Hydrologic Conditions and Quality of Rainfall and Storm Runoff for Two Agricultural Areas of the Oso Creek Watershed, Nueces County, Texas, 2005–07

By Darwin J. Ockerman

In cooperation with the Texas State Soil and Water Conservation Board, Coastal Bend Bays and Estuaries Program, and Texas AgriLife Research and Extension Center at Corpus Christi

Scientific Investigations Report 2008–5103

U.S. Department of the Interior
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Suggested citation:
Ockerman, D.J., 2008, Hydrologic conditions and quality of rainfall and storm runoff for two agricultural areas of the Oso Creek watershed, Nueces County, Texas, 2005–07: U.S. Geological Survey Scientific Investigations Report 2008–5103, 67 p.

Contents

Abstract 1
Introduction 2
Purpose and Scope 2
Description of Study Areas (Subwatersheds) 2
Texas Surface-Water-Quality Standards 4
Acknowledgments 4
Data Collection 5
Rainfall 5
Streamflow 5
Water Quality 5
Rainfall Sampling 6
Runoff Sampling 6
Quality Control and Assurance 8
Hydrologic Conditions 8
Rainfall 8
Runoff 10
Water Quality 10
Rainfall 10
Runoff 15
Nutrients and Major Inorganic Ions 15
Suspended Sediment 19
Pesticides 24
Bacteria 26
Summary 30
References 31
Appendix 1—Quality Control and Assurance Data for Rainfall Samples 33
Appendix 2—Water-Quality Data for Runoff Samples Collected at West Oso Creek 45
Appendix 3—Water-Quality Data for Runoff Samples Collected at an Unnamed Oso Creek Tributary 57

Figures

1. Map showing Coastal Bend Bays and Estuaries Program (CBBEP) area, South Texas, and Oso Creek watershed area, Nueces County, Texas 3
2. Chart showing typical timing of agricultural activities in Nueces County, Texas 4
3. Photographs showing streamflow-gaging and water-quality monitoring station Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Texas (08211525), September 19, 2006 6
4. Hydrograph showing cumulative rainfall, streamflow, and subsample-collection timing at station West Oso Creek at Merrett Road near Corpus Christi, Texas (08211517), during storm runoff March 14, 2007 7
5. Photographs showing suspended-sediment sample collection at station West Oso Creek at Merrett Road near Corpus Christi, Texas (08211517), June 2, 2006 7

6–9. Graphs showing:
6. Mean monthly rainfall for National Weather Service station at Corpus Christi International Airport (412015), 1972–2006; and monthly area-weighted rainfall for West Oso Creek and Oso Creek tributary subwatersheds (combined), Nueces County, Texas, water years 2006 and 2007 9
7. Rainfall/runoff response for West Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas, during March 12–18, 2007 11
8. Daily total nitrogen (DTN) deposition computed from event (daily) rainfall and sample concentrations, and DTN deposition estimated by regression of computed DTN deposition with daily rainfall, each relative to daily rainfall, for sampled rainfall events, Oso Creek watershed, Nueces County, Texas, water years 2006–07 16
9. Relations between suspended-sediment load (L) and streamflow (Q) for West Oso Creek (station 08211517) and Oso Creek tributary (station 082115725) subwatersheds, Nueces County, Texas, water years 2006–07 23

Tables

1. Monitoring stations providing data used for analysis of hydrologic and water-quality conditions in agricultural areas of the Oso Creek watershed, Nueces County, Texas 5
2. Estimated annual (water years 2006–07) rainfall for West Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas, and long-term average annual (water years 1972–2006) rainfall measured at National Weather Service station Corpus Christi International Airport (412015) 9
3. Annual (water years 2006–07) runoff from study subwatersheds and long-term average annual (water years 1973–2006) unit runoff from Oso Creek watershed, Nueces County, Texas 10
4. Rainfall, runoff volume, and runoff/rainfall coefficients (ratio of runoff volume to rainfall volume) for selected runoff events during water years 2006–07, West Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas 12
5. Event (daily) rainfall, Texas AgriLife Research at Corpus Christi weather station (WS1); and event concentrations of selected constituents in rainfall samples, Texas Agricultural Experiment Station near Corpus Christi, Texas (08211511), water years 2006–07 13
6. Summary statistics for event rainfall, Texas AgriLife Research at Corpus Christi weather station (WS1); and event concentrations of selected nutrients in rainfall samples, Texas Agricultural Experiment Station, Corpus Christi, Texas (08211511), water years 2006–07 15
7. Estimated monthly and annual total nitrogen rainfall deposition on Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas, water years 2006–07 17
8. Summary statistics for event concentrations of selected nutrients and major inorganic ions in runoff samples, West Oso Creek subwatershed (station 08211517) and Oso Creek tributary subwatershed (station 08211525), water years 2006–07 17
9. Event-median concentrations of selected nutrients and major inorganic ions in runoff samples by subwatershed (West Oso Creek station 08211517 and Oso Creek tributary station 08211525), water years 2006–07; and results of Wilcoxon rank-sum tests to indicate whether event-median concentrations for the two watersheds are significantly different 18

10. Event-median concentrations of selected nutrients in runoff samples for West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds combined, Nueces County, Texas, by season (pre-harvest and harvest/post-harvest), water years 2006–07; and results of Wilcoxon rank-sum tests to indicate whether event-median concentrations for the two seasons are significantly different 18
11. Event-median concentrations of selected nutrients in runoff samples for West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, by season (pre-harvest or harvest/post-harvest), water years 2006–07, used to estimate runoff loads for unsampled events 19
12. Estimated monthly and annual runoff loads of selected nutrients from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07 20
13. Estimated annual and average annual runoff yields of selected nutrients from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07 21
14. Fertilizer applications, rainfall deposition, and runoff yields of total nitrogen and total phosphorus for West Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas, water years 2006–07 21
15. Results of analyses for samples of suspended sediment in runoff from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07 22
16. Regression equations relating suspended-sediment load to streamflow for West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07 23
17. Estimated monthly and annual runoff suspended-sediment loads, West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07 24
18. Annual and average annual runoff yields of suspended sediment, West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07 24
19. Pesticides used in West Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas, water years 2006–07 24
20. Summary statistics of concentrations of selected pesticides in runoff samples from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07 25
21. Event-median concentrations of selected pesticides in runoff samples for West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, by season (pre-harvest or harvest/post-harvest), water years 2006–07, used to estimate runoff loads for unsampled events 27
22. Estimated monthly and annual runoff loads of selected pesticides from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07 27
23. Estimated annual and average annual application rates and runoff yields of selected pesticides from West Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas, water years 2006–07 28
24. Bacteria densities in runoff samples from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07 28

25. Summary statistics of bacteria densities in runoff samples from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07; and Texas surface-water-quality standards for bacteria in Oso Bay and Oso Creek, Texas Commission on Environmental Quality segments 2485 and 2485A, respectively 29

Conversion Factors, Datum, and Water-Quality Abbreviations

Inch/Pound to SI

Multiply	By	To obtain
	Length	
inch (in.)	25.4	millimeter (mm)
foot (ft)	.3048	meter (m)
mile (mi)	1.609	kilometer (km)
	Area	
acre	.4047	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Flow rate	
cubic foot per second (ft^3/s)	.02832	cubic meter per second (m^3/s)
million gallons per day (Mgal/d)	.04381	cubic meter per second (m^3/s)
inch per year (in/yr)	25.4	millimeter per year (mm/yr)
	Application rate	
pounds per acre per year [(lb/acre)/yr]	1.121	kilograms per hectare per year [(kg/ha)/yr]

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

°C=(°F-32)/1.8

Datum

Horizontal coordinate information is referenced to the North American Datum of 1983 (NAD 83).

Water-Quality Abbreviations

CFU/100 mL, colony forming units per 100 milliliters

mg/L, milligrams per liter

µg/L, micrograms per liter

µm, micrometers

mm, millimeters

Hydrologic Conditions and Quality of Rainfall and Storm Runoff for Two Agricultural Areas of the Oso Creek Watershed, Nueces County, Texas, 2005–07

By Darwin J. Ockerman

Abstract

The U.S. Geological Survey, in cooperation with the Texas State Soil and Water Conservation Board, Coastal Bend Bays and Estuaries Program, and Texas AgriLife Research and Extension Center at Corpus Christi, studied hydrologic conditions and quality of rainfall and storm runoff of two (primarily) agricultural areas (subwatersheds) of the Oso Creek watershed in Nueces County, Texas. One area, the upper West Oso Creek subwatershed, is 5,145 acres. The other area, a subwatershed drained by an unnamed Oso Creek tributary (hereinafter, Oso Creek tributary), is 5,287 acres. Rainfall and runoff (streamflow) were continuously monitored at the outlets of the two subwatersheds during October 2005–September 2007. Fourteen rainfall samples were collected and analyzed for nutrients and major inorganic ions. Nineteen composite runoff samples (10 West Oso Creek, nine Oso Creek tributary) were collected and analyzed for nutrients, major inorganic ions, and pesticides. Twenty-two discrete suspended-sediment samples (10 West Oso Creek, 12 Oso Creek tributary) and 13 bacteria samples (eight West Oso Creek, five Oso Creek tributary) were collected and analyzed. These data were used to estimate, for selected constituents, rainfall deposition to and runoff loads and yields from the study subwatersheds. Quantities of fertilizers and pesticides applied in the subwatersheds were compared with quantities of nutrients and pesticides in rainfall and runoff. For the study period, total rainfall was greater than average. Most of the runoff at both subwatershed outlet sites occurred in response to a few specific storm periods. The West Oso Creek subwatershed produced more runoff during the study period than the Oso Creek tributary subwatershed, 10.83 inches compared with 7.28 inches. Runoff response was quicker and peak flows were higher in the West Oso Creek subwatershed than in the Oso Creek tributary subwatershed. Total nitrogen runoff yield for the 2-year study period averaged 2.61 pounds per acre per year from the West Oso Creek subwatershed and 0.966 pound per acre per year from the Oso Creek tributary subwatershed. Total phosphorus yields from the West Oso Creek and the Oso Creek tributary subwatersheds for the 2-year period were 0.776 and 0.498 pound per acre per year. Runoff yields of nitrogen and phosphorus were relatively small compared to inputs of nitrogen in fertilizer and rainfall deposition. Average annual runoff yield of total nitrogen (subwatersheds combined) represents about 2.4 percent of nitrogen applied as fertilizer and nitrogen entering the subwatersheds through rainfall deposition. Average annual runoff yield of total phosphorus (subwatersheds combined) represents about 4.4 percent of the phosphorus in applied fertilizer and rainfall deposition. Suspended-sediment yields from the West Oso Creek subwatershed were more than twice those from the Oso Creek tributary subwatershed. The average suspended-sediment yield from the West Oso Creek subwatershed was 582 pounds per acre per year. The average suspended-sediment yield from the Oso Creek tributary subwatershed was 257 pounds per acre per year. Twenty-two herbicides and eight insecticides were detected in runoff samples collected from the two subwatershed outlet sites. At the West Oso Creek site, 18 herbicides and four insecticides were detected, and at the Oso Creek tributary site, 17 herbicides and six insecticides. Seventeen pesticides were detected in only one sample at low concentrations (near the laboratory reporting level). Atrazine, atrazine degradation byproducts 2-chloro-4-isopropylamino-6-amino-s-triazine (CIAT) and 2-hydroxy-4-isopropylamino-6-ethylamino-s-triazine (OIET), glyphosate, and glyphosate byproduct aminomethylphosphonic acid (AMPA) were detected in all samples. Of all pesticides detected in runoff, the highest runoff yields were for glyphosate, 0.013 pound per acre per year for the West Oso Creek subwatershed and 0.001 pound per acre per year for the Oso Creek tributary subwatershed. About 0.8 percent of glyphosate applied to the West Oso Creek subwatershed croplands was detected in runoff. For the Oso Creek tributary subwatershed, about 0.07 percent of applied glyphosate was detected in runoff. At both subwatershed outlet sites, most sample concentrations of fecal coliform, *Escherichia coli* (*E. coli)*, and *Enterococci* were greater than Texas surface-water-quality standards for those bacteria established for the receiving waters of Oso Bay and Oso Creek. Because runoff

and associated bacteria concentrations represent relatively brief and infrequent conditions, the resulting effect on Oso Bay and Oso Creek is not known.

Introduction

The Coastal Bend Bays and Estuaries of South Texas is one of 28 estuaries, or groups of estuaries, in the United States that have been designated nationally important, and as such are part of the National Estuaries Program of the U.S. Environmental Protection Agency (2008). The Coastal Bend Bays and Estuaries Program (CBBEP) area (fig. 1) encompasses the 12 counties of the Coastal Bend Council of Governments extending from the land cut in the Laguna Madre north along the coast to the Aransas National Wildlife Refuge (Coastal Bend Bays and Estuaries Program, 2008). The bays and estuaries of the CBBEP are affected by nonpoint-source runoff from agricultural land, which constitutes about 88 percent of the CBBEP area.

The Oso Creek watershed drains about 234 square miles to Oso Bay. Agricultural land (pasture and cropland) accounts for about 69 percent of the Oso Creek watershed. Oso Bay, along the southern shore of Corpus Christi Bay, is relatively small (surface area about 7 square miles) and shallow (average depth about 2.3 feet) (Quenzer and others, 1998). Ecologically, Oso Bay provides habitat for many plants and animals and is important for water purification and storm protection (Texas Commission on Environmental Quality, 2007).

During October 2005 through September 2007, the U.S. Geological Survey (USGS), in cooperation with the Texas State Soil and Water Conservation Board, CBBEP, and Texas AgriLife Research and Extension Center at Corpus Christi (formerly Texas Agricultural Experiment Station-Corpus Christi and hereinafter referred to as Texas AgriLife Research), studied hydrologic conditions and quality of rainfall and storm runoff of two (primarily) agricultural areas (subwatersheds) of the Oso Creek watershed (fig.1).

Purpose and Scope

The purpose of this report is to characterize hydrologic conditions and the quality of rainfall and storm runoff for two (primarily) agricultural areas (subwatersheds) in the Oso Creek watershed in Nueces County. The report presents the results of collection and analysis of hydrologic data and water-quality samples of rainfall and runoff. During the 2-year data-collection period October 2005–September 2007, continuous rainfall and streamflow data were collected at monitoring stations at the outlets of the study subwatersheds. Fourteen rainfall samples were collected and analyzed for nutrients and major inorganic ions. Rainfall nutrient analyses and daily rainfall totals were used to estimate rainfall nutrient deposition to the study subwatersheds. Nineteen runoff samples were collected by automatic sampling equipment during storm-runoff events. These samples were analyzed for nutrients, major inorganic ions, and pesticides. Twenty-two discrete samples of runoff suspended sediment were collected and analyzed for sediment size and concentration. Thirteen discrete samples of runoff were collected and analyzed for fecal coliform, *Escherichia coli* (*E. coli*), and *Enterococcus* bacteria. These data were used to estimate, for selected constituents, rainfall deposition to and runoff loads and yields from the study subwatersheds. Quantities of fertilizers and pesticides applied in the subwatersheds were compared with quantities of nutrients and pesticides in rainfall and runoff.

Description of Study Areas (Subwatersheds)

Of the two subwatersheds studied (fig. 1), one surrounds the upstream reaches of West Oso Creek and drains about 5,145 acres to Oso Bay. The other surrounds the upstream reaches of an unnamed tributary to Oso Creek (hereinafter, Oso Creek tributary) and drains about 5,287 acres to Oso Bay. The topography of the areas is flat with altitudes ranging from about 15 feet above sea level where Oso Creek enters Oso Bay to about 65 feet above sea level in the upland parts of the West Oso Creek subwatershed. Because of negligible relief, the Oso Creek tributary subwatershed might include some noncontributing drainage area. The streams of the study subwatersheds are ephemeral, producing runoff lasting from a few hours to several weeks, depending on rainfall duration and intensity and antecedent soil moisture. The main stem of Oso Creek maintains a continuous flow from wastewater discharges by the cities of Robstown and Corpus Christi. The study subwatersheds do not include any wastewater discharges.

The Oso Creek watershed area is described as having a subtropical, subhumid climate characterized by hot summers and mild, dry winters (Larkin and Bomar, 1983). Maximum rainfall tends to occur in spring, early summer, and fall but can occur anytime during the year. The following meteorological statistics are from the National Weather Service (NWS) station at the Corpus Christi International Airport (U.S. Department of Commerce, National Climatic Data Center, 2006): Average annual rainfall (1971–2000) is 32.92 inches. Rainfall greater than 0.01 inch occurs, on average, 82 days per year. The average monthly low temperatures range from 46.2 degrees Fahrenheit (°F) in January to 74.5 °F in August. Average monthly high temperatures range from 66.0 °F in January to 93.4 °F in August. Mean annual temperature is 71.5 °F.

Besides climate and rainfall, the type and nature of the soils affect the rainfall-runoff process. Victoria Association clays are the dominant soil in the study subwatersheds (U.S. Department of Agriculture, Soil Conservation Service, 1965). During dry periods these soils crack and absorb water rapidly, which reduces runoff. However, once the soils are wet, water infiltrates slowly, increasing the potential for runoff.

During 2006–07, the primary crops in the West Oso Creek and Oso Creek tributary subwatersheds were cotton

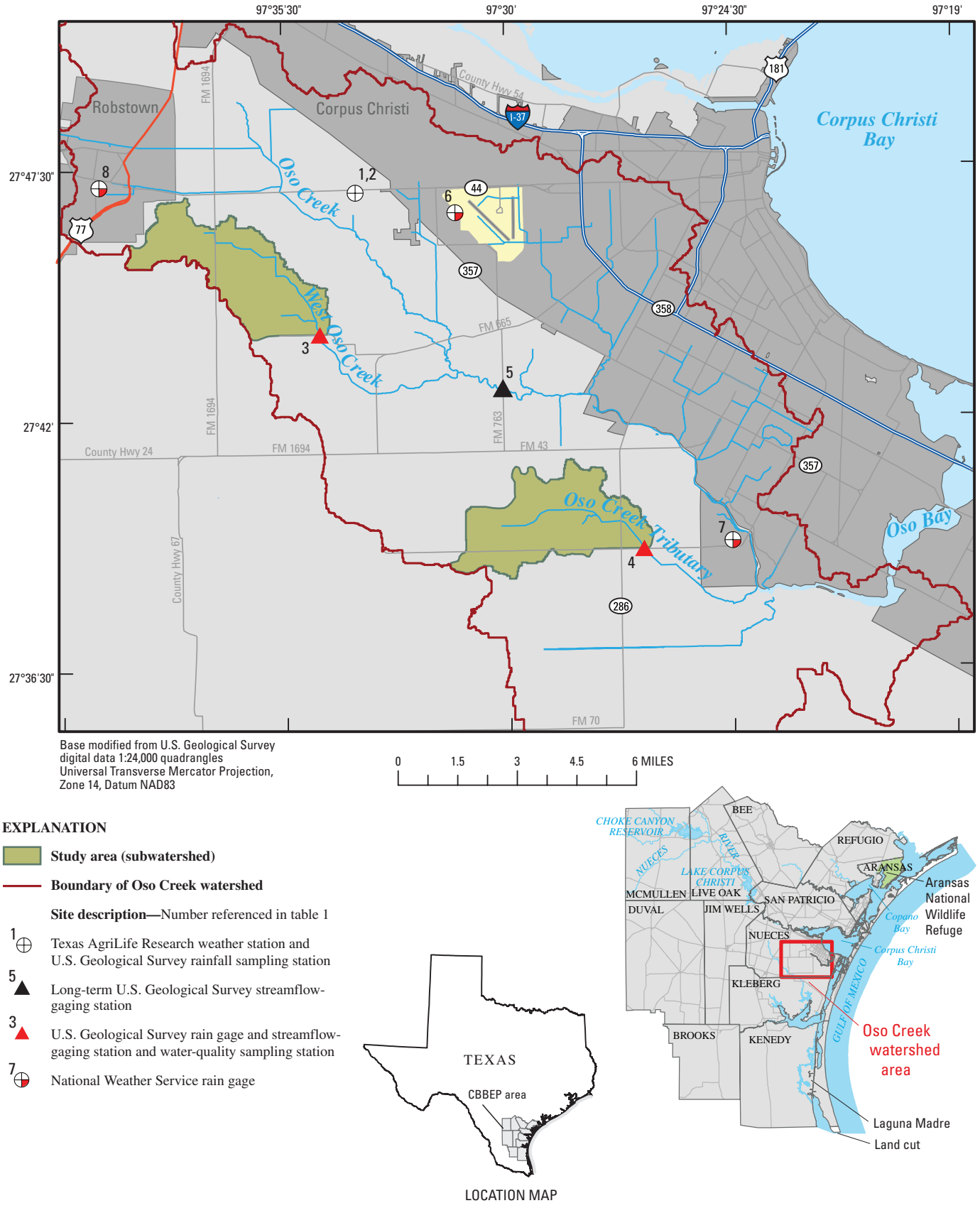

Figure 1. Coastal Bend Bays and Estuaries Program (CBBEP) area, South Texas, and Oso Creek watershed area, Nueces County, Texas.

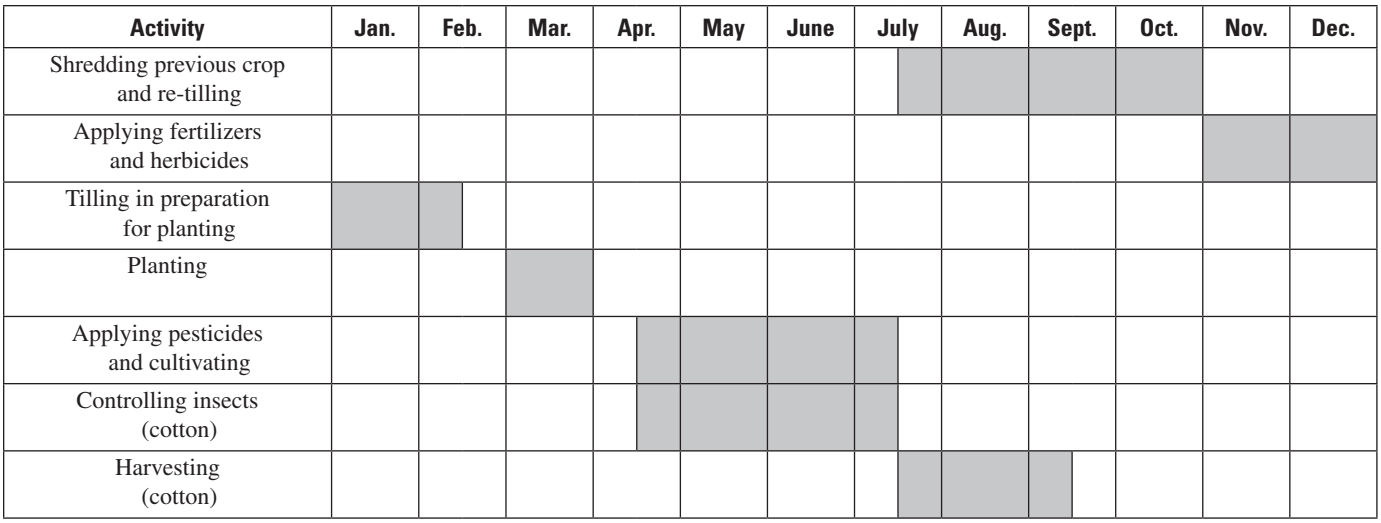

Figure 2. Typical timing of agricultural activities in Nueces County, Texas.

and grain sorghum, accounting for about 92 percent of the total agricultural land (Dr. Bobby Eddleman, Texas AgriLife Research and Extension Center at Corpus Christi, written commun., 2007). Corn and wheat accounted for about 6 percent of the acreage. The remaining 2 percent was fallow or pasture. Impervious land in the subwatersheds is about 2 percent and consists mostly of roads.

