Baseline Data-Collection and Quality-Control Protocols and Procedures for the *Equus* Beds Ground-Water Recharge Demonstration Project Near Wichita, Kansas, 1995–96

By A.C. ZIEGLER and L.J. COMBS

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CONVERSION FACTORS AND VERTICAL DATUM

Multiply	By	To obtain
cubic foot per second	0.02832	liter per second
foot	0.3048	meter
gallon per minute	0.06309	liter per second
inch	2.54	centimeter
mile	1.609	kilometer
quart	0.9464	liter

Temperature in degrees Celsius (°C) or degrees Fahrenheit (°F) can be converted using the following equations:

°C = 5/9 (°F - 32)

°F = 9/5 (°C) + 32.

Sea level: In this report, "sea level" refers to the National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum of 1929.

Baseline Data-Collection and Quality-Control Protocols and Procedures for the *Equus* Beds Ground-Water Recharge Demonstration Project Near Wichita, Kansas, 1995–96

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Abstract

The *Equus* Beds Ground-Water Recharge Demonstration Project is being conducted from 1995 through 1999 as part of the High Plains States Groundwater Recharge Demonstration Program to determine if recharge of the *Equus* beds aquifer in south-central Kansas is a viable alternative in meeting the increased demands for water in this rapidly growing part of the State. As part of the demonstration project, protocols and procedures were developed for the collection of baseline hydrologic and water-quality data from September 1995 through September 1996 and are described in this report. During this initial phase of the demonstration project, 33 data-collection sites were identified and instrumented, and an aquifer test at one site was conducted to determine transmissivity, specific yield, hydraulic conductivity, and riverbed conductance of the *Equus* beds aquifer in the area northwest of Wichita, Kansas. Selected water-quality samples were analyzed for as many as 340 chemical constituents to determine the baseline or ambient concentrations of inorganic and organic constituents.

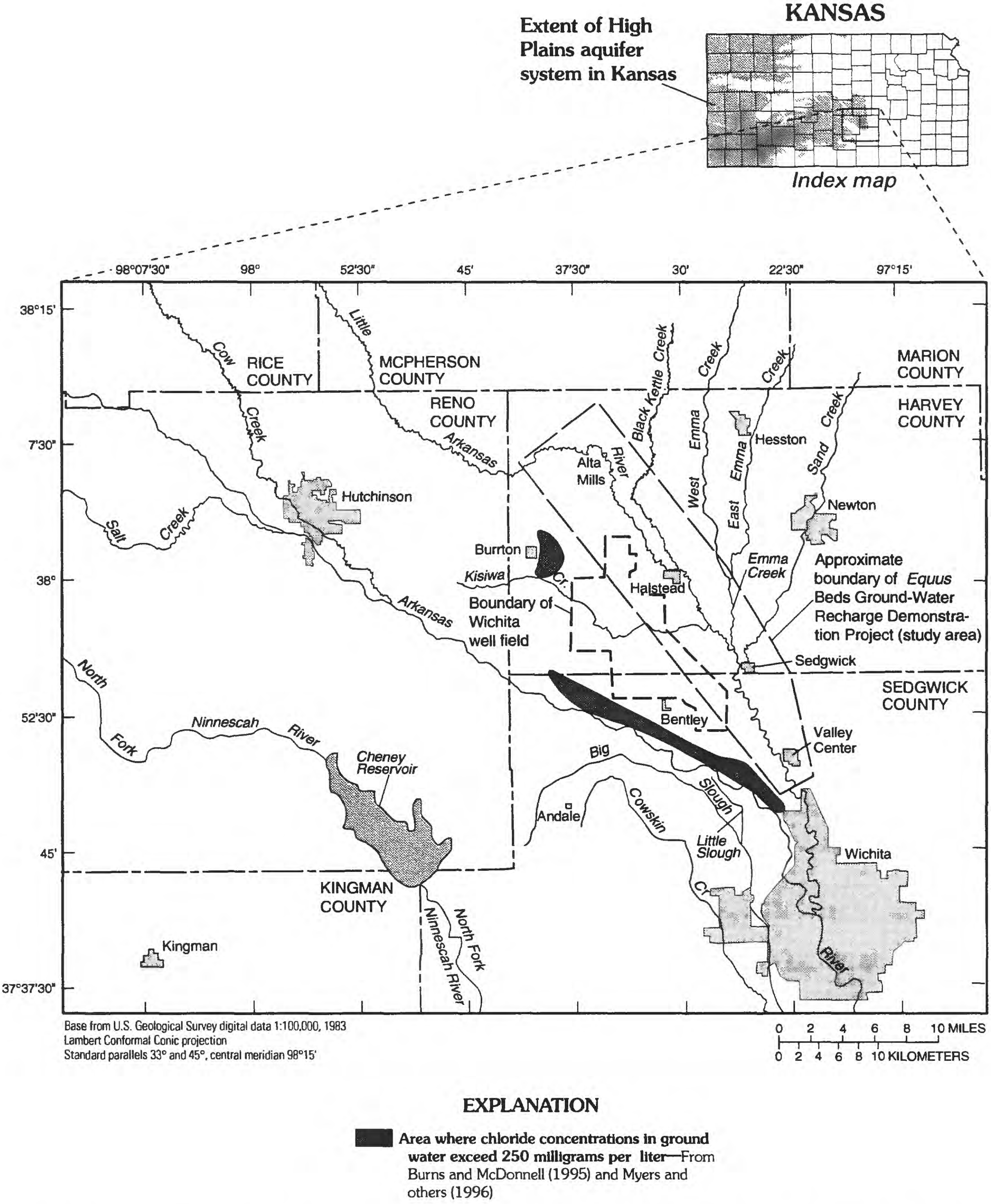
INTRODUCTION

The water supply for the city of Wichita in south-central Kansas currently (1997) comes from two primary sources—the Wichita well field completed in the *Equus* beds aquifer (a part of the regional High Plains aquifer system) and Cheney Reservoir (fig. 1). Because of the area's expected population growth and regionalization of the water system, the available water supply needs to be increased to meet future water demands. Recharge of the *Equus* beds aquifer is one alternative being considered to meet these increased demands.

