PESTICIDE-SAMPLING EQUIPMENT, SAMPLE-COLLECTION AND PROCESSING PROCEDURES, AND WATER-QUALITY DATA AT CHICOD CREEK, NORTH CAROLINA, 1992

by Tammy K. Manning, Kelly E. Smith, Carlton D. Wood,
and Janie B. Williams

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ROBERT M. HIRSCH, Acting Director

For additional information write to:

District Chief
U.S. Geological Survey, WRD
3916 Sunset Ridge Road
Raleigh, North Carolina 27607

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CONVERSION FACTORS, VERTICAL DATUM, ABBREVIATIONS, AND ACRONYMS

Multiply	by	To obtain
	Length	
inch	25.4	millimeter
foot	0.3048	meter
mile	1.609	kilometer
square mile	2.590	square kilometer
	Volume	
gallon	3.785	liter
	Specific Conductance	
micromho per centimeter at 25 degrees Celsius (µmho/cm at 25° C)	1.000	microsiemen per centimeter at 25 degrees Celsius

<u>Temperature</u>: In this report, temperature is given in degrees Celsius (°C), which can be converted to degrees Fahrenheit (°F) by using the following equation:

$$°F = 1.8\,(°C) + 32$$

ABBREVIATIONS AND ACRONYMS:

CFR - Code of Federal Regulations
COLS/100ML - colonies per 100 milliliters
DEG C - degrees Celsius
DIAM - diameter
DIS - dissolved
EWI - equal-width increment
FLD - field
FLT - filtered
FWS - U.S. Fish and Wildlife Service
GC/MS - gas chromatograph/mass spectrometry
GF - glass fiber
IT - incremental titration
MAX - maximum
MG/L (mg/L) - milligram per liter
MIN - minimum
ML (mL) - milliliter
MM (mm) - millimeter
MM OF HG (mm of Hg) - millimeter of mercury
NAWQA - National Water-Quality Assessment Program, U.S. Geological Survey
NWQL - National Water-Quality Assessment Program, U.S. Geological Survey
PVC - polyvinyl chloride
REC - recorded
SCS - U.S. Soil and Conservation Service
SIM - selected-ion monitoring
SPE - solid-phase extraction
T - ton
TOT - total
U - micron
UG/L (µg/L) - microgram per liter
USGS - U.S. Geological Survey
WAT - water
WH - whole

Pesticide-Sampling Equipment, Sample-Collection and Processing Procedures, and Water-Quality Data at Chicod Creek, North Carolina, 1992

By Tammy K. Manning, Kelly E. Smith, Carlton D. Wood, *and* Janie B. Williams

ABSTRACT

Water-quality samples were collected from Chicod Creek in the Coastal Plain Province of North Carolina during the summer of 1992 as part of the U.S. Geological Survey's National Water-Quality Assessment Program. Chicod Creek is in the Albemarle-Pamlico drainage area, one of four study units designated to test equipment and procedures for collecting and processing samples for the solid-phase extraction of selected pesticides. The equipment and procedures were used to isolate 47 pesticides, including organonitrogen, carbamate, organochlorine, organophosphate, and other compounds, targeted to be analyzed by gas chromatography/mass spectrometry.

Sample-collection and processing equipment, equipment cleaning and set-up procedures, methods pertaining to collecting, splitting, and solid-phase extraction of samples, and water-quality data resulting from the field test are presented in this report. Most problems encountered during this intensive sampling exercise were operational difficulties relating to equipment used to process samples.

INTRODUCTION

Background

In December of 1991, the National Leadership Team of the U.S. Geological Survey's (USGS) National Water-Quality Assessment (NAWQA) Program decided to conduct prototypes of intensive surface-water sampling at fixed sites in 1992 to precede full-scale nationwide data collection. Intensive sampling at these fixed sites include a detailed investigation of three major surface water-quality issues--suspended sediment, nutrient, and pesticide concentrations. The Albemarle-Pamlico (ALBE) drainage area was one of four study units designated to participate in this prototype program.

The ALBE study unit was chosen to investigate selected pesticide concentrations in the surface-water component of the "occurrence and distribution assessment" phase of the NAWQA Program. Careful attention was given to selecting a site where pesticide concentrations are most probably a water-quality issue. A site on Chicod Creek, located in the central Coastal Plain Province of eastern North Carolina, was selected for conducting the prototype pesticide sampling work (fig. 1).

The Chicod Creek sampling site has a drainage area of 45 square miles (mi^2). This basin is predominantly rural with 42 percent of the land dedicated to agriculture, including a total of 25 hog and chicken operations. Dominant crops grown in the basin in 1992 were corn and soybeans (55 percent of all crops grown), and wheat (16 percent).

Chicod Creek and its tributaries are sluggish with low gradients and are bounded by broad cypress and tupelo wetlands. During 1978-81, selected streams in the basin, including Chicod Creek, were modified by using special channel-modification techniques developed by the U.S. Soil Conservation Service (SCS) and the U.S. Fish and Wildlife Service (FWS) to minimize negative environmental effects and improve drainage efficiency. Throughout channelization, the USGS in cooperation with the SCS, monitored surface- and ground-water quality at Chicod Creek.

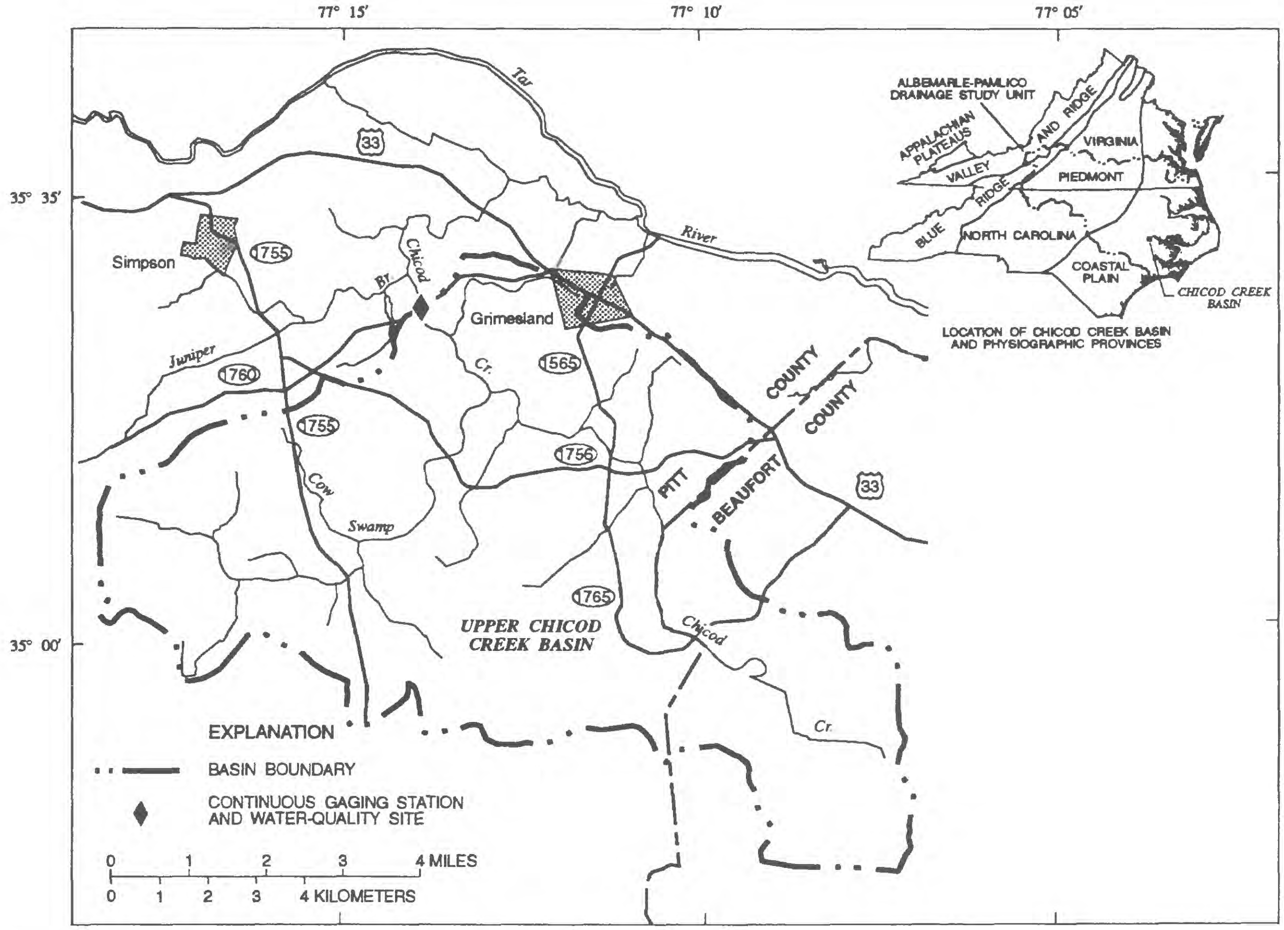

Figure 1.--Location of sampling site in Chicod Creek basin.

Purpose and Scope

This report describes the field methods used by the ALBE-NAWQA study team to collect and process surface-water samples for the analysis of pesticides using solid-phase extraction. The report also describes the intensive pesticide field-sampling equipment, procedures, and processing employed at the study site and presents the results of the analyses of samples and other data collected from Chicod Creek between May and September 1992.

The major emphasis of this report is on organic pesticides and pesticide sample-processing protocols, with primary focus on adapting laboratory-based solid-phase extraction methods to the field. Field-based pesticide processing protocols and associated problems are discussed so that uniform workable procedures may be developed to benefit other NAWQA study units and render consistency on a national scale before nationwide intensive sampling begins.

The site was sampled 43 times during the 18-week sampling period. Samples were collected three times per week during the first six weeks and the last six weeks of the sampling period in an attempt to sample when the largest volume of pesticides was applied to agricultural fields.

Although the emphasis of this report focuses on organic pesticide sample processing and collection, water samples also were collected and analyzed for inorganic constituents, physical properties, suspended sediment, and bacteria. These data and streamflow records at the collection site are presented in supplemental tables at the end of this report, along with the pesticide analyses.

Acknowledgments

The authors wish to thank Cary Faulk, Director, and Julie Jones and Judy Rouse of the Pitt County Agricultural Stabilization and Conservation Service; and John Goodwin, Director, and Donna Sutton of the Beaufort County Agricultural Stabilization and Conservation Service for their assistance in obtaining land-use data.

PESTICIDE-SAMPLING EQUIPMENT AND PROCEDURES

The equipment and procedures described in this section were used to isolate and determine the concentrations of selected pesticides in water from Chicod Creek. These pesticides include the herbicides and insecticides listed in the following table.

Sampling Equipment

This section lists the equipment and describes the cleaning and setup procedures used during sampling for pesticides. The equipment-cleaning and setup procedures are described in detail to give the reader a working guide for the adaption of solid-phase extraction to an operational field environment.

[Number indicates type of compound: 1, organonitrogen; 2, carbamate; 3, organochlorine; 4, organophosphate; 5, miscellaneous; 6, pesticide metabolite]

Herbicides		Insecticides	
alachlor (1)	molinate (2)	alpha-BHC (3)	fonofos (4)
atrazine (1)	napropamide (5)	carbaryl (2)	lindane (3)
benfluralin (1)	pebulate (2)	carbofuran (2)	malathion (4)
butylate (2)	pendimethalin (1)	chlorpyrifos (4)	methylazinphos (4)
cyanazine (1)	prometon (1)	diazinon (4)	methylparathion(4)
DCPA (Dacthal) (3)	pronamide (5)	dieldrin (3)	parathion (4)
p,p'-DDE (6)	propachlor (1)	dimethoate (4)	permethrin cis (5)
desethylatrazine (1)	propanil (1)	disulfoton (4)	phorate (4)
2,6-diethylniline (6)	simazine (1)	ethoprop (4)	propargite (5)
EPTC (Eptam) (2)	tebuthiuron (1)		terbufos (4)
ethalfluralin (1)	terbacil (1)		
linuron (1)	thiobencarb (2)		
metolachlor (1)	triallate (2)		
metribuzin sencor (1)	trifluralin (1)		

The chemical analyses for pesticides were performed by the USGS National Water-Quality Laboratory (NWQL) in Arvada, Colorado. The samples for these pesticide analyses were field processed by solid-phase extractions (SPE) (Sandstrom, 1989) and analyzed by gas chromatograph-mass spectrometry (GCMS) according to procedures similar to those documented by Sandstrom and others (1991); general procedures for handling samples and for cleaning equipment for processing organic samples also are described by Sandstrom (1990). Method detection limits determined according to 40 Code of Federal Regulations (CRF) 136.B for these compounds range from 0.004 microgram per liter (μg/L) to 0.05 μg/L. Because this was a special development method, the concentrations of pesticides were reported to values below normal detection limits in order to test methods-development research at the laboratory and also to determine the actual presence or absence of these compounds in the samples.

Primary Equipment

More than 20 items of primary equipment were used (1) to collect and split samples, (2) to filter samples, and (3) in solid-phase extraction (tables 1-2; figs. 2-4). Accessory items used in the sampling process are powderless latex gloves, heavy-duty aluminum foil, 12-volt batteries, bubble level, stopwatch, plastic beakers for waste collection, safety goggles, resealable plastic bags, permanent markers, pens, laboratory sheets, and SPE data sheets. Plastic storage containers (2.5 ft x 7.5 ft x 1.0 ft) with hinged tops and hold-down latches were used to store and transport all equipment in table 1 except samplers, and all equipment in table 2 except items 17 and 21.

Table 1.--***Sample-collection, splitting, and filtration equipment***

[EWI, equal-width integrated; USGS, U.S. Geological Survey; TM, trace metal; PVC, polyvinyl chloride: mm, millimeter]

Item number (figures 2 and 3)	Description of equipment	Use of equipment
1	Stainless-steel milk can with lid (19-liter capacity)	To composite EWI samples.
2	USGS DH-81 sampler, nozzles, and wading rod	To collect EWI samples.
3	USGS D-77 TM sampler (requires boom and reel)	To collect EWI samples during high flow.
4	Teflon sampling bottle with 3-liter capacity	For use with numbers 2 and 3 above.
5	Teflon bottle adapter	For use with numbers 2 and 3 above.
6	Teflon cone splitter, Teflon discharge tubes, and PVC support apparatus	To split composite sample.
7	Ceramic-piston filtration pump and associated convoluted Teflon tubing	To pump sample through filter unit.
8	Breaker switch	To control current to pump.
9	Aluminum filtration unit (142-mm diameter)	To hold glass fiber filter.
10	Glass-fiber filters, baked (142-mm diameter), 0.7-micron pore size	For use in number 9 above.
11	Flat-tipped stainless-steel forceps	To handle glass fiber filter.