The crop season begins during late July to early September with shredding of crop residue from the previous crop and plowing in stubble, or killing crop residue with herbicides (in the conservation tillage systems), to prepare the ground to absorb fall and winter rains (fig. 2) (Dr. Bobby Eddleman, Texas AgriLife Research and Extension Center at Corpus Christi, written commun., 2007). The soil is re-tilled or re-sprayed during September and October to destroy winter weeds and to prepare the seedbed for the succeeding crop. Preplant fertilizers and broadcast pre-emergent herbicides usually are applied during the low-rainfall months of November and December. During January to mid-February, additional tilling might be done to prepare for planting. Planting begins in early-to-late March, depending on the available soil moisture, soil temperature, and type of crop. After crops have emerged from the soil, production practices throughout the season consist of pesticide application and row cultivation. From mid-to-late April through early-July, few field operations are required for grain sorghum. However, for cotton, this is a period involving insect control. Grain sorghum usually is harvested in early-to-mid July. Cotton harvest usually begins with application of harvest aids (defoliants) around mid-July and ends around mid-August to early-September.

Texas Surface-Water-Quality Standards

The Texas Commission on Environmental Quality (TCEQ) has designated (Texas) surface-water-quality standards (TSWQS) and appropriate uses (such as aquatic life, contact or noncontact recreation, or drinking water) for specific stream, estuary, and bay segments (Texas Commission on Environmental Quality, 2006). TSWQS have not been established for the specific streams or subwatersheds in this study (West Oso Creek and Oso Creek tributary). However, these subwatersheds drain to Oso Creek and Oso Bay, receiving water bodies for which TSWQS have been established. TSWQS are defined by a combination of designated uses and criteria necessary to maintain the designated uses. The designated uses for Oso Bay are contact recreation and aquatic life. Oso Creek (TCEQ segment 2485A) is considered an unclassified water body associated with a classified segment, Oso Bay (TCEQ segment 2485). Oso Creek, segment 2485A, includes all of Oso Creek to its confluence with Oso Bay. Oso Creek and Oso Bay are on the “2008 Texas Water Quality Inventory and 303d List” (Texas Commission on Environmental Quality, 2008) for elevated bacteria counts. Oso Bay also is listed for depressed dissolved oxygen concentration.

Acknowledgments

Special thanks are extended to Dr. Bobby Eddleman and Carlos Correa, Texas AgriLife Research, for their substantial support for this project. Dr. Eddleman provided valuable project oversight and technical assistance, including compilation of pesticide and fertilizer application information obtained from producers in the study subwatersheds. Carlos Correa assisted with station and equipment maintenance and sample-collection activities. Thanks also are extended to personnel of the Nueces County Soil and Water Conservation District and U.S. Department of Agriculture, Natural Resources Conservation Service, for assisting in delineating the study subwatersheds and providing contacts with agricultural producers in the subwatersheds.

Table 1. Monitoring stations providing data used for analysis of hydrologic and water-quality conditions in agricultural areas of the Oso Creek watershed, Nueces County, Texas.

[Texas AgriLife Research, Texas AgriLife Research and Extension Center; USGS, U.S. Geological Survey; NWS, National Weather Service; --, unknown]

Site number (fig. 1)	Station name, number	Latitude (degrees minutes seconds)	Longitude (degrees minutes seconds)	Type of data	Period of record used
1	Texas AgriLife Research at Corpus Christi, weather station WS1	27° 46' 57"	97° 33' 43"	Hourly, daily rainfall	October 2005–September 2007
2	Texas Agricultural Experiment Station near Corpus Christi, USGS station 08211511	27° 46' 57"	97° 33' 43"	Rainfall quality	October 2005–September 2007
3	West Oso Creek at Merrett Road near Corpus Christi, Tex., USGS station 08211517	27° 43' 50"	97° 34' 37"	Rainfall, streamflow, water quality	October 2005–September 2007
4	Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex., USGS station 08211525	27° 39' 07"	97° 26' 40"	Rainfall, streamflow, water quality	October 2005–September 2007
5	Oso Creek at Corpus Christi, Tex., USGS station 08211520	27° 42' 40"	97° 30' 06"	Streamflow	October 1972–September 2007
6	Corpus Christi International Airport, NWS station 412015	27° 46' --"	97° 31' --"	Hourly, daily rainfall	January 1972–September 2007
7	Corpus Christi Botanical Gardens, NWS station 412013	27° 39' --"	97° 24' --"	Daily rainfall	October 2005–September 2007
8	Robstown, NWS station 417677	27° 47' --"	97° 40' --"	Daily rainfall	October 2005–September 2007

Data Collection

Monitoring stations providing data for this study are listed in table 1 and include an hourly weather station with rain gage operated by Texas AgriLife Research (site 1), a USGS rainfall-quality sampling station (site 2), two USGS rainfall, streamflow, and water-quality sampling stations located at the outlets of the study subwatersheds (sites 3, 4), a long-term USGS streamflow-gaging station on the main stem of Oso Creek (site 5), and three NWS rain gages (sites 6, 7, 8).

Rainfall

Rainfall amounts in the Oso Creek watershed area were obtained from six monitoring stations (fig. 1; table 1). Hourly and daily rainfall were recorded at the Texas AgriLife Research weather station (site 1). Two tipping-bucket rain gages were installed, one at each monitoring station at the outlet of each study subwatershed (sites 3, 4). These stations recorded 15-minute rainfall totals. Also, daily rainfall data were obtained from three NWS rain gages (sites 6, 7, 8). Daily rainfall in the West Oso Creek study subwatershed was estimated using a Thiessen-weighted average (Wanielista, 1990) of rainfall measured at sites 1, 3, and 8. Daily rainfall in the Oso Creek tributary subwatershed was estimated using rainfall primarily from site 4. The NWS Corpus Christi Botanical Gardens station (site 7) was used for estimating daily rainfall on the Oso Creek tributary subwatershed for several days when data were not available from site 4. Rainfall data from the NWS Corpus Christi International Airport station (site 6) were used to represent long-term rainfall conditions in both subwatersheds.

Streamflow

Water-surface elevation (stage) was continuously monitored (at 15-minute intervals) at the study subwatershed stations (sites 3, 4, table 1) by up-looking acoustic transducers mounted on the streambeds. At each station, relations between stage and runoff (streamflow) were developed from streamflow measurements made during various flow conditions during runoff events (Buchanan and Somers, 1969). From these relations, continuous runoff was computed for each study subwatershed (Kennedy, 1984).

Water Quality

Water-quality samples were collected for two sources, rainfall and runoff. Rainfall-quality samples were collected to measure nutrient concentrations and compute nutrient deposition to the study subwatersheds. Runoff-quality samples were collected to characterize runoff quality and to estimate constituent loads and yields of selected nutrients, suspended sediment, and pesticides transported from the study subwatersheds. Also, runoff-quality samples were collected during runoff events and analyzed for fecal coliform,

E. coli, and *Enterococci* bacteria. Water-quality sample collection was fairly well distributed between the two cycles of agricultural activity (crop cycles).

Rainfall Sampling

Rainfall samples for nutrients and major inorganic ions were collected at the USGS rainfall-quality sampling station (site 2, table 1) by an automatic rainfall sampler. Fifty-seven percent of the rainfall-quality samples were collected in water year 2006, and 43 percent were collected in water year 2007. Distribution of rainfall-quality samples between the pre-harvest period (November–May) and the harvest/post-harvest period (July–October) was 50 percent and 50 percent, respectively. No samples were collected during February, April, August, November, or December.

The sampler is equipped with a polyethylene bucket that is covered to prevent contamination of the bucket and sample when rainfall is not occurring. A moisture sensor activates a mechanism to uncover the sample-collection bucket when rainfall begins and to cover the sample when rainfall ends. Rainfall samples were collected as a single composite sample for rainfall events. Results of the analyses of the composite samples represent the average constituent concentrations during rainfall events. As soon as possible after rainfall, samples were retrieved from the rainfall sample collector and immediately chilled. Part of the sample was bottled as unfiltered samples, representing whole-water samples. Analyses of unfiltered samples provide concentrations of the constituents associated with water and sediment. Some samples were filtered through 0.45-micrometer (μm) pore-diameter filters. Analyses of filtered samples provide concentrations of the dissolved constituents. Some nutrient samples were unfiltered and some were filtered. Major inorganic ion samples were filtered. Analytical methods are described in Fishman (1993), Fishman and Friedman (1989), Patton and Truitt (2000), and U.S. Environmental Protection Agency (1993).

Runoff Sampling

Automatic water samplers at the runoff-monitoring stations (sites 3, 4, table 1) collected runoff samples for nutrients, major inorganic ions, and pesticides during storm events. Runoff samples were distributed 47 percent to 53 percent between water years 2006 and 2007, respectively. When runoff was detected by the streamflow-gaging instrumentation (fig. 3), automatic water-quality samplers were activated to collect samples. Discrete aliquots (water-quality subsamples) were collected hourly during a period of runoff. Near or at the end of the runoff event, sampling was completed and the aliquots from each site were combined into a single streamflow-weighted composite sample (separate composite samples from each station). For example, an aliquot collected when streamflow measured 10 cubic feet per second would have twice the volume in the composite sample as an aliquot that was collected when streamflow measured 5 cubic feet per second. In this way, analysis of the composite sample represents the event-mean concentration (EMC) during runoff (Huber, 1993, p. 14.1). Figure 4 shows a rainfall-streamflow hydrograph at West Oso Creek during March 14, 2007, including the subsample-collection timing during the event. As runoff samples were retrieved from the autosampler they were immediately chilled. When sample collection was complete, portions of each individual aliquot, based on flow at the time of aliquot collection, were combined in a Teflon-coated churn. Samples were then drawn from the churn, bottled, and submitted for laboratory analysis. Similar to rainfall samples, some samples were withdrawn from the churn and bottled as unfiltered samples for laboratory analysis; some were filtered through 0.45-μm pore-diameter filters. Some nutrient samples were unfiltered and some were filtered. Major inorganic ion samples and pesticide samples were filtered. Analytical methods are described in Fishman (1993), Fishman and Friedman (1989), Furlong and others (2001), Lindley and others (1996), Madsen and others (2003), Patton and Truitt (2000), Sandstrom and others (2001), U.S. Environmental Protection Agency (1993), and Zaugg and others (1995).

Figure 3. Streamflow-gaging and water-quality monitoring station Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Texas (08211525), September 19, 2006.

Suspended-sediment samples also were collected during storm-runoff events. Suspended-sediment samples were collected as discrete samples during various streamflow conditions. Samples were collected by a depth-integrating, equal-width increment method (sampler is raised and lowered through the water column at equal intervals across the stream) (U.S. Geological Survey, 2006) using isokinetic sampling devices. An isokinetic sampler collects a water-sediment sample from the stream at a rate such that the velocity of the intake nozzle is equal to the incident stream velocity at the nozzle entrance. The water-sediment sample collected is thus representative of the suspended-sediment load throughout the channel cross section and is appropriate for use in estimating sediment load carried by the stream (Davis, 2005).

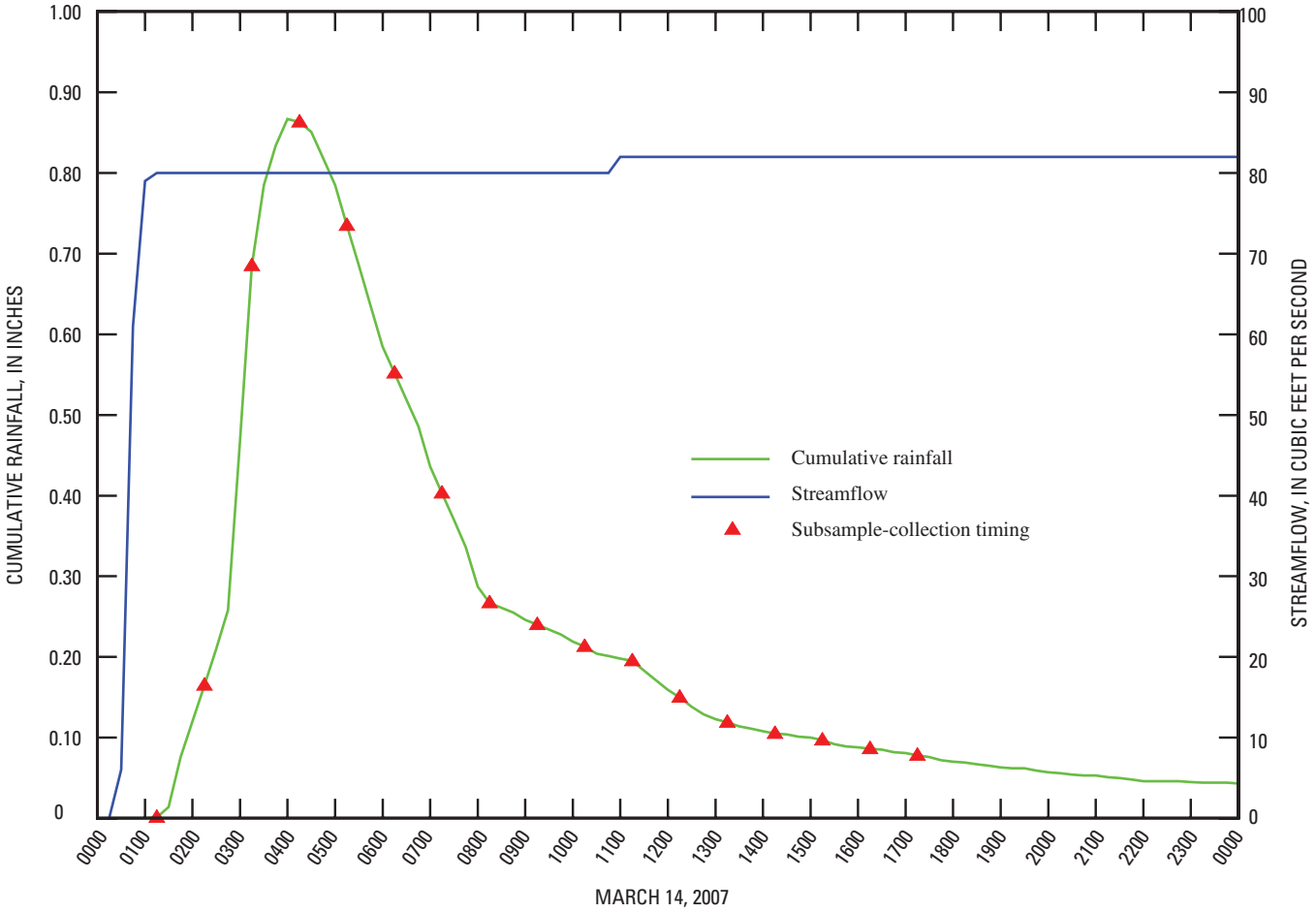

Figure 4. Hydrograph showing cumulative rainfall, streamflow, and subsample-collection timing at station West Oso Creek at Merrett Road near Corpus Christi, Texas (08211517), during storm runoff March 14, 2007.

Suspended-sediment samples were collected by wading (fig. 5) or from bridge-suspended equipment during relatively large streamflows. Suspended-sediment samples were analyzed by the USGS sediment laboratory in Iowa City, Iowa. Samples were analyzed for suspended-sediment concentration and sand-break analysis (Guy, 1969). Sand-break analysis gives the percentage of sediment by weight that is finer than 0.062 millimeter (mm). Particle sizes less than 0.62 mm are defined as silt and clay. Particles greater than 0.062 mm are defined as sand.

Discrete bacteria samples were collected during several events at each of the sampling stations. Samples were collected by USGS and Texas AgriLife Research personnel and analyzed by the Texas A&M University Environmental Microbiology Laboratory in Corpus Christi. Bacteria samples were collected as grab samples and analyzed for fecal coliform (American Public Health Association, 1998), *E. coli* (American Public Health Association, 1998), and *Enterococci* (U.S. Environmental Protection Agency, 2000). The objective for bacteria sampling was a single sample collected as soon

Figure 5. Suspended-sediment sample collection at station West Oso Creek at Merrett Road near Corpus Christi, Texas (08211517), June 2, 2006.

as possible after runoff began. Accordingly, samples were collected within several hours of the beginning of runoff and do not necessarily represent average concentrations during the entire runoff event.

Quality Control and Assurance

Quality control and assurance samples, designed to ensure the integrity of water-quality data analyzed in this report, represented more than 10 percent of field samples collected. Field blank samples were used to indicate the adequacy of field and sample processing protocols for rainfall and composite runoff samples. These samples were collected by passing highly purified water through the same equipment used to collect and process routine water-quality samples. These blank samples were then collected, processed, and analyzed in the same way as routine environmental samples. Most compounds were not detected in the blank samples, but if detected the reported concentrations were less than or near the laboratory reporting level for the compounds (appendix 1). The concentration of the laboratory reporting level is reported with a "less than" (<) remark code for samples in which the analyte was not detected. Concentrations reported by the NWQL for pesticides are flagged as "estimated" (indicated by an E where reported) when they are qualitatively identified as present, but the reported concentrations have a greater uncertainty than usual (Childress and others, 1999). Cases that result in an "estimated" flag include concentrations that are less than the laboratory reporting level but still detectable in the analyst's judgment. Estimated concentrations were included in computations of event loads and yields and for statistical analyses. Laboratory reporting levels for some compounds changed during the study. The NWQL updates laboratory reporting levels yearly on the basis of results of internal quality control sample analyses.

Two field blank samples were collected at the Texas Agricultural Experiment Station near Corpus Christi (station 08211511). These samples were analyzed for nutrients and inorganic ions. Two field blank samples were collected at the West Oso Creek subwatershed outlet site (station 08211517). The first of these samples, collected in November 2006, was analyzed for pesticides. The second sample, collected in October 2007, was analyzed for nutrients and inorganic ions. One blank sample was collected at the Oso Creek tributary subwatershed outlet site (station 08211525). This sample was analyzed for nutrients and inorganic ions. Field blank samples were not collected or analyzed for sediment or bacteria samples. Quality control and assurance methods for these protocols and constituents focused on laboratory procedures.

Quality control and assurance procedures applied by the USGS NWQL and sediment laboratories include the determination and tracking of long-term method detection level, internal and external audits, blind-blank and blind-spike programs using standard reference materials. Laboratory quality assurance data and methods are documented by the USGS Office of Water Quality, Branch of Quality Systems (U.S. Geological Survey, 2007).

Quality assurance procedures applied by the Texas A&M microbiology laboratory for bacteria include field split samples, laboratory duplicates, and method blanks (Texas Commission on Environmental Quality, 2003). Analytical results of laboratory duplicates and field splits are included with primary bacteria sample results.

Water-quality sample data were reviewed by a USGS Data Manager before data were entered into the USGS National Water Information System (NWIS) (U.S. Geological Survey, 2008). The emphasis of the review was to verify the accuracy and completeness of the laboratory data, to determine whether laboratory quality control and assurance data were within acceptable limits, and to determine whether samples were handled appropriately in the field and the laboratory.

Hydrologic Conditions

The 2-water-year study period represents two crop cycles in the study subwatersheds. Water year 2006 was very dry, especially during the planting and pre-harvest periods. In fact, some producers did not plant or abandoned crops because of lack of rainfall (Dr. Carlos Fernandez, Texas AgriLife Research and Extension Center at Corpus Christi, oral commun., 2007). The harvest/post-harvest period of 2006 included several major runoff events. Water year 2007 was relatively wet during most of the year.

Rainfall

Long-term (1972–2006) rainfall from the NWS Corpus Christi International Airport station (site 6, table 1) was compared with rainfall in the subwatersheds during water years 2006–07 (October 2005–September 2007) (table 2). Average annual rainfall in the Corpus Christi area during 1972–2006 was 32.12 inches. Area-weighted, average annual rainfall on the two study subwatersheds during water years 2006–07 was 37.50 inches. Rainfall during the 2006 water year was less than average. Rainfall during the 2007 water year was much greater than average. A few periods of heavy rainfall, interspersed between relatively dry periods, accounted for much of the rainfall during the 2-year study period.

Mean (1972–2006) monthly rainfall for the NWS Corpus Christi International Airport station and monthly area-weighted rainfall for the West Oso Creek and Oso Creek tributary subwatersheds (combined) for October 2005–September 2006 and October 2006–September 2007 are shown in figure 6. Although rainfall was greater than average during the 2-year study period, monthly rainfall was below average during 15 of the 24 months.

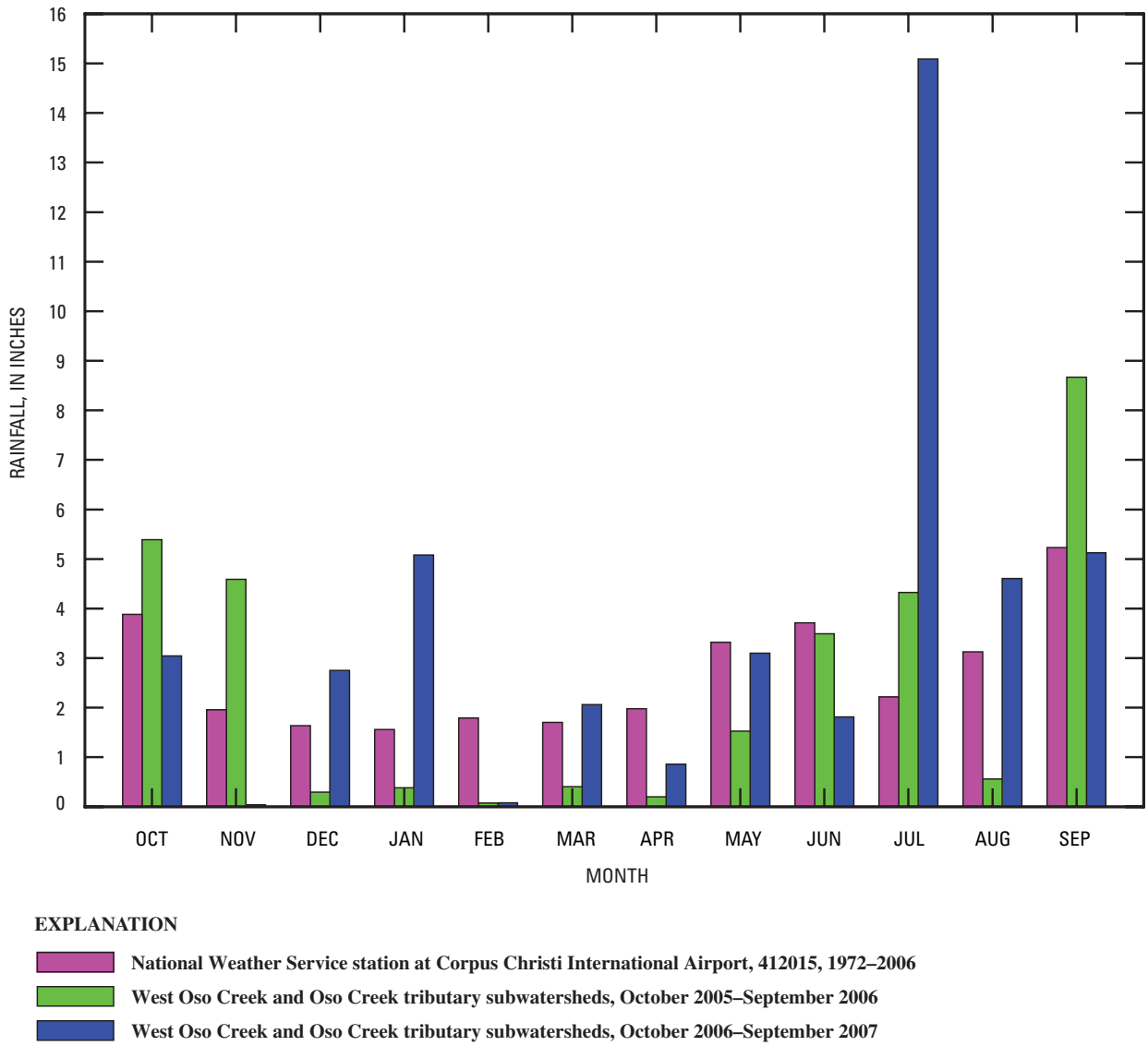

Figure 6. Mean monthly rainfall for National Weather Service station at Corpus Christi International Airport (412015), 1972–2006; and monthly area-weighted rainfall for West Oso Creek and Oso Creek tributary subwatersheds (combined), Nueces County, Texas, water years 2006 and 2007.