The High Plains States Groundwater Recharge Demonstration Program is a cooperative effort between the U.S. Department of Interior, Bureau of Reclamation, U.S. Geological Survey, and U.S. Environmental Protection Agency. The purpose of the program is to study the potential for artificial ground-water recharge in 17 Western States and to demonstrate artificial-recharge technologies under a variety of hydrogeologic conditions. The results of demonstration projects will assist in determining the physical, chemical, and economic feasibility of artificial recharge.

Description of *Equus* Beds Ground-Water Recharge Demonstration Project

To determine if recharge storage and recovery is a viable alternative water supply for the city of Wichita, the *Equus* Beds Ground-Water Recharge Demonstration Project is being conducted from 1995 through 1999 as part of the High Plains States Groundwater Recharge Demonstration Program. The project is a cooperative effort among the following agencies and engineering consulting firms: city of Wichita, Groundwater Management District No. 2 (Halstead, Kansas),



Base from U.S. Geological Survey digital data 1:100,000, 1983
Lambert Conformal Conic projection
Standard parallels 33° and 45°, central meridian 98°15'

EXPLANATION

▇ **Area where chloride concentrations in ground water exceed 250 milligrams per liter**—From Burns and McDonnell (1995) and Myers and others (1996)

Figure 1. Location of *Equus* Beds Ground-Water Recharge Demonstration Project near Wichita, Kansas, and areas where chloride concentrations in ground water exceed 250 milligrams per liter.

Bureau of Reclamation and U.S. Geological Survey (both U.S. Department of the Interior agencies), U.S. Environmental Protection Agency, Kansas State agencies, Mid-Kansas Engineering Consultants (Wichita, Kansas), and Burns and McDonnell Engineering Consultants (Kansas City, Missouri).

The primary purpose of the *Equus* Beds Ground-Water Recharge Demonstration Project is to evaluate two ground-water recharge and recovery techniques—surface-spreading basins and direct-injection recharge wells. Evaluation of these techniques will include description of recharge effects on ground-water quality, determination of operation and maintenance requirements for the two recharge methods, and identification of problems associated with long-term infiltration of recharge water. This project also will evaluate the potential of deterring the migration of saltwater (as identified by chloride concentrations exceeding 250 milligrams per liter) northwest of the existing Wichita well field (fig. 1) as identified by Burns and McDonnell (1995) and Myers and others (1996). The results of the demonstration project will be used to determine the feasibility and design and operating criteria for a full-scale recharge project. A detailed description of the *Equus* Beds Ground-Water Recharge Demonstration Project is provided by Burns and McDonnell (1995).

Project participants and responsibilities are outlined in figure 2. The city of Wichita and Bureau of Reclamation cosponsor the overall project. Burns and McDonnell (consulting engineers, Kansas City, Missouri) manage the project for the city of Wichita and are responsible for the aquifer testing. The U.S. Geological Survey (USGS) is responsible for ensuring the collection and interpretation of water-quality and quantity data. Analysis of water-quality samples will be done by the city of Wichita laboratory, the USGS laboratory in Lawrence, Kansas, and the USGS National Water-Quality Laboratory in Arvada, Colorado.

Description of Study Area

The *Equus* beds aquifer consists of interbedded sand, gravel, and clay. The general directions of ground-water movement are southward and towards or away from the Little Arkansas River, the major source of recharge water for this project. Ground-water levels in the area fluctuate in response to water levels in the Little Arkansas River and to pumping of ground water for irrigation. Water levels generally are within 20 feet of the land surface. Long-term water-level declines are evident in the area because of pumping for irrigation and municipal use. The water resources of Sedgwick County, Kansas, are described in detail by Bevans (1988).

The source of recharge water for the demonstration project is the Little Arkansas River between Halstead and Sedgwick, Kansas (fig. 1). Water will be recharged during the demonstration project whenever water levels in the Little Arkansas River are above base flow. Base flow has been determined to be when the discharge exceeds 42 cubic feet per second at USGS streamflow-gaging station 07143672 (fig. 3) near Halstead.

Purpose and Scope of This Report

The purpose of this report is to document the data-collection and quality-control protocols and procedures used in the collection of baseline data for the *Equus* Beds Ground-Water Recharge Demonstration Project near Wichita, Kansas, from February 1995 through September 1996. This report describes selection of sampling sites, water-level and discharge measurements, onsite water-quality measurements, instrument calibration, water-quality sample collection, identification, preservation, and chain of sample custody, and references the analytical techniques used. Quality-control protocols and procedures are incorporated for each data-collection activity.