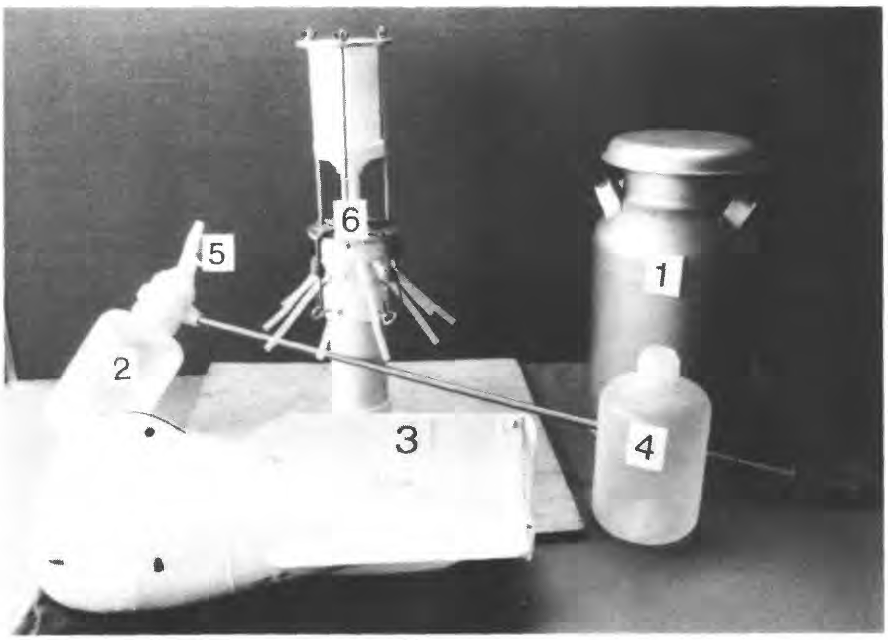

Figure 2.--Sample-collection and splitting equipment. (Numbered items are described in table 1.)

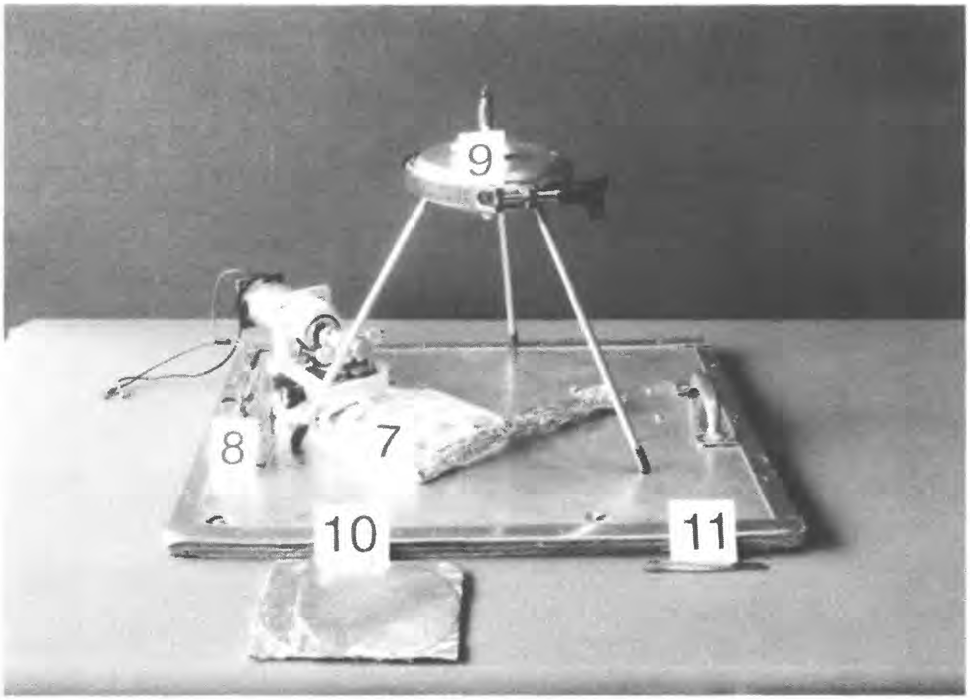

Figure 3.--Sampling-filtration equipment. (Numbered items are described in table 1.)

Table 2.--*Solid-phase extraction equipment*

[SPE, solid-phase extraction; mL, milliliter]

Item number (figure 4)	Description of equipment	Use of equipment
12	Ceramic-piston SPE metering pump and associated convoluted Teflon tubing	To pump sample through SPE cartridge.
13	Base and chain clamp for metering pump	To hold pump in position.
14	SPE cartridges	To extract selected pesticides from sample.
15	Stainless-steel collection beaker	To contain filtered sample.
16	Stopcock	To condition SPE cartridge.
17	Surrogate mixture	To be added to appropriate water samples.
18	Balance, 6,000 grams	To weigh containers and liquids to calculate volume.
19	Precision dispenser for methanol	To dispense microliters of methanol.
20	Microdispenser with glass bores	To add surrogate and spikes to samples.
21	Amber-borosilicate glass bottles baked with Teflon-lined caps	To contain and transport samples.
22	Teflon bottles, 1 liter	To contain filtered water for processing.
23	Teflon wash bottles (500 mL) for methanol, pesticide-free deionized water and 2-percent phosphate-free detergent solution	To clean and rinse equipment.

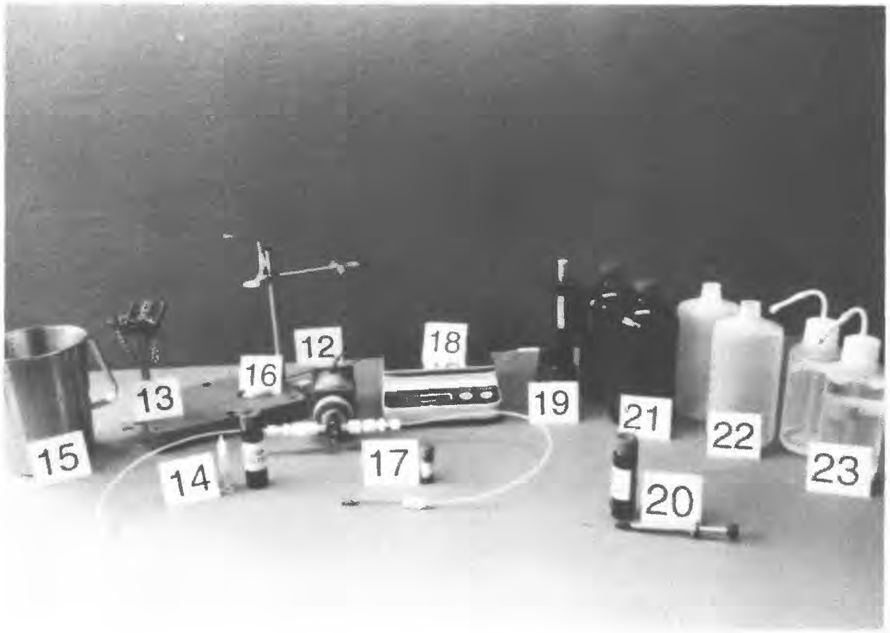

Figure 4.--Solid-phase extraction equipment. (Numbered items are described in table 2.)

Equipment Cleaning

Cleaning the equipment for the SPE of selected pesticides involved three steps: (1) washing with a 2-percent solution of phosphate-free detergent, (2) rinsing thoroughly with either tap or deionized water (Both were used for this sampling exercise.), and (3) rinsing with high-purity methanol (Sandstrom, 1990). Because high concentrations of methanol are described as a skin irritant and a class 1B flammable liquid (U.S. Department of Health and Human Services, 1990), the methanol rinse should take place in a well-ventilated area by personnel wearing safety goggles and powderless latex gloves. The used methanol should be recovered and later disposed of according to Federal, State, or local regulations for the proper disposal of hazardous materials. In the field, this rinse was done outside of the work vehicle whenever possible; however, when this rinse is performed in the laboratory, an appropriate ventilator hood should be used.

All equipment listed in tables 1 and 2 was assembled. New powderless latex gloves were worn during each procedure and were replaced before each new procedure. All work surfaces were covered with aluminum foil during the cleaning process to prevent contamination. To facilitate the cleaning of tubing, SPE metering pumps were set up on an aluminum-covered work surface and tubing was attached. One 12-volt battery was connected to each pump. (Gloves were changed after handling the batteries.)

Cleaning procedures were as follows:

1. Two liters of warm water was run into a stoppered stainless-steel sink or wash basin.
2. Forty milliliters of phosphate-free detergent was added to the warm water, and each piece of equipment that would contact sample water was washed thoroughly in this solution.
3. Washed equipment was rinsed with tap or deionized water at least three times and then inverted on the aluminum-covered work surface to dry.
4. The interior of the equipment storage container was then rinsed with this solution, and the solution was discarded.

5. Because the 19-liter stainless-steel milk can used to collect the sample would not fit into a sink or basin, the milk can was filled halfway with a solution of warm water and 2-percent phosphate-free detergent. After the milk can was swirled to allow the solution to contact all surfaces, the solution was poured out while rotating the milk can to ensure that the solution contacted the entire opening of the can. The milk can was rinsed with tap or deionized water at least three times following this same technique. The can was then inverted and placed on the aluminum-covered work area.
6. All equipment was allowed to air dry thoroughly.
7. While the equipment was drying, 500 milliliters of a solution containing 2-percent phosphate-free detergent was pumped through the tubing. Tap or deionized water was then pumped through the tubing until no evidence of suds remained; the pump was turned off after all of the rinse water was out of the tubing. Five-hundred milliliters of high-purity methanol was pumped through the tubing into a waste container until all of the methanol was out of the tubing. The technicians wore safety goggles and powderless latex gloves while handling the methanol. The tubing was allowed to dry and was disconnected from the pump. Open ends of the pump and tubing were covered with aluminum foil. Pieces of cleaned tubing with both ends covered by aluminum foil were placed in an appropriately marked sealable plastic bag ("Clean" should be written on the outside of the bag.) and placed in the pesticide-equipment storage container. The SPE pump was placed in its styrofoam case and stored in the pesticide-equipment storage container. The filtration pump and its base was stored in the laboratory or work vehicle for the next sampling trip.
8. After the washed equipment had air-dried, the methanol rinse was performed. Because no ventilator hood was available, the methanol rinse was performed outside of the building with fans situated to blow fumes away from the work area. Each piece of equipment was rinsed (using the Teflon wash bottle containing methanol) over an overflow container for the methanol. The equipment was then placed back on the aluminum-foil covered surface to dry. Safety goggles and powderless latex gloves were used during this procedure.
9. After the equipment was thoroughly rinsed, the milk can and Teflon bottles were placed at an angle to allow all of the methanol to evaporate.
10. When the bottles were thoroughly dry, the bottle openings were covered with aluminum foil and placed in the storage container. The clean lid of the milk can was placed tightly on the can and stored in the work vehicle. Smaller pieces of equipment were wrapped in aluminum foil and placed in a small storage container which was placed inside of the pesticide-equipment storage container. The openings of clean wash bottles also were covered with aluminum foil and placed in the pesticide-equipment storage container. When all equipment was cleaned and placed in the pesticide-equipment storage container, the container lid was closed and stored in the work vehicle.
11. Methanol in the overflow container was poured into a safety container marked as methanol for later disposal. The overflow container was rinsed with approximately 20 milliliters of tap or deionized water to remove methanol residue. This rinse water was poured into the safety container marked for the disposal of methanol. After the methanol on the aluminum foil evaporated, the foil was removed from the work surfaces and placed in a waste container for recycling or disposal.
12. Work surfaces were wiped down with a soapy sponge to remove any traces of methanol.

Equipment Setup

To expedite the sample processing, filtration and SPE pesticide equipment were set up inside of the work vehicle before collecting the sample. Powderless latex gloves were always worn to prevent contamination, and all work areas for processing the SPE pesticide sample were covered with aluminum foil to provide a clean work space. Filtration and the SPE of the sample took place inside of the work vehicle, which enhanced the operation and helped to prevent contamination from exhaust fumes, airborne chemicals, and dust, in addition to wind and precipitation (M.W. Sandstrom, U.S. Geological Survey, written commun., 1991).

The following steps were used to set up the filtration unit:

1. The aluminum filtration unit, tubing for the filtration system, pump, and switch were taken out of the pesticide-equipment storage container and placed on the prepared work area.
2. The legs were attached to the filtration unit and the filtration unit and pump were leveled.
3. The pump and switch were connected.
4. After removing the aluminum foil from the ends, the appropriate tubing was connected to the inlet and outlet ports of the pump, and the tubing on the outlet port of the pump was connected to the top of the filtration unit (fig. 5). All fittings were hand-tightened and the aluminum foil was left covering the unattached ends of the tubing until the sample was ready to process.

The following steps were used to set up the SPE equipment:

1. The SPE metering pump, current limiter, and tubing for SPE pesticide sample processing, base, balance, and chain clamp were removed from the storage container and placed on the prepared work area. (Note: The SPE metering pump is different from the pump used for filtration in that the flow rate can be adjusted to 20-25 milliliters per minute, which is necessary for the solid-phase extraction.)
2. The balance was removed from solid styrofoam packing, placed on the prepared work area, and leveled.
3. The solid styrofoam packing used to store the balance was covered with aluminum foil and used as a platform to elevate the pump base (which eased the processing of the sample).
4. The chain clamp was placed in the base; the pump was set on the chain clamp; and the chain was tightened to secure the pump. The current limiter was connected to the proper posts on the pump.
5. The tubing was attached to the appropriate ports on the pump (fig. 6) and, as with the filtration system, all fittings were manually tightened. The aluminum foil was left covering all unattached ends of the tubing until sample processing began.