Table 2. Estimated annual (water years 2006–07) rainfall for West Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas, and long-term average annual (water years 1972–2006) rainfall measured at National Weather Service station Corpus Christi International Airport (412015).

Subwatershed	October 2005–September 2006 rainfall (inches)	October 2006–September 2007 rainfall (inches)	Annual rainfall, October 2005–September 2007 (inches)	Long-term average annual rainfall, 1972–2006 (inches)
West Oso Creek	27.91	44.87	36.39	32.12
Oso Creek tributary	31.97	45.19	38.58	32.12
Mean (subwatershed area weighted)	29.97	45.03	37.50	32.12

Runoff

The USGS, in cooperation with the Texas Water Development Board, has operated the streamflow-gaging station on Oso Creek at Corpus Christi, Tex., 08211520, since 1972 (station 5, fig. 1; table 1). Data from this station were used to estimate long-term annual runoff volumes for comparison with study subwatershed runoff volumes. Land use in the 90.3-square-mile watershed upstream from the gaging station is largely cropland, similar to that in the study subwatersheds. However, a substantial amount of impervious cover, associated with the town of Robstown, is in the watershed upstream from the gaging station. Average streamflow during water years 1973–2006 was 29.6 cubic feet per second. Excluding an estimated wastewater treatment discharge of about 3 million gallons per day from Robstown, long-term average annual runoff at the Oso Creek at Corpus Christi station was 3.76 inches. During the study, average annual runoff at the Oso Creek at Corpus Christi station was 7.63 inches, or about twice the average runoff (table 3).

Runoff during water years 2006–07 corresponded to rainfall patterns, with runoff events interspersed between periods of no runoff. The West Oso Creek subwatershed produced more runoff than the Oso Creek tributary subwatershed. Unit runoff for study subwatersheds was less than the overall unit runoff for the Oso Creek watershed. Selected runoff events are listed in table 4, including dates, rainfall totals, runoff volumes, and runoff coefficients (ratio of runoff volume, in inches, to rainfall volume, in inches). Minor runoff events, for which study subwatersheds had less than 0.001 inch of runoff are not listed separately but are included in the totals in table 4. Table 4 also indicates whether runoff water-quality samples were collected during the event. See appendixes 2 and 3 for a complete list of sampled events.

Runoff is highly dependent on antecedent conditions. Rainfall of 2 to 3 inches during May 25–29, 2007, resulted in no runoff or only minor runoff at the subwatershed sites. Less rainfall during January 24–February 3, 2007, produced substantially more runoff because of antecedent wet conditions from rainfall in early January.

Most of the runoff from the study subwatersheds occurred in response to a few specific storm periods (events). More than 75 percent of the runoff from each subwatershed occurred during two wet periods: September 18–October 1, 2006, and July 2–August 8, 2007 (table 4). During both periods, multiple rainfall events and prolonged wet-soil conditions contributed to substantial runoff.

The West Oso Creek subwatershed produced more runoff during the study period than the Oso Creek tributary subwatershed, 10.83 inches compared with 7.28 inches (table 4). Runoff response was quicker and peak flows were larger in the West Oso Creek subwatershed than in the Oso Creek tributary subwatershed. Differences in hydrologic response between the subwatersheds might be explained by slightly greater land slopes in the West Oso Creek subwatershed and possible noncontributing areas in the Oso Creek tributary subwatershed. Figure 7 shows the rainfall/runoff response for each subwatershed during the March 14–18, 2007, event.

Water Quality

Rainfall

Fourteen rainfall samples were collected and analyzed for major inorganic ions and nutrients during the study. During October 2005–September 2007, 70.62 inches of rainfall were recorded at the Texas AgriLife Research station (site 1, fig. 1). The 14 rainfall-quality samples represent 28.00 inches of rainfall recorded at the Texas AgriLife Research station, or about 40 percent of total rainfall during the study period. Ten samples were collected during rainfall for which runoff events were sampled. Four rainfall samples were collected during events for which no runoff occurred. These four samples were collected during rainfall events with about 0.5 inch of rainfall or less. These samples provided only enough sample volume for nutrient analyses. Results of sample analyses are shown in table 5.

Summary statistics for selected rainfall nutrient concentrations are shown in table 6. Most of the nitrogen in rainfall is in the form of dissolved ammonia and dissolved nitrate (the nitrite plus nitrate analysis is predominantly nitrate

Table 3. Annual (water years 2006–07) runoff from study subwatersheds and long-term average annual (water years 1973–2006) unit runoff from Oso Creek watershed, Nueces County, Texas.

[--, not applicable]

Subwatershed or station name (number)	October 2005–September 2006 runoff (inches)	October 2006–September 2007 runoff (inches)	Average annual study area runoff (inches)	Water years 1973–2006 average annual runoff (inches)
West Oso Creek (08211517)	3.19	8.19	5.69	--
Oso Creek tributary (08211525)	2.60	4.67	3.64	--
Oso Creek at Corpus Christi, Tex.[1] (08211520)	4.37	10.89	7.63	3.76

[1] Runoff at station 08211520 excludes an estimated annual 3 million gallons per day of wastewater discharge.

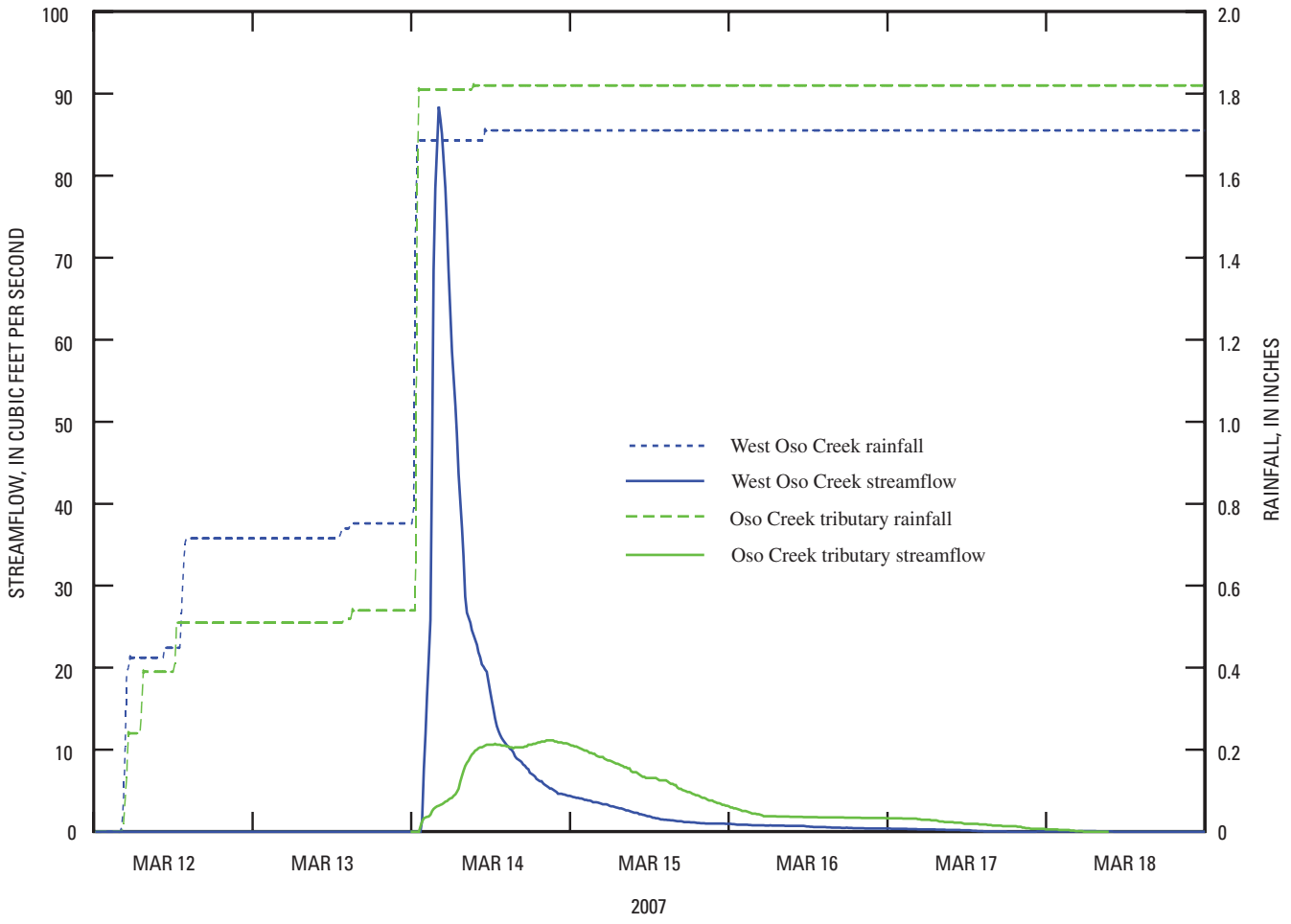

Figure 7. Rainfall/runoff response for West Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas, during March 12–18, 2007.

in these samples; therefore, nitrite plus nitrate is referred to as nitrate in this report), which were detected in all of the samples. Median concentrations of ammonia and nitrate were 0.16 and 0.10 milligram per liter (mg/L), respectively. Organic forms of nitrogen were detected in all samples at relatively low concentrations; the median concentration of total organic nitrogen was 0.07 mg/L. Nitrite was detected in about one-half the samples at low concentrations; the median concentration was 0.002 mg/L. Total phosphorus was detected in about one-half the samples at relatively small concentrations; the median concentration was less than 0.008 mg/L.

The deposition of rainfall constituents, in pounds per acre, can be defined as the product of the EMC and rainfall volume and a conversion factor. For rainfall events during which rainfall samples were collected and analyzed, thus providing EMCs, daily deposition of a constituent was computed (using total nitrogen for example) as

$$DTN = EMCTN \times R \times cf, \quad (1)$$

where

DTN = daily deposition of total nitrogen, in pounds per acre;

EMCTN = total nitrogen rainfall event-mean concentration, in milligrams per liter;

R = daily rainfall on the study subwatershed, in inches; and

cf = conversion factor of 0.2266.

For unsampled rainfall events, those for which nitrogen concentrations were not available, daily deposition of nitrogen was estimated from a regression equation that relates daily rainfall and daily nitrogen deposition. Least-squares regression was used with the computed daily deposition from sampled events to develop the equation relating daily rainfall and daily deposition. The resulting regression equation is

$$DTN = 0.116 \times R^{0.484}, \quad (2)$$

where

DTN = daily deposition of total nitrogen, in pounds per acre; and

R = daily rainfall on the study subwatershed, in inches.

The coefficient of determination (r^2) for the regression equation was .41, which indicates a relatively weak correlation between rainfall and total nitrogen deposition.

Table 4. Rainfall, runoff volume, and runoff/rainfall coefficients (ratio of runoff volume to rainfall volume) for selected runoff events during water years 2006–07, West Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas.

[--, not applicable]

Event date	Subwatershed							
	West Oso Creek				Oso Creek tributary			
	Rainfall (inches)	Runoff (inches)	Runoff/ rainfall coefficient	Runoff water-quality samples collected?	Rainfall (inches)	Runoff (inches)	Runoff/ rainfall coefficient	Runoff water-quality samples collected?
2005								
Oct. 11–13	0.92	0	0	No	7.18	0.14	0.02	No
Nov. 16–17	.49	.01	.02	No	.95	0	0	No
Nov. 26–29	2.62	.24	.09	No	3.80	.04	.01	No
2006								
June 1–4	3.90	.65	.17	Yes	2.50	.08	.03	Yes
July 1–5	2.32	.01	.005	Yes	1.75	.002	.001	Yes
July 6–9	.88	.01	.01	Yes	1.73	.02	.01	Yes
July 26–27	1.34	.02	.01	No	.15	0	0	No
Aug. 19–20	.60	.01	.02	No	0	0	0	No
Sept. 9–17	2.79	.01	0	Yes	2.91	.18	.06	Yes
Sept. 18–23	3.17	.96	.30	Yes	3.58	1.31	.37	Yes
Sept. 24–Oct. 1	2.82	1.29	.46	No	2.04	.85	.42	No
Oct. 22–25	1.36	0	0	No	1.01	.06	.06	No
2007								
Jan. 3–7	1.68	.02	.01	Yes	2.13	.06	.03	Yes
Jan. 24–Feb. 3	2.29	.14	.06	Yes	2.40	.29	.12	Yes
Mar. 14–18	1.71	.12	.07	Yes	1.82	.08	.04	Yes
May 25–29	2.48	0	0	Yes	3.15	.02	.01	No
July 2–10	8.20	2.70	.33	Yes	10.72	3.26	.30	Yes
July 19–24	2.07	1.26	.61	No	1.76	.05	.03	No
July 26–Aug. 8	6.37	2.32	.36	No	2.13	.27	.13	No
Aug. 30–Sept. 2	2.45	0	0	No	1.05	.10	.10	Yes
Sept. 3–13	1.29	.63	.49	No	1.67	.18	.11	No
Sept. 29–30	3.21	.24	.07	No	2.43	.28	.12	No
Total—22 events	54.96	10.64	.19	--	56.86	7.27	.13	--
Total—Oct. 2005–Sept. 2007	72.78	10.83	.15	--	77.16	7.28	.09	--

Table 5. Event (daily) rainfall, Texas AgriLife Research at Corpus Christi weather station (WS1); and event concentrations of selected constituents in rainfall samples, Texas Agricultural Experiment Station near Corpus Christi, Texas (08211511), water years 2006–07.

[fltrd, filtered; mg/L, milligrams per liter; N, nitrogen; unfltrd, unfiltered; --, not analyzed; <, less than; P, phosphorus]

Sample date	Event (daily) rainfall (inches)	Calcium, water, fltrd (mg/L)	Magnesium, water, fltrd (mg/L)	Potassium, water, fltrd (mg/L)	Sodium, water, fltrd (mg/L)	Chloride, water, fltrd (mg/L)	Sulfate, water, fltrd (mg/L)	Ammonia + organic nitrogen, water, fltrd (mg/L as N)	Ammonia + organic nitrogen, water, unfltrd (mg/L as N)	Ammonia nitrogen, water, fltrd (mg/L as N)
May 10, 2006	1.10	1.20	1.10	0.127	0.142	1.15	2.69	1.1	1.0	0.82
May 14, 2006	.52	--	--	--	--	--	--	2.3	1.1	.75
June 1, 2006	9.30	<.02	<.008	<.010	<.20	.16	.16	.17	<.10	.04
July 3, 2006	1.60	.14	.040	.029	.32	.56	.69	.28	.26	.22
July 6, 2006	1.30	.11	.027	.018	.20	.35	.67	.18	.18	.16
July 26, 2006	2.40	.38	.109	.046	.73	1.29	.95	.29	.20	.21
Sept. 11, 2006	.46	--	--	--	--	--	--	.13	2.0	.10
Sept. 24, 2006	1.80	.04	.010	.031	.47	.76	.64	<.10	.10	.08
Oct. 14, 2006	.14	--	--	--	--	--	--	.75	.75	.71
Jan. 3, 2007	1.49	.09	.035	.024	.34	.47	.59	.17	.17	.13
Jan. 24, 2007	.51	--	--	--	--	--	--	.18	.18	.07
Mar. 14, 2007	1.19	.23	.044	.047	.39	.54	.88	.24	.24	.17
May 25, 2007	1.52	.13	.048	.046	.49	1.46	.71	.20	.20	.20
July 2, 2007	4.67	.07	.028	.014	.20	.35	.38	.08	.08	.05

Table 5. Event (daily) rainfall, Texas AgriLife Research at Corpus Christi weather station (WS1); and event concentrations of selected constituents in rainfall samples, Texas Agricultural Experiment Station near Corpus Christi, Texas (08211511), water years 2006–07—Continued.

Sample date	Event (daily) rainfall, (inches)	Nitrite + nitrate nitrogen, water, fltrd (mg/L as N)	Nitrite nitrogen, water, fltrd (mg/L as N)	Organic nitrogen, water, fltrd (mg/L as N)	Organic nitrogen, water, unfltrd (mg/L as N)	Total nitrogen, water, fltrd (mg/L as N)	Total nitrogen, water, unfltrd (mg/L as N)	Phosphorus, water, fltrd (mg/L as P)	Phosphorus, water, unfltrd (mg/L as P)	Ortho-phosphate phosphorus, water, fltrd (mg/L as P)
May 10, 2006	1.10	0.378	0.004	0.31	0.18	1.5	1.4	<0.004	0.006	<0.006
May 14, 2006	.52	.338	.003	1.6	.31	2.6	1.4	.21	.043	<.006
June 1, 2006	9.30	.029	<.002	.14	--	.20	--	<.004	.007	<.006
July 3, 2006	1.60	.135	<.002	.06	.04	.41	.39	.006	<.004	<.006
July 6, 2006	1.30	.122	<.002	.02	.02	.30	.30	<.004	<.004	<.006
July 26, 2006	2.40	.149	<.002	.08	--	.44	.35	.004	.005	<.006
Sept. 11, 2006	.46	.091	<.002	.03	1.9	.22	2.1	<.004	<.004	<.006
Sept. 24, 2006	1.80	.078	<.002	.16	--	.32	--	<.004	<.004	<.006
Oct. 14, 2006	.14	.250	.004	.01	.04	.96	1.0	.018	.028	.013
Jan. 3, 2007	1.49	.064	.002	.03	.04	.22	.24	.005	<.008	.003
Jan. 24, 2007	.51	.066	.002	.05	.10	.19	.24	<.006	<.008	<.006
Mar. 14, 2007	1.19	.092	.001	.05	.07	.31	.33	<.006	.005	<.006
May 25, 2007	1.52	.102	.002	.09	.005	.39	.30	<.006	<.008	<.006
July 2, 2007	4.67	.057	<.002	.08	.03	.19	--	<.006	.004	<.006

Table 6. Summary statistics for event rainfall, Texas AgriLife Research at Corpus Christi weather station (WS1); and event concentrations of selected nutrients in rainfall samples, Texas Agricultural Experiment Station, Corpus Christi, Texas (08211511), water years 2006–07.

[mg/L, milligrams per liter; <, less than]

Constituent	Number of samples	Mean	Median	Minimum	Maximum
Rainfall, inches	14	2.00	1.40	0.14	9.30
Ammonia + organic nitrogen, dissolved, mg/L	14	.45	.23	.12	2.30
Ammonia + organic nitrogen, total, mg/L	14	.42	.19	.06	2.00
Ammonia nitrogen, dissolved, mg/L	14	.264	.163	.035	.820
Nitrite + nitrate nitrogen, dissolved, mg/L	14	.14	.10	.029	.780
Nitrite nitrogen, dissolved, mg/L	14	.002	.002	<.002	.004
Organic nitrogen, total, mg/L	14	.22	.07	.02	1.9
Nitrogen, total, mg/L	14	.63	.32	.19	2.10
Phosphorus, dissolved, mg/L	14	<.006	<.006	<.004	.021
Phosphorus, total, mg/L	14	<.006	<.008	<.004	.028
Orthophosphate phosphorus, dissolved, mg/L	14	<.006	<.006	<.006	.013

The sampling periods for most rainfall-quality samples collected during the study ranged from 12 to 24 hours and in most cases, represented the total rainfall for a day. Thus, for purposes of computing deposition of rainfall constituents using equation 1 and for developing equation 2 relating daily rainfall and daily total nitrogen deposition, the event rainfall for each rainfall sample (table 5) was treated as a daily rainfall total.

Daily total nitrogen deposition for the 14 sampled rainfall events computed using equation 1 with event (daily) rainfall and total nitrogen sample concentrations (representing EMCs) (total nitrogen unfiltered, table 5), and the corresponding daily total nitrogen deposition estimated using equation 2, each relative to daily rainfall, are shown in figure 8.

Using equation 2 with daily rainfall for each subwatershed, daily total nitrogen rainfall deposition was estimated for each subwatershed; estimated monthly and annual deposition computed from daily deposition are shown in table 7. The average (area-weighted) annual total nitrogen deposition for the subwatersheds over the 2-year study period was 5.50 pounds per acre.

Rainfall deposition of total phosphorus was much less than that of total nitrogen. The median total phosphorus concentration for the 14 rainfall samples was less than the minimum laboratory reporting level, 0.008 mg/L (table 6). Using equation 1 with mean annual (October 2005–September 2007) rainfall for the subwatersheds (37.50 inches, table 2) and the minimum laboratory reporting level to estimate an upper limit of annual total phosphorus deposition for the study period resulted in an estimate of less than 0.07 pound per acre per year.

Runoff

During June 2006–September 2007, 19 event-composite runoff (streamflow) samples were collected at the two subwatershed outlet monitoring sites: 10 samples at West Oso Creek (site 3, fig. 1) and nine samples at Oso Creek tributary (site 4, fig. 1). Samples were analyzed to characterize the quality of storm runoff from the study subwatersheds. Results of analyses of West Oso Creek and Oso Creek tributary samples are shown in appendixes 2 and 3, respectively.

Nutrients and Major Inorganic Ions

Summary statistics for event concentrations of selected nutrient and major inorganic ions for each subwatershed runoff site are shown in table 8. Total nitrogen concentrations in runoff were greater at the West Oso Creek site than at the Oso Creek tributary site. Phosphorus and major inorganic ion concentrations were greater at the Oso Creek tributary site than at the West Oso Creek site.

The results of Wilcoxon rank-sum tests (Helsel and Hirsch, 1992), done to indicate whether event-median concentrations of respective constituents at the two subwatershed sites are significantly different at the .05 level, are shown in table 9. The tests indicate that event-median concentrations of selected nutrient and major inorganic ions in runoff from the two subwatersheds are significantly different at the .05 level for each constituent except nitrite plus nitrate; and the "borderline" p-value for nitrite plus nitrate (.07) indicates that those two site concentrations are significantly different at the .10 level.

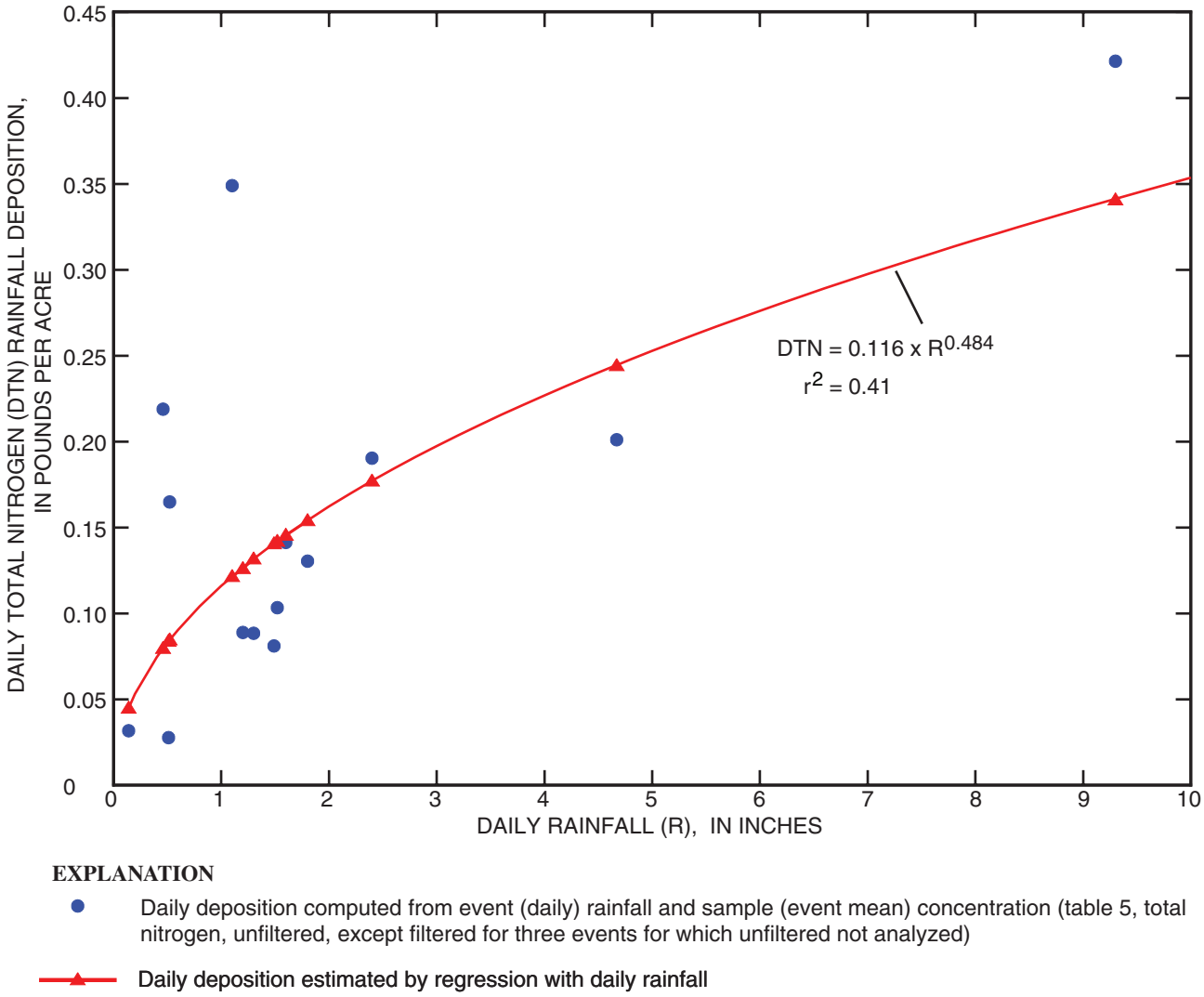

Figure 8. Daily total nitrogen (DTN) deposition computed from event (daily) rainfall and sample concentrations, and DTN deposition estimated by regression of computed DTN deposition with daily rainfall, each relative to daily rainfall, for sampled rainfall events, Oso Creek watershed, Nueces County, Texas, water years 2006–07.

