[illegible]	[illegible]	[illegible]	[illegible]
RPD	[illegible]	[illegible]	[illegible]	[illegible]

SPIKE SAMPLE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
SPIKED SAMPLE	[illegible]	[illegible]	[illegible]	[illegible]
SPIKE AMOUNT	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

QC CHECK

FOUND	[illegible]	[illegible]	[illegible]	[illegible]
TRUE	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

BLANK	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

SUBMITTED BY

[illegible]

Aquatic Research Incorporated

3927 Aurora Ave. N / Seattle, WA 98103 / (206) 632-2715

CHAIN-OF-CUSTODY RECORD

CLIENT:

SAMPLING DATE:

SAMPLERS:

SHEET ___ OF ___

PROJECT ID:

CASE FILE NO.

DATA RECORDED BY:

SAMPLE INFORMATION

PARAMETERS

| DATE | TIME | | |

Data Quality Assurance Worksheet

HERRERA ENVIRONMENTAL CONSULTANTS

By [illegible]

Project Name/No./Client: CAVFS 04 02916 002

Date 2 11 06 Page 1 of 1

Laboratory/Parameters: TSS, SRP, TP, Hardness, Copper (diss, tot), Zinc (diss, tot), TPH

Checked: initials

Sample Date/Sample ID [illegible] Cert gather, control

date

Parameter	Holding Times	Blanks/ Detection Limit	Matrix Spikes/ Surrogate Recoveries	Lab Duplicates	Field Duplicates	Lab Control Samples	ACTION
TSS	[illegible] day 7 (2.0)	ok	NA	ok	NA	ok	None
SRP	ok		ok				
TP							
Hardness							
Copper (dissolved)							
Zinc (dissolved)							
Copper (total)							
Zinc (total)							
TPH (diesel)		both values BDL	NA	NA			[illegible]
TPH (motor oil)			NA	NA			

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] AVENUE NORTH, SEATTLE, WA [illegible]

PHONE: (206) 632-[illegible] FAX: (206) 632-[illegible]

CASE FILE NUMBER:	[illegible]	PAGE 3	
REPORT DATE:	[illegible]		
DATE SAMPLED:	[illegible]	DATE RECEIVED:	[illegible]

FINAL REPORT - LABORATORY ANALYSES OF SELECTED PARAMETERS ON WATER SAMPLES FROM [illegible] ENVIRONMENTAL.

CASE NARRATIVE

[illegible]

SAMPLE DATA

	[illegible]	[illegible]	[illegible]	[illegible]
SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	DISSOLVED METALS		TOTAL METALS	
	[illegible]	[illegible]	[illegible]	[illegible]
SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AQUATIC RESEARCH INCORPORATED
LABORATORY & CONSULTING SERVICES
2803 AURORA AVENUE NORTH, SEATTLE WA 98103
PHONE: (206) [illegible] FAX: (206) 632-3117

CASE FILE NUMBER: [illegible] PAGE 2
REPORT DATE: [illegible]
DATE SAMPLED: 12/28/05 DATE RECEIVED: 12/28/05
FINAL REPORT: LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRERA ENVIRONMENTAL

QUALITY CONTROL WATER

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
METHOD	[illegible]	[illegible]	[illegible]	[illegible]
DATE ANALYZED	12/28/05	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
DUPLICATE	[illegible]	[illegible]	[illegible]	[illegible]
RPD	[illegible]	[illegible]	[illegible]	[illegible]

SPIKE ANALYSIS

SAMPLE ID		[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]
SPIKED SAMPLE		[illegible]	[illegible]	[illegible]
SPIKE ADDED		[illegible]	[illegible]	[illegible]
% RECOVERY	N/A	[illegible]	[illegible]	[illegible]

QC CHECK

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TRUE	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

BLANK	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] AVENUE NORTH, SEATTLE, WA 98109
PHONE [illegible] FAX [illegible]

CASE FILE NUMBER:	[illegible]	PAGE 1
REPORT DATE:	01/15/06	
DATE SAMPLED:	12/21/05	DATE RECEIVED: 12/21/05

FINAL REPORT LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HARBORS ENVIRONMENTAL

QA/QC DATA WATER

QC PARAMETER	DISSOLVED METALS		TOTAL METALS	
	[illegible]	[illegible]	[illegible]	[illegible]
	ug/L	mg/L	ug/L	mg/L
METHOD	[illegible]	[illegible]	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]	[illegible]	[illegible]
DETECTION LIMIT	[illegible]	[illegible]	[illegible]	[illegible]