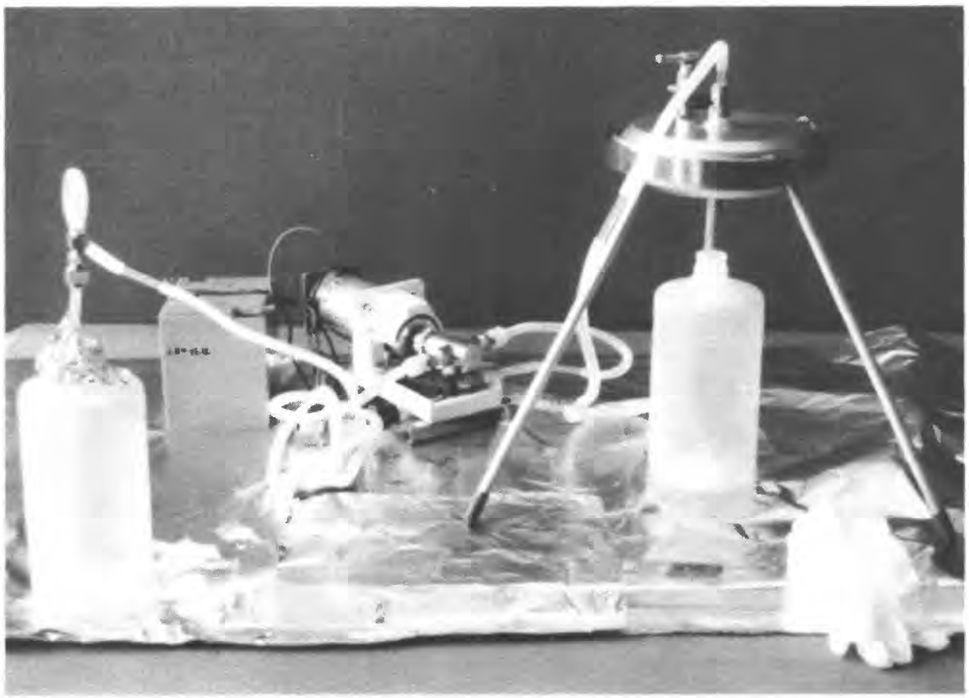

Figure 5.--Set-up of filtration unit showing tubing connections.

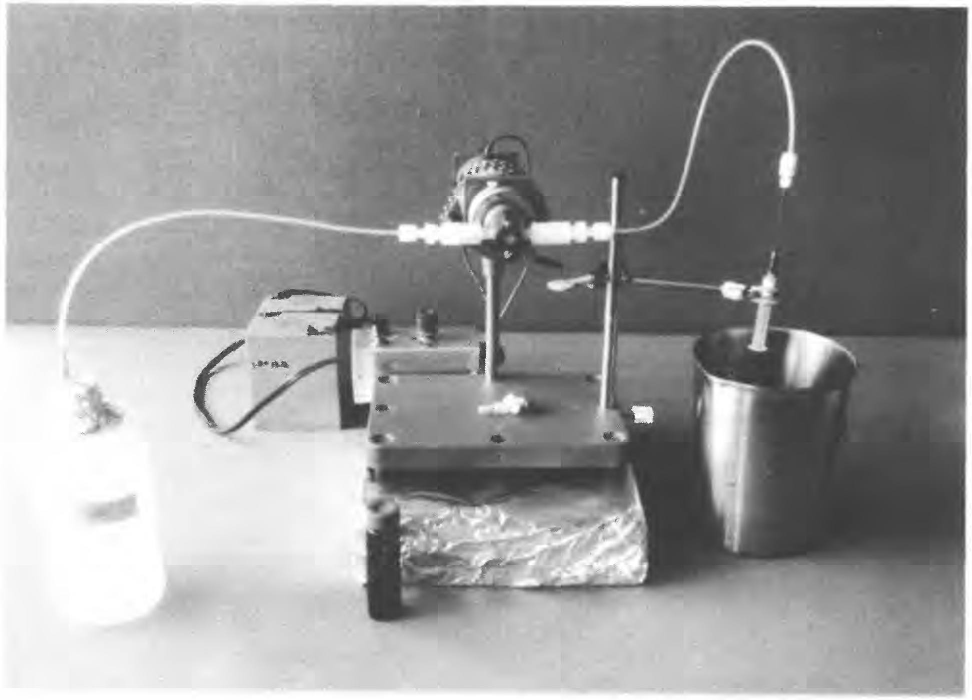

Figure 6.--Set-up of solid-phase extraction equipment showing tubing connections.

After the equipment was set up, the shaft of each pump was turned manually to check for freedom of movement, and a 12-volt battery was connected to each pump. (Gloves were changed to prevent contamination from the battery.) The filtration unit and SPE tubing were rinsed with 500 and 250 milliliters of native water, respectively. The ends of the tubing were again covered with aluminum foil.

A glass-microfiber filter (wrapped in aluminum foil), forceps, syringe, stopcock, a 1-liter Teflon bottle, waste beakers, a graduated 50-milliliter beaker, stainless-steel beaker, and SPE cartridge in its storage vial were placed at the SPE equipment setup but left in aluminum foil until ready for use. Teflon wash bottles containing methanol, pesticide-free deionized water, 2-percent phosphate-free detergent solution, precision dispenser containing methanol, microdispenser (for dispensing the surrogate and spike mixtures), and SPE laboratory form (fig. 7) were placed at the work space.

Next, the cone splitter was set up outside of the work vehicle. The cone splitter was set on reasonably level ground away from possible sources of contamination, such as exhaust fumes from the work vehicle, and the support apparatus was assembled for use. The sections of the cone splitter were removed from the pesticide equipment storage container, and the sections were assembled by connecting the reservoir funnel to the cone splitter housing, which contains the 10 exit ports, with a short section of stand pipe. This structure was further secured with two stainless-steel disks and three stainless-steel rods. After the cone splitter was carefully placed on top of the support apparatus, it was secured with bungee cords; the discharge tubing was attached, and the cone splitter was leveled. The top of the cone splitter and the openings of all of the discharge tubes were covered with aluminum foil. A case of organically cleaned, 1-liter bottles was placed next to the cone splitter for later use.

Solid-Phase Extraction- GC/MS Analysis - Filtered Water Schedule 2010
NAWQA Project Intensive Fixed-Sites (March 93)

Station ID or Unique Number: ____________ Station Name ____________
Date: ____________ Time: ________ Collector: ____________
Telephone Number of Collector: ____________
Comments: ____________

NWQL INFORMATION

☐ SPE Cartridge
Type: ____________
Lot #: ____________
Dry Wt.: ____________ gm

FIELD INFORMATION

☐ Filter Sample 0.7 µm glass fiber filter Date filtered:
☐ SPE Cartridge Conditioning: Date of SPE procedure:
Methanol (2 ml): ____________ ml
Organic-free water (2 ml): ____________ ml
(DO NOT LET CARTRIDGE GO DRY ONCE CONDITIONING STARTED)
☐ Sample Sample + bottle: ____________ gm
(-) bottle tare wt. ____________ gm
= Sample wt. ____________ gm
Add 1% methanol: ____________ ml
Sample + bottle + MeOH: ____________ gm
☐ Surrogate Solution ID: ____________
Volume added: ____________ µL
☐ QA Samples - Spike Mixture
Solution ID: ____________
Volume added: ____________ µL
☐ Sample through cartridge
Sample + plastic beaker ____________ gm
plastic beaker ____________ gm
☐ Flow rate: Start time ____________ hr:min
Finish time ____________ hr:min
☐ Remove excess water - Write station ID, date, time on cartridge - Store in 40-ml vial @ 4°C

NWQL INFORMATION

Lab ID: ____________ Set#: ______ Date Received ____________
☐ Dry cartridge with CO_2: Date:
Pressure: ____________ psi
Time: ____________ min
SPE cartridge wt.: ____________ gm
☐ SPE Elution Date:
add 1.8 ml HIP (3:1) ____________ ml
☐ Internal Standard (PAH-d_n mixture in toluene keeper)
Solution ID: ____________
Volume added (100µL): ____________ µL
☐ Evaporate solvent - nitrogen Date:
Pressure : ____________ psi
Time: ____________ min
☐ Analysis - Instrument ID: ____________ Date: ____________

Comments:

National Water Quality Laboratory USGS-WRD

Figure 7.--Example of form (reduced from actual size) for recording solid-phase extraction data.

Sample-Collection Procedures

Equal-width increment (EWI) water samples were collected from Chicod Creek using either the DH-81 (by wading) or the D-77 (from the bridge) samplers following USGS standard methods described by Edwards and Glysson (1988) and Ward and Harr (1990). Samplers are designed to collect the sample in proportion to the flow (isokinetic). Samplers were raised and lowered at a fixed rate (depth-integrated) until the 3-liter Teflon bottle was three-fourths full; the bottle was removed from the sampler, and the sample was swirled and poured into the milk can. This procedure was repeated until a 5- to 9-liter sample had been collected in the 19-liter milk can. Additional water was collected in the 3-liter Teflon sampling bottle to rinse out the cone splitter with native water prior to splitting the sample water. The sample, rinse water, and equipment were taken back to the work vehicle and the sample was split with the cone splitter.

Sample-Processing Procedures

This section describes the three main steps involved in sample processing: sample splitting, filtration, and solid-phase extraction. Methods are discussed in detail to provide the reader with a description of the procedures involved in processing samples once the equipment has been set up and the sample has been collected.

First, the sample was split using a USGS cone splitter to assure that the subdivided samples were equivalent in concentrations of suspended and dissolved constituents. Once sample splitting was complete, sample water designated for organic analysis was pumped through an aluminum filter to remove suspended particulate matter and to prepare the sample for the next step, which is solid-phase extraction.

As described by Mark Sandstrom and others (1992), solid-phase extraction is a method of isolation of organonitrogen herbicides from natural water samples. This method was implemented in the NWQL in March 1991 and used as an alternative to liquid-liquid extraction. In the field, solid-phase extraction was accomplished by pumping filtered sample water through pre-cleaned disposable cartridges, supplied by the NWQL, which contained porous silica to remove the pesticides. Once the extraction was complete, the SPE cartridge was shipped to the NWQL where the eluate was analyzed by capillary-column GC/MS with selected-ion monitoring for selective confirmation and quantitation of the pesticides.

Sample Splitting

Prior to rinsing the cone splitter, the collection bottles were placed around the base of the cone splitter in the configuration shown in figure 8 by emptying four ports into two 3-liter Teflon bottles (two ports in each bottle); each of the remaining ports were emptied into an organically cleaned, 1-liter glass bottle. The discharge tubing was inserted in to the bottles far enough to prevent spilling but not far enough to become submerged. The bottles and cone splitter were rinsed three times with native water and approximately 1 liter of native water was poured through the cone splitter for each rinse. The milk can was swirled to suspend any remaining sediments. The sample water was poured quickly through the cone splitter maintaining a constant head in the barrel of the cone splitter. After approximately one-half of the sample water had been poured through the cone splitter, the water in the cone splitter was allowed to drain into the bottles. The remaining sample water was thoroughly swirled and one-half of the water was again poured through the cone splitter, while maintaining a constant head in the barrel of the cone splitter. All water was allowed to drain out of the cone splitter, and the last of the sample was swirled vigorously and poured through the cone splitter.

Figure 8.--Bottle configuration around cone splitter.

After all the water was out of the cone splitter, the 1-liter, organically-cleaned glass bottles were removed from the discharge tubes, checked for equal volumes, and covered with aluminum foil. Out of the next split, the sediment samples and raw inorganic bottles were filled. Sediment and inorganic bottles were placed under the discharge tubes, and the 1-liter subsamples were swirled and poured as rapidly as possible through the cone splitter until the sediment and inorganic bottles contained the appropriate volumes. This procedure often took four or five splits after the initial split taken from the milk can.

Filtration

Bottles filled with the split sample were taken to the work vehicle for filtering. New powderless latex gloves were worn for processing the samples. The upper plate of the filter unit was removed, and a pre-cleaned glass fiber filter was placed on the lower plate of the filter unit. Stainless-steel forceps were used to manipulate the filter and a few drops of organic-free water (contained in a Teflon squeeze bottle) were used to wet the filter and secure it in place as the unit was reassembled (M.W. Sandstorm, U.S. Geological Survey, written commun., 1991). Aluminum foil was removed from the ends of the tubing and the intake end of the tubing was placed in the sample bottle. A clean Teflon bottle was placed under the outlet from the filtration unit, and 250 milliliters of sample water was pumped through the filtration unit as a final rinse to remove all residue. After discarding this rinse water, the procedure was repeated. The second volume of filtered rinse water was retained to use in rinsing the SPE equipment. A clean 1-liter Teflon bottle was placed on the balance; the weight was recorded on the laboratory sheet, and the balance was tared. The bottle was then placed under the outlet of the filtration unit and filled, leaving 2-3 centimeters of headspace for the surrogate and conditioner (M.W. Sandstrom, U.S. Geological Survey, written commun., 1991). The weight of the Teflon bottle and sample was determined and recorded.

Because of the time involved in processing the pesticide samples and in driving to the site, technicians worked simultaneously to collect and process the necessary samples; while one technician filtered and processed the SPE sample, the other technician filtered and processed the inorganic samples and ran the incremental titration for alkalinity. Filtering the inorganic sample (with an acrylic filtration unit, a peristaltic pump, and a 0.45-micron membrane filter) was done according to Ward and Harr (1990).

Solid-Phase Extraction

The following steps were used in the solid-phase extraction:

1. After removing the aluminum foil, the intake tubing for the SPE equipment was placed in the Teflon bottle containing the second volume of rinse water. A waste container was placed under the outlet tubing for the SPE equipment, the pump was turned on, and 250 milliliters of

native rinse water was pumped through the SPE system.