Selected water-quality samples were analyzed for as many as 340 chemical constituents to determine the baseline or ambient concentrations of inorganic and organic constituents. Potential constituents of concern include chloride and herbicides.

DATA-COLLECTION OBJECTIVES AND INTENDED USE OF BASELINE DATA

The overall objective of the data-collection activities is to determine the baseline hydrologic and water-quality conditions in the ground water and surface water along the Little Arkansas River and the adjacent *Equus* beds aquifer. These baseline data describe and will assist later in quantifying the effects of the *Equus* Beds Ground-Water Recharge Demonstration Project and in determining if a full-scale project is technically, environmentally, and economically feasible.

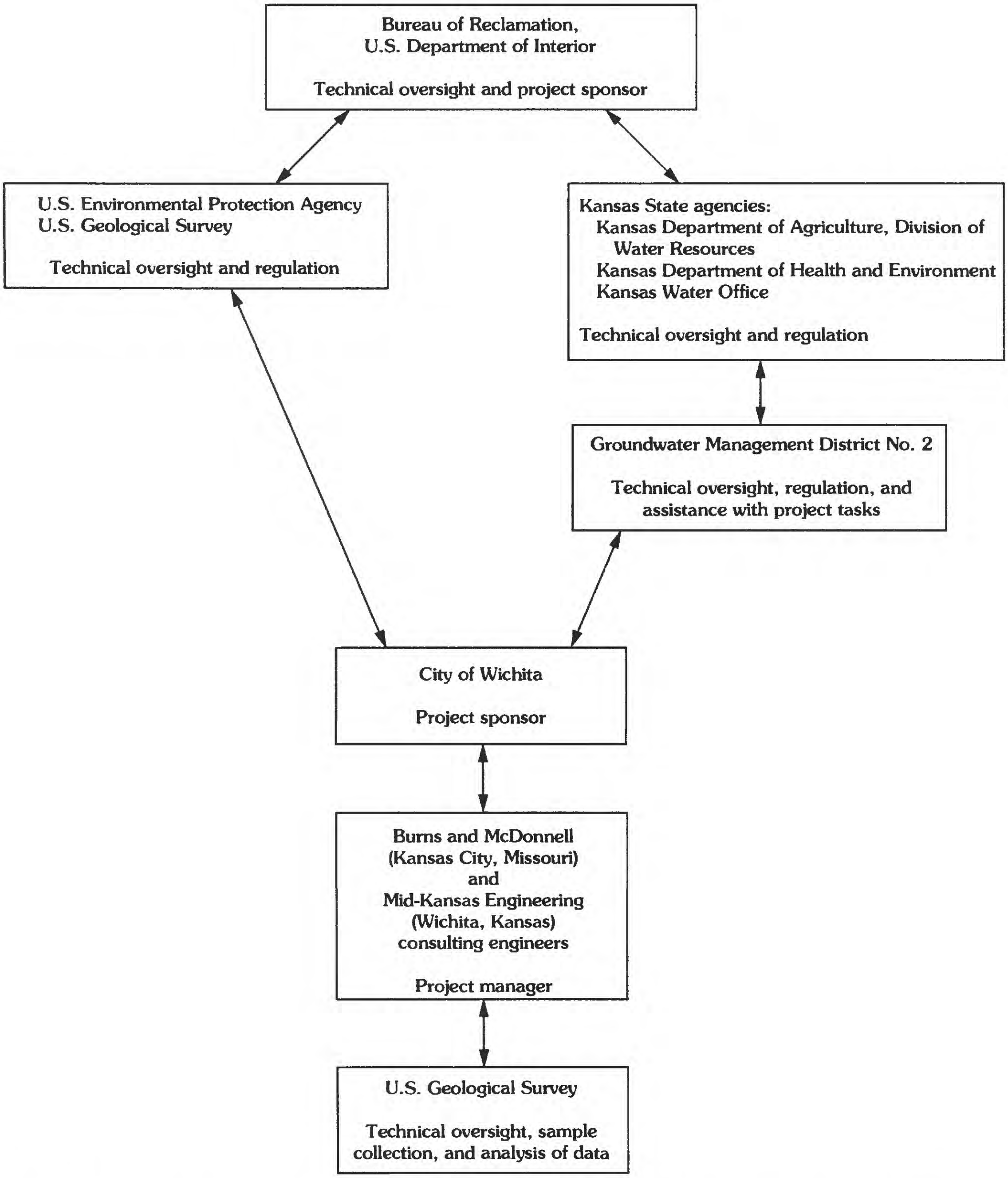


Figure 2. *Equus* Beds Ground-Water Recharge Demonstration Project participants and responsibilities.

Precipitation, Streamflow, and Water Levels

Precipitation and streamflow measurements and water-level data from both surface and ground water will be used to determine the vertical and horizontal movement and quantity of water in the river, at the planned recharge sites (near Wichita Well No. 4 and Wichita Well No. 36, fig. 3), and in the aquifer.