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
DUPLICATE	[illegible]	[illegible]	[illegible]	[illegible]
RPD	[illegible]	[illegible]	[illegible]	[illegible]

SPIKE SAMPLE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
SPIKED SAMPLE	[illegible]	[illegible]	[illegible]	[illegible]
SPIKE ADDED	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

QC STDS

FOUND	[illegible]	[illegible]	[illegible]	[illegible]
TRUE	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

BLANK	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

1H0071-61

Aquatic Research Incorporated

3927 Aurora Ave. N. / Seattle, WA 98103 / (206) 632-2715

CHAIN-OF-CUSTODY RECORD

CLIENT:
SAMPLING DATE:
SAMPLERS

SHEET 1 OF 1
PROJECT ID: CAVI
CASE FILE NO.:
DATA RECORDED BY:

SAMPLE INFORMATION

PARAMETERS

SAMPLE ID	DATE/TIME COLLECTED								BOTTLE #	NOTES

Relinquished By	Date/Time	Received By	Date/Time

Relinquished By	Date/Time	Received By	Date/Time

#5 CONTAINERS WASHED

HERRERA ENVIRONMENTAL CONSULTANTS

Data Quality Assurance Worksheet

By [illegible]

Date 2-16-06 Page 1 of 1

Project Name/No./Client CAVTS 04-029; 6-002

Laboratory/Parameters TSS, SRP, TP, Hardness, Copper (diss, tot), Zinc (diss, tot), TPH

Sample Date/Sample ID [illegible] Cutter gutter, control, compost

Checked: Initials

date

Parameter	Holding Times	Blanks/ Detection Limit	Matrix Spikes/ Surrogate Recoveries	Lab Duplicates	Field Duplicates	Lab Control Samples	ACTION
TSS	[illegible]	OK	NA	OK	NA	OK	none
SRP	OK		OK				
TP							
Hardness							
Copper (dissolved)							
Zinc (dissolved)							
Copper (total)							
Zinc (total)							
TPH (diesel)							
TPH (motor oil)							

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

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CASE FILE NUMBER:	HER071-60	PAGE 1	
REPORT DATE:	01/27/06		
DATE SAMPLED:	12/21/05	DATE RECEIVED:	12/21/05

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRERA ENVIRONMENTAL

CASE NARRATIVE

Three water samples were delivered to the laboratory in good condition. The samples were analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows and QA/QC data is contained on subsequent pages.

SAMPLE DATA

	NWTPH-DX	
	DIESEL	MOTOR OIL
SAMPLE ID	(mg/l)	(mg/l)
CURB-GUTTER	<0.05	5.08
CONTROL	<0.05	2.48
COMPOST 2	<0.05	0.19

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 633-2719 FAX: (206) 633-2613

CASE/PROJECT NUMBER:	[illegible]	TASK: 2	
REPORT DATE:	12/27/05		
DATE SAMPLED:	12/20/05	DATE RECEIVED:	12/21/05

FINAL REPORT, LABORATORY ANALYSES OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRERA ENVIRONMENTAL

QA/QC DATA WATER

QC PARAMETER	[illegible]	[illegible]
	mg/L	mg/L
METHOD	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]
DETECTION LIMIT	[illegible]	[illegible]
DUPLICATE		
SAMPLE ID		
ORIGINAL		
DUPLICATE		
RPD	NA	NA
SPIKE SAMPLE		
SAMPLE ID		
ORIGINAL		
SPIKED SAMPLE		
SPIKE ADDED		
% RECOVERY	NA	NA
BLANK		
BLANK	[illegible]	[illegible]
TRUE	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]
BLANK	[illegible]	[illegible]

[illegible]

SUBMITTED BY

[illegible]

Acoustic Research Incorporated

CHAIN OF CUSTODY RECORD

PROJECT

SAMPLING DATE

SAMPLERS

SAMPLE NOMENCLATURE

PROJECT

PROPERTY ID

CASE NO.