2. The SPE cartridge was conditioned using methanol and pesticide-free deionized water.
   A. The stopcock (with valve set to the open position) was attached to the small end of the cartridge.
   B. The cartridge was clamped to the SPE equipment base; the small end was pointing down over a waste beaker.
   C. Approximately 2 milliliters of methanol was introduced into the large open end of the cartridge and allowed to drain through, followed by 2 milliliters of pesticide-free deionized water. (Note: The SPE cartridge bed must be completely covered with methanol or water at all times once conditioning has begun.)
   D. When the water displaced all of the methanol in the cartridge, the stopcock valve was closed to prevent the water from completely draining through the cartridge and to allow it to dry out.
3. A precision dispenser containing methanol was checked for accuracy by pumping the dispenser until air bubbles were removed and then dispensing 1 milliliter into a graduated cylinder for comparison.
4. An amount of methanol was dispensed into the sample which was approximately equal to 1 percent of the weight of the sample (about 10 milliliters).
5. The weight of the Teflon bottle, sample, and methanol conditioner was determined and recorded.
6. The microdispenser and vial of glass bores were gathered for use; the surrogate vial was then taken out of the cooler.
7. The microdispenser was taken out of storage and the tip was rinsed with methanol. The tip of the microdispenser was inserted into a glass bore, the glass bore was removed from the vial and positioned so that the line on the glass bore near the tip lined up with the tip of the microdispenser, and the ring on the microdispenser was tightened to hold the bore snugly.
8. The surrogate vial was opened and the plunger on the microdispenser was depressed. The tip of the glass bore was submerged in the surrogate solution, and 100 microliters of the surrogate solution was drawn into the glass bore by releasing the microdispenser plunger.
9. The glass bore was withdrawn from the surrogate solution and quickly checked to make sure there were no air bubbles in the bore or drops hanging from the bore. The end of the glass bore was submerged in sample and the microdispenser plunger was depressed releasing the surrogate solution into the sample. The glass bore was removed from the sample, and the end was gently tapped on the side of the bottle to ensure that no surrogate solution remained in the glass bore.
10. The sample was swirled gently to facilitate mixing.
11. The glass bore was removed from the microdispenser and placed in a vial of used glass bores. The tip of the microdispenser was rinsed with methanol, and the microdispenser was placed in the storage container.
12. The surrogate vial was returned to the cooler.
13. The intake tubing was placed in the prepared sample bottle.
14. The outlet end of tubing and SPE cartridge with the stopcock removed was taken in hand, and the SPE pump was turned on.
15. After all of the air bubbles had passed through the tubing, the cartridge was connected to the tubing; the pesticide-free deionized water remaining in the cartridge was poured into a waste container, and the cartridge was clamped over a previously weighed stainless-steel collection beaker. The pump rate was calibrated to 20-25 milliliters per minute.
16. The weight of the stainless-steel collection beaker and the time were recorded on the SPE laboratory form (fig. 7).
17. Using a graduated 50-milliliter beaker, the rate of the pump was set to between 20 and 25 milliliters per minute.
18. The rate of the pump was checked after about 500 milliliters of sample had been processed to ensure that the rate was accurate and constant. The speed of the pump was changed to adjust the flow rate (if necessary).
19. While the SPE sample was processing, there was time to clean the filtration unit or help process other samples.

20. As soon as all of the SPE sample was processed through the cartridge, the time and the stainless-steel collection beaker and sample weight were recorded.

Clean-Up Procedures

Before dismantling the equipment, the filtration, SPE pumps, and associated tubing were cleaned to rinse any debris out of the equipment. After the tubing and pumps were disconnected from the aluminum filtration unit, they were rinsed with each of the following: 500 milliliters of a 2-percent solution of phosphate-free detergent, followed by enough deionized water (about 500 milliliters) to ensure that all of the phosphate-free detergent was out of the tubing. This procedure was followed by a 500-milliliter methanol rinse as described in the Equipment Cleaning section. The remaining equipment was taken apart and either placed in a storage container to be cleaned later or cleaned at the site following the methods stated in the Equipment Cleaning section.

Time Needed to Complete Sampling Procedures

The following table lists the estimated man-hours required to perform the procedures described in the preceding sections.

Procedures	Hours required to complete procedures: Start of sampling season	Hours required to complete procedures: End of sampling season	Percentage decrease in required time between the start and end of sampling season
Initial cleaning	3.50	2.75	22
Set up	1.00	.75	25
Sampling			
DH-81 sampler	.75	.50	33
D-77 sampler	1.50	1.00	33
Splitting	.50	.25	50
Filtering	.25	.25	0
Cleanup	.30	.30	0
Solid-phase extraction	1.50	1.25	17

Equipment cleaning to prepare for sampling required about 3.5 hours at the beginning of the sampling season, but was reduced by about 45 minutes by the end of the season. Set up, sampling, splitting, filtering, and solid-phase extraction took from 3.5 to 5 hours. The time required for set-up, sampling, splitting, filtering, cleanup, and solid-phase extraction was reduced from as much as 5.25 hours at the start of the season to as little as 3.3 hours by the end of the season. The time savings was realized when using the DH-81 sampler as opposed to the D-77 sampler. The greatest time savings, 20 percent (time-task weighed), was realized at the end of the sampling season after the field personnel had become familiar with the procedures.

Problems

Most of the problems encountered were related to two pieces of equipment--the cone splitter and the pump used for the SPE. The problems that were encountered with the cone splitter were uneven volume splits, short discharge tubes (which caused difficulty in getting the necessary number of bottles around the cone splitter), and unsteady support legs. The problem with uneven splits was partially solved by making sure the cone splitter was leveled before use. However, debris from the blackwater stream was often present in the collected sample and caused uneven splits by clogging ports. This problem was not resolved during the study period. A possible solution would be to have Teflon or stainless-steel screening inside the cone-splitter barrel. The problem of unsteady support legs was solved by constructing a new support apparatus for the cone splitter. The short discharge tubes could have been solved during the study period but the proper replacement tubing was on backorder. A cone splitter with longer discharge tubes arrived after the study period was over.

A few problems were associated with the operation of the SPE pump. There was a slight, recurring leak at the outlet of the pumphead. The outlet head threads were Teflon, and the nut on the end of the connecting tubing was stainless steel; if the nut was not threaded carefully, it cut into the threads on the outlet head and caused a leak. On two occasions (once in the laboratory during the cleaning procedure and once in the field during sample processing) the SPE pumphead locked up and blew a fuse. In each case the pumphead was dismantled, cleaned with a 5-percent nitric acid solution or methanol, and restored to proper working order. However, this problem did not occur after the pumps and tubing were routinely cleaned with 2-percent phosphate-free detergent solution and rinsed with tap or deionized water and methanol immediately after each sample set was processed.

Another problem occurred during high flows when suspended sediment in the filtered water clogged the SPE cartridge. When this happened the process was halted; the cartridge was removed and labeled, and a new cartridge was conditioned. This process continued until the remainder of the specified sample was run through the new cartridge. Both cartridges were labeled as a part of the same sample and shipped to the USGS laboratory for analysis. A 0.7-micron pore-size filter was used to remove sediment in preparation for processing the sample through the SPE cartridge. If a smaller pore size were used in this initial filtering process, less sediment would be in the sample water that would go through the SPE cartridge; however, the initial filtration process would require more time. It was estimated that using the smaller pore size in the initial filtration would require more time to filter the sample than the time it would take to condition the second cartridge.

The last concern was in the use of methanol inside a work vehicle during a North Carolina summer day. Because methanol gas is heavier than air, the work vehicle was ventilated by opening the side and rear doors, and methanol was used outside the work vehicle whenever possible. Also, clean methanol should be transported in an unbreakable container (possibly an extra Teflon bottle), and waste methanol should be transported in a proper flammable-liquids container.

WATER-QUALITY DATA

In addition to analyzing each sample for selected pesticides, water-quality data were collected to determine concentrations of major dissolved constituents, major nutrients, minor elements, bacteria, suspended sediment, and the physical characteristics of water. These data are listed in supplemental tables 2 and 3 at the end of the report. Major constituents include calcium, magnesium, sodium, potassium, bicarbonate, sulfate, chloride, fluoride, and silica; minor elements include iron and manganese. Major nutrients include combinations of dissolved and total nitrate, nitrite, ammonia, and organic nitrogen; phosphorus, orthophosphorus, and orthophosphate. Bacteria includes coliform and streptococci types. Physical characteristics of the water include dissolved-oxygen concentration, water temperature, pH, and specific conductance. The methods for collecting and processing the inorganic, suspended sediment, and bacterial samples are documented by Ward and Harr (1990), Edwards and Glysson (1988), and Britton and Greeson (1987), respectively.

Chemical analyses for major dissolved constituents, major nutrients, and minor elements were performed in the USGS laboratory in Arvada, Colorado. The methods and procedures used by the USGS laboratory are documented by Fishman and Friedman (1985). Concentrations of suspended sediment and bacteria were determined in the USGS District laboratory in Raleigh, North Carolina. Physical and chemical characteristics, such as specific conductance, pH, water temperature, dissolved oxygen, and alkalinity, were analyzed in the field at the time of sample collection.

Hourly determinations of specific conductance, water temperature, and dissolved oxygen were recorded by an automatic water-quality monitor from May 8 through September 2, 1992; and pH was recorded from May 19 through September 2, 1992. Daily values calculated from the hourly data (maximum, minimum, and mean) are presented in supplemental table 3.

Streamflow was monitored at 15-minute intervals from May 1 to September 30, 1992; and daily means and related streamflow statistics for the period are listed in supplemental table 1. These data were collected to provide supplemental information which can be used for interpretation of the water-quality data.

SUMMARY

During the summer of 1992, water-quality samples were collected from Chicod Creek in the Coastal Plain Province of eastern North Carolina as part of the U.S. Geological Survey's (USGS) National Water-Quality Assessment Program. Chicod Creek is in the Albemarle-Pamlico drainage area, which is one of four study units selected to participate in a prototype pesticide study designed to field test equipment and procedures for collecting and processing samples for the solid-phase extraction of selected pesticides.

The Chicod Creek sampling site has a drainage area of 45 square miles. This basin is predominantly rural with 42 percent of the land dedicated to agriculture, including a total of 25 pig and chicken operations. During 1978-81, selected streams in the basin, including Chicod Creek, were modified using special channel-modification techniques developed by the U.S. Soil Conservation Service and the U.S. Fish and Wildlife Service to minimize negative environmental effects and improve drainage efficiency.

The equipment and procedures described in this report were used to isolate and determine the concentrations of 47 selected pesticides. These pesticides consisted of 28 herbicides and 19 insecticides. The samples for these pesticide analyses were field processed by solid-phase extraction (SPE), and the chemical analyses were performed by the USGS's National Water- Quality Laboratory (NWQL) in Arvada, Colorado.

Sampling equipment is listed and a detailed description of the cleaning and setup procedures is included in this report to provide the reader with a working guide for the adaption of SPE to an operational field environment. To avoid contamination, proper cleaning of equipment was imperative. Thorough cleaning of the equipment for the SPE process involved (1) washing with a 2-percent solution of phosphate-free detergent, (2) rinsing thoroughly with both tap or deionized water, and (3) rinsing with high-purity methanol. All equipment was allowed to air dry thoroughly.

In order to expedite the sample processing and to prevent contamination, the filtration and SPE pesticide equipment was set up inside the work vehicle before collecting the sample. Powderless latex gloves were always worn, and all work areas were covered with aluminum foil to provide a clean work space for processing the SPE pesticide sample.

Once the equipment was set up and properly assembled, equal-width increment depth-integrated samples were collected from Chicod Creek using either the DH-81 or D-77 samplers, depending upon stream conditions. After the sample was collected and composited in a 19-liter milk can, it was taken back to the work vehicle to be processed.

Sample processing involved three main steps: sampling splitting, filtration, and SPE. First, the sample was split to assure that subdivided samples were equivalent in concentration of suspended and dissolved constituents for the organic and inorganic analyses. Once sample splitting was complete, sample water designated for organic analysis was pumped through the aluminum filter unit to remove suspended particulate matter and to prepare the sample for the final step, SPE. During the SPE process, the pesticides were extracted from the filtered water sample, placed (or inserted) into a cartridge and sent to the NWQL where the eluate was analyzed by capillary-column gas chromatograph/mass spectrometry.

Before dismantling the equipment, the filtration, SPE pumps, and associated tubing were cleaned to rinse any debris from the equipment. The remaining equipment was taken apart and either placed in a storage container to be cleaned later, or cleaned at the site following processing.

The time needed to complete sampling procedures (initial cleaning, set-up, sampling, splitting, filtering, cleanup, and SPE) for organic pesticides was 9.3 hours at the beginning of the sampling season, but was reduced to 7.05 hours at the end of the sampling season when field personnel had become familiar with the procedures. Because of the time involved in processing the pesticide samples and in driving to the site, technicians worked simultaneously to collect and process the necessary samples; while one technician filtered and processed the SPE sample, the other technician filtered and processed the inorganic samples and ran the incremental titration for alkalinity. Working simultaneously increased time efficiency and helped to maintain sample integrity.

Most of the problems encountered during this intensive sampling exercise were operational difficulties relating to the equipment used to process samples--the cone splitter and the pump used for the solid-phase extraction. The use of methanol inside of a work vehicle during a hot summer day was also a concern.

Although the emphasis of this report is on organic pesticide sample processing and sample collection, other water-quality data were collected to determine concentrations of major dissolved constituents, major nutrients, minor elements, bacteria, suspended sediment, and physical characteristics of water. Chemical analyses for major dissolved constituents, major nutrients, and minor elements were performed in the USGS laboratory in Arvada, Colorado. Streamflow data also were collected for supplemental information. These data, along with the organic pesticide data, are listed in supplemental tables at the end of the report.

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SUPPLEMENTAL TABLES

Page

Supplemental table 1.--*Discharge data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 1992*

[Daily mean values in cubic feet per second;---, no day of the month; $(ft^3/s)/mi^2$, cubic feet per second per square mile]

Day	May	June	July	August	September
1	8.4	20	11	4.1	8.7
2	7.5	9.8	6.5	3.5	7.6
3	5.0	6.0	4.4	12	6.2
4	4.0	4.5	6.6	18	5.4
5	3.4	4.3	32	7.8	5.9
6	3.2	3.9	24	5.6	31
7	3.6	3.2	15	4.7	27
8	7.1	2.3	7.8	4.6	17
9	5.8	9.8	4.7	4.2	22
10	4.1	150	3.4	4.5	36
11	3.4	115	2.6	4.7	47
12	3.1	50	1.8	9.9	30
13	3.1	27	1.4	78	17
14	3.0	14	1.3	355	11
15	2.2	8.2	1.5	1,180	8.6
16	1.7	49	.81	1,400	7.3
17	1.7	71	.36	1,320	5.9
18	1.5	23	.36	1,350	5.1
19	4.0	8.3	374	572	4.3
20	7.2	5.3	154	264	3.9
21	7.9	36	42	243	3.7
22	3.9	101	16	175	3.8
23	2.8	54	9.6	101	3.8
24	1.9	24	8.6	67	3.5
25	1.5	11	10	48	3.4
26	1.8	7.5	6.6	35	3.2
27	3.0	31	5.9	25	3.0
28	2.4	81	21	17	2.8
29	1.7	49	12	22	2.8
30	16	23	7.3	16	1.9
31	44	---	5.1	12	---

Day	May	June	July	August	September
Total	169.9	1,002.1	797.6	7,363.6	338.8
Mean	5.48	33.4	25.7	238	11.3
Maximum	44	150	374	1,400	47
Minimum	1.5	2.3	[a].36	3.5	1.9
$(ft^3/s)/mi^2$	.12	.74	.57	5.28	.25
Inches	.14	.83	.66	6.09	.28

May - September 1992		
Instantaneous peak flow	1,610	August 18
Instantaneous peak stage	10.64	August 18
Instantaneous low flow	[a]0	July 18

[a] No estimated daily discharges. Records good. Minimum discharge for current period occurred July 17.