Wilcoxon rank-sum tests also were done to indicate whether event-median concentrations of selected nutrients in runoff varied by season (table 10). Nutrient concentrations for both subwatersheds were combined and grouped into pre-harvest and harvest/post-harvest seasons. Pre-harvest season comprises January–June; harvest/post-harvest season comprises July–September. No samples were collected during October–December. Significant seasonal differences at the .05 level are indicated for total nitrogen, ammonia, and nitrite plus nitrate. These differences are likely because of timing of application of ammonia and nitrate fertilizers. The median organic nitrogen concentration was higher in pre-harvest samples, but not significantly. Likewise, the median total phosphorus concentration was higher in pre-harvest samples, but not significantly.

The load of a constituent in runoff (streamflow) is the mass of a given constituent transported past a site on a stream during a specified period (Huber, 1993, p. 14.2). Daily nutrient loads were computed for the study subwatershed outlet sites from runoff and concentration data. For runoff events that were sampled and for which EMCs were determined, the daily constituent load at a particular site is computed as

$$L = EMC \times R \times cf, \quad (3)$$

where

L = constituent load, in pounds per day;
EMC = event-mean concentration during runoff event, in milligrams per liter or micrograms per liter;
R = runoff, in acre-feet per day; and
cf = conversion factor, 2.719 for concentrations in milligrams per liter or 2.719×10^{-3} for concentrations in micrograms per liter.

Table 7. Estimated monthly and annual total nitrogen rainfall deposition on Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas, water years 2006–07.

[In pounds per acre]

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
West Oso Creek subwatershed													
2006	0.50	0.43	0.09	0.20	0.11	0.19	0.14	0.47	0.37	0.78	0.26	1.12	4.66
2007	.38	.04	.51	.78	.10	.29	.39	.60	.56	.81	.99	.79	7.22
Oso Creek tributary subwatershed													
2006	.75	.54	.17	.16	0	.08	0	.33	.26	.48	.08	1.06	3.92
2007	.69	0	.54	.77	.06	.26	.29	.34	.42	1.34	.83	.65	6.21

Table 8. Summary statistics for event concentrations of selected nutrients and major inorganic ions in runoff samples, West Oso Creek subwatershed (station 08211517) and Oso Creek tributary subwatershed (station 08211525), water years 2006–07.

[mg/L, milligrams per liter]

Constituent	Number of samples	Mean	Median	Minimum	Maximum
West Oso Creek subwatershed					
Ammonia nitrogen, dissolved, mg/L	10	0.087	0.040	0.017	0.228
Nitrite + nitrate nitrogen, dissolved, mg/L	10	.96	.61	.22	3.26
Organic nitrogen, total, mg/L	10	2.10	2..08	.73	4.20
Nitrogen, total, mg/L	10	3.15	3.15	.98	5.10
Phosphorus, total, mg/L	10	.31	.28	.19	.49
Calcium, dissolved, mg/L	9	14.1	14.2	8.9	18.4
Potassium, dissolved, mg/L	9	4.44	4.07	3.24	6.74
Chloride, dissolved, mg/L	9	1.83	1.58	.97	3.11
Sulfate, dissolved, mg/L	9	1.79	1.50	.90	3.65
Oso Creek tributary subwatershed					
Ammonia nitrogen, dissolved, mg/L	9	.037	.021	.012	.171
Nitrite + nitrate nitrogen, dissolved, mg/L	9	.37	.20	.06	1.0
Organic nitrogen, total, mg/L	9	1.23	1.06	.87	2.4
Nitrogen, total, mg/L	9	1.63	1.23	1.10	3.50
Phosphorus, total, mg/L	9	.45	.42	.26	.69
Calcium, dissolved, mg/L	8	17.4	18.3	13.5	20.2
Potassium, dissolved, mg/L	8	7.15	7.65	4.82	9.32
Chloride, dissolved, mg/L	8	10.9	8.79	1.97	21.6
Sulfate, dissolved, mg/L	8	6.28	5.56	1.30	12.8

Table 9. Event-median concentrations of selected nutrients and major inorganic ions in runoff samples by subwatershed (West Oso Creek station 08211517 and Oso Creek tributary station 08211525), water years 2006–07; and results of Wilcoxon rank-sum tests to indicate whether event-median concentrations for the two watersheds are significantly different.

[mg/L, milligrams per liter]

Constituent	Subwatershed median concentration (mg/L)		p-value	Concentrations significantly different at .05 level?
	West Oso Creek	Oso Creek tributary		
Ammonia nitrogen, dissolved	0.040	0.021	.05	Yes
Nitrite + nitrate nitrogen, dissolved	.61	.20	.07	No
Organic nitrogen, total	2.08	1.06	.05	Yes
Nitrogen, total	3.15	1.23	.02	Yes
Phosphorus, total	.28	.42	.03	Yes
Calcium, dissolved	14.2	18.3	.05	Yes
Potassium, dissolved	4.07	7.65	.003	Yes
Chloride, dissolved	1.58	8.79	.0006	Yes
Sulfate, dissolved	1.50	5.56	.01	Yes

Table 10. Event-median concentrations of selected nutrients in runoff samples for West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds combined, Nueces County, Texas, by season (pre-harvest and harvest/post-harvest), water years 2006–07; and results of Wilcoxon rank-sum tests to indicate whether event-median concentrations for the two seasons are significantly different.

[mg/L, milligrams per liter]

Nutrient	Season median concentration (mg/L)		p-value	Concentrations significantly different at .05 level?
	Pre-harvest (January–June)	Harvest/post-harvest (July–September)		
Ammonia nitrogen, dissolved	0.148	0.024	.018	Yes
Nitrite + nitrate nitrogen, dissolved	.81	.24	.0008	Yes
Organic nitrogen, total	2.06	1.15	.142	No
Nitrogen, total	3.5	1.36	.008	Yes
Phosphorus, total	.78	.64	.29	No

Event-median concentrations of selected nutrients in samples at each site, by season (pre-harvest or harvest/post-harvest) (table 11), were used to estimate runoff loads for unsampled events at each site. During water years 2006–07, sampled runoff events represent about 41 percent of total runoff from the West Oso Creek subwatershed. About 59 percent of the runoff was unsampled. Sampled and unsampled runoff percentages from the Oso Creek tributary subwatershed were about 74 percent and 26 percent, respectively.

Constituent yield, a measure of the load-producing characteristics of a watershed, is computed by dividing the runoff load by the drainage area of the watershed:

$$Y = L/DA, \quad (4)$$

where

Y = constituent yield, in pounds per acre per month (or year);

L = constituent load exiting the watershed, in pounds per month (or year); and

DA = contributing drainage area of the watershed, in acres.

Estimated monthly and annual loads of selected nutrients in runoff from each of the study subwatersheds are listed in table 12, and the corresponding annual runoff yields are listed in table 13. Monthly and annual nutrient loads were highly variable, depending on storm runoff. About 50 percent of the entire total nitrogen runoff load from both watersheds and 56 percent of the entire total phosphorus load occurred during July 2007.

Table 11. Event-median concentrations of selected nutrients in runoff samples for West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, by season (pre-harvest or harvest/post-harvest), water years 2006–07, used to estimate runoff loads for unsampled events.

[In milligrams per liter]

Nutrient	Season median concentration		Median concentration, all samples
	Pre-harvest (January–June)	Harvest/post-harvest (July–September)	
West Oso Creek subwatershed			
Ammonia nitrogen, dissolved	0.15	0.04	0.04
Nitrite + nitrate nitrogen, dissolved	.78	.49	.61
Organic nitrogen, total	2.1	2.1	2.1
Nitrogen, total	4.5	2.6	3.2
Phosphorus, total	.78	.66	.71
Orthophosphate phosphorus, dissolved	.31	.25	.26
Oso Creek tributary subwatershed			
Ammonia nitrogen, dissolved	.03	.02	.02
Nitrite + nitrate nitrogen, dissolved	.66	.18	.24
Organic nitrogen, total	1.4	.97	1.1
Nitrogen, total	1.8	1.1	1.2
Phosphorus, total	.80	.61	.61
Orthophosphate phosphorus, dissolved	.35	.43	.37

Nutrient yields from the West Oso Creek subwatershed were greater than yields from the Oso Creek tributary subwatershed for two reasons: First, West Oso Creek subwatershed runoff was greater. Second, nutrient concentrations generally were greater for the West Oso Creek subwatershed. Average total nitrogen yield from the West Oso Creek subwatershed was 2.61 pounds per acre per year for the 2-year study period. Average total nitrogen yield from the Oso Creek tributary subwatershed for the 2-year period was less than one-half that for the West Oso Creek subwatershed, 0.966 pound per acre per year. Average total phosphorus yields from the West Oso Creek and the Oso Creek tributary subwatersheds for the 2-year period were 0.776 and 0.498 pound per acre per year.

Information on fertilizer nutrient application in study subwatershed croplands during 2006–07 was compiled by AgriLife Research and the National Resources Conservation Service (Dr. Bobby Eddleman, Texas AgriLife Research and Extension Center at Corpus Christi, written commun., 2007). Annual runoff yields of total nitrogen and total phosphorus were compared to nutrient inputs from fertilizer applications and rainfall deposition (table 14).

Nitrogen input from fertilizer is much larger than input from rainfall deposition or outputs from runoff. Average (area-weighted for both subwatersheds) annual application of fertilizer-based nitrogen was 67.1 pounds per acre per year, compared to 5.50 pounds per acre per year from rainfall deposition and 1.78 pounds per acre per year in runoff. Annual rainfall deposition of nitrogen exceeds runoff yields because most rainfall does not contribute to runoff, even though for most periods of runoff, nitrogen runoff yields exceed rainfall nitrogen deposition. The average annual runoff yield of total nitrogen represents about 2.4 percent of nitrogen applied as fertilizer and nitrogen entering the subwatersheds through rainfall deposition. Also, nearly all of the nitrogen applied as fertilizer and entering the subwatersheds through rainfall deposition is in the form of ammonia and nitrate. Nitrogen exiting the study subwatersheds in runoff is mostly organic nitrogen (table 13).

As with nitrogen, fertilizer inputs of phosphorus are much greater than phosphorus runoff yields. Average annual fertilizer input of phosphorus was 14.3 pounds per acre per year. Average runoff of total phosphorus was 0.635 pound per acre per year, or about 4.4 percent of the phosphorus applied as fertilizer. Average phosphorus input from rainfall was relatively small, estimated to be less than 0.07 pound per acre per year. Fertilizer is applied as soluble orthophosphate. Most of the runoff phosphorus also was in the form of orthophosphate (table 13).

Suspended Sediment

Results of analyses for 22 samples of suspended sediment in runoff are shown in table 15. Ten samples were collected at West Oso Creek (station 08211517), and 12 samples were collected at Oso Creek tributary (station 08211525). The

Table 12. Estimated monthly and annual runoff loads of selected nutrients from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07.

[In pounds]

Nutrient	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
West Oso Creek subwatershed													
Water year 2006													
Ammonia nitrogen, dissolved	0	11	0	0	0	0	0	0	13	1.1	0.5	105	131
Nitrite + nitrate nitrogen, dissolved	0	140	0	0	0	0	0	0	190	13	4.2	1,320	1,670
Organic nitrogen, total	0	601	0	0	0	0	0	0	910	65	17	4,760	6,350
Nitrogen, total	0	744	0	0	0	0	0	0	1,140	79	22	6,080	8,060
Phosphorus, total	0	189	0	0	0	0	0	0	356	36	5.6	1,640	2,220
Orthophosphate phosphorus, dissolved	0	123	0	0	0	0	0	0	127	8.9	3.7	929	1,190
Water year 2007													
Ammonia nitrogen, dissolved	.1	0	0	11	0	27	0	.4	0	231	9.0	41	320
Nitrite + nitrate nitrogen, dissolved	.9	0	0	583	.4	105	0	2.2	0	2,760	563	498	4,510
Organic nitrogen, total	3.9	0	0	251	.1	566	0	7.4	0	11,100	474	2,135	14,540
Nitrogen, total	4.8	0	0	851	.5	688	0	10	0	13,990	587	2,640	18,770
Phosphorus, total	1.2	0	0	102	.1	205	0	2.9	0	4,620	149	671	5,750
Orthophosphate phosphorus, dissolved	.8	0	0	48	.03	48	0	1.0	0	3,260	97	437	3,890

Nutrient	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
Oso Creek tributary subwatershed													
Water year 2006													
Ammonia nitrogen, dissolved	3.3	1.0	0	0	0	0	0	0	2.3	0.3	0	63	70
Nitrite + nitrate nitrogen, dissolved	29	8.9	0	0	0	0	0	0	24	1.3	0	538	602
Organic nitrogen, total	158	48	0	0	0	0	0	0	135	25	0	2,540	2,910
Nitrogen, total	179	54	0	0	0	0	0	0	162	26	0	3,080	3,500
Phosphorus, total	100	30	0	0	0	0	0	0	88	17	0	1,460	1,690
Orthophosphate phosphorus, dissolved	70	21	0	0	0	0	0	0	57	12	0	887	1,050
Water year 2007													
Ammonia nitrogen, dissolved	1.9	0	0	9.0	.3	16	0	.6	0	74	3.3	12	117
Nitrite + nitrate nitrogen, dissolved	16	0	0	311	6.2	95	0	12	0	662	28	103	1,230
Organic nitrogen, total	85	0	0	426	7.4	228	0	26	0	4,110	166	558	5,610
Nitrogen, total	96	0	0	749	14	333	0	34	0	4,660	190	633	6,710
Phosphorus, total	53	0	0	194	3.4	93	0	15	0	2,780	80	343	3,570
Orthophosphate phosphorus, dissolved	38	0	0	118	2.2	35	0	6.5	0	2,330	59	302	2,890

Table 13. Estimated annual and average annual runoff yields of selected nutrients from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07.

[In pounds per acre per year]

Nutrient	Water year 2006	Water year 2007	Water year 2006–07 average
West Oso Creek subwatershed (5,145 acres)			
Ammonia nitrogen, dissolved	0.025	0.062	0.044
Nitrite + nitrate nitrogen, dissolved	.323	.876	.600
Organic nitrogen, total	1.24	2.83	2.03
Nitrogen, total	1.57	3.65	2.61
Phosphorus, total	.432	1.12	.776
Orthophosphate phosphorus, dissolved	.231	.756	.494
Oso Creek tributary subwatershed (5,287 acres)			
Ammonia nitrogen, dissolved	.013	.022	.018
Nitrite + nitrate nitrogen, dissolved	.114	.233	.174
Organic nitrogen, total	.555	1.06	.808
Nitrogen, total	.661	1.27	.966
Phosphorus, total	.320	.675	.498
Orthophosphate phosphorus, dissolved	.198	.546	.372

Table 14. Fertilizer applications, rainfall deposition, and runoff yields of total nitrogen and total phosphorus for West Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas, water years 2006–07.

[lb/acre, pounds per acre; (lb/acre)/yr, pounds per acre per year]

Subwatershed and period	Fertilizer application	Rainfall deposition	Runoff yield
Total nitrogen			
West Oso Creek			
Water year 2006, lb/acre	71.3	4.66	1.57
Water year 2007, lb/acre	65.6	7.22	3.65
2006–07 average, (lb/acre)/yr	68.4	5.94	2.61
Oso Creek tributary			
Water year 2006, lb/acre	68.7	3.92	.661
Water year 2007, lb/acre	62.9	6.21	1.27
2006–07 average, (lb/acre)/yr	65.8	5.06	.966
Area-weighted average, both subwatersheds, 2006–07, (lb/acre)/yr	67.1	5.50	1.78
Total phosphorus			
West Oso Creek			
Water year 2006, lb/acre	15.4	< .06	.432
Water year 2007, lb/acre	14.3	< .06	1.12
2006–07 average, (lb/acre)/yr	14.8	< .06	.776
Oso Creek tributary			
Water year 2006, lb/acre	14.6	< .08	.320
Water year 2007, lb/acre	12.9	< .08	.675
2006–07 average, (lb/acre)/yr	13.8	< .08	.498
Area-weighted average, both subwatersheds, 2006–07, (lb/acre)/yr	14.3	< .07	.635

Table 15. Results of analyses for samples of suspended sediment in runoff from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07.

[ft^3/s, cubic feet per second; mg/L, milligrams per liter]

Sample-collection date	Collection time	Discharge (ft^3/s)	Concentration (mg/L)	Percentage silt and clay, by weight
West Oso Creek subwatershed				
June 1, 2006	1400	129	745	96
	1140	27	447	99
	1600	24	315	97
July 3, 2006	1717	.81	1,400	99
Jan. 4, 2007	1145	2.8	1,005	100
	1530	2.5	1,070	100
Jan. 25, 2007	0900	9.2	383	97
Mar. 14, 2007	1430	10	2,560	99
July 2, 2007	1845	108	234	72
July 3, 2007	0945	230	136	73
Oso Creek tributary subwatershed				
June 1, 2006	1710	25	923	97
Sept. 15, 2006	1400	22.4	293	99
	1505	22.5	311	99
	1730	22.1	234	99
	1930	20.3	239	96
Sept. 16, 2006	0730	13.5	163	96
Jan. 4, 2007	1415	8.1	484	97
Jan. 25, 2007	0700	24.8	200	100
Mar. 14, 2007	1700	10	1,504	98
July 3, 2007	1930	32	50	99
July 4, 2007	0830	56	76	100
Aug. 30, 2007	0800	11	44	99

samples were analyzed for concentration and for percentage silt and clay, by weight (particle size less than 0.62 mm). The sediment concentrations from these samples are not EMCs but represent sediment concentrations at the time of sample collection. Sediment concentrations, loads, and yields are a function of streamflow and other factors, including soil erodibility, rainfall intensity and duration, and crop growth stage and tillage practices (U.S. Department of Agriculture, Agricultural Research Service, 2006). Generally, suspended-sediment concentrations, loads, and yields were larger for the West Oso Creek subwatershed than the Oso Creek tributary subwatershed. Also, concentrations were greater for both subwatersheds in runoff that occurred when fields were bare (before crops emerged or after harvest). Considering all samples from both sites, the percentage of silt and clay was 96 or greater for 20 of the 22 samples.

For each subwatershed outlet station (sites 3, 4, fig. 1), two regression equations were developed relating suspended-sediment load ([instantaneous] tons per day) to streamflow (cubic feet per second). The first equation was developed from samples collected when fields were bare (before crops emerged or after harvest), and the second equation was developed from samples collected when crops provided some degree of soil cover. Generally, both subwatersheds produced greater suspended-sediment loads during periods when fields were bare. The equations for each site are shown in figure 9 and table 16.

From these equations, instantaneous sediment loads were computed for each subwatershed outlet site and aggregated to obtain monthly and annual loads (table 17). As with runoff and nutrient loads, suspended-sediment loads were highly variable by month. Most of the entire sediment load from each site occurred during September 2006 and July 2007.

Annual and average annual suspended-sediment yields for the subwatersheds were computed from the loads and watershed drainage areas (table 18). Suspended-sediment

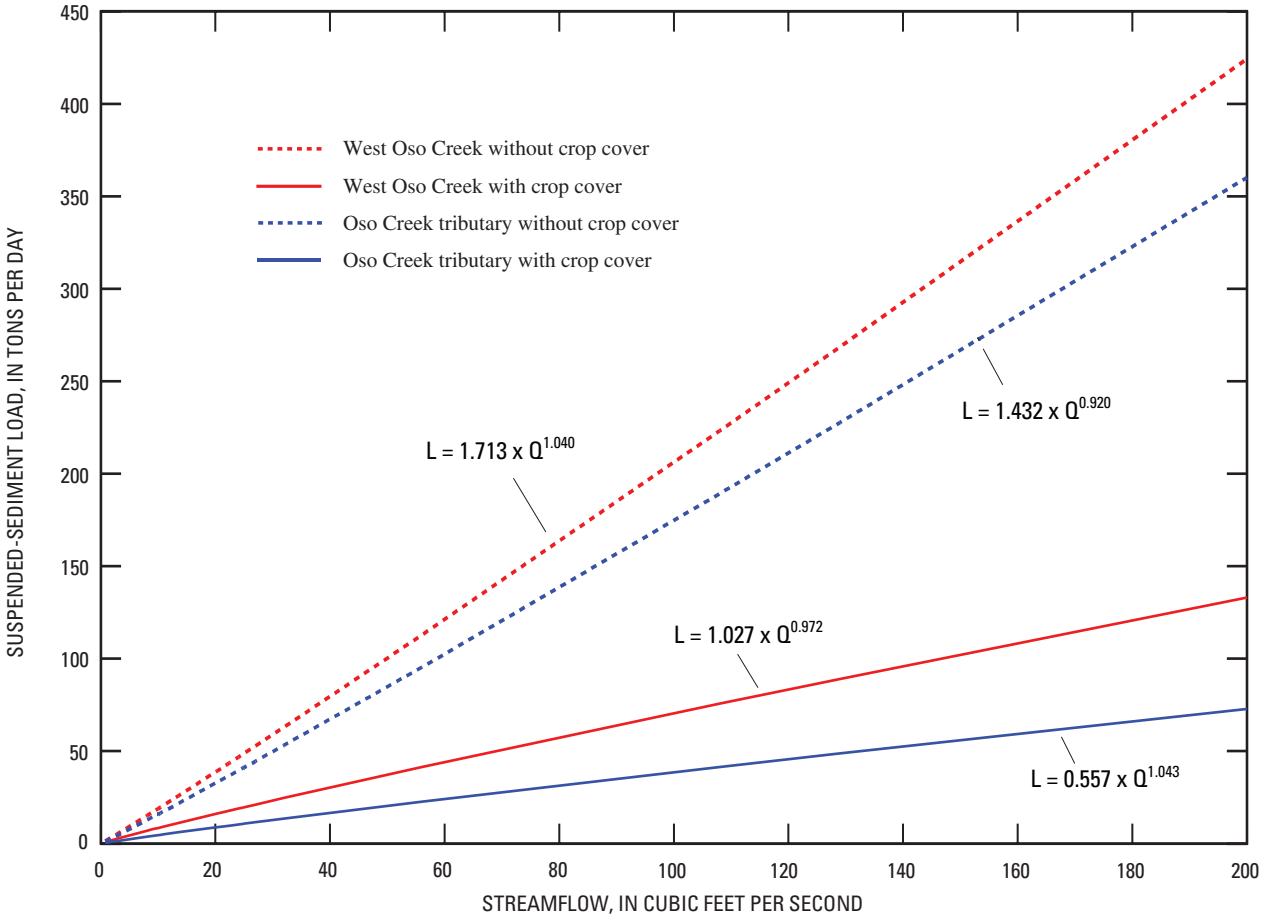

Figure 9. Relations between suspended-sediment load (L) and streamflow (Q) for West Oso Creek (station 08211517) and Oso Creek tributary (station 082115725) subwatersheds, Nueces County, Texas, water years 2006–07.