REQUIRED COMPLETION

Data Quality Assurance Worksheet

By

Date

Checked

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-1715 FAX: (206) 632-2415

CASE FILE NUMBER:	HR8071 70	PAGE 1	
REPORT DATE:	01 22[illegible]		
DATE SAMPLED:	12 [illegible]	DATE RECEIVED:	12-13-85

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS IN WATER SAMPLES FROM HERRERA ENVIRONMENTAL

CASE NARRATIVE

[illegible]

SAMPLE DATA

SAMPLE ID	[illegible] (mg/l)	[illegible] (mg/l CaCO3)	[illegible] (mg/l)	[illegible] (mg/l)
[illegible]	32	5.79	0.021	2.1EJ
[illegible]	4.11	[illegible]	0.009	[illegible]
[illegible]	.1	32.7	[illegible]	[illegible]

	DISSOLVED [illegible]		TOTAL [illegible]	
	COPPER	ZINC	COPPER	ZINC
SAMPLE ID	(mg/l)	(mg/l)	(mg/l)	(mg/l)
[illegible]	0.010	[illegible]	0.095	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	0.003	0.003	0.036	0.32

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

1927 AURORA AVENUE NORTH SEATTLE, WA 98109

PHONE (206) 633-0715 FAX (206) 632-2487

CASE FILE NUMBER	[illegible]	PAGE 1
REPORT DATE:	01.22.06	
DATE SAMPLED:	12.28.05	DATE RECEIVED: 12.28.05

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS FOR WATER SAMPLES FROM INTERGEN ENVIRONMENTAL

QA QC DATA WATER

QC PARAMETER	TSS	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
SET UP DATE	[illegible]	[illegible]	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]	[illegible]	[illegible]
DETECTION LIMIT	[illegible]	[illegible]	[illegible]	[illegible]

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
DUPLICATE	[illegible]	[illegible]	[illegible]	[illegible]
RPD	[illegible]	[illegible]	[illegible]	[illegible]

SPIKE SAMPLE

SAMPLE ID		[illegible]	[illegible]	[illegible]
ORIGINAL		[illegible]	[illegible]	[illegible]
SPIKE SAMPLE		[illegible]	[illegible]	[illegible]
SPIKE ADDED		[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

QC CHECK

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TRUE	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]
BLANK	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES
3925 AURORA AVENUE NORTH, SEATTLE, WA 98103
PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	[illegible]	PAGE 3
REPORT DATE:	01/22/96	
DATE SAMPLED:	12/28/95	DATE RECEIVED: 12/28/95

FINAL REPORT, RANDOM TEST ANALYSIS OF SELECTED PARAMETERS ON WATER
SAMPLES FROM HERRERA ENVIRONMENTAL

QA/QC DATA WATER

QC PARAMETER	DISSOLVED METALS [illegible]	DISSOLVED METALS [illegible]	TOTAL METALS [illegible]	TOTAL METALS [illegible]
METHOD	[illegible]	[illegible]	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]	[illegible]	[illegible]
DETECTION LIMIT	0.0010	0.005	0.0010	0.005

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	0.012	0.0062	0.005
DUPLICATE	[illegible]	0.012	0.0025	0.009
RPD	NC	[illegible]	[illegible]	[illegible]

SPIKE SAMPLE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
UNSPIKED	[illegible]	0.012	[illegible]	0.005
SPIKED SAMPLE	0.0150	0.025	0.0[illegible]	0.105
SPIKE ADDED	0.[illegible]25	[illegible]	0.0125	100
% RECOVERY	[illegible]	[illegible]	[illegible]	91.25%

QC CHECK

BLANK	0.0254	0.077	0.[illegible]	[illegible]
CRM	0.0258	[illegible]	0.2790	[illegible]
% RECOVERY	33.3%	37.4%	55.5%	94.4%

[illegible]

[illegible]

SUBMITTED BY

[illegible]

Octopus Research Incorporated

CHAIN OF CUSTODY RECORD

SHEET

PROJECT

CASE FILE

DATE RECEIVED

PARAMETERS

NOTES

HERRERA
ENVIRONMENTAL CONSULTANTS

Data Quality Assurance Worksheet

By: [illegible]

Project Name/No./Client: CAVFS 04-02916.002

Date: [illegible] Page 1 of 1

Laboratory/Parameters: TSS, SRP, TP, Hardness, Copper (diss, tot), Zinc (diss, tot), TPH

Checked: initials ____ date ____

Sample Date/Sample ID: 12-23-05 Control Gulch, Control, Composite

Parameter	Holding Times	Blanks/ Detection Limit	Matrix Spikes/ Surrogate Recoveries	Lab Duplicates	Field Duplicates	Lab Control Samples	ACTION
TSS	OK	OK	NA	OK	NA	OK	None
SRP	↓	↓	OK	↓	↓	↓	↓
TP	↓	↓	↓	↓	↓	↓	↓
Hardness	↓	↓	↓	↓	↓	↓	↓
Copper (dissolved)	↓	↓	↓	NC	↓	↓	↓
Zinc (dissolved)	↓	↓	↓	↓	↓	↓	↓
Copper (total)	↓	↓	↓	↓	↓	↓	↓
Zinc (total)	↓	↓	↓	↓	↓	↓	↓
TPH (diesel)	OK	~~<0.05~~ <0.05	NA	NA	NA	96%	None 8x
TPH (motor oil)	OK	~~<0.10~~ <0.10	NA	NA	NA	86%	↓ 10/31/06