Supplemental table 2.--*Water-quality data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 2, 1992*

[Abbreviations are listed on page iv; ---, no data available; >, greater than; <, less than]

DATE	TIME	DIS-CHARGE INST CUBIC FEET PER SECOND	SPE-CIFIC CON-DUCT-ANCE (US/CM)	PH WATER WHOLE FLD (STAND-ARD UNITS)	TEM-PER-ATURE WATER (DEG C)	BARO-METRIC PRES-SURE (MM OF HG)	OXY-GEN, DIS (MG/L)	OXY-GEN, DIS (PER-CENT SATUR-ATION)	COLI-FORM, FECAL, 0.7 (COLS/ 100 ML)	STREP-TOCOCCI FECAL, (COLS/ PER 100 ML)	CAL-CIUM DIS (MG/L AS CA)
May											
08	1100	8.4	135	6.4	13.0	757	7.2	69	---	---	17
15	1200	3.0	188	7.5	18.0	763	5.4	57	---	---	21
18	1045	2.7	470	7.7	18.5	762	2.4	26	---	---	27
20	1030	6.9	179	6.3	17.0	767	9.9	102	---	---	21
22	1045	5.0	134	7.3	15.0	767	6.8	67	---	---	15
25	1030	2.7	167	7.4	18.0	757	2.9	31	---	---	16
27	1200	3.8	215	7.4	15.0	762	4.3	43	---	---	20
29	1100	3.8	192	7.4	16.0	765	3.4	34	---	---	21
June											
01	1100	22	149	7.3	18.0	760	5.6	59	---	---	---
03	1100	22	135	7.2	19.0	762	5.7	61	---	---	14
05	1045	5.7	172	6.9	21.0	753	5.0	57	---	---	16
08	1145	5.6	167	7.2	---	---	5.3	---	[b]80	---	18
10	1450	181	133	7.7	22.0	755	4.8	55	5,400	---	11
12	1030	53	132	7.3	20.0	760	5.0	55	5,400	>10,000	10
15	1300	9.6	211	7.4	21.0	759	4.3	48	---	---	15
17	1115	23	115	7.4	20.0	766	5.5	60	---	---	9.4
19	1000	10	146	7.0	21.0	756	3.4	38	---	---	13
24	1300	25	108	7.2	19.0	759	6.9	75	490	180	8.9
July											
02	1200	8.2	157	6.7	23.5	757	3.3	39	960	8,800	10
08	1030	10	141	7.3	22.0	765	4.7	54	350	240	9.3
17	1130	.65	190	7.5	26.0	764	2.5	31	210	330	14
20	1130	125	105	7.5	24.5	764	4.9	58	[b]9,000	490	8.7
22	0930	15	109	8.1	24.5	764	4.9	58	---	---	9.5
24	0930	5.8	130	6.6	24.5	768	4.2	50	---	---	12
27	1150	5.4	152	6.5	24.5	757	4.6	56	330	640	15
28	1100	23	151	5.8	24.5	762	3.8	45	22,000	36,000	16
29	1300	10	186	6.7	24.0	764	3.6	42	[b]1,600	---	16
31	1100	6.4	126	6.9	24.5	760	4.4	52	---	350	12
Aug.											
03	1130	7.4	179	7.0	25.0	757	3.4	41	5,800	5,700	13
03	1745	23	155	7.5	25.0	757	4.3	52	[b]3,800	[b]7,200	11
05	1115	6.9	148	6.7	23.5	763	2.9	34	190	320	14
07	1115	4.0	166	7.0	22.0	766	4.3	49	160	170	12
10	1100	3.7	328	7.1	24.0	765	2.0	24	3,400	2,900	15
12	0945	3.1	143	7.2	25.0	763	3.2	39	210	420	12
12	2000	12	139	7.0	24.5	761	4.9	58	---	---	11
14	1030	296	107	7.3	22.5	765	4.9	56	5,600	2,700	9.3
17	1600	1,120	64	6.0	22.5	768	5.4	62	210	1,900	---
19	1100	506	68	6.2	22.5	768	4.5	51	230	620	6.4
21	1045	229	89	6.4	21.5	769	4.7	53	[b]2,200	960	8.1
24	1215	65	85	6.1	22.0	769	5.9	67	---	---	8.5
26	1130	37	119	6.2	23.0	765	5.7	66	[b]1,400	560	9.7
28	1100	15	108	6.6	24.0	746	5.4	66	---	660	11
Sept.											
02	1030	7.2	130	6.8	22.0	756	4.6	53	100	310	---

[b] Number based on non-ideal colony count.

Supplemental table 2.--*Water-quality data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 2, 1992*--**Continued**

[Abbreviations are listed on page iv; ---, no data available; >, greater than; <, less than]

DATE	MAGNE-SIUM, DIS (MG/L AS MG)	SO-DIUM DIS (MG/L AS NA)	SO-DIUM PER-CENT	SO-DIUM AD-SORP-TION RATIO	POTAS-SIUM, DIS (MG/L AS K)	BICAR-BONATE WATER DIS IT FLD (MG/L AS HC03)	ALKA-LINITY WAT DIS TOT IT FLD (MG/L AS CAC03)	SUL-FATE DIS (MG/L AS SO4)	CHLO-RIDE, DIS (MG/L AS CL)	FLUO-RIDE, DIS (MG/L AS F)	SILICA, DIS (MG/L AS SI02)
May											
08	2.4	7.3	22	0.4	4.2	53	43	12	14	0.20	8.4
15	2.7	8.1	20	.4	4.3	68	56	14	14	.20	8.3
18	3.5	13	20	.6	22	190	156	15	20	.30	9.5
20	2.8	7.4	19	.4	5.3	54	44	11	13	.30	8.3
22	2.3	6.2	21	.4	3.7	39	32	8.0	12	.20	7.6
25	2.6	7.6	22	.5	6.9	54	44	8.6	12	1.5	8.0
27	2.8	8.0	20	.4	6.0	49	40	9.8	13	.20	8.6
29	2.8	7.7	19	.4	6.6	73	60	10	14	.10	9.9
June											
01	---	---	---	---	---	78	64	---	---	---	---
03	2.3	7.1	24	.5	4.2	29	24	10	12	.30	7.4
05	2.6	6.9	21	.4	5.1	63	52	11	12	<.10	7.6
08	2.7	7.4	20	.4	5.6	29	24	11	13	.40	8.1
10	1.8	5.2	20	.4	7.6	24	20	12	9.5	<.10	6.2
12	2.1	5.6	23	.4	6.1	29	24	11	12	.20	7.3
15	2.7	8.2	23	.5	9.5	55	45	12	14	3.1	9.2
17	1.9	4.5	20	.4	6.3	21	17	7.8	10	.10	5.7
19	2.5	7.1	23	.5	7.6	24	20	12	13	.20	8.4
24	2.0	5.1	23	.4	5.2	10	8	8.3	11	<.10	7.1
July											
02	2.3	6.5	24	.5	7.4	34	28	7.4	12	.10	7.7
08	2.0	4.8	22	.4	4.9	24	20	6.6	10	.10	6.2
17	2.5	6.1	20	.4	5.8	37	30	5.5	12	.10	7.1
20	1.7	4.5	21	.4	6.0	22	22	12	13	.30	5.5
22	2.0	4.6	21	.4	4.7	49	---	11	9.2	.50	7.6
24	2.3	5.6	21	.4	5.0	22	18	11	11	.20	8.8
27	2.5	6.1	19	.4	5.7	18	22	11	13	.20	9.4
28	2.7	6.2	18	.4	8.4	39	32	12	13	.20	8.6
29	2.7	7.1	20	.4	9.5	49	40	12	13	.20	8.6
31	2.3	5.9	22	.4	5.4	27	22	6.8	12	.10	7.5
Aug.											
03	2.5	7.2	22	.5	11	71	58	7.4	13	.10	7.9
03	2.1	5.1	19	.4	8.2	32	26	6.1	9.3	.10	5.8
05	2.3	5.7	19	.4	7.4	32	26	8.1	11	.40	6.8
07	2.3	5.4	20	.4	6.4	20	16	5.2	10	.10	6.4
10	3.0	10	22	.6	21	142	116	6.6	20	.20	7.6
12	2.3	5.2	19	.4	6.8	24	20	5.6	11	.10	5.8
12	2.0	4.8	20	.3	5.7	22	18	4.9	8.2	.10	5.1
14	1.6	4.0	19	.3	6.6	10	8	10	8.5	<.10	6.3
17	---	---	---	---	3.9	---	---	---	---	---	---
19	1.5	2.9	19	.3	3.6	---	---	5.8	4.5	.30	6.0
21	1.8	4.0	21	.3	4.6	9	7	9.3	8.0	.20	7.7
24	2.0	5.4	26	.4	3.2	10	8	10	9.5	.10	8.6
26	2.1	5.1	23	.4	3.1	17	14	10	9.9	.10	9.0
28	2.3	5.3	22	.4	3.2	37	31	11	10	.30	9.5
Sept.											
02	---	---	---	---	---	37	30	---	---	---	---

Supplemental table 2.--*Water-quality data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 2, 1992*--**Continued**

[Abbreviations are listed on page iv; ---, no data available; >, greater than; <, less than]

DATE	SOLIDS, RESIDUE AT 180 DEG C DIS (MG/L)	SOLIDS, SUM OF CONSTI-TUENTS, DIS (MG/L)	NITRO-GEN, NIT-RATE DIS (MG/L AS N)	NITRO-GEN, NIT-RATE DIS (MG/L AS N)	NITRO-GEN, NO2+NO3 DIS (MG/L AS N)	NITRO-GEN, AM-MONIA DIS (MG/L AS N)	NITRO-GEN, AM-MONIA DIS (MG/L AS NH4)	NITRO-GEN, ORGANIC DIS (MG/L AS N)	NITRO-GEN, AM-MONIA + ORGANIC TOT (MG/L AS N)	NITRO-GEN, AM MONIA + ORGANIC DIS (MG/L AS N)	NITRO-GEN, DIS (MG/L AS N)
May											
08	114	98	1.16	0.040	1.20	0.100	0.13	0.30	0.60	0.40	1.6
15	126	107	---	---	---	---	---	---	---	---	---
18	268	246	1.46	.140	1.60	23.0	30	4.0	29	27	29
20	130	104	1.46	.040	1.50	.110	.14	.49	.70	.60	2.1
22	120	80	.940	.020	.960	.040	.05	.56	.60	.60	1.6
25	128	106	2.32	.180	2.50	1.80	2.3	.60	2.6	2.4	4.9
27	130	104	2.09	.110	2.20	.230	.30	.37	.90	.60	2.8
29	151	124	2.64	.160	2.80	.910	1.2	.59	1.6	1.5	4.3
June											
01	---	---	1.66	.140	1.80	.840	1.1	.76	1.6	1.6	3.4
03	122	79	1.37	.030	1.40	.080	.10	.52	.80	.60	2.0
05	121	100	1.37	.030	1.40	.080	.10	.62	.80	.70	2.1
08	114	92	2.14	.060	2.20	.300	.39	.60	.90	.90	3.1
10	96	77	1.80	.100	1.90	1.40	1.8	.50	2.8	1.9	3.8
12	94	79	1.44	.160	1.60	1.70	2.2	.80	2.8	2.5	4.1
15	128	121	2.23	.270	2.50	5.10	6.6	1.1	6.5	6.2	8.7
17	92	65	1.50	.100	1.60	.690	.89	.61	2.0	1.3	2.9
19	110	89	2.27	.230	2.50	.900	1.2	.80	1.7	1.7	4.2
24	80	61	1.42	.080	1.50	.630	.81	.47	1.5	1.1	2.6
July											
02	94	82	1.40	.100	1.50	2.90	3.7	.90	4.5	3.8	5.3
08	72	63	1.15	.050	1.20	.100	.13	.70	.70	.80	2.0
17	100	77	.720	.020	.740	.250	.32	.55	1.0	.80	1.5
20	94	68	.880	.040	.920	.550	.71	1.8	1.6	2.3	3.2
22	---	78	.690	.020	.710	.100	.13	.60	.80	.70	1.4
24	106	73	.920	.040	.960	.140	.18	.86	.90	1.0	2.0
27	114	78	1.08	.020	1.10	.050	.06	.55	.70	.60	1.7
28	128	94	1.12	.080	1.20	.320	.41	.68	1.4	1.0	2.2
29	128	103	1.21	.190	1.40	1.20	1.5	1.0	2.5	2.2	3.6
31	98	72	1.08	.020	1.10	.080	.10	.62	.90	.70	1.8
Aug.											
03	108	118	1.93	.170	2.10	6.10	7.9	1.2	8.1	7.3	9.4
03	110	64	---	---	---	---	---	---	3.6	2.9	---
05	122	82	1.42	.280	1.70	.770	.99	.63	1.8	1.4	3.1
07	84	66	1.47	.030	1.50	.050	.06	.55	.80	.60	2.1
10	176	189	1.67	.130	1.80	16.0	21	5.0	25	21	23
12	94	69	1.28	.020	1.30	.090	.12	.61	1.0	.70	2.0
12	93	58	.930	.020	.950	.100	.13	.50	.80	.60	1.6
14	78	56	.590	.040	.630	.660	.85	.54	1.8	1.2	1.8
17	50	---	.700	.030	.730	.300	.39	.80	1.4	1.1	1.8
19	91	---	.540	.030	.570	.300	.39	.80	1.1	1.1	1.7
21	84	54	.800	.050	.850	.540	.70	.96	1.6	1.5	2.4
24	91	57	.750	.020	.770	.110	.14	.79	.90	.90	1.7
26	86	58	---	---	---	---	---	---	---	---	---
28	93	75	.670	.010	.680	.040	.05	.46	.70	.50	1.2
Sept.											
02	---	---	.650	.010	.660	.070	.09	.43	.70	.50	1.2