Precipitation and streamflow were measured continuously from February 1995 through September 1996 at four USGS streamflow-gaging stations (07143665, 07143672, 07144100, and 07144200, fig. 3 or 4). Surface-water levels were measured continuously at sampling sites 07143680, 07143950, and 07144100 (fig. 4). Ground-water levels were measured continuously at three monitoring-well string sites located approximately perpendicular to the Little Arkansas River at

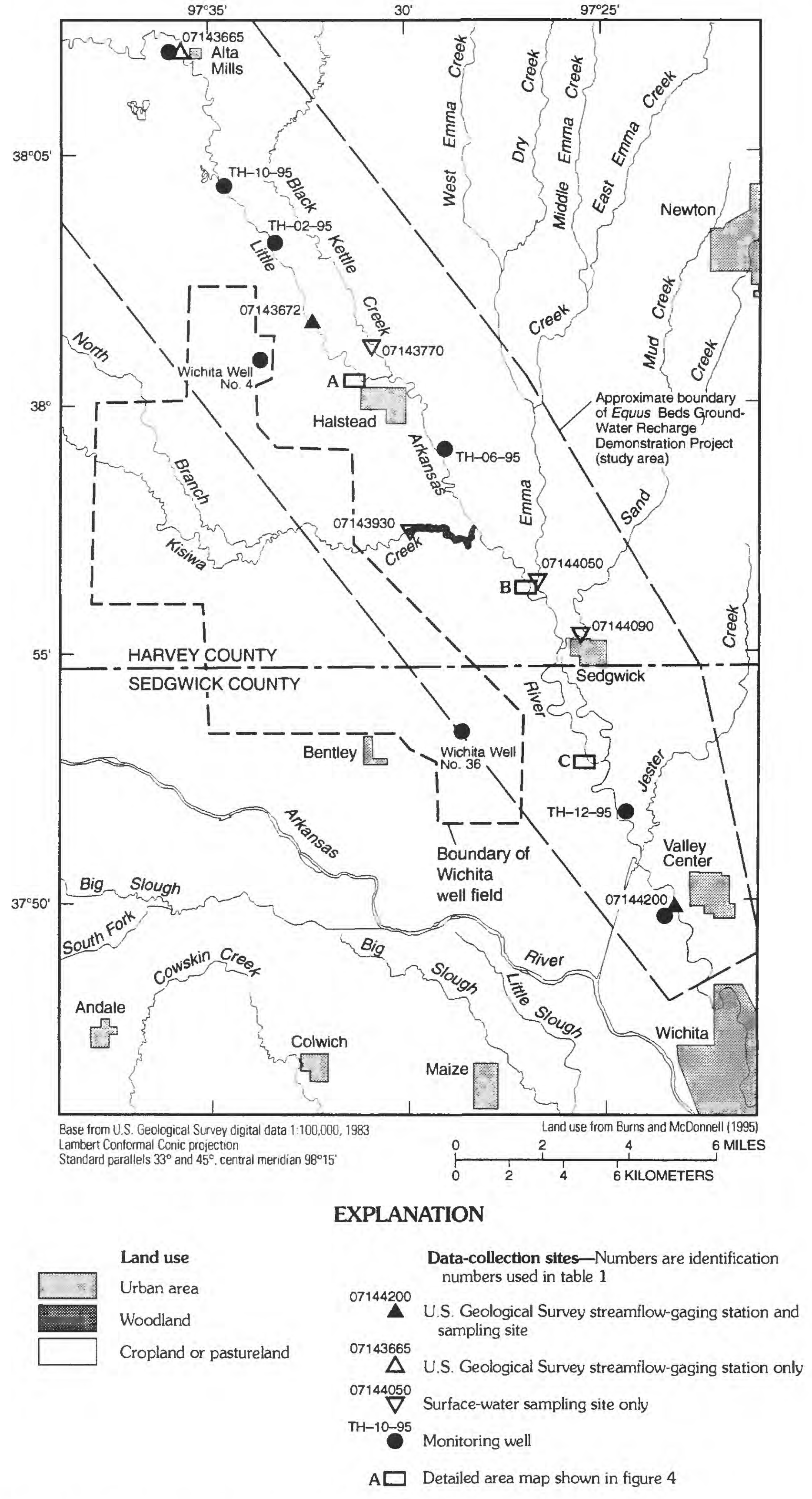


Figure 3. Land use and location of data-collection sites in study area.