Herrera Environmental Consultants

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	HER071-67	PAGE 1	
REPORT DATE:	01/31/06		
DATE SAMPLED:	12/28/05	DATE RECEIVED:	12/28/05

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRERA ENVIRONMENTAL

CASE NARRATIVE

Three water samples were delivered to the laboratory in good condition. The samples were analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this sample. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

	NWTPH-DX	
SAMPLE ID	DIESEL (mg/L)	MOTOR OIL (mg/L)
CURB+GUTTER 122805	<0.08	<0.15
CONTROL-122805	<0.05	6.88
COMPOSITE 122805	<0.05	1.50

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) [illegible] FAX: (206) [illegible]

CASE FILE NUMBER:	HRB07F 57	PAGE 3
REPORT DATE	03/30/06	
DATE SAMPLED:	12/28/05	DATE RECEIVED: 12/28/05

FINAL REPORT: LABORATORY ANALYSES OF SELECTED PARAMETERS IN WATER SAMPLES FROM HERRERA ENVIRONMENTAL

QA/QC BATCH WATER

QC PARAMETER	[illegible]	[illegible]
	[illegible]	[illegible]
METHOD	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]
DETECTION LIMIT	[illegible]	[illegible]

DUPLICATE

SAMPLE ID		
ORIGINAL		
DUPLICATE		
RPD	NA	NA

SPIKE SAMPLE

SAMPLE ID		
ORIGINAL		
SPIKED SAMPLE		
SPIKE ADDED		
% RECOVERY	NA	NA

QC CHECK

[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
BLANK	[illegible]	[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

MICHAEL [illegible]

[illegible]

Laboratory Director

Acoustic Research Incorporated

CHAIN OF CUSTODY RECORD

SHEET

PROJECT ID

CASE FILE NO

DATA RECORDED BY

Data Quality Assurance Worksheet

HERRERA ENVIRONMENTAL CONSULTANTS

By: Rebecca Dziegielski

Project Name/No./Client: CAVFS 01-02916 002

Date: 2/13/02 Page 1 of 1

Laboratory/Parameters: TSS, SRP, TP, Hardness, Copper (diss, tot), Zinc (diss, tot), TPH

Checked: initials

Sample Date/Sample ID: 12/28/01 [illegible], control, composite

date

Parameter	Holding Times	Blanks/ Detection Limit	Matrix Spikes/ Surrogate Recoveries	Lab Duplicates	Field Duplicates	Lab Control Samples	ACTION
TSS							
SRP							
TP							
Hardness							
Copper (dissolved)							
Zinc (dissolved)							
Copper (total)							
Zinc (total)							
TPH (diesel)	OK	All values BDL	NA	NA	NA	OK	BDL values → 0
TPH (motor oil)	↓	1 value ≥ BDL	↓	↓	↓	↓	BDL value → U

All [illegible]

Herrera Environmental Consultants

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER:	HER071-76	PAGE 1	
REPORT DATE:	02/07/06		
DATE SAMPLED:	01/05/06	DATE RECEIVED:	01/05/06

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRERA ENVIRONMENTAL

CASE NARRATIVE

Four water samples were delivered to the laboratory in good condition. The samples were analyzed according to the chain of custody. No difficulties were encountered in the preparation or analysis of this samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

	NWTPH-DX	
SAMPLE ID	DIESEL (mg/l)	MOTOR OIL (mg/l)
CURB - GUTTER 010506	<0.05	3.7
CONTROL-010506	<0.05	<0.20
COMPOSITE 010506	<0.05	0.44
DUPE-010506	<0.05	3.48

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LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: HER071-76 PAGE 2
REPORT DATE: 02/07/06
DATE SAMPLED: 01/05/06 DATE RECEIVED: 01/05/06
FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRERA ENVIRONMENTAL

QA/QC DATA WATER

QC PARAMETER	DIESEL (mg/l)	MOTOR OIL (mg/l)
METHOD	NWTPH-DX	NWTPH-DX
DATE ANALYZED	01/19/06	01/19/06
DETECTION LIMIT	0.05	0.10
DUPLICATE		
SAMPLE ID		
ORIGINAL		
DUPLICATE		
RPD	NA	NA
SPIKE SAMPLE		
SAMPLE ID		
ORIGINAL		
SPIKED SAMPLE		
SPIKE ADDED		
% RECOVERY	NA	NA
QC CHECK		
FOUND	0.26	0.17
TRUE	0.25	0.50
% RECOVERY	104.40%	93.40%
BLANK	<0.05	<0.10