Supplemental table 2.--*Water-quality data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 2, 1992*--**Continued**

[Abbreviations are listed on page iv; ---, no data available; >, greater than; <, less than]

DATE	PHOS-PHORUS TOT (MG/L AS P)	PHOS-PHORUS DIS (MG/L AS P)	PHOS-PHORUS ORTHO, DIS (MG/L AS P)	PHOS-PHATE, ORTHO, DIS (MG/L AS PO4)	IRON, DIS (UG/L AS FE)	MANGA-NESE, DIS (UG/L AS MN)	SEDI-MENT, SUS-PENDED (MG/L)	SEDI-MENT, DIS-CHARGE, SUS-PENDED (TONS/DAY)	SEDMENT SUS-PENDED SIEVE, DIAM. PERCENT FINER THAN 0.062 MM
May									
08	0.320	0.130	0.130	0.40	750	25	---	---	---
15	---	---	---	---	470	23	---	---	---
18	2.20	1.70	1.70	5.2	420	68	---	---	---
20	.360	.260	.280	.86	670	21	---	---	---
22	.270	.180	.160	.49	990	14	23	0.31	76
25	.790	.540	.570	1.7	690	37	14	.10	73
27	.470	.350	.360	1.1	450	25	28	.29	79
29	.640	.530	.460	1.4	570	31	12	.12	70
June									
01	.280	.230	.190	.58	---	---	30	1.8	56
03	.310	.200	.180	.55	620	23	16	.95	69
05	.390	.240	.230	.71	360	28	22	.34	80
08	.500	.380	.400	1.2	390	41	40	.60	76
10	.560	.330	.310	.95	540	18	96	47	79
12	.420	.250	.240	.74	420	22	34	4.9	59
15	.660	.550	.560	1.7	520	32	14	.36	71
17	.420	.150	.170	.52	230	15	67	4.1	85
19	.420	.300	.270	.83	440	37	22	.61	86
24	.430	.200	.210	.64	290	22	40	2.7	89
July									
02	.760	.480	.480	1.5	210	27	12	.26	82
08	.340	.490	.390	1.2	660	25	16	.43	92
17	.900	.650	.610	1.9	470	96	14	.02	74
20	.380	.280	.230	.71	310	16	20	6.8	76
22	.290	.220	.190	.58	600	28	---	---	---
24	.450	.340	.300	.92	650	32	39	.61	91
27	.510	.320	.270	.83	530	28	10	.15	99
28	.750	.490	.410	1.3	290	25	34	2.1	79
29	.460	.480	.400	1.2	440	34	20	.54	84
31	.550	.390	.330	1.0	670	25	16	.28	92
Aug.									
03	1.60	1.20	1.10	3.4	670	40	62	1.2	93
03	.980	.610	---	---	390	26	13	.79	100
05	.640	.450	.410	1.3	420	28	10	.19	100
07	.550	.460	.350	1.1	680	23	10	.11	100
10	3.20	2.30	2.20	6.7	850	79	13	.13	100
12	.740	.510	.500	1.5	560	20	9	.08	100
12	.630	.430	.370	1.1	360	27	41	1.4	92
14	.460	.270	.250	.77	600	14	39	31	94
17	---	.330	.270	.83	---	---	29	88	74
19	.270	.230	.170	.52	450	26	6	8.2	73
21	.340	.270	.230	.71	620	23	2	1.2	50
24	.200	.090	.100	.31	590	35	7	1.2	77
26	---	---	---	---	630	36	7	.71	85
28	.210	.140	.110	.34	660	31	40	1.7	77
Sept.									
02	.260	.220	.160	.49	---	---	15	.29	68

Supplemental table 2.--*Water-quality data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 2, 1992*--Continued

[Abbreviations are listed on page iv; ---, no data available; >, greater than; <, less than]

DATE	TIME	PROPA-CHLOR, WAT, DIS, REC (UG/L)	BUTYL-ATE, WAT, DIS, REC (UG/L)	SIMAZ-INE, WAT, DIS, REC (UG/L)	PRO-METON, WAT, DIS, REC (UG/L)	DESE-THYL ATRAZ-INE, WAT, DIS, REC (UG/L)	CYAN-AZINE, WAT, DIS, REC (UG/L)	FONO-FOS WAT, DIS, REC (UG/L)	ALPHA HCH DIS (UG/L)	P,P' DDE DIS (UG/L)	CHLOR-PYRIFOS DIS (UG/L)
May											
08	1100	<0.002	<0.002	0.0090	0.150	<0.050	<0.010	<0.005	<0.005	<0.010	<0.010
15	1200	<.002	<.002	.0050	.370	<.050	<.020	<.005	<.005	<.010	<.010
18	1045	---	---	---	---	---	---	---	---	---	---
20	1030	<.002	<.002	.130	.270	<.020	<.010	<.005	<.005	<.010	<.010
22	1045	<.002	<.002	.0090	.090	<.020	<.020	<.005	<.005	<.010	<.010
25	1030	<.002	<.002	.010	.012	.020	<.020	<.005	<.005	.010	<.010
27	1200	<.002	<.002	.0110	.120	<.020	<.020	<.005	<.005	<.010	<.010
29	1100	<.002	<.002	.026	.140	<.020	<.020	<.005	<.005	<.010	<.010
June											
01	1100	<.002	.017	.056	.680	.026	<.020	<.005	<.005	<.010	<.010
03	1100	<.002	<.002	.031	.400	<.020	<.020	<.005	<.005	<.010	<.010
05	1045	<.002	<.002	.027	.360	<.020	<.020	<.005	<.005	<.010	<.010
08	1145	<.002	.011	.010	.350	<.020	<.010	<.005	<.005	<.010	<.005
10	1450	<.002	.011	.058	.310	<.020	<.010	<.005	<.010	<.002	<.002
12	1030	<.002	.0040	.0110	.068	<.020	<.010	<.005	<.010	<.002	<.002
15	1300	<.002	.0060	.0110	.078	<.020	<.010	<.005	<.010	<.002	<.002
17	1115	<.002	<.002	.0050	.073	<.020	<.010	<.005	<.010	<.002	<.002
19	1000	<.002	.0040	.0060	.088	<.020	<.010	<.005	<.010	<.002	.0040
24	1300	<.002	.0020	.0040	.100	<.020	<.010	<.005	<.010	.0040	<.002
July											
02	1200	<.002	<.002	<.010	.049	<.020	<.010	<.005	<.010	<.002	<.002
08	1030	<.002	<.002	.0050	.110	<.020	<.010	<.005	<.010	<.002	<.002
17	1130	<.002	<.002	.0050	.230	<.020	<.010	<.005	<.010	<.002	<.002
20	1130	<.002	<.002	<.010	.140	<.020	<.010	<.005	<.010	<.002	<.002
22	0930	---	---	---	---	---	---	---	---	---	---
24	0930	<.002	<.002	.0050	.098	<.020	.054	<.005	<.010	<.002	.0060
27	1150	<.002	<.002	<.0100	.100	<.020	.011	<.005	<.010	<.002	.0030
28	1100	<.002	<.002	.0080	.120	<.020	.018	<.005	<.010	<.002	.0080
29	1300	<.002	<.002	.0050	.240	<.020	.029	<.005	<.010	<.002	.0060
31	1100	<.002	<.002	.0030	.150	<.020	.010	<.005	<.010	.0020	<.002
Aug.											
03	1130	---	---	---	---	---	---	---	---	---	---
03	1745	<.002	<.002	.0070	.140	<.020	.028	<.005	<.010	<.002	.0050
05	1115	<.002	<.002	.0030	.100	<.020	.070	<.005	<.010	<.002	<.0020
07	1115	<.002	<.002	.0030	.058	<.020	.079	<.005	<.010	<.002	<.0020
10	1100	<.002	<.002	<.010	.084	<.020	.028	<.005	<.010	<.002	.0040
12	0945	<.002	<.002	.0020	.087	<.020	.030	<.005	<.010	<.002	.0030
12	2000	<.002	<.002	.0020	.081	<.020	.027	<.005	<.010	<.002	.0040
14	1030	.0030	.0020	.0070	.160	.020	.0040	.0040	.010	.0090	.0070
17	1600	<.002	<.002	.0070	.061	<.020	<.010	<.005	<.010	<.002	.0040
19	1100	<.002	<.002	.0020	.035	<.020	<.010	<.005	<.010	<.002	.0030
21	1045	<.002	<.002	.0030	.065	<.020	<.010	<.005	<.010	<.002	<.002
24	1215	<.002	<.002	.0010	.039	<.020	<.010	<.005	<.010	<.002	<.002
26	1130	---	---	---	---	---	---	---	---	---	---
28	1100	<.002	<.002	<.010	.047	<.020	<.010	<.005	<.010	<.002	<.002
Sept.											
02	---	---	---	---	---	---	---	---	---	---	---

Supplemental table 2.--*Water-quality data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 2, 1992*--**Continued**

[Abbreviations are listed on page iv; ---, no data available; >, greater than; <, less than]

DATE	LIN-DANE DIS (UG/L)	DIEL-DRIN DIS (UG/L)	METO-LACHLOR WAT, DIS (UG/L)	MALA-THION, DIS (UG/L)	PARA-THION, DIS (UG/L)	DIA-ZINON, DIS (UG/L)	ATRAZ-INE, WAT, DIS, REC (UG/L)	ALA-CHLOR, WAT, DIS, REC, (UG/L)	METRI-BUZIN SENCOR WAT, DIS (UG/L)	2,6-DI-ETHYL ANA-LINE WAT FLT 0.7 U GF, REC (UG/L)
May										
08	<0.005	<0.050	0.037	<0.005	<0.010	<0.002	0.054	0.029	<0.005	<0.002
15	<.005	<.050	.048	<.005	<.010	<.002	.049	.011	<.005	<.002
18	---	---	---	---	---	---	---	---	---	---
20	<.005	<.050	.140	<.010	<.010	<.002	.250	.034	<.005	<.002
22	<.005	<.050	.086	<.010	<.010	<.002	1.30	3.20	.072	<.002
25	<.005	<.050	.010	<.010	<.010	<.002	1.40	2.40	.120	<.002
27	<.005	<.050	.110	<.010	<.010	<.002	1.10	1.30	.045	<.002
29	<.005	<.050	.095	<.010	<.010	<.002	.830	.980	.120	<.002
June										
01	<.005	<.050	.220	<.010	<.010	<.002	1.800	1.80	.120	<.005
03	<.005	<.050	.280	<.010	<.010	.0090	.580	.830	.066	<.005
05	<.005	<.050	.210	<.010	<.010	.0090	.380	.510	.068	<.005
08	<.010	<.020	.140	<.010	<.005	.0050	.200	.190	.023	.0010
10	<.005	.021	.540	<.010	<.005	.0090	.370	.450	.260	.0010
12	<.005	<.020	.270	<.010	<.005	.0080	.130	.470	.093	.0020
15	<.005	<.020	.120	<.010	<.005	<.005	.065	.100	.023	.0060
17	<.005	<.020	.870	<.010	<.005	.0040	.190	.350	.096	.0020
19	<.005	<.020	.690	<.010	<.005	.0060	.120	.120	.049	.0010
24	<.005	<.020	.300	<.010	<.005	.0050	.120	1.50	.100	.0010
July										
02	<.008	<.020	.100	<.010	<.008	<.005	.058	.023	.0093	.0090
08	<.008	<.020	.400	<.010	<.008	.0020	.170	3.20	.120	.012
17	<.008	<.020	.320	<.010	<.008	<.005	.064	.360	.120	.014
20	<.008	<.020	.018	<.010	<.008	<.010	.0090	.011	<.010	<.003
22	---	---	---	---	---	---	---	---	---	---
24	.076	<.020	.110	<.010	<.008	.0040	.033	.120	.020	.0030
27	.026	<.020	.072	<.010	<.008	<.005	.012	.048	.0080	<.002
28	.019	<.020	.079	<.010	<.008	<.005	.021	.085	.060	.0030
29	.014	<.020	.140	<.010	<.008	<.005	.019	.130	.012	.0020
31	.0080	<.020	.110	<.010	<.008	<.005	.019	.100	.011	.0030
Aug.										
03	---	---	---	---	---	---	---	---	---	---
03	.010	<.020	.091	<.010	<.008	<.005	.017	.045	.035	.0020
05	.0050	<.020	.082	<.010	<.008	<.005	.018	.024	.022	<.002
07	.0060	<.020	.061	<.010	<.008	<.005	.022	1.40	.016	.0030
10	.0050	<.020	.071	<.010	<.008	<.005	.023	1.30	.014	.0060
12	.0050	<.020	.086	<.010	<.008	<.005	.036	.900	.019	.0040
12	<.008	<.020	.068	.0090	<.008	<.005	.030	.620	.019	<.002
14	.0070	.200	.068	.010	.0080	.033	.070	.440	.017	.0060
17	<.008	<.020	.076	<.010	<.008	.0060	.040	.046	.025	.0020
19	<.008	<.020	.043	<.010	<.008	<.005	.026	.037	.010	.0010
21	<.008	<.020	.032	<.010	<.008	<.005	.024	.034	.013	<.002
24	<.008	<.020	.021	<.010	<.008	<.005	.011	.013	.0060	<.002
26	---	---	---	---	---	---	---	---	---	---
28	.008	<.020	.018	<.010	<.008	<.005	.0070	.011	.0090	<.0020
Sept.										
02	<.008	<.020	.017	<.010	<.008	<.005	.0070	.010	<.010	<.002

Supplemental table 2.--*Water-quality data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 2, 1992*--Continued

[Abbreviations are listed on page iv; ---, no data available; >, greater than; <, less than]