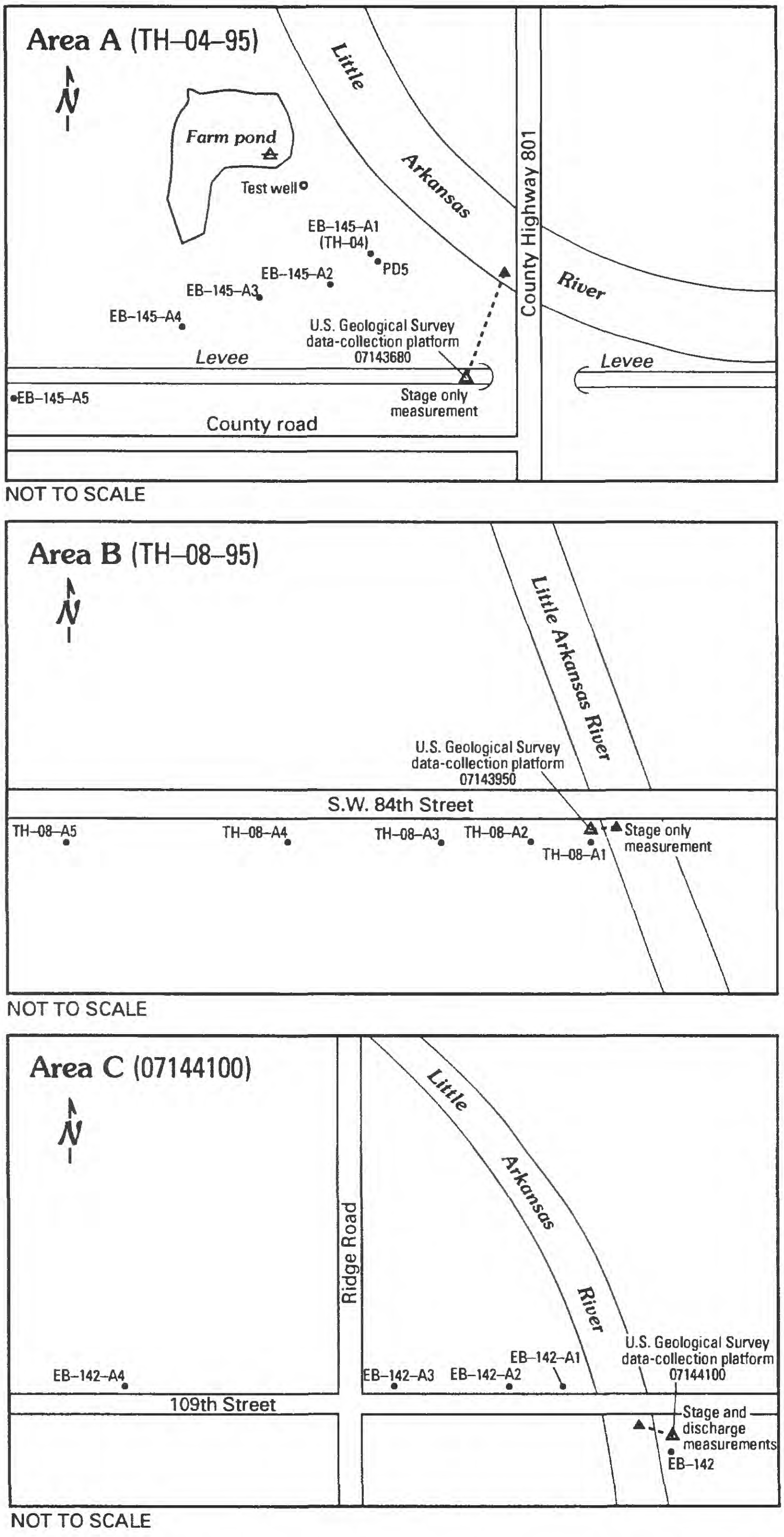


TABLE OF DISTANCES

From	*To*	*Distance, in feet*
River	Test well	80
River	Monitoring well EB–145–A1	54
Monitoring well EB–145–A1	Monitoring well EB–145–A2	85
Monitoring well EB–145–A2	Monitoring well EB–145–A3	200
Monitoring well EB–145–A3	Monitoring well EB–145–A4	300
Monitoring well EB–145–A4	Monitoring well EB–145vA5	956

TABLE OF DISTANCES

From	*To*	*Distance, in feet*
River	Monitoring well TH–08–A1	10 (approximate)
Monitoring well TH–08–A1	Monitoring well TH–08–A2	98
Monitoring well TH–08–A2	Monitoring well TH–08–A3	204
Monitoring well TH–08–A3	Monitoring well TH–08–A4	299
Monitoring well TH–08–A4	Monitoring well TH–08–A5	440

TABLE OF DISTANCES

From	*To*	*Distance, in feet*
River	Monitoring well EB–142	134
River	Monitoring well EB–142–A1	20 (approximate)
Monitoring well EB–142–A1	Monitoring well EB–142–A2	103
Monitoring well EB–142–A2	Monitoring well EB–142–A3	231
Monitoring well EB–142–A3	Monitoring well EB–142–A4	1,781

EXPLANATION

▲ **Streamflow-measurement site**

△ **Staff gage**

EB–142 ● **Monitoring well**—Number is identification number used in table 1

Figure 4. Location of data-collection sites in detailed areas A–C as shown in figure 3.

detailed areas A, B, and C (fig. 4). There are at least five monitoring wells in each string site (fig. 4). Manual calibrations of automated and electronic data loggers were made on a monthly basis.

Water Quality

The overall objectives of the water-quality monitoring generally are defined in the "Quality-Assurance Program Plan for the High Plains States Groundwater Recharge Demonstration Program" (U.S. Environmental Protection Agency, written commun., December 18, 1991). This document requires that demonstration projects be protective of human health and the environment to such a degree that constituent concentrations at the point of recharge do not exceed the U.S. Environmental Protection Agency's (EPA) Primary Drinking-Water Regulations [that is, Maximum Contaminant Level (MCLs)] published in U.S. Environmental Protection Agency (1995) or EPA recommended health advisory levels (HALs) that have been peer reviewed by the EPA, or that constituents in the recharge water do not exceed the ambient (existing) concentrations in ground water.

Data collected during the baseline monitoring will be used to document "action levels" for determination of whether the recharge activities planned in 1997 may have an adverse effect on the aquifer. After sampling both surface- and ground-water sites at least monthly from February 1995 through September 1996 to determine background water quality, action levels were determined at constituent concentrations that exceeded the EPA MCLs. Action levels are met when concentrations of constituents exceed the EPA MCL.