RPD = RELATIVE PERCENT DIFFERENCE
NA = NOT APPLICABLE OR NOT AVAILABLE
ND = NOT DETECTABLE (BELOW DETECTION LIMIT)
QA = QUALITY ASSURANCE (ALL QC DATA COMPARED TO SAMPLE ID OF ORIGINAL SAMPLE FOR LOW RELATIVE PERCENT DIFFERENCE)

SUBMITTED BY:

Steven Lazos
Laboratory Director

HEM071-76

Aquatic Research Incorporated

3527 Aurora Ave. N / Seattle, WA 98103 / (206) 632-2715

CHAIN-OF-CUSTODY RECORD

CLIENT:
SAMPLING DATE
SAMPLERS

SHEET 1 OF 1
PROJECT ID: CAVET
CASE FILE NO.:
DATA RECORDED BY:

SAMPLE INFORMATION

PARAMETERS

| SAMPLE | DATE/TIME COLLECTED | | |

Data Quality Assurance Worksheet

HERRERA

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH SEATTLE, WA 98103

PHONE: [illegible] FAX: [illegible]

CASE FILE NUMBER:	[illegible]	PAGE 1	
REPORT DATE:	[illegible]		
DATE SAMPLED:	[illegible]	DATE RECEIVED:	[illegible]

FINAL REPORT: LABORATORY ANALYSIS OF SELECTED PARAMETERS IN WATER SAMPLES FROM [illegible] ENVIRONMENTAL

CASE NARRATIVE

[illegible]

SAMPLE DATA

	TSS	[illegible]	[illegible]	[illegible]
SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	DISSOLVED METALS		TOTAL METALS	
SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) [illegible] FAX: (206) [illegible]

CASE FILE NUMBER:	JFR071-78	PAGE 2
REPORT DATE:	07/02/06	
DATE SAMPLED:	01/04/06	DATE RECEIVED: 01/04/06

FINAL REPORT: LABORATORY ANALYSIS OF SPECIMENS FOR A MARINE BIOTA WATER SAMPLES FROM EMERALD ENVIRONMENTAL

QA/QC DATA SUMMARY

QC PARAMETER	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
METHOD	[illegible]	[illegible]	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]	[illegible]	[illegible]
DETECTION LIMIT	[illegible]	[illegible]	[illegible]	[illegible]

DUPLICATE

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
DUPLICATE	[illegible]	[illegible]	[illegible]	[illegible]
RPD	[illegible]	[illegible]	[illegible]	[illegible]

SPIKE SAMPLE

SAMPLE ID		[illegible]	[illegible]	[illegible]
ORIGINAL		[illegible]	[illegible]	[illegible]
SPIKED SAMPLE		[illegible]	[illegible]	[illegible]
SPIKE AMOUNT		[illegible]	[illegible]	[illegible]
% RECOVERY	N/A	[illegible]	[illegible]	[illegible]

QC CHECK

FOUND	[illegible]	[illegible]	[illegible]	[illegible]
TRUE	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

BLANK	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) [illegible] FAX: (206) [illegible]

CASE FILE NUMBER:	[illegible]	PAGE 3
REPORT DATE:	[illegible]	
DATE SAMPLED:	[illegible]	DATE RECEIVED: [illegible]

FINAL REPORT - LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM [illegible] ENVIRONMENTAL

QA/QC DATA WATER

	DISSOLVED METALS		TOTAL METALS	
QC PARAMETER	COPPER	ZINC	COPPER	ZINC
	(mg/l)	(mg/l)	(mg/l)	(mg/l)
METHOD	[illegible]	[illegible]	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]	[illegible]	[illegible]
DETECTION LIMIT	[illegible]	[illegible]	[illegible]	[illegible]

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
DUPLICATE	[illegible]	[illegible]	[illegible]	[illegible]
RPD	[illegible]	[illegible]	[illegible]	[illegible]

SPIKE SAMPLE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
SPIKED SAMPLE	[illegible]	[illegible]	[illegible]	[illegible]
SPIKE ADDED	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

QC CHECK

	[illegible]	[illegible]	[illegible]	[illegible]
TRUE	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

BLANK	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

SIGNED: [illegible]

[illegible]