DATE	TRIFLU-RALIN WAT FLT 0.7 U GF, REC (UG/L)	DIMETH-OATE WAT FLT 0.7 U GF, REC (UG/L)	THAL-FLUR-ALIN WAT FLT 0.7 U GF, REC (UG/L)	PHORATE WAT FLT 0.7 U GF, REC (UG/L)	TER-BACIL WAT FLT 0.7 U GF, REC (UG/L)	LIN-URON WAT FLT 0.7 U GF, REC (UG/L)	METHYL PARA-THION WAT FLT 0.7 U GF, REC (UG/L)	EPTC (EPTAM) WAT FLT 0.7 U GF, REC (UG/L)	PEBU-LATE WAT FLT 0.7 U GF, REC (UG/L)	TEBU-THIURON WAT FLT 0.7 U GF, REC (UG/L)
May										
08	<0.005	<0.050	<0.010	<0.020	<0.010	<0.020	<0.005	<0.002	<0.002	<0.010
15	<.005	<.050	<.010	<.020	<.010	<.020	<.005	<.002	<.002	<.010
18	---	---	---	---	---	---	---	---	---	---
20	.0040	<.050	<.010	<.020	<.010	<.020	<.005	<.002	<.002	<.010
22	.0030	<.050	<.010	<.020	<.010	<.020	<.005	<.002	<.002	<.010
25	<.005	<.050	<.010	<.020	<.010	<.020	<.005	<.002	<.002	<.010
27	<.005	<.050	<.010	<.020	<.010	<.020	<.005	<.002	<.002	<.010
29	<.005	<.050	<.010	<.020	<.010	<.020	<.005	<.002	<.002	<.010
June										
01	.0040	<.050	<.010	<.060	<.010	<.020	<.005	<.002	<.002	<.010
03	.0040	<.050	<.010	<.060	<.010	<.010	<.005	<.002	<.002	.160
05	.0040	<.050	<.010	<.060	<.010	<.020	<.005	<.002	<.002	.120
08	.0030	<.020	<.010	<.020	<.010	<.010	<.005	<.002	<.002	.096
10	.0070	<.020	<.005	<.020	<.010	.030	<.005	<.002	<.010	.029
12	.0040	<.020	<.005	<.020	<.010	.014	<.005	<.002	<.010	.085
15	.0030	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	.047
17	.027	<.020	<.005	<.020	<.010	.020	<.005	<.002	<.010	.074
19	.0060	<.020	<.005	<.020	<.010	.012	<.005	<.002	<.010	.180
24	.0070	<.020	<.005	<.020	<.010	.034	<.005	<.002	<.010	.026
July										
02	.0030	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	.016
08	.0040	<.020	<.005	<.020	<.010	.055	<.005	<.002	<.010	.0090
17	.0040	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	<.010
20	<.005	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.002	<.005
22	---	---	---	---	---	---	---	---	---	---
24	.0060	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	<.010
27	.0050	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	.0070
28	.0090	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	<.010
29	.0060	<.020	<.005	<.020	<.010	<.010	<.005	.010	<.010	<.010
31	.0050	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	.013
Aug.										
03	---	---	---	---	---	---	---	---	---	---
03	.0070	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	<.010
05	.0050	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	.014
07	.0050	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	.026
10	.0050	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	.033
12	.0050	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	.037
12	.0050	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	.032
14	.0090	.020	.0060	.020	.010	.010	.0050	.0020	.010	.047
17	.0060	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	<.010
19	.0060	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	<.010
21	.0050	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	<.010
24	<.005	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	<.010
26	---	---	---	---	---	---	---	---	---	---
28	<.005	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	<.010
Sept.										
02	<.005	<.020	<.005	<.020	<.010	<.010	<.005	<.002	<.010	<.010

Supplemental table 2.--*Water-quality data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 2, 1992*--**Continued**

[Abbreviations are listed on page iv; ---, no data available; >, greater than; <, less than]

DATE	THIO-BENCARB WAT FLT 0.7 U GF, REC (UG/L)	DCPA (DATHAL) WAT FLT 0.7 U GF, REC (UG/L)	PEN-DIMETH-ALIN WAT FLT 0.7 U GF, REC (UG/L)	NAPROP-AMIDE WAT FLT 0.7 U GF, REC (UG/L)	PRO-PARGITE WAT FLT 0.7 U GF, REC (UG/L)	METHYL-AZINPHOS WAT FLT 0.7 U GF, REC (UG/L)	PER-METHRIN CIS WAT FLT 0.7 U GF, REC (UG/L)
May							
08	<0.010	<0.005	<0.010	<0.010	<0.002	<0.010	<0.010
15	<.010	<.005	<.010	<.010	<.002	<.010	<.010
18	---	---	---	---	---	---	---
20	<.010	<.005	<.010	.010	<.002	<.050	<.010
22	<.010	<.005	<.010	<.010	<.002	<.050	<.010
25	<.010	<.005	<.010	<.010	<.002	<.050	<.010
27	<.010	<.005	<.010	.0080	<.002	<.050	<.010
29	<.010	<.005	<.010	.012	<.002	<.050	<.010
June							
01	<.010	<.005	<.010	.034	<.002	<.050	<.010
03	<.010	<.005	<.010	.020	<.002	<.050	<.010
05	<.010	<.005	<.010	.015	<.002	<.050	<.010
08	<.010	<.010	<.040	.0060	<.010	<.008	<.010
10	<.005	<.002	.0090	.019	<.010	<.010	<.010
12	<.005	<.002	<.010	.040	<.010	<.010	<.010
15	<.005	<.002	<.010	.014	<.010	<.010	<.010
17	<.005	<.002	.0050	.010	<.010	<.010	<.010
19	<.005	<.002	.0050	.010	<.010	<.010	<.010
24	<.005	<.002	.0070	.024	.013	<.010	<.005
July							
02	<.008	<.002	<.010	.011	<.010	<.010	<.010
08	<.008	<.002	<.010	.013	<.010	<.010	<.010
17	<.008	<.002	<.010	.013	<.010	<.010	<.010
20	<.008	<.002	<.010	<.002	<.010	<.010	<.010
22	---	---	---	---	---	---	---
24	<.008	<.002	<.008	.010	<.010	<.010	<.010
27	<.008	<.002	<.010	.0090	<.010	<.010	<.010
28	<.008	<.002	<.008	.0090	<.010	<.010	<.010
29	<.008	<.002	<.008	.010	<.010	<.010	<.010
31	<.008	<.002	<.010	.011	<.010	<.010	<.010
Aug.							
03	---	---	---	---	---	---	---
03	<.008	<.002	<.005	.0090	<.010	.0090	<.010
05	<.008	<.002	<.010	.010	<.010	<.010	<.010
07	<.005	<.002	<.010	.012	<.010	<.010	<.010
10	<.008	<.002	<.010	.013	<.010	<.010	<.010
12	<.008	<.002	<.010	.012	<.010	<.010	<.010
12	<.008	<.002	<.010	.010	<.010	<.010	<.010
14	<.005	<.003	.0090	.014	<.010	.013	.012
17	<.008	<.002	<.010	.0080	<.010	<.010	<.010
19	<.008	<.002	<.010	<.002	<.010	<.010	<.010
21	<.008	<.002	<.010	<.002	<.010	<.010	<.010
24	<.008	<.002	<.010	.0040	<.010	<.010	<.010
26	---	---	---	---	---	---	---
28	<.008	<.002	.007	<.002	<.010	<.010	<.010
Sept.							
02	<.008	<.002	<.010	<.002	<.010	<.010	<.010

Supplemental table 2.--*Water-quality data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 2, 1992*--**Continued**

[Abbreviations are listed on page iv; ---, no data available; >, greater than; <, less than]

DATE	MOLINATE WAT FLT 0.7 U GF, REC (UG/L)	ETHOPROP WAT FLT 0.7 U GF, REC (UG/L)	BEN-FLURALIN WAT FLT 0.7 U GF, REC (UG/L)	CARBO-FURAN WAT FLT 0.7 U GF, REC (UG/L)	TER-BOFOS WAT FLT 0.7 U GF, REC (UG/L)	PRO-NAMIDE WAT FLT 0.7 U GF, REC (UG/L)	DISUL-FOTON WAT FLT 0.7 U GF, REC (UG/L)	TRIAL-LATE WAT FLT 0.7 U GF, REC (UG/L)	PRO-PANIL WAT FLT 0.7 U GF, REC (UG/L)	CAR-BARYL WAT FLT 0.7 U GF, REC (UG/L)
May										
08	<0.002	<0.005	<0.005	<0.002	<0.050	<0.010	<0.050	<0.002	<0.005	<0.002
15	<.002	<.005	<.005	<.002	<.050	<.010	<.050	<.002	<.005	<.002
18	---	---	---	---	---	---	---	---	---	---
20	<.002	<.005	<.005	<.002	<.050	<.010	<.050	<.002	<.005	.021
22	<.002	<.005	<.005	<.002	<.050	<.010	<.050	<.002	<.005	<.005
25	<.002	<.005	<.005	<.002	<.050	<.010	<.050	<.002	<.005	<.005
27	<.002	<.005	<.005	<.002	<.050	<.010	<.050	<.002	<.005	<.005
29	<.002	<.005	<.005	<.002	<.050	<.010	<.050	<.002	<.005	<.005
June										
01	<.002	<.005	<.005	<.005	<.050	<.010	<.050	<.002	<.005	<.010
03	<.002	<.005	<.005	<.005	<.050	<.010	<.050	<.002	<.005	<.010
05	<.002	<.005	<.005	<.005	<.050	<.010	<.050	<.002	<.005	<.010
08	<.002	<.005	<.005	.019	<.050	<.010	<.050	<.002	<.005	<.010
10	<.005	<.005	<.005	<.008	<.010	<.010	<.050	<.002	<.002	.026
12	<.005	<.005	<.005	.011	<.010	<.010	<.050	<.002	<.002	.017
15	<.005	<.005	<.005	<.008	<.010	<.010	<.050	<.002	<.002	.0020
17	<.005	<.005	<.005	<.008	<.010	<.010	<.050	<.002	<.002	.0050
19	<.005	<.005	<.005	.0030	<.010	<.010	<.050	<.002	<.002	.015
24	<.005	<.005	.0040	.012	<.010	<.010	<.050	<.002	<.002	<.005
July										
02	<.005	<.005	<.005	<.005	<.010	<.010	<.050	<.002	<.005	<.008
08	<.005	<.005	<.005	<.005	<.010	<.010	<.050	<.002	<.005	<.008
17	<.005	<.005	<.005	<.005	<.010	<.010	<.050	<.002	<.005	<.008
20	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	<.008
22	---	---	---	---	---	---	---	---	---	---
24	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.0050
27	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	<.008
28	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.0060
29	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.017
31	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.0040
Aug.										
03	---	---	---	---	---	---	---	---	---	---
03	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.027
05	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.010
07	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.0060
10	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.0060
12	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.0080
12	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.0080
14	.0050	.0060	.0080	<.005	<.010	<.010	.100	.0040	<.005	.013
17	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.0090
19	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.0060
21	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	<.008
24	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	<.008
26	---	---	---	---	---	---	---	---	---	---
28	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	.004
Sept.										
02	<.005	<.005	<.005	<.005	<.010	<.010	<.100	<.002	<.005	<.008

Supplemental table 3.--*Water-quality monitoring data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 1992*

[---, no data available or no day of the month]

	Specific conductance, microsiemen per centimeter at 25 degrees Celsius								
	May			June			July		
Day	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean
1	---	---	---	---	---	---	108	98	101
2	---	---	---	---	---	---	125	99	107
3	---	---	---	---	---	---	123	108	111
4	---	---	---	---	---	---	128	107	112
5	---	---	---	---	---	---	214	118	159
6	---	---	---	---	---	---	156	117	138
7	---	---	---	194	146	152	---	---	---
8	---	---	---	205	160	178	---	---	---
9	---	---	---	225	129	181	---	---	---
10	---	---	---	182	124	143	---	---	---
11	---	---	---	153	125	143	---	---	---
12	---	---	---	154	137	145	---	---	---
13	---	---	---	222	137	174	---	---	---
14	---	---	---	253	187	231	290	201	219
15	---	---	---	213	173	184	204	154	168
16	---	---	---	---	---	---	165	160	163
17	---	---	---	---	---	---	165	159	162
18	---	---	---	---	---	---	162	147	158
19	262	171	202	162	157	160	147	98	112
20	193	137	177	164	158	159	116	102	114
21	139	134	137	166	126	149	161	114	136
22	147	138	144	161	122	147	118	115	117
23	456	145	192	122	111	116	194	115	156
24	481	225	353	153	111	124	143	122	135
25	253	171	190	175	116	131	167	137	148
26	259	192	220	123	116	120	163	127	140
27	192	173	182	157	118	139	156	133	146
28	450	182	253	118	94	101	231	137	179
29	366	192	228	110	98	102	---	---	---
30	254	158	185	103	99	101	168	130	150
31	254	218	236	---	---	---	---	---	---
Monthly mean	---	---	---	---	---	---	---	---	---

Supplemental table 3.--*Water-quality monitoring data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 1992*--Continued

[---, no data available or no day of the month]

Day	Specific conductance, microsiemen per centimeter at 25 degrees Celsius					
	August			September		
	Maximum	Minimum	Mean	Maximum	Minimum	Mean
1	143	132	137	137	121	127
2	157	133	136	128	121	125
3	424	147	200	267	125	184
4	173	153	168	229	126	143
5	169	133	153	135	125	131
6	144	133	136	134	83	92
7	140	132	135	93	90	91
8	132	128	130	93	90	92
9	164	129	135	111	86	94
10	251	164	196	164	91	135
11	179	124	134	103	78	91
12	131	114	122	83	77	81
13	152	129	140	86	83	85
14	---	---	---	144	86	109
15	---	---	---	96	92	94
16	---	---	---	204	96	167
17	---	---	---	147	119	129
18	---	---	---	119	114	116
19	---	---	---	127	115	121
20	---	---	---	171	126	132
21	---	---	---	387	165	296
22	---	---	---	240	163	198
23	---	---	---	178	173	175
24	---	---	---	190	178	184
25	---	---	---	191	182	188
26	---	---	---	182	169	175
27	---	---	---	173	166	171
28	---	---	---	393	168	210
29	---	---	---	439	244	340
30	---	---	---	244	233	237
31	---	---	---	---	---	---
Monthly mean	---	---	---	439	77	150

Supplemental table 3.--*Water-quality monitoring data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 1992*--Continued

[---, no data available or no day of the month]