Aquifer Testing

The objective of aquifer testing was to determine the water quality of the induced surface water at the time pumping began at the aquifer-test well and throughout a 30-day and extended 75-day pumping period. Water-quality data were used to evaluate the effects of induced surface water in the ground-water system and to define the potential decrease or increase in constituent concentrations. Water-level data were used to determine the transmissivity, specific yield, hydraulic-conductivity, and riverbed-conductance values at detailed data-collection area A (TH–04–95) near Halstead, Kansas (fig. 4). A large-diameter (24-inch inside diameter) test well and 22 piezometers were installed to collect these data. These data will be used to design future recharge facilities, to determine the effect of the river on test-well water quality, and to evaluate the available quantity of induced surface water for recharge.

DATA-COLLECTION AND QUALITY-CONTROL PROTOCOLS AND PROCEDURES

Data-collection sites and activities are described in this section. The procedures for precipitation, discharge, and water-level measurements, water-quality sampling, aquifer testing, and quality control are included in this description.

Precipitation, Streamflow, and Water Levels

Precipitation gages were located at all of the streamflow-gaging stations in the study area except Little Arkansas River at SW 84th Street near Sedgwick, Kansas (station 07143950). Tipping-bucket rain gages were used to measure precipitation in 0.01-inch increments. Precipitation data were recorded every 15 minutes and totalled for each day. These data were transmitted by a data-collection platform (DCP) to a satellite and then to the USGS computer in Lawrence, Kansas. Precipitation data were verified against nearby National Weather Service precipitation gages located in Halstead and Wichita, Kansas (fig. 1).

Stream water-surface elevation (stage) was determined at six streamflow-gaging stations along the Little Arkansas River (Appendix A, table 1, and figs. 3 and 4) with nonsubmersible, pressure transducers and was measured to the nearest 0.01 foot. The stage was recorded relative to an arbitrary datum, which has been referenced to the elevation of the gage datum (Appendix A, table 1). Stage data were electronically recorded and transmitted by DCP. The data then were transmitted by satellite to a downlink site and then to the computer at the USGS office in Lawrence, Kansas. These data were recorded every 15 minutes and transmitted at least every 4 hours. The data obtained with the pressure-transducer equipment were verified at least monthly with physical measurements of water-surface elevations from an established reference mark on a bridge or by a permanently fixed wire-weight gage

(Buchanan and Somers, 1968). Elevations were surveyed to the reference marks and gages and were verified annually. Methods used to determine streamflow are described in Carter and Davidian (1968) and Buchanan and Somers (1969).

Four of the six streamflow-gaging stations (07143665, 07143672, 07144100, and 07144200) were operated as continuous streamflow or discharge stations, and stage-discharge ratings were developed and maintained for these sites. The remaining two gaging stations (07143680 and 07143950) continuously recorded the water elevation or stage of the stream. Streamflow or discharge measurements were made at each station at least monthly by determining the cross-sectional area of the stream and measuring the flow velocity for at least 10 vertical transects in the cross section. Methods for discharge measurements are described by Buchanan and Somers (1969). A stage-discharge relation was developed on the basis of discharge measurements and the stage of the stream at the time of measurement. Methods used to develop the stage-discharge relations and to compute continuous discharge records for streamflow are described by Kennedy (1983, 1984).

Monitoring wells used in this study were constructed of polyvinyl chloride pipe. Well depth for most wells is shallow (about 50 feet below land surface), except for the aquifer-test well (depth 136.5 feet) and well TH–04–PD5 (depth 117 feet). The test well is screened from 71 to 132 feet below land surface; other monitoring wells typically are screened in the lowermost 10 feet of the casing.

Water levels in the monitoring wells were recorded to the nearest 0.01 foot at 15-minute intervals and transmitted from the same DCP as the colocated streamflow-gaging stations at all of the sites listed in Appendix A, table 1, except sites TH–10–95, TH–02–95, TH–06–95, and TH–12–95, which were measured only at the time of sampling. Water-level sensing equipment consisted of submersible transducers that transmitted the water level to the DCP. Water levels were recorded and then transmitted every 4 hours to the USGS office in Lawrence, Kansas. The data from the transducers were verified at least monthly by manual measurements, and the computer data corrected on the basis of the results of the manual measurements. Water levels were measured manually at all sites by measurement to the water surface with either a steel or electric tape from a known reference-point elevation on the top of the well casing. Methods used for measurement of ground-water levels are described by Stallman (1971).

Water Quality

Water-quality data were collected during February 1995 through September 1996 to document a baseline for the quality of water in the Little Arkansas River and the quality of ground water in the adjacent *Equus* beds aquifer. Selected samples were analyzed for the constituents listed in Appendix A, tables 2 through 13. The sampling frequency and constituents for analysis are presented in Appendix A, tables 14 and 15. At least one sample per month was collected from the two surface-water sites (07143672 and 07144100), and quarterly samples were collected from six wells and analyzed for a subset of the EPA MCL list (Appendix A, tables 2 and 4) and other indicator constituents. Water-quality samples were collected once each quarter during the first three quarters of the project and analyzed for all of the constituents listed in Appendix A, tables 2–13. Chloride and triazine herbicides were expected to be the primary constituents of concern.

Daily water samples from the Little Arkansas River and test well were collected and analyzed for triazine herbicide concentrations during the aquifer test at site 07143672. On the basis of the quality-assurance/quality-control (QA/QC) verified results from the aquifer test and from analytical results from the baseline sampling, all inorganic and organic constituents with values greater than the MCL in these surface-water samples will be monitored for the remainder of the demonstration project. Subsequent data-collection activities will determine the possible effects of the withdrawal of test-well water and water from the river and of recharging the water 2 to 3 miles away in a different part of the aquifer.