Table 16. Regression equations relating suspended-sediment load to streamflow for West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07.

[L, load in tons per day; Q, streamflow in cubic feet per second]

Subwatershed and condition	Equation	Coefficient of determination (r^2)
West Oso Creek without crop cover	$L = 1.713 \times Q^{1.040}$	.966
West Oso Creek with crop cover	$L = 1.027 \times Q^{0.972}$	.972
Oso Creek tributary without crop cover	$L = 1.432 \times Q^{0.920}$	.956
Oso Creek tributary with crop cover	$L = 0.557 \times Q^{1.043}$	.972

yields from the West Oso Creek subwatershed were more than twice those from the Oso Creek tributary subwatershed. The average suspended-sediment yield from the West Oso Creek subwatershed was 582 pounds per acre per year. The average suspended-sediment yield from the Oso Creek tributary subwatershed was 257 pounds per acre per year. One reason the West Oso Creek sediment yield is greater is that the subwatershed produced more runoff than the Oso Creek tributary subwatershed. Also, because runoff response is more rapid for the West Oso Creek subwatershed than for the Oso Creek tributary subwatershed, larger peak flows can generate higher stream velocities and, potentially, greater sediment concentrations and loads. The West Oso Creek monitoring site is on the edge of an agricultural field with no pasture buffer or structural controls to mitigate sediment runoff to the monitoring site. Also, part of West Oso Creek upstream from the monitoring site is not a well-defined channel, but a watercourse that flows through (over) cultivated cropland. In contrast, the Oso

Table 17. Estimated monthly and annual runoff suspended-sediment loads, West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07.

[In tons]

Water year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
West Oso Creek subwatershed													
2006	0	107	0	0	0	285	5.4	0.8	0	0	0.8	1,000	1,400
2007	.5	0	0	6.4	.02	48	0	.9	0	1,270	40	227	1,590
Oso Creek tributary subwatershed													
2006	33	12	0	0	0	0	0	0	20	2.4	0	547	614
2007	21	0	0	91	2.1	22	0	1.9	0	524	18	67	747

Table 18. Annual and average annual runoff yields of suspended sediment, West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07.

[In pounds per acre per year]

Subwatershed	Water year 2006	Water year 2007	Average, 2006–07
West Oso Creek	544	619	582
Oso Creek tributary	232	283	257

Creek tributary upstream from the monitoring site on that stream is surrounded by a buffer area of grassland along the sides of the channel.

Pesticides

Runoff samples were analyzed for a suite of 88 pesticides. The pesticide analysis schedules requested from the USGS NWQL included some pesticides not used in the subwatersheds, and some pesticides used in the subwatersheds were not included in the 88 requested analyses because some analyses were not available through the NWQL. Also, a complete list of pesticides applied by agricultural users in the subwatersheds was not available at the beginning of the study. Texas AgriLife Research, with assistance from the Natural Resources Conservation Service in Nueces County, compiled information on pesticide application rates for the study subwatersheds during 2005–07 (Dr. Bobby Eddleman, Texas AgriLife Research and Extension Center at Corpus Christi, written commun., 2007). The pesticides that were reportedly applied in the study subwatersheds during 2005–07 are listed in table 19. Table 19 also indicates the reportedly applied pesticides that were not included in the laboratory analyses of runoff samples.

Table 19. Pesticides used in West Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas, water years 2006–07.

[* indicates chemical not included in runoff-sample laboratory analysis]

Herbicides	Insecticides	Defoliants, desicants, growth regulators
2,4-D	*Acephate	*Ethephon
Atrazine	*Acetamiprid	*Mepquat chloride
Glyphosate	Dicrotophos	*Thidiazron
Glufosinate-ammonium	Imidacloprid	*Thidiazrom + diuron
*Prosulfuron	Malathion	*Paraquat chloride
Pendimethalin	Myclobutanil[1]	
Prometryn	Propoxur[2]	
Trifluralin	*Thiamethoxam	
	Zeta-cypermethrin	

[1] Fungicide used primarily for residential applications.

[2] Insecticide used primarily for residential applications.

Pesticides detected in runoff samples and concentration summary statistics are listed in table 20. Pesticide analytical results for all samples are in appendixes 2 and 3. Laboratory analyses indicated detection of 30 pesticide compounds (22 herbicides and eight insecticides) in 19 runoff samples collected from the two subwatershed outlet sites combined. At the West Oso Creek site, 22 pesticides were detected (18 herbicides and four insecticides). At the Oso Creek tributary site, 23 pesticides were detected (17 herbicides and six insecticides). Eight pesticides were detected only once at the West Oso Creek site and nine pesticides only once at the Oso Creek tributary site, all at low concentrations (near the respective minimum laboratory reporting levels); two of these pesticides were detected once at both sites. Five herbicides were detected in all samples from both sites: atrazine, atrazine degradation byproducts 2-chloro-4-isopropylamino-6-amino-s-triazine (CIAT) and 2-hydroxy-4-isopropylamino-6-ethylamino-s-triazine (OIET), glyphosate, and glyphosate byproduct aminomethylphosphonic acid (AMPA). Herbicides 2,4-D and pendimethalin were detected in more than 50 percent of all samples at both sites.

Pesticide runoff loads and yields were computed using equations 3 and 4, respectively, for atrazine, glyphosate, and pendimethalin. Similar to nutrients, pesticide concentrations also demonstrated seasonal trends, as expected, because of timing of pesticide applications. For sampled events, sample concentrations were used to estimate runoff loads. For unsampled runoff, the pre-harvest median and harvest/post-harvest median concentrations were used to estimate runoff loads. Table 21 shows seasonal median concentrations from each site used to estimate selected pesticide runoff loads for unsampled runoff. Table 22 shows monthly and annual estimates of selected pesticide runoff loads.

Annual and average annual application rates and runoff yields for selected pesticides are shown in table 23. Similar to results for nutrients and suspended sediment, runoff yields of the herbicides atrazine, glyphosate, and pendimethalin were greater for the West Oso Creek watershed than for the

Table 20. Summary statistics of concentrations of selected pesticides in runoff samples from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07.

[µg/L, micrograms per liter; --, not computed; <, less than]

Pesticide	Number of samples	Number of detections	Mean (µg/L)	Median (µg/L)	Minimum (µg/L)	Maximum (µg/L)
West Oso Creek subwatershed						
Herbicides						
2,4-D	10	7	--	0.09	<0.04	6.24
2-Chloro-4-isopropylamino-6-amino-s-triazine (CIAT)	10	10	0.06	.04	.015	.18
2-Chloro-6-ethylamino-4-amino-s-triazine (CEAT)	10	2	<.08	<.08	<.08	<.08
2-Hydroxy-4-isopropylamino-6-ethylamino-s-triazine (OIET)	10	10	.18	.11	.063	.529
Acifluorfen	10	1	<.06	<.06	<.028	<.06
Aldicarb sulfoxide	10	1	<.04	<.04	<.04	<.04
Aminomethylphosphonic acid (AMPA)	10	10	5.44	3.60	1.13	13.2
Atrazine	10	10	1.07	.12	.02	8.90
Benfluralin	10	1	<.01	<.01	<.01	<.01
Dacthal monoacid	10	1	<.02	<.02	<.02	<.02
DCPA	10	1	--	<.003	<.003	.0035
Diuron	10	2	<.04	<.04	<.02	.04
Glufosinate	10	2	--	<.14	<.14	<.58
Glyphosate	10	10	17.6	8.51	1.81	53.5
Metolachlor	10	3	--	<.006	<.006	.228
Pendimethalin	10	10	--	1.18	<.02	13.7
Simazine	10	3	--	<.005	<.005	.022
Trifluralin	10	3	--	<.009	<.009	.05
Insecticides						
Dicrotophos	10	1	<.08	<.08	<.08	<.08
Imidacloprid	10	1	--	<.02	<.02	.086
Myclobutanil	10	3	<.033	<.033	<.033	<.033
Propoxur	10	1	--	<.008	<.008	<.04

Table 20. Summary statistics of concentrations of selected pesticides in runoff samples from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07—Continued.

Pesticide	Number of samples	Number of detections	Mean (µg/L)	Median (µg/L)	Minimum (µg/L)	Maximum (µg/L)
Oso Creek tributary subwatershed						
Herbicides						
2,4-D	9	6	--	<0.04	<0.04	1.23
2-Chloro-4-isopropylamino-6-amino-s-triazine (CIAT)	9	9	0.058	.029	.011	.184
2-Chloro-6-ethylamino-4-amino-s-triazine (CEAT)	9	2	--	<.08	<.08	.11
2-Hydroxy-4-isopropylamino-6-ethylamino-s-triazine (OIET)	9	9	.26	.10	.021	.902
Aminomethylphosphonic acid (AMPA)	8	8	.90	.60	.35	1.94
Atrazine	9	9	1.32	.042	.012	9.42
Bromacil	9	1	--	<.04	<.02	.05
Carbaryl	9	1	<.02	<.02	<.02	<.02
DCPA	9	1	--	<.003	<.003	.004
Dicamba	9	1	--	<.08	<.04	.97
Diuron	9	2	<.04	<.04	<.02	.04
Glyphosate	8	8	2.56	1.08	.59	10.6
Metolachlor	9	3	--	<.01	<.006	.008
Pendimethalin	9	6	--	.052	<.02	.144
Simazine	9	4	--	<.006	<.005	.064
Terbuthylazine	9	1	--	<.01	<.01	.02
Trifluralin	9	3	--	<.009	<.009	.054
Insecticides						
Azinphos-methyl	9	1	<.05	<.05	<.05	<.08
Dicrotophos	9	1	<.08	<.08	<.08	<.08
Malathion	9	2	--	.018	<.016	2.64
Fipronil sulfide	9	1	--	<.013	<.013	<.013
Malaoxon	9	1	--	<.039	<.039	.049
Myclobutanil	9	3	<.033	<.033	<.01	<.033

Oso Creek tributary watershed. In addition to greater runoff volumes in the West Oso Creek watershed, median runoff concentrations of all three pesticides were much greater in the West Oso Creek watershed. Of all pesticides detected in runoff, the highest runoff yields were for glyphosate, 0.013 pound per acre per year for the West Oso Creek subwatershed and 0.001 pound per acre per year for the Oso Creek tributary subwatershed. Average annual runoff yields of atrazine were 0.003 and 0.0001 pound per acre per year, respectively, from the West Oso Creek and Oso Creek tributary subwatersheds. Comparison of applications and runoff yields indicates that, for 2006–07, about 0.8 percent of glyphosate applied to the West Oso Creek subwatershed croplands was detected in runoff. For the Oso Creek tributary subwatershed, about 0.07 percent of applied glyphosate was detected in runoff. The percentages of applied atrazine in runoff were about 0.5 and 0.02, respectively, in the West Oso Creek and Oso Creek tributary subwatersheds. Applied pendimethalin in runoff was estimated to be 0.08 and 0.02 percent respectively, in the West Oso Creek and Oso Creek tributary subwatersheds.

Bacteria

Thirteen bacteria samples were collected during the study, eight from the West Oso Creek subwatershed outlet site and five from the Oso Creek tributary subwatershed outlet site (table 24). Summary statistics of bacteria sample analysis results are shown in table 25. Table 25 also shows TSWQS for bacteria in Oso Bay and Oso Creek, TCEQ segments 2485 and 2485A, respectively (Texas Commission on Environmental Quality, 2006).

Similar to other constituents, bacteria densities were greater at the West Oso Creek subwatershed outlet site than at the Oso Creek tributary subwatershed outlet site. Bacteria loads and yields were not estimated because bacteria samples were collected near the beginning of runoff events, and concentrations do not necessarily represent bacteria

Table 21. Event-median concentrations of selected pesticides in runoff samples for West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, by season (pre-harvest or harvest/post-harvest), water years 2006–07, used to estimate runoff loads for unsampled events.

[In micrograms per liter]

Pesticide	Season median concentration		Median concentration, all samples
	Pre-harvest (January–June)	Harvest/post-harvest (July–September)	
West Oso Creek subwatershed			
Atrazine	0.144	0.097	0.120
Glyphosate	5.10	12.6	8.51
Pendimethalin	2.14	.21	1.18
Oso Creek tributary subwatershed			
Atrazine	.95	.042	.042
Glyphosate	1.34	1.08	1.08
Pendimethalin	.112	.027	.052

Table 22. Estimated monthly and annual runoff loads of selected pesticides from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07.

[In pounds]

Pesticide	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Annual
West Oso Creek subwatershed													
Water year 2006													
Atrazine	0	0.029	0	0	0	0	0	0	0.755	0.002	0.001	0.182	0.970
Glyphosate	0	3.60	0	0	0	0	0	0	1.37	.581	.104	21.5	27.2
Pendimethalin	0	.612	0	0	0	0	0	0	.015	.043	.002	.728	1.40
Water year 2007													
Atrazine	.0002	0	0	.010	0	.034	0	.0004	0	28.4	.023	.102	28.6
Glyphosate	.023	0	0	.448	0	.703	0	.153	0	92.5	2.85	12.8	109
Pendimethalin	.0004	0	0	.483	0	.003	0	.007	0	1.20	.05	.21	1.95
Oso Creek tributary subwatershed													
Water year 2006													
Atrazine	.007	.002	0	0	0	0	0	0	.170	.007	0	.086	.272
Glyphosate	.176	.053	0	0	0	0	0	0	.055	.014	0	2.34	2.64
Pendimethalin	.004	.001	0	0	0	0	0	0	.002	.001	0	.162	.170
Water year 2007													
Atrazine	.004	0	0	.009	0	.897	0	.001	0	.24	.063	.083	1.29
Glyphosate	.096	0	0	.335	.005	.364	0	.024	0	8.24	.234	.677	10.0
Pendimethalin	.002	0	0	.056	.001	.013	0	0	0	.112	.063	.075	.322

Table 23. Estimated annual and average annual application rates and runoff yields of selected pesticides from West Oso Creek and Oso Creek tributary subwatersheds, Nueces County, Texas, water years 2006–07.

[In pounds per acre per year]

Pesticide	Water year 2006		Water year 2007		Water year 2006–07 average	
	Application	Runoff yield	Application	Runoff yield	Application	Runoff yield
West Oso Creek subwatershed (5,145 acres)						
Atrazine	0.54	0.0002	0.58	0.006	0.56	0.003
Glyphosate	1.40	.005	1.85	.021	1.625	.013
Pendimethalin	.39	.0003	.36	.0004	.375	.0003
Oso Creek tributary subwatershed (5,287 acres)						
Atrazine	.54	.00005	.67	.0002	.605	.0001
Glyphosate	1.42	.0005	1.65	.002	1.535	.001
Pendimethalin	.38	.00003	.27	.00006	.325	.00005

Table 24. Bacteria densities in runoff samples from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07.

[CFU/100 mL, colony forming units per 100 milliliters; *E. coli*, *Escherichia coli*; --, not analyzed for]

	Sample-collection date	Collection time	Fecal coliform (CFU/100 mL)	*E. coli* (CFU/100 mL)	*Enterococci* (CFU/100 mL)
West Oso Creek subwatershed					
July 7, 2006	(primary sample)	1015	320	46	59,000
	(lab duplicate)	1015	--	--	107,000
	(average concentration)	1015	320	46	83,000
July 27, 2006	(primary sample)	0935	31,000	4,700	127,000
	(field split sample)	0935	42,000	9,000	154,000
	(lab duplicate of primary sample)	0935	--	--	145,000
	(average concentration)	0935	36,500	6,850	142,000
Sept. 18, 2006	(primary sample)	0918	60,000	84,000	96,000
	(field split sample)	0918	46,000	100,000	88,000
	(average concentration)	0918	53,000	92,000	92,000
Jan. 4, 2007	(primary sample)	1154	6,000	7,600	21,000
	(lab duplicate)	1154	14,000	--	--
	(average concentration)	1154	10,000	7,600	21,000
Jan. 25, 2007	(primary sample)	0900	44,000	39,000	64,000
	(lab duplicate)	0900	45,000	--	--
	(average concentration)	0900	44,500	39,000	64,000
May 25, 2007	(primary sample)	1512	304	391	5,200
	(lab duplicate)	1512	761	--	--
	(average concentration)	1512	532	391	5,200
July 7, 2007	(primary sample)	1150	--	15,600	45,000
	(field split sample)	1150	--	5,800	83,000
	(lab duplicate of primary sample)	1150	--	7,200	49,000
	(average concentration)	1150	--	9,530	59,000
Aug. 30, 2007	(primary sample)	1540	82,000	12,500	145,000
	(field split sample)	1540	69,000	69,000	143,000
	(lab duplicate of primary sample)	1540	--	30,000	--
	(average concentration)	1540	75,500	37,200	144,000

Table 24. Bacteria densities in runoff samples from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07—Continued.

	Sample-collection date	Collection time	Fecal coliform (CFU/100 mL)	*E. coli* (CFU/100 mL)	*Enterococci* (CFU/100 mL)
		Oso Creek tributary subwatershed			
July 7, 2006	(primary sample)	1110	145	80	4,800
	(field split sample)	1110	253	77	5,200
	(lab duplicate)	1110	--	53	--
	(lab duplicate of primary sample)	1110	83	--	--
	(average concentration)	1110	160	70	5,000
Sept. 15, 2006	(primary sample)	1000	3,600	16,000	25,000
	(field split sample)	1000	8,000	21,000	28,000
	(lab duplicate of primary sample)	1000	--	--	25,000
	(average concentration)	1000	5,800	18,500	26,000
Jan. 4, 2007	(primary sample)	1217	4,300	5,300	31,000
	(field split sample)	1217	2,780	3,000	39,000
	(average concentration)	1217	3,540	4,150	35,000
Jan. 25, 2007	(primary sample)	0920	14,900	4,100	22,000
July 2, 2007	(primary sample)	1150	--	5,000	75,000

Table 25. Summary statistics of bacteria densities in runoff samples from West Oso Creek (station 08211517) and Oso Creek tributary (station 08211525) subwatersheds, Nueces County, Texas, water years 2006–07; and Texas surface-water-quality standards for bacteria in Oso Bay and Oso Creek, Texas Commission on Environmental Quality segments 2485 and 2485A, respectively.

[CFU/100 mL, colony forming units per 100 milliliters; TSWQS, Texas surface-water-quality standard; *E. coli, Escherichia coli*]

Bacteria	Number of samples	Mean (CFU/100 mL)	Median (CFU/100 mL)	Minimum (CFU/100 mL)	Maximum (CFU/100 mL)	TSWQS[1] for receiving waters of Oso Bay and Oso Creek (CFU/100 mL)
			West Oso Creek subwatershed			
Fecal coliform	7	31,500	36,500	320	75,500	[2]200/400
E. coli	8	24,100	8,560	46	92,000	[3]126/394
Enterococci	8	76,300	73,500	5,200	144,000	[4]35/89
			Oso Creek tributary subwatershed			
Fecal coliform	4	6,100	4,670	160	14,900	[2]200/400
E. coli	5	6,360	4,150	70	18,500	[3]126/394
Enterococci	5	32,600	26,000	5,000	75,000	[4]35/89

[1] Texas Commission on Environmental Quality (2006).

[2] Geometric mean of fecal coliform should not exceed 200 CFU/100 mL; single samples should not exceed 400 CFU/100 mL (freshwater, contact recreation criteria).

[3] Geometric mean of *E. coli* should not exceed 126 CFU/100 mL; single samples should not exceed 394 CFU/100 mL (freshwater, contact recreation criteria).

[4] Geometric mean of *Enterococci* should not exceed 35 CFU/100 mL; single samples should not exceed 89 CFU/100 mL (saltwater, contact recreation criteria).

conditions throughout the runoff events. Most sample bacteria densities exceeded TSWQS (table 25). The TSWQS in table 25 apply to Oso Bay and Oso Creek and are not technically applicable to the study subwatersheds. Also, because runoff and associated bacteria densities represent relatively brief and infrequent conditions, the resulting effect on downstream receiving waters (Oso Bay and Oso Creek) is not known. However, the relatively large bacteria densities (compared to TSWQS) indicate that runoff from these subwatersheds is a potential source of bacteria to Oso Bay and Oso Creek.

Summary

During water years 2006–07 (October 2005–September 2007), the U.S. Geological Survey (USGS) in cooperation with the Texas State Soil and Water Conservation Board, Coastal Bend Bays and Estuaries Program (CBBEP), and Texas AgriLife Research and Extension Center at Corpus Christi, studied hydrologic conditions and quality of rainfall and storm runoff of two (primarily) agricultural areas (subwatersheds) of the Oso Creek watershed in Nueces County, Tex. One area, the upper West Oso Creek subwatershed, is 5,145 acres. The other area, a subwatershed drained by an unnamed Oso Creek tributary (hereinafter, Oso Creek tributary), is 5,287 acres.

Rainfall and runoff (streamflow) were continuously monitored at USGS stations at the outlets of the study subwatersheds during the 24-month study. Fourteen rainfall samples were collected and analyzed for nutrients and major inorganic ions. Nineteen composite runoff samples (10 West Oso Creek, nine Oso Creek tributary) were collected and analyzed for nutrients, major inorganic ions, and pesticides. Twenty-two discrete suspended-sediment samples (10 West Oso Creek, 12 Oso Creek tributary) were collected and analyzed, and 13 bacteria samples (eight West Oso Creek, five Oso Creek tributary) were collected and analyzed for fecal coliform, *Escherichia coli* (*E. coli)*, and *Enterococcus*. These rainfall, streamflow, and water-quality data were used to estimate loads of selected constituents entering the study subwatersheds in rainfall and exiting the subwatersheds in runoff. Data on applications of fertilizers to croplands in the study subwatersheds were compiled and compared with quantities of nutrients in rainfall deposition and runoff yields; and data on applications of pesticides were compiled and compared with quantities of pesticides in runoff yields.

For the study period, total rainfall was greater than average, although rainfall during water year 2006 was less than average and monthly rainfall was less than average during 15 of the 24 months. Runoff in the subwatersheds during water years 2006–07 corresponded to rainfall patterns, with periods of runoff interspersed between periods of no runoff. Most of the runoff at both subwatershed outlet sites occurred in response to a few specific storm periods. More than 75 percent of the runoff from each subwatershed occurred during two wet periods: September 18–October 1, 2006, and July 2–August 8, 2007. During both periods, multiple rainfall events and prolonged wet-soil conditions contributed to substantial runoff. The West Oso Creek subwatershed produced more runoff during the study period than the Oso Creek tributary subwatershed, 10.83 inches compared with 7.28 inches. Runoff response was quicker and peak flows were larger in the West Oso Creek subwatershed than in the Oso Creek tributary subwatershed.

Most of the nitrogen in rainfall is in the form of dissolved ammonia and dissolved nitrate, which were detected in all of the samples. Median concentrations of ammonia and nitrate were 0.16 and 0.10 mg/L, respectively. Organic forms of nitrogen were detected in all of the samples at relatively low concentrations; the median value of total organic nitrogen was 0.07 mg/L. Nitrite was detected in about one-half of the samples at low concentrations; the median concentration was 0.002 mg/L. Total phosphorus was detected in about one-half of the samples at relatively small concentrations; the median concentration was less than 0.008 mg/L.

Based on rainfall volumes on the study subwatersheds and sample concentrations, daily total nitrogen and total phosphorus deposition were computed for each subwatershed. The average (area-weighted) annual total nitrogen deposition for both subwatersheds over the 2-year study was 5.50 pounds per acre per year, compared with less than 0.07 pound per acre per year for total phosphorus.