Day	pH, standard units								
	May			June			July		
	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean
1	---	---	---	---	---	---	6.7	6.4	6.6
2	---	---	---	---	---	---	7.0	6.5	6.8
3	---	---	---	---	---	---	6.7	6.4	6.6
4	---	---	---	---	---	---	6.7	6.6	6.7
5	---	---	---	---	---	---	6.9	6.5	6.7
6	---	---	---	---	---	---	6.7	6.4	6.6
7	---	---	---	7.6	7.2	7.4	6.6	6.2	6.4
8	---	---	---	7.3	7.0	7.1	6.4	6.3	6.3
9	---	---	---	7.3	7.0	7.1	6.5	6.3	6.4
10	---	---	---	7.0	6.7	6.9	6.4	6.3	6.4
11	---	---	---	7.0	6.7	6.9	6.4	6.3	6.4
12	---	---	---	7.0	6.7	6.8	6.4	6.2	6.3
13	---	---	---	6.9	6.6	6.8	6.8	6.3	6.6
14	---	---	---	7.3	6.8	7.1	6.6	6.4	6.5
15	---	---	---	7.1	6.5	6.7	6.5	6.3	6.4
16	---	---	---	---	---	---	6.5	6.4	6.4
17	---	---	---	---	---	---	6.5	6.4	6.5
18	---	---	---	---	---	---	6.5	6.5	6.5
19	7.2	7.0	7.1	6.7	6.6	6.6	6.5	6.0	6.1
20	7.4	7.1	7.2	6.7	6.6	6.7	6.1	6.0	6.0
21	7.2	7.1	7.2	6.7	6.5	6.6	6.3	6.0	6.2
22	7.4	7.2	7.3	6.7	6.5	6.6	6.4	6.1	6.2
23	7.6	7.3	7.4	6.5	6.4	6.5	6.8	6.3	6.6
24	7.7	7.3	7.5	6.7	6.4	6.5	6.5	6.3	6.4
25	7.4	7.1	7.2	6.8	6.4	6.5	6.6	6.5	6.6
26	7.5	7.3	7.4	6.5	6.4	6.5	6.7	6.6	6.6
27	7.5	7.3	7.4	6.7	6.5	6.6	6.7	6.6	6.6
28	7.9	7.5	7.6	6.5	6.3	6.4	6.8	6.5	6.6
29	7.8	7.4	7.5	6.5	6.3	6.4	---	---	---
30	7.6	7.4	7.5	6.5	6.4	6.4	6.9	6.6	6.8
31	7.7	7.5	7.6	---	---	---	6.9	-.2	6.5
Monthly mean	---	---	---	---	---	---	---	---	---

Supplemental table 3.--*Water-quality monitoring data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 1992*--Continued

[---, no data available or no day of the month]

Day	pH, standard units					
	August			September		
	Maximum	Minimum	Mean	Maximum	Minimum	Mean
1	7.0	6.7	7.0	7.2	7.0	7.1
2	7.2	6.8	6.9	7.1	7.0	7.1
3	7.6	6.9	7.3	7.5	7.0	7.2
4	7.1	6.8	6.9	7.4	6.9	7.0
5	6.8	6.5	6.7	7.0	6.9	7.0
6	6.9	6.4	6.5	7.0	6.4	6.6
7	7.1	6.9	7.0	6.7	6.5	6.6
8	7.3	7.0	7.1	6.6	6.5	6.5
9	7.7	7.2	7.4	6.6	6.4	6.5
10	8.0	7.6	7.9	6.8	6.4	6.7
11	7.6	7.3	7.4	6.5	6.1	6.3
12	7.6	7.4	7.5	6.3	6.1	6.2
13	7.5	7.3	7.5	6.3	6.1	6.2
14	7.4	7.1	7.3	6.5	6.1	6.3
15	7.1	6.7	6.9	6.3	6.1	6.2
16	6.7	6.5	6.6	6.7	6.2	6.5
17	6.6	6.5	6.5	6.4	6.2	6.3
18	6.7	6.5	6.6	6.2	6.1	6.2
19	6.6	6.5	6.6	6.3	6.2	6.2
20	6.8	6.6	6.7	6.4	6.2	6.2
21	6.9	6.8	6.8	6.8	6.4	6.7
22	6.8	6.8	6.8	6.5	6.3	6.4
23	7.0	6.8	6.9	6.3	6.2	6.3
24	6.9	6.8	6.9	6.2	6.2	6.2
25	7.0	6.9	6.9	6.2	6.1	6.1
26	7.0	6.9	7.0	6.1	5.9	6.1
27	7.1	6.9	7.0	6.0	5.9	5.9
28	7.1	6.9	7.0	6.3	5.8	6.0
29	7.1	7.0	7.1	7.2	6.3	6.8
30	7.1	7.0	7.0	7.1	6.9	7.0
31	---	---	---	---	---	---
Monthly mean	---	---	---	7.5	5.8	6.5

Supplemental table 3.--*Water-quality monitoring data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 1992*--Continued

[---, no data available or no day of the month]

Day	Water temperature, degrees Celsius								
	May			June			July		
	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean
1	---	---	---	---	---	---	---	---	---
2	---	---	---	---	---	---	---	---	---
3	---	---	---	---	---	---	---	---	---
4	---	---	---	---	---	---	---	---	---
5	---	---	---	---	---	---	---	---	---
6	---	---	---	---	---	---	---	---	---
7	---	---	---	22.5	20.6	21.6	---	---	---
8	---	---	---	24.1	21.9	22.8	---	---	---
9	---	---	---	23.4	21.7	22.8	---	---	---
10	---	---	---	---	---	---	---	---	---
11	---	---	---	---	---	---	---	---	---
12	---	---	---	---	---	---	---	---	---
13	---	---	---	---	---	---	---	---	---
14	---	---	---	---	---	---	---	---	---
15	---	---	---	---	---	---	---	---	---
16	---	---	---	---	---	---	---	---	---
17	---	---	---	---	---	---	---	---	---
18	---	---	---	---	---	---	---	---	---
19	21.0	19.0	20.1	---	---	---	---	---	---
20	19.0	16.7	17.4	---	---	---	---	---	---
21	18.0	16.3	17.0	---	---	---	---	---	---
22	17.7	15.4	16.6	---	---	---	---	---	---
23	18.7	16.2	17.5	22.3	19.8	20.7	---	---	---
24	19.8	17.3	18.6	23.1	21.1	22.0	---	---	---
25	19.7	17.6	18.8	26.5	23.1	24.5	---	---	---
26	17.6	16.1	16.6	27.0	25.8	26.6	---	---	---
27	16.4	15.5	16.0	25.8	24.4	25.0	---	---	---
28	16.9	15.1	16.0	25.3	23.8	24.3	---	---	---
29	16.3	15.5	15.8	24.0	22.3	22.9	---	---	---
30	17.5	15.6	16.3	23.1	22.0	22.6	25.1	23.9	24.4
31	19.2	17.4	18.1	---	---	---	---	---	---
Monthly mean	---	---	---	---	---	---	---	---	---

Supplemental table 3.--*Water-quality monitoring data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 1992*--Continued

[---, no data available or no day of the month]

Day	Water temperature, degrees Celsius					
	August			September		
	Maximum	Minimum	Mean	Maximum	Minimum	Mean
1	25.7	24.0	24.7	23.0	21.9	22.4
2	24.0	22.3	23.0	22.9	21.7	22.3
3	23.5	22.7	23.1	23.4	22.1	22.7
4	24.1	23.1	23.6	23.5	22.5	23.0
5	23.9	23.3	23.6	23.5	22.5	23.1
6	23.7	22.8	23.1	23.5	22.9	23.1
7	22.9	22.0	22.4	23.2	22.6	22.9
8	23.3	21.9	22.6	23.4	22.6	23.0
9	24.5	23.1	23.6	23.4	22.8	23.1
10	24.4	23.4	23.9	23.6	22.5	23.0
11	25.4	23.9	24.5	23.6	22.6	22.9
12	25.4	23.6	24.9	22.9	20.8	21.5
13	23.6	22.8	23.1	20.8	19.2	19.8
14	23.4	22.5	22.8	19.8	18.9	19.5
15	22.8	22.5	22.6	20.2	19.2	19.6
16	22.8	22.5	22.6	21.4	20.1	20.6
17	22.7	22.4	22.5	22.5	21.2	21.8
18	22.8	22.4	22.6	22.7	21.5	22.2
19	23.4	22.5	22.8	23.1	22.2	22.6
20	23.4	22.5	23.0	22.9	22.3	22.6
21	22.5	21.8	22.2	23.2	22.4	22.7
22	22.4	21.3	21.8	23.5	22.6	23.1
23	22.3	21.0	21.6	23.5	20.7	22.6
24	23.2	21.7	22.3	20.7	18.0	19.0
25	23.5	22.4	22.9	18.0	17.5	17.8
26	23.8	22.8	23.3	18.5	17.2	17.7
27	24.4	23.6	23.9	20.5	18.5	19.4
28	24.4	23.8	24.1	20.9	20.2	20.5
29	24.3	22.9	23.6	21.0	19.6	20.5
30	22.9	21.6	22.1	19.6	16.8	17.9
31	---	---	---	---	---	---
Monthly mean	---	---	---	23.6	16.8	21.4

Supplemental table 3.--*Water-quality monitoring data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 1992*--Continued

[---, no data available or no day of the month]

	Dissolved oxygen, milligram per liter								
	May			June			July		
Day	Maximum	Minimum	Mean	Maximum	Minimum	Mean	Maximum	Minimum	Mean
1	---	---	---	---	---	---	6.2	5.2	5.7
2	---	---	---	---	---	---	5.3	3.0	4.1
3	---	---	---	---	---	---	5.0	3.0	4.1
4	---	---	---	---	---	---	5.3	3.8	4.6
5	---	---	---	---	---	---	4.6	3.8	4.2
6	---	---	---	---	---	---	4.4	3.7	4.0
7	---	---	---	5.5	2.2	4.1	4.7	3.8	4.2
8	---	---	---	3.5	1.7	2.5	5.2	4.7	5.0
9	---	---	---	6.1	.8	2.6	5.1	4.8	4.9
10	---	---	---	5.3	4.9	5.1	4.9	4.3	4.7
11	---	---	---	5.1	5.0	5.0	4.6	3.5	4.1
12	---	---	---	5.3	5.0	5.2	3.5	2.2	2.8
13	---	---	---	5.4	3.7	4.7	2.3	.3	1.4
14	---	---	---	3.8	2.9	3.4	1.8	1.1	1.5
15	---	---	---	3.1	2.1	2.7	3.0	1.5	2.2
16	---	---	---	---	---	---	2.8	2.0	2.5
17	---	---	---	---	---	---	2.5	1.5	2.0
18	---	---	---	---	---	---	2.5	.9	1.5
19	4.5	2.4	3.5	3.7	2.8	3.3	5.7	2.4	4.7
20	7.5	4.5	6.2	2.8	2.5	2.6	5.5	4.8	5.2
21	8.1	7.5	7.8	5.9	2.7	4.4	5.7	5.1	5.4
22	8.4	7.6	7.9	5.9	5.4	5.7	5.9	5.6	5.8
23	7.7	2.5	6.1	6.9	5.9	6.7	5.6	3.8	4.3
24	3.5	2.5	2.9	6.8	5.3	6.1	5.1	4.3	4.7
25	3.1	1.9	2.6	6.2	3.7	4.9	5.0	4.4	4.7
26	3.1	1.9	2.6	6.1	5.1	5.4	4.8	4.5	4.6
27	6.2	3.0	4.8	6.1	4.4	5.1	4.8	4.5	4.7
28	6.8	2.6	5.2	6.0	5.4	5.8	5.1	3.8	4.5
29	4.9	2.9	3.6	6.6	5.4	6.1	---	---	---
30	7.5	4.9	6.2	6.5	6.0	6.2	3.8	2.8	3.2
31	6.1	4.9	5.7	---	---	---	---	---	---
Monthly mean	---	---	---	---	---	---	---	---	---

Supplemental table 3.--***Water-quality monitoring data for Chicod Creek at Secondary Road 1760 near Simpson, May through September 1992***--**Continued**

[---, no data available or no day of the month]

	Dissolved oxygen, milligram per liter					
	August			September		
Day	Maximum	Minimum	Mean	Maximum	Minimum	Mean
1	4.2	3.0	3.7	4.5	4.1	4.3
2	4.7	1.7	4.1	4.7	4.5	4.6
3	4.3	1.4	2.8	4.7	2.8	3.7
4	4.1	2.7	3.5	3.8	2.9	3.4
5	3.2	2.4	2.7	4.2	3.8	4.0
6	3.9	2.5	3.3	5.1	4.1	4.7
7	4.3	2.8	3.8	5.1	4.8	5.0
8	4.7	3.8	4.4	5.1	5.0	5.0
9	4.5	1.7	3.5	5.8	4.3	5.0
10	1.9	1.2	1.5	4.7	3.6	4.1
11	2.6	1.8	2.2	5.0	4.5	4.7
12	4.5	2.5	3.2	5.7	5.0	5.4
13	4.3	3.7	3.9	6.1	5.7	5.9
14	5.8	4.0	4.8	6.0	4.8	5.1
15	5.7	5.3	5.5	5.6	5.5	5.6
16	5.7	5.4	5.6	5.5	3.2	3.6
17	5.9	5.5	5.6	3.2	2.8	3.0
18	5.9	5.4	5.5	3.7	2.9	3.4
19	5.5	5.4	5.5	3.5	2.6	3.1
20	5.5	5.2	5.3	2.9	2.1	2.6
21	5.5	5.2	5.4	2.1	1.8	1.9
22	5.6	5.5	5.6	2.3	1.8	2.1
23	5.8	5.3	5.6	2.3	2.1	2.2
24	5.9	5.5	5.8	2.8	2.3	2.6
25	5.8	5.6	5.7	3.0	2.6	2.7
26	5.8	5.6	5.7	3.4	2.6	2.8
27	5.7	5.4	5.6	3.3	2.3	2.6
28	5.4	4.7	5.3	2.7	1.5	2.3
29	4.7	4.3	4.5	1.8	1.1	1.5
30	5.2	4.7	4.9	2.4	1.5	1.9
31	---	---	---	---	---	---
Monthly mean	---	---	---	6.1	1.1	3.6