Baseline data collected were of a definable and documented quality with respect to the precision and accuracy of the measurement (Appendix A, tables 1–12), representativeness of the sampled media, comparability between sites and sampling periods, and completeness of data (Appendix A, tables 2–13). Use of approved EPA or USGS onsite and laboratory methods helped ensure the precision and accuracy of the data. Representativeness of the samples was defined by the number of samples collected at the surface- and ground-water locations. The representativeness of each sample collected was described by the methods used for collection of samples. Detection limits, method detection limits, or reporting limits were used to quantify concentrations in water samples at the levels of at least 20 percent of the currently published MCL for each constituent analyzed except for antimony, beryllium, thallium, 1,2 dibromo-3-chloropropane, heptachlor, heptachlor epoxide, lindane, toxaphene, benzo(a-k)anthenes, bis(2-ethlyhexyl) phthalate, and chrysene (Appendix A, tables 2–13). Antimony and beryllium had reporting levels sufficient to quantify at the level of the MCL. The reporting limits for the organic constituents listed above were greater than the MCL; however, these constituents were not expected to be detected. Reporting limits for constituents without MCLs are listed in Appendix A, tables 2–13.

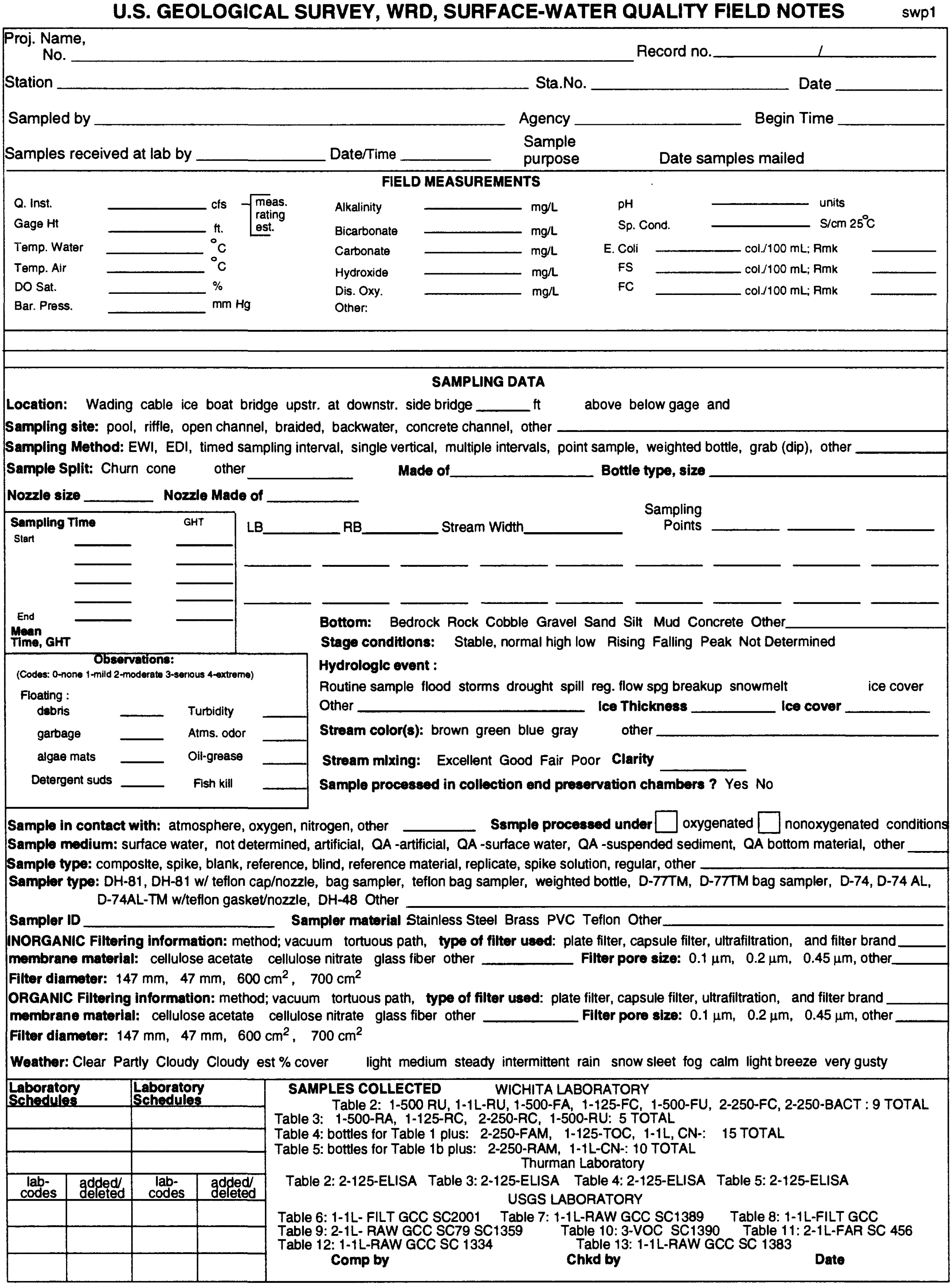
Onsite and laboratory quality-control samples included equipment and trip blanks, field spikes, reference water samples, replicate samples, and concurrent samples. Equipment blanks are collected by passing certified inorganic and organic blank water through the sample-collection and processing equipment. About 5 percent of samples collected were equipment blanks. Trip blanks are collected by filling the sample bottles with certified blank water and are analyzed at the end of the trip. About 1 percent of the samples collected were trip blanks. Field spikes were collected by adding a known quantity of analyte to the sample. Field spikes were about 1 percent of the sample total. Reference water samples are samples with known quantities of analytes in the sample. About 1 percent of the samples analyzed were reference water samples. Data from equipment and trip blanks, field spikes, and reference water samples were used to define the bias from the introduction of contamination at any stage in the sample-collection and analysis process.