Laboratory Director

VEN071-78

Aquatic Research Incorporated

3927 Aurora Ave. N / Seattle, WA 98103 / (206) 632-2715

CHAIN-OF-CUSTODY RECORD

CLIENT:
SAMPLING DATE:
SAMPLERS:

SHEET 1 OF 1
PROJECT ID: CAVI
CASE FILE NO.:
DATA RECORDED BY:

SAMPLE INFORMATION

PARAMETERS

| SAMPLE # | DATE/TIME COLLECTED | | |

Data Quality Assurance Worksheet

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3017 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2917

CASE FILE NUMBER:	[illegible]	PAGE 1	
REPORT DATE:	[illegible]		
DATE SAMPLED:	[illegible]	DATE RECEIVED:	[illegible]

FINAL REPORT. LABORATORY ANALYSES OF SELECTED PARAMETERS ON WATER SAMPLES FROM [illegible] ENVIRONMENTAL.

CASE NARRATIVE

[illegible]

SAMPLE DATA

	SAMPLE ID	NWT BH-DR DIESEL (mg/L)	NWT BH-DR MOTOR OIL (mg/L)
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] ATLANTIC BOULEVARD, SEATTLE, WA 98104

PHONE: (206) 633-2345 FAX: (206) 633-2417

CASE FILE NUMBER:	HERRTL-NO	PAGE 2
REPORT DATE:	02/03/06	
DATE SAMPLED:	01/03/06	DATE RECEIVED: 01/04/06

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRITRA ENVIRONMENTAL

QA/QC Data - Water

QC PARAMETER	[illegible]	[illegible]
METHOD	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]
DETECTION LIMIT	[illegible]	[illegible]

DUPLICATE

SAMPLE ID	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]
DUPLICATE	[illegible]	[illegible]
RPD	[illegible]	[illegible]

SPIKE SAMPLE

SAMPLE ID		
ORIGINAL		
SPIKED SAMPLE		
SPIKE ADDED		
% RECOVERY	N/A	N/A

QC CHECK

EQUIP	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]

BLANK [illegible] [illegible]

[illegible]

SUBMITTED BY

[illegible]

HLRC71-80

Aquatic Research Incorporated

3927 Aurora Ave. N / Seattle, WA 98103 / (206) 632-2715

CHAIN-OF-CUSTODY RECORD

CLIENT:
SAMPLING DATE
SAMPLERS:

SHEET 1 OF 1
PROJECT ID: CAVES
CASE FILE NO
DATA RECORDED BY:

SAMPLE INFORMATION

PARAMETERS

| SAMPLE ID | DATE TIME COLLECTED | | |

Data Quality Assurance Worksheet

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

[illegible] AURORA AVENUE NORTH, SEATTLE, WA [illegible]

PHONE: (206) [illegible] FAX: (206) [illegible]

CASE REFERENCE:	[illegible]	PAGE 1	
REPORT DATE:	[illegible]		
DATE SAMPLED	[illegible]	DATE RECEIVED	[illegible]

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES STORM HERMOSA ENVIRONMENTAL.

CASE SUMMARY

[illegible]

AVERAGE DATA

SAMPLE ID	[illegible] (mg/L)	[illegible] (mg/L)	[illegible] (mg/L)	[illegible] (mg/L)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	DISSOLVED METALS		TOTAL METALS	
SAMPLE ID	[illegible] (mg/L)	[illegible] (mg/L)	[illegible] (mg/L)	[illegible] (mg/L)
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 633-7613

CASE FILE ATTACHED	11L0791-01	PAGE 1
REPORT DATE:	02/02/06	
DATE SAMPLED:	01/30/06	DATE RECEIVED: 01/30/06

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERBER ENVIRONMENTAL

QA/QC DATA WATER

QC PARAMETER	[illegible]	BARIUM-135	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]
METHOD	[illegible]	[illegible]	[illegible]	[illegible]
DATE ANALYZED	01/30/06	[illegible]	01/31/06	01/30/06
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
DUPLICATE	[illegible]	[illegible]	[illegible]	[illegible]
RPD	[illegible]	[illegible]	[illegible]	[illegible]

SPIKE SAMPLE

SAMPLE ID		[illegible]	[illegible]	[illegible]
ORIGINAL		[illegible]	[illegible]	[illegible]
SPIKED SAMPLE		[illegible]	[illegible]	[illegible]
SPIKE ADDED		[illegible]	[illegible]	[illegible]
% RECOVERY	N/A	[illegible]	[illegible]	[illegible]