Total nitrogen concentrations in runoff were greater at the West Oso Creek site than at the Oso Creek tributary site. Phosphorus and major inorganic ion concentrations were greater at the Oso Creek tributary site than at the West Oso Creek site. Wilcoxon rank-sum tests indicate that event-median concentrations of selected nutrient and major inorganic ions in runoff from the two subwatersheds are significantly different at the .05 level for each constituent except nitrite plus nitrate; and nitrite plus nitrate is significantly different at the .10 level.

Runoff loads and yields were computed for selected nutrients. Total nitrogen runoff yield for the 2-year study period averaged 2.61 pounds per acre per year from the West Oso Creek subwatershed and 0.966 pound per acre per year from the Oso Creek tributary subwatershed. Total phosphorus yields from the West Oso Creek and the Oso Creek tributary subwatersheds for the 2-year period were 0.776 and 0.498 pound per acre per year. Runoff yields of nitrogen and phosphorus were relatively small compared to inputs of nitrogen in fertilizer and rainfall deposition. Average annual runoff yield of total nitrogen (subwatersheds combined) represents about 2.4 percent of nitrogen applied as fertilizer and nitrogen entering the subwatersheds through rainfall deposition. Average annual runoff yield of total phosphorus (subwatersheds combined) represents about 4.4 percent of the phosphorus in applied fertilizer and rainfall deposition.

Suspended-sediment yields from the West Oso Creek subwatershed were more than twice those from the Oso Creek tributary subwatershed. The average suspended-sediment yield

from the West Oso Creek subwatershed was 582 pounds per acre per year. The average suspended-sediment yield from the Oso Creek tributary subwatershed was 257 pounds per acre per year.

Thirty pesticide compounds (22 herbicides and eight insecticides) were detected in runoff samples collected from the two subwatershed outlet sites. At the West Oso Creek site, 22 pesticides were detected (18 herbicides and four insecticides). At the Oso Creek tributary site, 23 pesticides were detected (17 herbicides and six insecticides). Seventeen pesticides were detected in only one sample at low concentrations (near the respective minimum laboratory reporting levels). Five herbicides were detected in all samples: atrazine, atrazine degradation byproducts 2-chloro-4-isopropylamino-6-amino-s-triazine (CIAT) and 2-hydroxy-4-isopropylamino-6-ethylamino-s-triazine (OIET), glyphosate, and glyphosate byproduct aminomethylphosphonic acid (AMPA). Herbicides 2, 4-D and pendimethalin were detected in more than 50 percent of the samples.

Runoff yields of the herbicides glyphosate, atrazine, and pendimethalin were greater for the West Oso Creek subwatershed than for the Oso Creek tributary subwatershed by roughly an order of magnitude. Of all pesticides detected in runoff, the highest runoff yields were for glyphosate, 0.013 pound per acre per year for the West Oso Creek subwatershed and 0.001 pound per acre per year for the Oso Creek tributary subwatershed. Comparison of applications and runoff yields indicates that, for 2006–07, about 0.8 percent of glyphosate applied to the West Oso Creek subwatershed croplands was detected in runoff. For the Oso Creek tributary subwatershed, about 0.07 percent of applied glyphosate was detected in runoff.

At both subwatershed outlet sites, most sample concentrations of fecal coliform, *E. coli*, and *Enterococci* were greater than Texas surface-water-quality standards for those bacteria established for the receiving waters of Oso Bay and Oso Creek. Because runoff and associated bacteria densities represent relatively brief and infrequent conditions, the resulting effect on Oso Bay and Oso Creek is not known. However, the relatively large bacteria densities (compared to Texas surface-water-quality standards) indicate that runoff from the study subwatersheds is a potential source of bacteria to Oso Bay and Oso Creek.

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Appendix 1—Quality Control and Assurance Data for Rainfall Samples

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Appendix 1. Quality control and assurance data for rainfall samples collected at Texas Agricultural Experiment Station near Corpus Christi, Texas (station 08211511); and for runoff samples collected at West Oso Creek (station 08211517) and an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07.

[unfltrd, unfiltered; µS/cm, microsiemens per centimeter at 25 degrees Celsius; fltrd, filtered; mg/L, milligrams per liter; E, estimated, <, less than; --, not analyzed; N, nitrogen; P, phosphorus; µg/L, micrograms per liter; CIAT, 2-chloro-4-isopropylamino-6-amino-s-triazine; CEAT, chloroethylamino-s-triazine; OIET, 2-hydroxy-4-isopropylamino-6-ethylamino-s-triazine; DCPA, dimethyl tetrachloroterephthalate; MCPA, 4-chloro-2-methylphenoxy acetic acid; MCPB, 4-(2-methyl-4-chlorophenoxy)butyric acid]

Date	Sample type	pH, water, unfltrd lab (standard units)	Specific conductance, unfltrd, lab (µS/cm)	Calcium water, fltrd (mg/L)	Magnesium, water, fltrd (mg/L)	Potassium, water, fltrd (mg/L)	Sodium, water, fltrd (mg/L)	Chloride, water, fltrd (mg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.								
Mar. 28, 2006	Blank	8.5	3	0.11	E0.005	E0.005	0.26	<0.01
Oct. 25, 2007	Blank	6.1	5	<.04	<.02	.006	<.12	<.01
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.								
Nov. 20, 2006	Blank	--	--	--	--	--	--	--
Oct. 25, 2007	Blank	5.8	5	<.04	<.02	.007	<.12	<.01
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.								
Mar. 28, 2006	Blank	9.5	14	<.04	.02	.03	<.12	<.01

Date	Sample type	Fluoride, water, fltrd (mg/L)	Silica, water, fltrd (mg/L)	Sulfate water, fltrd (mg/L)	Ammonia + organic-N, water, fltrd (mg/L as N)	Ammonia + organic-N, water, unfiltered (mg/L as N)	Ammonia water, fltrd (mg/L as N)	Nitrite + nitrate water filtered (mg/L as N)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.								
Mar. 28, 2006	Blank	0.03	--	<0.01	<0.10	<0.10	<0.01	<0.016
Oct. 25, 2007	Blank	<.01	<0.02	<.01	E .08	<.02	<.02	<.016
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.								
Nov. 20, 2006	Blank	--	--	--	--	--	--	--
Oct. 25, 2007	Blank	<.01	<.02	<.01	--	--	<.02	<.016
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.								
Mar. 28, 2006	Blank	.03	.03	<.01	--	--	<.01	<.016

Appendix 1. Quality control and assurance data for rainfall samples collected at Texas Agricultural Experiment Station near Corpus Christi, Texas (station 08211511); and for runoff samples collected at West Oso Creek (station 08211517) and an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07.

Date	Sample type	Nitrite water, fltrd (mg/L as N)	Organic nitrogen, water, fltrd (mg/L)	Organic nitrogen, water, unfltrd (mg/L)	Total nitrogen, water, fltrd (mg/L)	Total nitrogen, water, unfltrd (mg/L)	Ortho-phosphate, water, fltrd (mg/L as P)	Phosphorus, water, unfltrd (mg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.								
Mar. 28, 2006	Blank	<0.002	--	--	--	--	<0.006	<0.004
Oct. 25, 2007	Blank	<.002	--	--	--	--	<.006	<.008
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.								
Nov. 20, 2006	Blank	--	--	--	--	--	--	--
Oct. 25, 2007	Blank	<.002	--	--	--	--	<.006	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.								
Mar. 28, 2006	Blank	E .001	--	--	--	--	<.006	--

Date	Sample type	1-Naphthol, water, fltrd (µg/L)	2,4-D methyl-ester, water, fltrd (µg/L)	2,4-D, water, fltrd (µg/L)	2,4-DB, water, fltrd (µg/L)	2,6-Diethyl-aniline water, fltrd (µg/L)	2-Chloro-2,6-diethyl acetanilide water, fltrd (µg/L)	CIAT, water, fltrd (µg/L)	CEAT, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.									
Nov. 20, 2006	Blank	<0.09	<0.19	<0.04	<0.02	<0.006	<0.006	<0.014	<0.08
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--

Appendix 1. Quality control and assurance data for rainfall samples collected at Texas Agricultural Experiment Station near Corpus Christi, Texas (station 08211511); and for runoff samples collected at West Oso Creek (station 08211517) and an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Sample type	2-Ethyl-6-methyl-aniline water, fltrd (µg/L)	OIET, water, fltrd (µg/L)	3,4-Dichloro-aniline water, fltrd (µg/L)	3-Hydroxy carbofuran, water, fltrd (µg/L)	4-Chloro-2-methyl phenol, water, fltrd (µg/L)	Acetochlor, water, fltrd (µg/L)	Acifluorfen, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.								
Nov. 20, 2006	Blank	<0.010	<0.08	<0.004	<0.008	<0.005	<0.006	<0.06
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--

Date	Sample type	Alachlor, water, fltrd (µg/L)	Aldicarb sulfone water, fltrd (µg/L)	Aldicarb sulfoxide, water, fltrd (µg/L)	Aldicarb, water, fltrd (µg/L)	Atrazine, water, fltrd (µg/L)	Azinphos-methyl oxon, water, fltrd (µg/L)	Azinphos-methyl, water, fltrd (µg/L)	Bendiocarb, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.									
Nov. 20, 2006	Blank	<0.005	<0.08	<0.04	<0.04	<0.007	<0.04	<0.08	<0.04
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--

Appendix 1. Quality control and assurance data for rainfall samples collected at Texas Agricultural Experiment Station near Corpus Christi, Texas (station 08211511); and for runoff samples collected at West Oso Creek (station 08211517) and an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Sample type	Benfluralin, water, fltrd (µg/L)	Benomyl water, fltrd (µg/L)	Bensulfuron methyl, water, fltrd (µg/L)	Bentazon, water, fltrd (µg/L)	Bromacil, water, fltrd (µg/L)	Bromoxynil, water, fltrd (µg/L)	Carbaryl, water, fltrd (µg/L)	Carbofuran, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.									
Nov. 20, 2006	Blank	<0.01	<0.02	<0.06	<0.02	<0.04	<0.12	<0.02	<0.06
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--

Date	Sample type	Chloramben methyl ester, water, fltrd (µg/L)	Chlorimuron, water, fltrd (µg/L)	Chloro-di-amino-s-triazine, water, fltrd (µg/L)	Chlorpyrifos-oxon, water, fltrd (µg/L)	Chlorpyrifos water, fltrd (µg/L)	cis-Permethrin water fltrd (µg/L)	Clopyralid, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.								
Nov. 20, 2006	Blank	<0.10	<0.08	<0.12	<0.06	<0.005	<0.01	<0.06
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--

Appendix 1. Quality control and assurance data for rainfall samples collected at Texas Agricultural Experiment Station near Corpus Christi, Texas (station 08211511); and for runoff samples collected at West Oso Creek (station 08211517) and an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Sample type	Cycloate, water, fltrd (µg/L)	Cyfluthrin, water, fltrd (µg/L)	Cyper-methrin water, fltrd (µg/L)	Dacthal mono-acid, water, fltrd (µg/L)	DCPA, water, fltrd (µg/L)	Desulfinyl-fipronil, water, fltrd (µg/L)	Diazinon, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.								
Nov. 20, 2006	Blank	<0.06	<0.053	<0.046	<0.02	<0.003	<0.012	<0.005
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--

Date	Sample type	Dicamba water, fltrd (µg/L)	Dichlorprop, water, fltrd (µg/L)	Dicrotophos, water, fltrd (µg/L)	Dieldrin, water, fltrd (µg/L)	Dimethoate, water, fltrd (µg/L)	Dinoseb water, fltrd (µg/L)	Diphenamid, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.								
Nov. 11, 2006	Blank	<0.08	<0.04	<0.08	<0.009	<0.006	<0.04	<0.04
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--

Appendix 1. Quality control and assurance data for rainfall samples collected at Texas Agricultural Experiment Station near Corpus Christi, Texas (station 08211511); and for runoff samples collected at West Oso Creek (station 08211517) and an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Sample type	Diuron, water, fltrd (µg/L)	Ethion monoxon water, fltrd (µg/L)	Ethion, water, fltrd (µg/L)	Fenamiphos sulfone water, fltrd (µg/L)	Fenamiphos sulfoxide, water, fltrd (µg/L)	Fenamiphos, water, fltrd (µg/L)	Fenuron water, fltrd (µg/L)	Desulfinylfipronil amide, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.									
Nov. 11, 2006	Blank	<0.04	<0.021	<0.016	<0.053	<0.04	<0.03	<0.04	<0.029
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--

Date	Sample type	Fipronil sulfide water, fltrd (µg/L)	Fipronil sulfone water, fltrd (µg/L)	Fipronil, water, fltrd (µg/L)	Flumetsulam, water, fltrd (µg/L)	Fluometuron water, fltrd (µg/L)	Fonofos water, fltrd (µg/L)	Glufosinate, water, fltrd (µg/L)	Glyphosate, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.									
Nov. 11, 2006	Blank	<0.013	<0.024	<0.016	<0.06	<0.04	<0.006	<0.14	<0.15
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--

Appendix 1. Quality control and assurance data for rainfall samples collected at Texas Agricultural Experiment Station near Corpus Christi, Texas (station 08211511); and for runoff samples collected at West Oso Creek (station 08211517) and an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Sample type	Hexazinone, water, fltrd (µg/L)	Imazaquin, water, fltrd (µg/L)	Imazethapyr, water, fltrd (µg/L)	Imidacloprid water, fltrd (µg/L)	Iprodione, water, fltrd (µg/L)	Isofenphos, water, fltrd (µg/L)	Linuron water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.								
Nov. 11, 2006	Blank	<0.026	<0.04	<0.04	<0.06	<0.026	<0.011	<0.04
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--

Date	Sample type	Malaoxon, water, fltrd (µg/L)	Malathion, water, fltrd (µg/L)	MCPA, water, fltrd (µg/L)	MCPB, water, fltrd (µg/L)	Metalaxyl, water, fltrd (µg/L)	Methialthion water, fltrd (µg/L)	Methiocarb, water, fltrd (µg/L)	Methomyl, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.									
Nov. 11, 2006	Blank	<0.039	<0.016	<0.06	<0.2	<0.04	<0.007	<0.04	<0.06
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--

Appendix 1. Quality control and assurance data for rainfall samples collected at Texas Agricultural Experiment Station near Corpus Christi, Texas (station 08211511); and for runoff samples collected at West Oso Creek (station 08211517) and an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Sample type	Methyl paraoxon, water, fltrd (µg/L)	Methyl parathion, water, fltrd (µg/L)	Metolachlor, water, fltrd (µg/L)	Metribuzin, water, fltrd (µg/L)	Metsulfuron, water, fltrd (µg/L)	Myclobutanil water, fltrd (µg/L)	N-(4-Chloro-phenyl)-N'-methyl-urea (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.								
Nov. 11, 2006	Blank	<0.02	<0.008	<0.010	<0.012	<0.14	<0.033	<0.06
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--

Date	Sample type	Neburon water, fltrd (µg/L)	Nicosul-furon, water, fltrd (µg/L)	Norflurazon, water, fltrd (µg/L)	Oryzalin, water, fltrd (µg/L)	Oxamyl, water, fltrd (µg/L)	Pendi-methalin, water, fltrd (µg/L)	Phorate oxon, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.								
Nov. 11, 2006	Blank	<0.02	<0.10	<0.04	<0.04	<0.04	<0.02	<0.03
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--

Appendix 1. Quality control and assurance data for rainfall samples collected at Texas Agricultural Experiment Station near Corpus Christi, Texas (station 08211511); and for runoff samples collected at West Oso Creek (station 08211517) and an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Sample type	Phorate water, fltrd (µg/L)	Phosmet oxon, water, fltrd (µg/L)	Phosmet water, fltrd (µg/L)	Picloram, water, fltrd (µg/L)	Prometon, water, fltrd (µg/L)	Prometryn, water, fltrd (µg/L)	Propyz-amide, water, fltrd (µg/L)	Propham water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.									
Nov. 11, 2006	Blank	<0.02	<0.051	<0.008	<0.12	<0.01	<0.006	<0.004	<0.06
Oct. 25, 2007	--	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.									
Mar. 28, 2006	--	--	--	--	--	--	--	--	--

Date	Sample type	Propi-conazole, water, fltrd (µg/L)	Propoxur, water, fltrd (µg/L)	Siduron water, fltrd (µg/L)	Simazine, water, fltrd (µg/L)	Sulfomet-ruron, water, fltrd (µg/L)	Tebuthiuron water, fltrd (µg/L)	Terbacil, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.								
Nov. 11, 2006	Blank	<0.06	<0.04	<0.04	<0.006	<0.06	<0.02	<0.04
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--

Appendix 1. Quality control and assurance data for rainfall samples collected at Texas Agricultural Experiment Station near Corpus Christi, Texas (station 08211511); and for runoff samples collected at West Oso Creek (station 08211517) and an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Sample type	Terbufos oxon sulfone water, fltrd (µg/L)	Terbufos, water, fltrd (µg/L)	Terbuthyl-azine, water, fltrd (µg/L)	Tribuphos, water, fltrd (µg/L)	Triclopyr, water, fltrd (µg/L)	Trifluralin, water, fltrd (µg/L)	Dichlorvos, water, fltrd (µg/L)
Station 08211511—Texas Agricultural Experiment Station near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211517—West Oso Creek at Merrett Road near Corpus Christi, Tex.								
Nov. 11, 2006	Blank	<0.045	<0.012	<0.009	<0.035	<0.04	<0.009	<0.013
Oct. 25, 2007	--	--	--	--	--	--	--	--
Station 08211525—Unnamed Oso Creek tributary at Farm Road 2444 near Corpus Christi, Tex.								
Mar. 28, 2006	--	--	--	--	--	--	--	--

Appendix 2—Water-Quality Data for Runoff Samples Collected at West Oso Creek

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Appendix 2. Water-quality data for runoff samples collected at West Oso Creek (station 08211517), Nueces County, Texas, water years 2006–07.

[unfltrd, unfiltered; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; fltrd, filtered; --, not analyzed; N, nitrogen; <, less than; P, phosphorus; µg/L, micrograms per liter; CIAT, 2-chloro-4-isopropylamino-6-amino-s-triazine; E, estimated; CEAT, chloroethylamino-s-triazine; OIET, 2-hydroxy-4-isopropylamino-6-ethylamino-s-triazine; DCPA, dimethyl tetrachloroterephthalate; MCPA, 4-chloro-2-methylphenoxy acetic acid; MCPB, 4-(2-methyl-4-chlorophenoxy)butyric acid]

Date	pH, water, unfltrd field (standard units)	pH, water, unfltrd lab (standard units)	Specific conductance, unfltrd, lab (µS/cm)	Specific conductance, unfltrd, field (µS/cm)	Hardness, water, (mg/L as $CaCO_3$)	Calcium water, fltrd (mg/L)	Magnesium, water, fltrd (mg/L)	Potassium, water, fltrd (mg/L)
June 1–2, 2006	6.6	7.7	88	89	29	10.4	0.821	3.48
July 1–2, 2006	6.8	8.0	147	149	51	18.4	1.34	4.07
July 6, 2006	7.5	8.0	135	130	49	17.6	1.33	4.15
Sept. 9–10, 2006	7.4	8.3	124	122	38	13.5	.958	3.24
Sept. 18–19, 2006	7.2	8.0	139	130	50	17.8	1.38	6.57
Jan. 3–5, 2007	7.0	8.3	125	142	40	14.2	1.16	3.86
Jan. 24–25, 2007	6.8	7.6	136	141	45	15.7	1.49	4.24
Mar. 14–15, 2007	8.2	8.0	127	104	--	--	--	--
May 25, 2007	7.3	8.3	98	85	30	10.7	.807	3.60
July 2–3, 2007	6.7	7.3	86	77	26	8.91	1.20	6.74

Date	Sodium, water, fltrd (mg/L)	Chloride, water, fltrd (mg/L)	Fluoride, water, fltrd (mg/L)	Silica, water, fltrd (mg/L)	Sulfate water, fltrd (mg/L)	Ammonia + organic-N, water, fltrd (mg/L as N)	Ammonia + organic-N, water, unfiltered (mg/L as N)	Ammonia water, fltrd (mg/L)	Ammonia water, fltrd (mg/L as N)
June 1–2, 2006	2.33	1.17	0.1	6.4	0.9	0.42	1.2	0.02	0.017
July 1–2, 2006	7.38	1.58	.4	15.4	2.2	.49	2.1	.03	.027
July 6, 2006	5.82	1.61	.3	13.6	1.6	.75	2.4	.04	.032
Sept. 9–10, 2006	6.65	1.54	.5	11.2	1.5	2.7	3.3	.16	.121
Sept. 18–19, 2006	4.23	2.72	.2	10.9	1.3	.47	1.4	.05	.039
Jan. 3–5, 2007	6.33	2.24	.27	8.4	2.64	.56	2.3	.29	.228
Jan. 24–25, 2007	7.80	3.11	.20	8.1	3.65	.47	1.3	.05	.041
Mar. 14–15, 2007	--	--	--	--	--	.65	4.3	.26	.200
May 25, 2007	2.87	.97	.19	8.2	1.39	.55	2.8	.19	.148
July 2–3, 2007	1.81	1.52	.13	8.6	.93	.46	.75	--	<.020

Appendix 2. Water-quality data for runoff samples collected at West Oso Creek (station 08211517), Nueces County, Texas, water years 2006–07—Continued.

Date	Nitrate water, filtered, (mg/L as N)	Nitrite + nitrate water filtered, (mg/L as N)	Nitrite water, fltrd, (mg/L as N)	Organic nitrogen, water, fltrd (mg/L)	Organic nitrogen, water, unfltrd (mg/L)	Total nitrogen, water, fltrd (mg/L)	Total nitrogen, water, unfltrd (mg/L)	Ortho-phosphate, water, fltrd (mg/L)	Ortho-phosphate, water, fltrd (mg/L as P)
June 1–2, 2006	0.23	0.25	0.017	0.41	1.2	0.67	1.5	0.511	0.167
July 1–2, 2006	.44	.49	.049	.47	2.1	.98	2.6	.661	.216
July 6, 2006	.36	.38	.026	.72	2.3	1.1	2.8	.808	.264
Sept. 9–10, 2006	.65	.71	.058	2.6	3.2	3.4	4.0	.487	.159
Sept. 18–19, 2006	.49	.51	.017	.43	1.4	.97	1.9	.769	.251
Jan. 3–5, 2007	2.01	2.19	.178	.33	2.1	2.7	4.5	.950	.310
Jan. 24–25, 2007	3.13	3.26	.123	.43	1.3	3.7	4.6	.772	.252
Mar. 14–15, 2007	.72	.78	.057	.45	4.2	1.4	5.1	1.07	.350
May 25, 2007	.73	.77	.042	.40	2.6	1.3	3.5	1.05	.342
July 2–3, 2007	.21	.22	.008	.44	.73	.68	.98	1.42	.463

Date	Phosphorus, water, fltrd (mg/L)	Phosphorus, water, unfltrd (mg/L)	1-Naphthol, water, fltrd (µg/L)	2,4-D methylester, water, fltrd (µg/L)	2,4-D, water, fltrd (µg/L)	2,4-DB, water, fltrd (µg/L)	2,6-Diethyl-aniline water, fltrd (µg/L)	2-Chloro-2′,6′-diethyl acetanilide water, fltrd (µg/L)	CIAT, water, fltrd (µg/L)
June 1–2, 2006	0.189	0.47	<0.09	<0.190	E0.06	<0.02	<0.006	<0.006	E0.112
July 1–2, 2006	.25	.80	<.09	<.638	E6.24	<.02	<.006	<.006	E.048
July 6, 2006	.28	.66	<.09	<.190	E3.35	<.02	<.006	<.006	E.030
Sept. 9–10, 2006	.27	.75	<.09	<.190	<.04	<.02	<.006	<.006	E.109
Sept. 18–19, 2006	.27	.57	<.09	<.190	.59	<.02	<.006	<.006	E.029
Jan. 3–5, 2007	.35	.78	<.09	<.200	E.12	<.02	<.006	<.006	E.015
Jan. 24–25, 2007	.257	.52	<.09	<.200	.16	<.02	<.006	<.006	E.020
Mar. 14–15, 2007	.367	1.52	<.09	<.200	.04	<.02	<.006	<.006	E.021
May 25, 2007	.40	1.00	<.09	<.200	<.04	<.02	<.006	<.006	E.049
July 2–3, 2007	.49	.59	<.09	<.200	<.04	<.02	<.006	<.006	E.179

Appendix 2. Water-quality data for runoff samples collected at West Oso Creek (station 08211517), Nueces County, Texas, water years 2006–07—Continued.

Date	CEAT, water, fltrd (µg/L)	2-Ethyl-6-methyl-aniline water, fltrd (µg/L)	OIET, water, fltrd, (µg/L)	3,4-Di-chloro-aniline water, fltrd (µg/L)	3-Hydroxy carbofuran, water, fltrd (µg/L)	4-Chloro-2-methyl phenol, water, fltrd (µg/L)	Acetochlor, water, fltrd (µg/L)	Acifluorfen, water, fltrd (µg/L)	Alachlor, water, fltrd (µg/L)
June 1–2, 2006	<0.08	<0.010	0.242	<0.004	<0.008	<0.005	<0.006	<0.028	<0.005
July 1–2, 2006	<.08	<.010	.100	<.004	<.008	<.005	<.006	<.028	<.005
July 6, 2006	<.08	<.010	.111	<.004	<.008	<.005	<.006	<.028	<.005
Sept. 9–10, 2006	E.04	<.010	E.302	<.004	<.008	<.005	<.006	<.028	<.005
Sept. 18–19, 2006	<.08	<.010	.106	<.004	<.008	<.005	<.006	<.028	<.005
Jan. 3–5, 2007	<.08	<.010	E.063	<.004	<.020	<.005	<.006	<.006	<.005
Jan. 24–25, 2007	<.08	<.010	E.065	<.004	<.020	<.005	<.006	<.006	<.005
Mar. 14–15, 2007	<.08	<.010	.105	<.004	<.020	<.005	<.006	<.006	<.005
May 25, 2007	<.08	<.010	.149	<.006	<.020	<.005	<.006	<.006	<.005
July 2–3, 2007	E.07	<.010	.529	<.004	<.020	<.005	<.006	<.006	<.005

Date	Aldicarb sulfone water, fltrd (µg/L)	Aldicarb sulfoxide, water, fltrd (µg/L)	Aldicarb, water, fltrd (µg/L)	Amino-methyl-phosphonic acid, water, fltrd (µg/L)	Atrazine, water, fltrd (µg/L)	Azinphos-methyl oxon, water, fltrd (µg/L)	Azinphos-methyl, water, fltrd (µg/L)	Bendio-carb, water, fltrd (µg/L)	Benfluralin, water, fltrd (µg/L)
June 1–2, 2006	<0.02	<0.100	<0.15	1.34	0.996	<0.04	<0.050	<0.08	<0.010
July 1–2, 2006	<.02	<.100	<.15	13.2	.097	<.04	<.050	<.08	<.010
July 6, 2006	<.02	<.100	<.15	4.69	.053	<.04	<.050	<.08	<.010
Sept. 9–10, 2006	<.02	<.100	<.15	10.3	.192	<.04	<.050	<.08	<.010
Sept. 18–19, 2006	<.02	<.100	<.15	1.13	.030	<.04	<.050	<.08	<.010
Jan. 3–5, 2007	<.08	<.040	<.04	2.50	.022	<.04	<.080	<.04	E.007
Jan. 24–25, 2007	<.08	<.040	<.04	1.33	.056	<.04	<.080	<.04	<.010
Mar. 14–15, 2007	<.08	<.040	<.04	1.60	.252	<.04	<.080	<.04	<.010
May 25, 2007	<.08	<.040	<.04	10.1	.144	<.04	<.080	<.04	<.010
July 2–3, 2007	<.08	<.040	<.04	8.20	8.90	<.04	<.080	<.04	<.010

Appendix 2. Water-quality data for runoff samples collected at West Oso Creek (station 08211517), Nueces County, Texas, water years 2006–07—Continued.

Date	Benomyl water, fltrd (µg/L)	Bensulfuron methyl, water, fltrd (µg/L)	Bentazon, water, fltrd (µg/L)	Bromacil, water, fltrd (µg/L)	Bromoxynil, water, fltrd (µg/L)	Carbaryl, water, fltrd (µg/L)	Carbofuran, water, fltrd (µg/L)	Chloramben methyl ester, water, fltrd (µg/L)
June 1–2, 2006	<0.022	<0.02	<0.02	<0.02	<0.04	<0.02	<0.016	<0.02
July 1–2, 2006	<.022	<.02	<.02	<.02	<.04	<.02	<.016	<.02
July 6, 2006	<.022	<.02	<.02	<.02	<.04	<.02	<.016	<.02
Sept. 9–10, 2006	<.022	<.02	<.02	<.02	<.04	<.02	<.016	<.02
Sept. 18–19, 2006	<.022	<.02	<.02	<.02	<.04	<.02	<.016	<.02
Jan. 3–5, 2007	<.020	<.06	<.02	<.04	<.12	<.02	<.060	<.10
Jan. 24–25, 2007	<.020	<.06	<.02	<.04	<.12	<.02	<.060	<.10
Mar. 14–15, 2007	<.020	<.06	<.02	<.04	<.12	<.02	<.060	<.10
May 25, 2007	<.020	<.06	<.02	<.04	<.12	<.02	<.060	<.10
July 2–3, 2007	<.020	<.06	<.02	<.04	<.12	<.02	<.060	<.10

Date	Chlori-muron, water, fltrd (µg/L)	Chloro-di-amino-s-triazine, water, fltrd (µg/L)	Chlor-pyrifos-oxon, water, fltrd (µg/L)	Chlorpyri-fos water, fltrd (µg/L)	cis-Permethrin water fltrd (µg/L)	Clopyralid, water, fltrd (µg/L)	Cycloate, water, fltrd (µg/L)	Cyfluthrin, water, fltrd (µg/L)	Cyper-methrin water, fltrd (µg/L)
June 1–2, 2006	<0.032	<0.04	<0.06	<0.006	<0.006	<0.07	<0.01	<0.053	<0.046
July 1–2, 2006	<.032	<.04	<.06	<.005	<.006	<.07	<.01	<.053	<.046
July 6, 2006	<.032	<.04	<.06	<.005	<.006	<.07	<.01	<.053	<.046
Sept. 9–10, 2006	<.032	<.04	<.06	<.005	<.006	<.07	<.01	<.053	<.046
Sept. 18–19, 2006	<.032	<.04	<.06	<.005	<.006	<.07	<.01	<.053	<.046
Jan. 3-5, 2007	<.080	<.12	<.06	<.005	<.010	<.06	<.06	<.053	<.046
Jan. 24–25, 2007	<.080	<.12	<.06	<.005	<.010	<.06	<.06	<.053	<.046
Mar. 14–15, 2007	<.080	<.12	<.06	<.005	<.010	<.06	<.06	<.053	<.046
May 25, 2007	<.080	<.12	<.06	<.011	<.010	<.06	<.06	<.053	<.046
July 2–3, 2007	<.080	<.12	<.06	<.005	<.010	<.06	<.06	<.053	<.046

Appendix 2. Water-quality data for runoff samples collected at West Oso Creek (station 08211517), Nueces County, Texas, water years 2006–07—Continued.

Date	Dacthal mono-acid, water, fltrd (µg/L)	DCPA, water, fltrd (µg/L)	Desulfinyl-fipronil, water, fltrd (µg/L)	Diazinon, water, fltrd (µg/L)	Dicamba water, fltrd (µg/L)	Dichlorprop, water, fltrd (µg/L)	Dicrotophos, water, fltrd (µg/L)	Dieldrin, water, fltrd (µg/L)	Dimethoate, water, fltrd (µg/L)
June 1–2, 2006	<0.03	<0.003	<0.012	<0.005	<0.04	<0.03	<0.08	<0.009	<0.006
July 1–2, 2006	<.03	<.003	<.012	<.005	<.04	<.03	<.08	<.009	<.006
July 6, 2006	<.03	<.003	<.012	<.005	<.04	<.03	<.08	<.009	<.006
Sept. 9–10, 2006	<.03	<.003	<.012	<.005	<.04	<.03	<.08	<.009	<.006
Sept. 18–19, 2006	<.03	<.004	<.012	<.005	<.04	<.03	<.08	<.009	<.006
Jan. 3–5, 2007	<.02	<.003	<.012	<.005	<.08	<.04	<.08	<.009	<.006
Jan. 24–25, 2007	<.02	<.003	<.012	<.005	<.08	<.04	<.08	<.009	<.006
Mar. 14–15, 2007	<.02	E.004	<.012	<.005	<.08	<.04	<.08	<.009	<.006
May 25, 2007	<.02	<.003	<.012	<.005	<.08	<.04	<.08	<.009	<.006
July 2–3, 2007	<.02	<.003	<.012	<.005	<.08	<.04	E.04	<.009	<.006

Date	Dinoseb water, fltrd (µg/L)	Diphenamid, water, fltrd (µg/L)	Diuron, water, fltrd (µg/L)	Ethion monoxon water, fltrd (µg/L)	Ethion, water, fltrd (µg/L)	Fenamiphos sulfone water, fltrd (µg/L)	Fenamiphos sulfoxide, water, fltrd (µg/L)	Fenamiphos, water, fltrd (µg/L)	Fenuron water, fltrd (µg/L)
June 1–2, 2006	<0.04	<0.01	<0.02	<0.02	<0.016	<0.053	<0.04	<0.03	<0.10
July 1–2, 2006	<.04	<.01	<.02	<.02	<.016	<.053	<.04	<.03	<.10
July 6, 2006	<.04	<.01	<.02	<.02	<.016	<.053	<.04	<.03	<.10
Sept. 9–10, 2006	<.04	<.01	<.02	<.02	<.016	<.053	<.04	<.03	<.10
Sept. 18–19, 2006	<.04	<.01	<.02	<.02	<.016	<.053	<.04	<.03	<.10
Jan. 3–5, 2007	<.04	<.04	<.04	<.02	<.016	<.053	<.04	<.03	<.04
Jan. 24–25, 2007	<.04	<.04	<.04	<.02	<.016	<.053	<.04	<.03	<.04
Mar. 14–15, 2007	<.04	<.04	E.04	<.02	<.016	<.053	<.04	<.03	<.04
May 25, 2007	<.04	<.04	<.04	<.02	<.016	<.053	<.04	<.03	<.04
July 2–3, 2007	<.04	<.04	<.04	<.02	<.016	<.053	<.04	<.03	<.04

Appendix 2. Water-quality data for runoff samples collected at West Oso Creek (station 08211517), Nueces County, Texas, water years 2006–07—Continued.

Date	Desulfinyl-fipronil amide, water, fltrd (µg/L)	Fipronil sulfide water, fltrd (µg/L)	Fipronil sulfone water, fltrd (µg/L)	Fipronil, water, fltrd (µg/L)	Flumetsulam, water, fltrd (µg/L)	Fluo-meturon water, fltrd (µg/L)	Fonofos water, fltrd (µg/L)	Glufosinate, water, fltrd (µg/L)	Glyphosate, water, fltrd (µg/L)
June 1–2, 2006	<0.029	<0.013	<0.024	<0.016	<0.04	<0.02	<0.005	<0.140	1.81
July 1–2, 2006	<.029	<.013	<.024	<.016	<.04	<.02	<.005	<.140	51.2
July 6, 2006	<.029	<.013	<.024	<.016	<.04	<.02	<.005	<.140	11.8
Sept. 9–10, 2006	<.029	<.013	<.024	<.016	<.04	<.02	<.005	<.140	30.3
Sept. 18–19, 2006	<.029	<.013	<.024	<.016	<.04	<.02	<.005	<.140	2.00
Jan. 3–5, 2007	<.029	<.016	<.024	<.016	<.06	<.04	<.006	<.140	5.10
Jan. 24–25, 2007	<.029	<.016	<.024	<.016	<.06	<.04	<.006	<.140	2.10
Mar. 14–15, 2007	<.029	<.016	<.024	<.016	<.06	<.04	<.006	<.140	E5.22
May 25, 2007	<.029	<.016	<.024	<.016	<.06	<.04	<.006	.580	53.5
July 2–3, 2007	<.029	<.016	<.024	<.016	<.06	<.04	<.006	<.140	E12.6

Date	Hexazinone, water, fltrd (µg/L)	Imazaquin, water, fltrd (µg/L)	Imazethapyr, water, fltrd (µg/L)	Imidacloprid water, fltrd (µg/L)	Iprodione, water, fltrd (µg/L)	Isofenphos, water, fltrd (µg/L)	Linuron water, fltrd (µg/L)	Malaoxon, water, fltrd (µg/L)	Malathion, water, fltrd (µg/L)
June 1–2, 2006	<0.026	<0.04	<0.04	<0.020	<0.026	<0.011	<0.01	<0.039	<0.027
July 1–2, 2006	<.026	<.04	<.04	<.020	<.026	<.011	<.01	<.039	<.027
July 6, 2006	<.026	<.04	<.04	<.020	<.026	<.011	<.01	<.039	<.027
Sept. 9–10, 2006	<.026	<.04	<.04	<.020	<.026	<.011	<.01	<.039	<.027
Sept. 18–19, 2006	<.026	<.04	<.04	<.020	<.026	<.011	<.01	<.039	<.027
Jan. 3–5, 2007	<.026	<.04	<.04	<.060	<.026	<.011	<.04	<.039	<.016
Jan. 24–25, 2007	<.026	<.04	<.04	<.060	<.026	<.011	<.04	<.039	<.016
Mar. 14–15, 2007	<.026	<.04	<.04	.086	<.026	<.011	<.04	<.039	<.016
May 25, 2007	<.026	<.04	<.04	<.078	<.026	<.011	<.04	<.039	<.016
July 2–3, 2007	<.026	<.04	<.04	<.060	<.026	<.011	<.04	<.039	<.016

Appendix 2. Water-quality data for runoff samples collected at West Oso Creek (station 08211517), Nueces County, Texas, water years 2006–07—Continued.

Date	MCPA, water, fltrd (µg/L)	MCPB, water, fltrd (µg/L)	Metalaxyl, water, fltrd (µg/L)	Methialthion water, fltrd (µg/L)	Methiocarb, water, fltrd (µg/L)	Methomyl, water, fltrd (µg/L)	Methyl paraoxon, water, fltrd (µg/L)	Methyl parathion, water, fltrd (µg/L)	Metolachlor, water, fltrd (µg/L)
June 1–2, 2006	<0.07	<0.10	<0.065	<0.009	<0.034	<0.070	<0.02	<0.015	<0.006
July 1–2, 2006	<.07	<.10	<.007	<.009	<.034	<.070	<.02	<.015	<.006
July 6, 2006	<.07	<.10	<.007	<.009	<.034	<.070	<.02	<.015	<.006
Sept. 9–10, 2006	<.07	<.10	<.007	<.009	<.034	<.070	<.02	<.015	<.006
Sept. 18–19, 2006	<.07	<.10	<.007	<.009	<.034	<.070	<.02	<.015	<.006
Jan. 3–5, 2007	<.06	<.20	<.007	<.009	<.040	<.060	<.02	<.008	<.010
Jan. 24–25, 2007	<.06	<.20	<.007	<.009	<.040	<.060	<.02	<.008	.228
Mar. 14–15, 2007	<.06	<.20	<.011	<.009	<.040	<.060	<.02	<.008	.082
May 25, 2007	<.06	<.20	<.007	<.009	<.040	<.060	<.02	<.008	<.013
July 2–3, 2007	<.06	<.20	<.007	<.009	<.040	<.060	<.02	<.008	E.008

Date	Metribuzin, water, fltrd (µg/L)	Metsulfuron, water, fltrd (µg/L)	Myclobutanil water, fltrd (µg/L)	N-(4-Chloro-phenyl)-N'-methyl-urea (µg/L)	Neburon water, fltrd (µg/L)	Nicosul-furon, water, fltrd (µg/L)	Norflurazon, water, fltrd (µg/L)	Oryzalin, water, fltrd (µg/L)	Oxamyl, water, fltrd (µg/L)
June 1–2, 2006	<0.028	<0.07	<0.033	<0.04	<0.01	<0.04	<0.02	<0.02	<0.05
July 1–2, 2006	<.028	<.07	<.033	<.04	<.01	<.04	<.02	<.02	<.05
July 6, 2006	<.028	<.07	<.033	<.04	<.01	<.04	<.02	<.02	<.05
Sept. 9–10, 2006	<.028	<.07	<.033	<.04	<.01	<.04	<.02	<.02	<.05
Sept. 18–19, 2006	<.028	<.07	<.033	<.04	<.01	<.04	<.02	<.02	<.05
Jan. 3–5, 2007	<.012	<.14	<.033	<.06	<.02	<.10	<.04	<.04	<.04
Jan. 24–25, 2007	<.012	<.14	<.033	<.06	<.02	<.10	<.04	<.04	<.04
Mar. 14–15, 2007	<.012	<.14	<.033	<.06	<.02	<.10	<.04	<.04	<.04
May 25, 2007	<.012	<.14	E.013	<.06	<.02	<.10	<.04	<.04	<.04
July 2–3, 2007	<.012	<.14	<.033	<.06	<.02	<.10	<.04	<.04	<.04

Appendix 2. Water-quality data for runoff samples collected at West Oso Creek (station 08211517), Nueces County, Texas, water years 2006–07—Continued.

Date	Pendimethalin, water, fltrd (µg/L)	Phorate oxon, water, fltrd (µg/L)	Phorate water, fltrd (µg/L)	Phosmet oxon, water, fltrd (µg/L)	Phosmet water, fltrd (µg/L)	Picloram, water, fltrd (µg/L)	Prometon, water, fltrd (µg/L)	Prometryn, water, fltrd (µg/L)	Propyzamide, water, fltrd (µg/L)
June 1–2, 2006	<0.022	<0.03	<0.055	<0.05	<0.008	<0.03	<0.01	<0.006	<0.004
July 1–2, 2006	<.022	<.03	<.055	--	--	<.03	<.01	<.006	<.004
July 6, 2006	2.66	<.03	<.055	--	--	<.03	<.01	<.006	<.004
Sept. 9–10, 2006	13.7	<.03	<.055	<.05	<.008	<.03	<.01	<.006	<.004
Sept. 18–19, 2006	.210	<.03	<.055	<.05	<.008	<.03	<.01	<.006	<.004
Jan. 3–5, 2007	6.53	<.03	<.020	<.05	<.008	<.12	<.01	<.006	<.004
Jan. 24–25, 2007	2.14	<.03	<.020	<.05	<.008	<.12	<.01	<.006	<.004
Mar. 14–15, 2007	<.020	<.03	<.020	<.05	<.008	<.12	<.01	<.006	<.004
May 25, 2007	2.46	<.03	<.020	<.05	<.008	<.12	<.01	<.006	<.004
July 2–3, 2007	.100	<.03	<.020	<.05	<.008	<.12	<.01	<.006	<.004

Date	Propham water, fltrd (µg/L)	Propiconazole, water, fltrd (µg/L)	Propoxur, water, fltrd (µg/L)	Siduron water, fltrd (µg/L)	Simazine, water, fltrd (µg/L)	Sulfometruron, water, fltrd (µg/L)	Tebuthiuron water, fltrd (µg/L)	Terbacil, water, fltrd (µg/L)	Terbufos oxon sulfone water, fltrd (µg/L)
June 1–2, 2006	<0.030	<0.01	<0.008	<0.02	0.009	<0.090	<0.02	<0.026	<0.04
July 1–2, 2006	<.030	<.01	<.008	<.02	<.005	<.090	<.02	<.026	<.04
July 6, 2006	<.030	<.01	<.008	<.02	<.005	<.090	<.02	<.026	<.04
Sept. 9–10, 2006	<.030	<.01	<.008	<.02	<.010	<.090	<.02	<.026	<.04
Sept. 18–19, 2006	<.030	<.01	<.008	<.02	<.005	<.090	<.02	<.026	<.04
Jan. 3–5, 2007	<.060	<.06	<.040	<.04	<.006	<.060	<.02	<.040	<.04
Jan. 24–25, 2007	<.060	<.06	<.040	<.04	<.006	<.060	<.02	<.040	<.04
Mar. 14–15, 2007	<.060	<.06	<.040	<.04	E.006	<.060	<.02	<.040	<.04
May 25, 2007	<.060	<.06	<.040	<.04	<.006	<.060	<.02	<.040	<.04
July 2–3, 2007	<.060	<.06	<.040	<.04	.022	<.060	<.02	<.040	<.04

Appendix 2. Water-quality data for runoff samples collected at West Oso Creek (station 08211517), Nueces County, Texas, water years 2006–07—Continued.

Date	Terbufos, water, fltrd (µg/L)	Terbuthyl-azine, water, fltrd (µg/L)	Tribuphos, water, fltrd (µg/L)	Triclopyr, water, fltrd (µg/L)	Trifluralin, water, fltrd (µg/L)	Dichlorvos, water, fltrd (µg/L)
June 1–2, 2006	<0.02	<0.01	<0.035	<0.03	<0.009	<0.01
July 1–2, 2006	<.02	<.01	<.035	<.03	<.009	<.01
July 6, 2006	<.02	<.01	<.035	<.03	.028	<.01
Sept. 9–10, 2006	<.02	<.01	<.035	<.03	<.012	<.01
Sept. 18–19, 2006	<.02	<.01	<.035	<.03	<.009	<.01
Jan. 3–5, 2007	<.01	<.01	<.035	<.04	<.009	<.01
Jan. 24–25, 2007	<.01	<.01	<.035	<.04	<.009	<.01
Mar. 14–15, 2007	<.01	<.01	<.035	<.04	.020	<.01
May 25, 2007	<.01	<.01	<.035	<.04	E.050	<.01
July 2–3, 2007	<.01	<.01	<.035	<.04	<.009	<.01

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Appendix 3—Water-Quality Data for Runoff Samples Collected at an Unnamed Oso Creek Tributary

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Appendix 3. Water-quality data for runoff samples collected at an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07.