CCV CHECK

FOUND	[illegible]	[illegible]	[illegible]	[illegible]
TRUE	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

BLANK	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

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[illegible] NORTH SEATTLE, WA [illegible]

PHONE: (206) 632-[illegible] FAX: (206) 632-[illegible]

CASE FILE NUMBER:	[illegible]	PAGE 1
REPORT DATE:	02-01-06	
DATE SAMPLED:	[illegible]	DATE RECEIVED: [illegible]

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM [illegible] ENVIRONMENTAL

QA/QC DATA WATER

QC PARAMETER	DIPOLE VIDEOPLATE		TOTAL NITRATE	
	COPPER	ZINC	COPPER	ZINC
	(mg/L)	(mg/L)	(mg/L)	(mg/L)
METHOD	[illegible]	[illegible]	[illegible]	[illegible]
DATE ANALYZED	[illegible]	[illegible]	[illegible]	[illegible]
DETECTION LIMIT	[illegible]	[illegible]	[illegible]	[illegible]

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
DUPLICATE	[illegible]	[illegible]	[illegible]	[illegible]
RPD	[illegible]	[illegible]	[illegible]	[illegible]

SPIKE SAMPLE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	[illegible]	[illegible]	[illegible]	[illegible]
SPIKED SAMPLE	[illegible]	[illegible]	[illegible]	[illegible]
SPIKE ADDED	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]

QC CHECK

EQUIP.	[illegible]	[illegible]	[illegible]	[illegible]
TRUE	[illegible]	[illegible]	[illegible]	[illegible]
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]
BLANK	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

SUBMITTED BY

[illegible]

[illegible]

Aquatic Research Incorporated

3927 Aurora Ave. N / Seattle, WA 98103 / (206) 632 2715

CHAIN-OF-CUSTODY RECORD

CLIENT:
SAMPLING DATE:
SAMPLERS:

SHEET ___ OF ___
PROJECT ID:
CASE FILE NO.:
DATA RECORDED BY:

SAMPLE INFORMATION

PARAMETERS

| SAMPLE | DATE/TIME COLLECTED | | |

Data Quality Assurance Worksheet

AQUATIC RESEARCH INCORPORATED

LABORATORY & CONSULTING SERVICES

3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 633-1715 FAX: (206) 633-1417

CASE FILE NUMBER:	HER071-85	PAGE 1	
REPORT DATE:	02/15/06		
DATE SAMPLED:	01/16,17/06	DATE RECEIVED:	01/17/06

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRERA ENVIRONMENTAL

CASE NARRATIVE

Two water samples were delivered to the laboratory in good condition. The samples were analyzed according to the chain of custody. Samples for total metals were digested according to EPA procedures. No difficulties were encountered in the preparation or analysis of these samples. Sample data follows while QA/QC data is contained on subsequent pages.

SAMPLE DATA

SAMPLE ID	TSS (mg/l)	HARDNESS (mg CaCO3/l)	SSP (mg/l)	TOTAL-P (mg/l)	NWTPH-DX DIESEL (mg/l)	NWTPH-DX MOTOR OIL (mg/l)
CUBS+OUTFIRE GRAB					<0.05	1.36
CONTROL GRAB					<0.05	<0.10
COMPOSITE GRAB					<0.05	0.39
CUBS+OUTFIRE COMP	255	8.99	0.001	0.339		
CONTROL COMP	4.8	15.4	0.016	0.051		
COMPOSITE COMP	13	27.8	0.003	0.049		

SAMPLE ID	DISSOLVED METALS COPPER (mg/l)	DISSOLVED METALS ZINC (mg/l)	TOTAL METALS COPPER (mg/l)	TOTAL METALS ZINC (mg/l)
CUBS+OUTFIRE COMP	0.0344	0.027	0.0390	0.240
CONTROL COMP	0.0043	<0.005	0.0056	0.012
COMPOSITE COMP	0.0048	0.005	0.0077	0.014

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LABORATORY & CONSULTING SERVICES

[illegible] AVENUE NORTH, SEATTLE, WA 98109

PHONE: (206) 633-3715 FAX: (206) 633-2417

CASE FILE NUMBER:	HER071-05	PAGE 2	
REPORT DATE:	02/25/05		
DATE SAMPLED:	08/16,17/05	DATE RECEIVED:	08/17/05

FINAL REPORT: LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES SUBMITTED BY HERA ENVIRONMENTAL.