[unfltrd, unfiltered; µS/cm, microsiemens per centimeter at 25 degrees Celsius; mg/L, milligrams per liter; $CaCO_3$, calcium carbonate; fltrd, filtered; --, not analyzed; N, nitrogen; E, estimated; <, less than; P, phosphorus; µg/L, micrograms per liter; CIAT, 2-chloro-4-isopropylamino-6-amino-s-triazine; CEAT, chloroethylamino-s-triazine; OIET, 2-hydroxy-4-isopropylamino-6-ethylamino-s-triazine; DCPA, dimethyl tetrachloroterephthalate; MCPA, 4-chloro-2-methylphenoxy acetic acid; MCPB, 4-(2-methyl-4-chlorophenoxy)butyric acid]

Date	pH, water, unfltrd, field (standard units)	pH, water, unfltrd, lab (standard units)	Specific conductance, unfltrd, lab (µS/cm)	Specific conductance, unfltrd, field (µS/cm)	Hardness, water, (mg/L as $CaCO_3$)	Calcium water, fltrd (mg/L)	Magnesium, water, fltrd (mg/L)	Potassium, water, fltrd (mg/L)
June 1–2, 2006	6.9	7.4	156	152	48	16.4	1.74	7.64
July 6–7, 2006	7.1	7.4	178	175	60	20.2	2.37	8.31
Sept. 9–15, 2006	6.7	7.6	153	154	55	18.9	1.85	7.67
Sept. 18–19, 2006	6.9	7.4	111	120	41	14.0	1.35	4.82
Jan. 3–4, 2007	6.5	8.0	215	220	56	19.1	2.09	5.83
Jan. 24–25, 2007	6.8	7.5	196	203	57	19.1	2.22	5.26
Mar. 14–15, 2007	8.2	7.8	256	246	--	--	--	--
July 3–4, 2007	6.5	6.4	153	144	30	13.5	1.66	8.35
Aug. 30–31, 2007	7.0	7.3	198	192	26	17.7	2.18	9.32

Date	Sodium, water, fltrd (mg/L)	Chloride, water, fltrd (mg/L)	Fluoride, water, fltrd (mg/L)	Silica, water, fltrd (mg/L)	Sulfate water, fltrd (mg/L)	Ammonia + organic-N, water, fltrd (mg/L as N)	Ammonia + organic-N, water, unfiltered (mg/L as N	Ammonia water, fltrd (mg/L)	Ammonia water, fltrd (mg/L as N)
June 1–2, 2006	7.26	5.99	0.15	15.4	4.28	0.67	1.5	0.03	0.026
July 6–7, 2006	9.16	6.58	.20	22.8	4.88	.55	1.2	.02	.012
Sept. 9–15, 2006	6.15	3.20	.15	19.9	2.13	1.2	.92	.04	.028
Sept. 18–19, 2006	3.46	1.97	.13	11.0	1.30	.66	.89	.03	.021
Jan. 3–4, 2007	14.7	19.5	.12	11.0	12.8	.43	1.4	.03	.024
Jan. 24–25, 2007	15.7	17.2	.14	12.4	11.0	.48	.99	.03	.021
Mar. 14–15, 2007	--	--	--	--	--	1.1	2.5	.22	.171
July 3–4, 2007	9.75	11.0	.10	16.0	6.23	.64	.97	.19	E.013
Aug. 30–31, 2007	13.1	21.6	E.10	18.3	7.63	.71	1.1	--	<.020

Appendix 3. Water-quality data for runoff samples collected at an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Nitrate water, filtered (mg/L as N)	Nitrite + nitrate water filtered (mg/L as N)	Nitrite water, fltrd (mg/L as N)	Organic nitrogen, water, fltrd (mg/L)	Organic nitrogen, water, unfltrd (mg/L)	Total nitrogen, water, fltrd (mg/L)	Total nitrogen, water, unfltrd (mg/L)	Ortho-phosphate, water, fltrd (mg/L)	Ortho-phosphate, water, fltrd (mg/L as P)
June 1–2, 2006	0.22	0.27	0.058	0.64	1.5	0.94	1.8	1.94	0.663
July 6–7, 2006	--	<.06	.002	.54	1.1	--	--	1.61	.525
Sept. 9–15, 2006	.18	.20	.016	1.2	.89	1.4	1.1	1.32	.429
Sept. 18–19, 2006	.19	.20	.005	.63	.87	.85	1.1	.702	.229
Jan. 3–4, 2007	.49	.50	.015	.40	1.3	.93	1.9	1.01	.331
Jan. 24–25, 2007	.80	.81	.014	.46	.97	1.3	1.8	.846	.276
Mar. 14–15, 2007	.86	1.0	.144	.92	2.4	2.1	3.5	1.12	.366
July 3–4, 2007	.12	.13	.008	.40	.96	.77	1.1	1.71	.557
Aug. 30–31, 2007	.16	.17	.009	.70	1.1	.88	1.2	.995	.311

Date	Phosphorus, water, fltrd (mg/L)	Phosphorus, water, unfltrd (mg/L)	1-Naphthol, water, fltrd (µg/L)	2,4-D methylester, water, fltrd (µg/L)	2,4-D, water, fltrd (µg/L)	2,4-DB, water, fltrd (µg/L)	2,6-Diethyl-aniline water, fltrd (µg/L)	2-Chloro-2′,6′-diethyl acetanilide water, fltrd (µg/L)	CIAT, water, fltrd (µg/L)
June 1–2, 2006	0.69	0.98	<0.09	<0.190	<0.04	<0.02	<0.006	<0.006	E0.184
July 6–7, 2006	.55	.74	<.09	<.190	.27	<.02	<.006	<.006	E.089
Sept. 9–15, 2006	.53	.61	<.09	<.190	E.03	<.02	<.006	<.006	E.029
Sept. 18–19, 2006	.26	.45	<.09	<.190	E.01	<.02	<.006	<.006	E.021
Jan. 3–4, 2007	.38	.61	<.09	<.200	E.06	<.02	<.006	<.006	E.011
Jan. 24–25, 2007	.30	.43	<.09	<.200	.09	<.02	<.006	<.006	E.009
Mar. 14–15, 2007	.42	.98	<.09	.208	E1.23	<.02	<.006	<.006	E.119
July 3–4, 2007	.59	.66	<.09	<.200	<.04	<.02	<.006	<.006	E.049
Aug. 30–31, 2007	.33	.41	<.09	<.200	<.04	<.02	<.006	<.006	E.014

Appendix 3. Water-quality data for runoff samples collected at an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	CEAT, water, fltrd (µg/L)	2-Ethyl-6-methyl-aniline water, fltrd (µg/L)	OIET, water, fltrd (µg/L)	3,4-Di-chloro-aniline water, fltrd (µg/L)	3-Hydroxy carbofuran, water, fltrd (µg/L)	4-Chloro-2-methyl phenol, water, fltrd (µg/L)	Acetochlor, water, fltrd (µg/L)	Acifluorfen, water, fltrd (µg/L)	Alachlor, water, fltrd (µg/L)
June 1–2, 2006	0.11	<0.010	0.420	<0.004	<0.008	<0.005	<0.006	<0.028	<0.005
July 6–7, 2006	E.07	<.010	.517	<.004	<.008	<.005	<.006	<.028	<.005
Sept. 9–15, 2006	<.08	<.010	.272	<.004	<.008	<.005	<.006	<.028	<.005
Sept. 18–19, 2006	<.08	<.010	.037	<.004	<.008	<.005	<.006	<.028	<.005
Jan. 3–4, 2007	<.08	<.010	E.043	<.004	<.020	<.005	<.006	<.006	<.005
Jan. 24–25, 2007	<.08	<.010	E.023	<.004	<.020	<.005	<.006	<.006	<.005
Mar. 14–15, 2007	<.08	<.010	.902	<.004	<.020	<.005	<.006	<.006	<.005
July 3–4, 2007	<.08	<.010	.101	<.004	<.020	<.005	<.006	<.006	<.005
Aug. 30–31, 2007	<.08	<.010	.021	<.004	<.020	<.005	<.006	<.006	<.005

Date	Aldicarb sulfone water, fltrd (µg/L)	Aldicarb sulfoxide, water, fltrd (µg/L)	Aldicarb, water, fltrd (µg/L)	Amino-methyl-phosphonic acid, water, fltrd (µg/L)	Atrazine, water, fltrd (µg/L)	Azinphos-methyl oxon, water, fltrd (µg/L)	Azinphos-methyl, water, fltrd (µg/L)	Bendiocarb, water, fltrd (µg/L)	Benfluralin, water, fltrd (µg/L)
June 1–2, 2006	<0.02	<0.100	<0.15	0.420	1.88	<0.04	<0.050	<0.08	<0.010
July 6–7, 2006	<.02	<.100	<.15	1.10	.313	<.04	<.050	<.08	<.010
Sept. 9–15, 2006	<.02	<.100	<.15	.350	.042	<.04	<.050	<.08	<.010
Sept. 18–19, 2006	<.02	<.100	<.15	.670	.022	<.04	<.050	<.08	<.010
Jan. 3–4, 2007	<.08	<.040	<.04	1.78	.021	<.04	<.080	<.04	<.010
Jan. 24–25, 2007	<.08	<.040	<.04	.410	.021	<.04	<.080	<.04	<.010
Mar. 14–15, 2007	<.08	<.040	<.04	1.94	9.42	<.04	<.080	<.04	<.010
July 3–4, 2007	<.08	<.040	<.04	.530	.194	<.04	<.080	<.04	<.010
Aug. 30–31, 2007	<.08	<.040	<.04	--	.012	<.04	.038	<.04	<.010

Appendix 3. Water-quality data for runoff samples collected at an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Benomyl water, fltrd (µg/L)	Bensulfuron methyl, water, fltrd (µg/L)	Bentazon, water, fltrd (µg/L)	Bromacil, water, fltrd (µg/L)	Bromoxynil, water, fltrd (µg/L)	Carbaryl, water, fltrd (µg/L)	Carbofuran, water, fltrd (µg/L)	Chloramben methyl ester, water, fltrd (µg/L)
June 1–2, 2006	<0.022	<0.02	<0.02	<0.02	<0.04	<0.02	<0.016	<0.02
July 6–7, 2006	<.022	<.02	<.02	.05	<.04	<.02	<.016	<.02
Sept. 9–15, 2006	<.022	<.02	<.02	<.02	<.04	<.02	<.016	<.02
Sept. 18–19, 2006	<.022	<.02	<.02	<.02	<.04	<.02	<.016	<.02
Jan. 3–4, 2007	<.020	<.06	<.02	<.04	<.12	<.02	<.060	<.10
Jan. 24–25, 2007	<.020	<.06	<.02	<.04	<.12	<.02	<.060	<.10
Mar. 14–15, 2007	<.020	<.06	<.02	<.04	<.12	<.02	<.060	<.10
July 3–4, 2007	<.020	<.06	<.02	<.04	<.12	<.02	<.060	<.10
Aug. 30–31, 2007	<.020	<.06	<.02	<.04	<.12	.010	<.060	<.10

Date	Chlorimuron, water, fltrd (µg/L)	Chloro-di-amino-s-triazine, water, fltrd (µg/L)	Chlorpyrifos-oxon, water, fltrd (µg/L)	Chlorpyrifos water, fltrd (µg/L)	cis-Permethrin water fltrd (µg/L)	Clopyralid, water, fltrd (µg/L)	Cycloate, water, fltrd (µg/L)	Cyfluthrin, water, fltrd (µg/L)	Cypermethrin water, fltrd (µg/L)
June 1–2, 2006	<0.032	<0.04	<0.06	<0.005	<0.006	<0.07	<0.01	<0.053	<0.046
July 6–7, 2006	<.032	<.04	<.06	<.005	<.006	<.07	<.01	<.053	<.046
Sept. 9–15, 2006	<.032	<.04	<.06	<.005	<.006	<.07	<.01	<.053	<.046
Sept. 18–19, 2006	<.032	<.04	<.06	<.005	<.006	<.07	<.01	<.053	<.046
Jan. 3–4, 2007	<.080	<.12	<.06	<.005	<.010	<.06	<.06	<.053	<.046
Jan. 24–25, 2007	<.080	<.12	<.06	<.005	<.010	<.06	<.06	<.053	<.046
Mar. 14–15, 2007	<.080	<.12	<.06	<.005	<.010	<.06	<.06	<.053	<.046
July 3–4, 2007	<.080	<.12	<.06	<.005	<.010	<.06	<.06	<.053	<.046
Aug. 30–31, 2007	<.080	--	<.06	<.005	<.010	<.06	<.06	<.053	<.046

Appendix 3. Water-quality data for runoff samples collected at an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Dacthal mono-acid, water, fltrd (µg/L)	DCPA, water, fltrd (µg/L)	Desulfinyl-fipronil, water, fltrd (µg/L)	Diazinon, water, fltrd (µg/L)	Dicamba water, fltrd (µg/L)	Dichlorprop, water, fltrd (µg/L)	Dicrotophos, water, fltrd (µg/L)	Dieldrin, water, fltrd (µg/L)	Dimeth-oate, water, fltrd (µg/L)
June 1–2, 2006	<0.03	<0.003	<0.012	<0.005	<0.04	<0.03	<0.08	<0.009	<0.006
July 6–7, 2006	<.03	<.003	<.012	<.005	<.04	<.03	<.08	<.009	<.006
Sept. 9–15, 2006	<.03	<.003	<.012	<.005	<.04	<.03	<.08	<.009	<.006
Sept. 18–19, 2006	<.03	E.004	<.012	<.005	<.04	<.03	<.08	<.009	<.006
Jan. 3–4, 2007	<.02	<.003	<.012	<.005	<.08	<.04	<.08	<.009	<.006
Jan. 24–25, 2007	<.02	<.003	<.012	<.005	<.08	<.04	<.08	<.009	<.006
Mar. 14–15, 2007	<.02	<.003	<.012	<.005	.97	<.04	<.08	<.009	<.006
July 3–4, 2007	<.02	<.003	<.012	<.005	<.08	<.04	E.03	<.009	<.006
Aug. 30–31, 2007	<.02	<.003	<.012	<.005	<.08	<.04	<.08	<.009	<.006

Date	Dinoseb water, fltrd (µg/L)	Diphenamid, water, fltrd (µg/L)	Diuron, water, fltrd (µg/L)	Ethion monoxon water, fltrd (µg/L)	Ethion, water, fltrd (µg/L)	Fenamiphos sulfone water, fltrd (µg/L)	Fenamiphos sulfoxide, water, fltrd (µg/L)	Fenamiphos, water, fltrd (µg/L)	Fenuron water, fltrd (µg/L)
June 1–2, 2006	<0.04	<0.01	E0.02	<0.02	<0.016	<0.053	<0.04	<0.03	<0.10
July 6–7, 2006	<.04	<.01	.03	<.02	<.016	<.053	<.04	<.03	<.10
Sept. 9–15, 2006	<.04	<.01	<.02	<.02	<.016	<.053	<.04	<.03	<.10
Sept. 18–19, 2006	<.04	<.01	<.02	<.02	<.016	<.053	<.04	<.03	<.10
Jan. 3–4, 2007	<.04	<.04	<.04	<.02	<.016	<.053	<.04	<.03	<.04
Jan. 24–25, 2007	<.04	<.04	<.04	<.02	<.016	<.053	<.04	<.03	<.04
Mar. 14–15, 2007	<.04	<.04	<.04	<.02	<.016	<.053	<.04	<.03	<.04
July 3–4, 2007	<.04	<.04	<.04	<.02	<.016	<.053	<.04	<.03	<.04
Aug. 30–31, 2007	<.04	<.04	<.04	<.02	<.016	<.053	<.04	<.03	<.04

Appendix 3. Water-quality data for runoff samples collected at an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Desulfinyl-fipronil amide, water, fltrd (µg/L)	Fipronil sulfide water, fltrd (µg/L)	Fipronil sulfone water, fltrd (µg/L)	Fipronil, water, fltrd (µg/L)	Flumetsulam, water, fltrd (µg/L)	Fluo-meturon water, fltrd (µg/L)	Fonofos water, fltrd (µg/L)	Glufosinate, water, fltrd (µg/L)	Glyphosate, water, fltrd (µg/L)
June 1–2, 2006	<0.029	<0.013	<0.024	<0.016	<0.04	<0.02	<0.005	<0.140	0.610
July 6–7, 2006	<.029	<.013	<.024	<.016	<.04	<.02	<.005	<.140	.650
Sept. 9–15, 2006	<.029	<.013	<.024	<.016	<.04	<.02	<.005	<.140	1.51
Sept. 18–19, 2006	<.029	<.013	<.024	<.016	<.04	<.02	<.005	<.140	.590
Jan. 3–4, 2007	<.029	<.016	<.024	<.016	<.06	<.04	<.006	<.140	2.02
Jan. 24–25, 2007	<.029	<.016	<.024	<.016	<.06	<.04	<.006	<.140	.650
Mar. 14–15, 2007	<.029	<.016	<.024	<.016	<.06	<.04	<.006	<.140	3.82
July 3–4, 2007	<.029	<.016	<.024	<.016	<.06	<.04	<.006	<.140	10.7
Aug. 30–31, 2007	<.029	.005	<.024	<.016	<.06	<.04	<.006	--	--

Date	Hexazinone, water, fltrd (µg/L)	Imazaquin, water, fltrd (µg/L)	Imazethapyr, water, fltrd (µg/L)	Imidacloprid water, fltrd (µg/L)	Iprodione, water, fltrd (µg/L)	Isofenphos, water, fltrd (µg/L)	Linuron water, fltrd (µg/L)	Malaoxon, water, fltrd (µg/L)	Malathion, water, fltrd (µg/L)
June 1–2, 2006	<0.026	<0.04	<0.04	<0.020	<0.026	<0.011	<0.01	<0.039	<0.027
July 6–7, 2006	<.026	<.04	<.04	<.020	<.026	<.011	<.01	<.039	E.018
Sept. 9–15, 2006	<.026	<.04	<.04	<.020	<.026	<.011	<.01	<.039	<.027
Sept. 18–19, 2006	<.026	<.04	<.04	<.020	<.026	<.011	<.01	<.039	<.027
Jan. 3–4, 2007	<.026	<.04	<.04	<.060	<.026	<.011	<.04	<.039	<.016
Jan. 24–25, 2007	<.026	<.04	<.04	<.060	<.026	<.011	<.04	<.039	<.016
Mar. 14–15, 2007	<.026	<.04	<.04	<.060	<.026	<.011	<.04	<.039	<.016
July 3–4, 2007	<.026	<.04	<.04	<.060	<.026	<.011	<.04	<.039	<.016
Aug. 30–31, 2007	<.026	<.04	<.04	<.060	<.026	<.011	<.04	.049	2.64

Appendix 3. Water-quality data for runoff samples collected at an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	MCPA, water, fltrd (µg/L)	MCPB, water, fltrd (µg/L)	Metalaxyl, water, fltrd (µg/L)	Methialthion water, fltrd (µg/L)	Methiocarb, water, fltrd (µg/L)	Methomyl, water, fltrd (µg/L)	Methyl paraoxon, water, fltrd (µg/L)	Methyl parathion, water, fltrd (µg/L)	Metolachlor, water, fltrd (µg/L)
June 1–2, 2006	<0.07	<0.10	<0.065	<0.009	<0.034	<0.070	<0.02	<0.015	<0.006
July 6–7, 2006	<.07	<.10	<.007	<.009	<.034	<.070	<.02	<.015	E.06
Sept. 9–15, 2006	<.07	<.10	<.007	<.009	<.034	<.070	<.02	<.015	<.006
Sept. 18–19, 2006	<.07	<.10	<.007	<.009	<.034	<.070	<.02	<.015	<.006
Jan. 3–4, 2007	<.06	<.20	<.007	<.009	<.040	<.060	<.02	<.008	<.010
Jan. 24–25, 2007	<.06	<.20	<.007	<.009	<.040	<.060	<.02	<.008	E.008
Mar. 14–15, 2007	<.06	<.20	<.007	<.009	<.040	<.060	<.02	<.008	E.007
July 3–4, 2007	<.06	<.20	<.007	<.009	<.040	<.060	<.02	<.008	<.010
Aug. 30–31, 2007	<.06	<.20	<.007	<.009	<.040	<.060	<.02	<.008	<.010

Date	Metribuzin, water, fltrd (µg/L)	Metsulfuron, water, fltrd (µg/L)	Myclobutanil water, fltrd (µg/L)	N-(4-Chloro-phenyl)-N′-methyl-urea (µg/L)	Neburon water, fltrd (µg/L)	Nicosul-furon, water, fltrd (µg/L)	Norflurazon, water, fltrd (µg/L)	Oryzalin, water, fltrd (µg/L)	Oxamyl, water, fltrd (µg/L)
June 1–2, 2006	<0.028	<0.07	<0.033	<0.04	<0.01	<0.04	<0.02	<0.02	<0.05
July 6–7, 2006	<.028	<.07	E.012	<.04	<.01	<.04	<.02	<.02	<.05
Sept. 9–15, 2006	<.028	<.07	E.010	<.04	<.01	<.04	<.02	<.02	<.05
Sept. 18–19, 2006	<.028	<.07	<.033	<.04	<.01	<.04	<.02	<.02	<.05
Jan. 3–4, 2007	<.012	<.14	<.033	<.06	<.02	<.10	<.04	<.04	<.04
Jan. 24–25, 2007	<.012	<.14	<.033	<.06	<.02	<.10	<.04	<.04	<.04
Mar. 14–15, 2007	<.012	<.14	<.033	<.06	<.02	<.10	<.04	<.04	<.04
July 3–4, 2007	<.012	<.14	<.033	<.06	<.02	<.10	<.04	<.04	<.04
Aug. 30–31, 2007	<.012	<.14	<.033	<.06	<.02	<.10	<.04	<.04	<.04

Appendix 3. Water-quality data for runoff samples collected at an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Pendimethalin, water, fltrd (µg/L)	Phorate oxon, water, fltrd (µg/L)	Phorate water, fltrd (µg/L)	Phosmet oxon, water, fltrd (µg/L)	Phosmet water, fltrd (µg/L)	Picloram, water, fltrd (µg/L)	Prometon, water, fltrd (µg/L)	Prometryn, water, fltrd (µg/L)	Propyzamide, water, fltrd (µg/L)
June 1–2, 2006	<0.022	<0.03	<0.055	<0.05	<0.008	<0.03	<0.01	<0.006	<0.004
July 6–7, 2006	.027	<.03	<.055	--	--	<.03	<.01	<.006	<.004
Sept. 9–15, 2006	.131	<.03	<.055	<.05	<.008	<.03	<.01	<.006	<.004
Sept. 18–19, 2006	.052	<.03	<.055	<.05	<.008	<.03	<.01	<.006	<.004
Jan. 3–4, 2007	.091	<.03	<.020	<.05	<.008	<.12	<.01	<.006	<.004
Jan. 24–25, 2007	.144	<.03	<.020	<.05	<.008	<.12	<.01	<.006	<.004
Mar. 14–15, 2007	.133	<.03	<.020	<.05	<.008	--	<.01	<.006	<.004
July 3–4, 2007	<.020	<.03	<.020	<.05	<.008	<.12	<.01	<.006	<.004
Aug. 30–31, 2007	<.020	<.03	<.020	--	--	<.12	<.01	<.006	<.004

Date	Propham water, fltrd (µg/L)	Propi-conazole, water, fltrd (µg/L)	Propoxur, water, fltrd (µg/L)	Siduron water, fltrd (µg/L)	Simazine, water, fltrd (µg/L)	Sulfomet-ruron, water, fltrd (µg/L)	Tebuthiuron water, fltrd (µg/L)	Terbacil, water, fltrd (µg/L)	Terbufos oxon sulfone water, fltrd (µg/L)
June 1–2, 2006	<0.030	<0.01	<0.008	<0.02	0.019	<0.090	<0.02	<0.026	<0.04
July 6–7, 2006	<.030	<.01	<.008	<.02	E.007	<.090	<.02	<.026	<.04
Sept. 9–15, 2006	<.030	<.01	<.008	<.02	<.005	<.090	<.02	<.026	<.04
Sept. 18–19, 2006	<.030	<.01	<.008	<.02	<.005	<.090	<.02	<.026	<.04
Jan. 3–4, 2007	<.060	<.06	<.040	<.04	E.005	<.060	<.02	<.040	<.04
Jan. 24–25, 2007	<.060	<.06	<.040	<.04	<.006	<.060	<.02	<.040	<.04
Mar. 14–15, 2007	<.060	<.06	<.040	<.04	.064	<.060	<.02	<.040	<.04
July 3–4, 2007	<.060	<.06	<.040	<.04	<.006	<.060	<.02	<.040	<.04
Aug. 30–31, 2007	<.060	<.06	<.040	<.04	<.006	<.060	<.02	<.040	<.04

Appendix 3. Water-quality data for runoff samples collected at an unnamed Oso Creek tributary (station 08211525), Nueces County, Texas, water years 2006–07—Continued.

Date	Terbufos, water, fltrd (µg/L)	Terbuthyl-azine, water, fltrd (µg/L)	Tribuphos, water, fltrd (µg/L)	Triclopyr, water, fltrd (µg/L)	Trifluralin, water, fltrd (µg/L)	Dichlorvos, water, fltrd (µg/L)
June 1–2, 2006	<0.02	<0.01	<0.035	<0.03	<0.009	<0.01
July 6–7, 2006	<.02	<.01	<.035	<.03	<.009	<.01
Sept. 9–15, 2006	<.02	<.01	<.035	<.03	<.009	<.01
Sept. 18–19, 2006	<.02	<.01	<.035	<.03	.011	<.01
Jan. 3–4, 2007	<.01	<.01	<.035	<.04	E.007	<.01
Jan. 24–25, 2007	<.01	<.01	<.035	<.04	<.009	<.01
Mar. 14–15, 2007	.02	<.01	<.035	<.04	.054	<.01
July 3–4, 2007	<.01	<.01	<.035	<.04	<.009	<.01
Aug. 30–31, 2007	<.01	<.01	<.035	<.04	<.009	<.01

Publishing support provided by
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