QC DATA WATER

QC PARAMETER	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
MB DIRCN	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
DETECTION LIMIT	0.50	2.00	0.001	0.002	0.25	0.25

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]		
ORIGINAL	3.5	[illegible]	0.509	0.432		
DUPLICATE	6.0	[illegible]	[illegible]	0.659		
RPD	[illegible]	[illegible]	[illegible]	[illegible]	NA	NA

SPIKE SAMPLE

SAMPLE ID		[illegible]	[illegible]	[illegible]		
ORIGINAL		[illegible]	0.005	[illegible]		
SPIKED SAMPLE		[illegible]	0.003	[illegible]		
SPIKE ADDED		20.0	0.020	0.050		
% RECOVERY	NA	[illegible]	[illegible]	[illegible]	NA	NA

QC CHECK

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0.36	0.45
TRUE	[illegible]	40.0	0.003	0.050	0.25	0.35
% RECOVERY	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

BLANK	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]

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3927 AURORA AVENUE NORTH, SEATTLE, WA 98103

PHONE: (206) 632-2715 FAX: (206) 632-2417

CASE FILE NUMBER: HER071-85 PAGE 3

REPORT DATE: 02/15/06

DATE SAMPLED: 01/16,17/06 DATE RECEIVED: 01/17/06

FINAL REPORT, LABORATORY ANALYSIS OF SELECTED PARAMETERS ON WATER SAMPLES FROM HERRERA ENVIRONMENTAL

QA/QC DATA WATER

QC PARAMETER	DISSOLVED METALS COPPER (mg/l)	DISSOLVED METALS ZINC (mg/l)	TOTAL METALS COPPER (mg/l)	TOTAL METALS ZINC (mg/l)
METHOD	EPA 220.2	EPA 200.7	EPA 220.2	EPA 200.7
DATE ANALYZED	02/07/06	02/09/06	02/07/06	02/01/06
DETECTION LIMIT	0.0010	0.005	0.0010	0.005

DUPLICATE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	0.0048	<0.005	<0.0010	<0.005
DUPLICATE	0.0047	<0.005	<0.0010	<0.005
RPD	2.11%	NC	NC	NC

SPIKE SAMPLE

SAMPLE ID	[illegible]	[illegible]	[illegible]	[illegible]
ORIGINAL	0.0048	<0.005	<0.0010	<0.005
SPIKED SAMPLE	0.0182	1.09	0.0142	1.03
SPIKE ADDED	0.0125	1.00	0.0125	1.00
% RECOVERY	107.20%	108.78%	113.60%	102.92%

QC CHECK

FOUND	0.0239	0.925	0.0239	0.983
TRUE	0.0250	1.00	0.0250	1.00
% RECOVERY	95.60%	92.47%	95.60%	98.34%
BLANK	<0.0010	<0.005	<0.0010	<0.005

RPD = RELATIVE PERCENT DIFFERENCE

NA = NOT APPLICABLE OR NOT AVAILABLE

NC = NOT CALCULABLE DUE TO ONE OR MORE VALUES ZERO OR BELOW THE DETECTION LIMIT

QA = RECOVERY NOT CALCULABLE DUE TO SPIKE SAMPLE OUT OF RANGE BY SPIKE FOOLAPW RELATIVE TO SAMPLE CONCENTRATION

SUBMITTED BY:

Steven Lazoff

Laboratory Director

ACC 71-85

Aquatic Research Incorporated

3927 Aurora Ave. N / Seattle, WA 98103 / (206) 632 2715

CHAIN-OF-CUSTODY RECORD

CLIENT
SAMPLING DATE:
SAMPLERS:

SHEET 1 OF 1
PROJECT ID
CASE FILE NO.
DATA RECORDED BY:

SAMPLE INFORMATION

PARAMETERS

| SAMPLE ID | DATE/TIME COLLECTED | | |

Data Quality Assurance Worksheet

By [illegible]

Date [illegible] Page 1 of 1

Checked [illegible]

Date

Analyte	Holding Times	Calibration Blank	Matrix Spike/Matrix Spike Duplicate	Calibration	Field Duplicates	Laboratory Duplicate	Actions
[illegible]	[illegible]	[illegible]	N/A	[illegible]	N/A	[illegible]	[illegible]
[illegible]	[illegible]		[illegible]				
[illegible]							
[illegible]							
[illegible]	[illegible]	[illegible]					
[illegible]							[illegible]
[illegible]		[illegible]					
[illegible]		[illegible]					[illegible]
[illegible]		[illegible]	[illegible]	[illegible]			[illegible]
[illegible]		[illegible]	[illegible]	[illegible]			[illegible]
[illegible]		[illegible]	N/A	N/A			[illegible]

[illegible]

[illegible]