Replicate samples are samples collected in an essentially identical manner as the environmental samples so that the replicate sample should have concentrations equivalent to the environmental sample. Replicate split samples are samples collected from the same compositing container as the environmental sample. Concurrent samples are a type of replicate sample where samples are collected at the same time and placed in separate compositing containers. Replicate and concurrent samples were used to estimate the variability of the sample-collection and analysis process. Replicate and concurrent samples were about 2 percent of the sample total.

Each laboratory analyzing the samples had their own blanking and spiking protocols, usually 10 percent of the sample total. Consistent onsite and laboratory methods ensured comparability for all samples unless the data were not within acceptability limits as defined in Appendix A, tables 2–13. The goal was to obtain at least 90-percent completeness of all data collected onsite and all data resulting from analysis of the samples.

Before environmental sample collection, sampling equipment for both surface and ground water were cleaned with a nonphosphate-containing detergent, rinsed with deionized water, acid-rinsed with dilute hydrochloric acid (if equipment contained no metal parts), and rinsed again with deionized water. Equipment blanks were collected before each environmental sampling to document the cleanliness of the equipment. At the beginning of environmental sample collection, instruments for the measurement of specific conductance, pH, water temperature, and dissolved oxygen were calibrated, and the calibration was checked after sampling at each site. A more detailed discussion of the specific procedures for equipment cleaning, collection of environmental samples, collection of blanks, and equipment calibration is provided by Guy and Norman (1970), Edwards and Glysson (1988), Ward and Harr (1990), Wells and others (1990), Horowitz and others (1994), Koterba and others (1995), and Puls and Barcelona (1996). Onsite notes were recorded on surface-water field sheets (fig. 5), during sample collection at each site and included the site location, date and time of collection, collectors' names, calibration information for the onsite instrumentation, methods and equipment used for collection, stream and weather conditions at the time of sampling, bottles collected, preservatives used, volumes purged from wells, and onsite measurements.

During the anticipated "spring flush" of herbicides from cropland in the study area, automated samplers collected two samples per day at surface-water sites (07143672 and 07144100) and were analyzed for triazine herbicides by enzyme-linked immunosorbent assay (ELISA) (Thurman and others, 1990). Selected samples collected with autosamplers were verified by gas chromatography/mass spectrometry (GC/MS) analysis for triazine herbicide concentrations greater than 3.0 μg/L (micrograms per liter). When the river stage became high enough to inundate the autosamplers, the samplers were removed, and daily grab samples were collected. Equipment blanks and trip blanks were 6 percent of the automated sample total. Replicate and concurrent samples were 2 percent of the automated sample total. About 2 percent of the automated sample



U.S. GEOLOGICAL SURVEY, WRD, SURFACE-WATER QUALITY FIELD NOTES swp1

Proj. Name, No. ______ Record no. ______ / ______

Station ______ Sta.No. ______ Date ______

Sampled by ______ Agency ______ Begin Time ______

Samples received at lab by ______ Date/Time ______ Sample purpose Date samples mailed

FIELD MEASUREMENTS

Q. Inst.	______ cfs	meas. rating est.	Alkalinity	______ mg/L	pH	______ units		
Gage Ht	______ ft.		Bicarbonate	______ mg/L	Sp. Cond.	______ S/cm 25°C		
Temp. Water	______ °C		Carbonate	______ mg/L	E. Coli	______ col./100 mL; Rmk	______	
Temp. Air	______ °C		Hydroxide	______ mg/L	FS	______ col./100 mL; Rmk	______	
DO Sat.	______ %		Dis. Oxy.	______ mg/L	FC	______ col./100 mL; Rmk	______	
Bar. Press.	______ mm Hg		Other:					

SAMPLING DATA

Location: Wading cable ice boat bridge upstr. at downstr. side bridge ______ ft above below gage and

Sampling site: pool, riffle, open channel, braided, backwater, concrete channel, other ______

Sampling Method: EWI, EDI, timed sampling interval, single vertical, multiple intervals, point sample, weighted bottle, grab (dip), other ______

Sample Split: Churn cone other ______ **Made of** ______ **Bottle type, size** ______

Nozzle size ______ **Nozzle Made of** ______

Sampling Time GHT

Start ______ ______

End ______ ______

Mean Time, GHT

LB ______ RB ______ Stream Width ______ Sampling Points ______ ______ ______

Observations:

(Codes: 0-none 1-mild 2-moderate 3-serious 4-extreme)

Floating :			
debris	______	Turbidity	______
garbage	______	Atms. odor	______
algae mats	______	Oil-grease	______
Detergent suds	______	Fish kill	______

Bottom: Bedrock Rock Cobble Gravel Sand Silt Mud Concrete Other ______

Stage conditions: Stable, normal high low Rising Falling Peak Not Determined

Hydrologic event :

Routine sample flood storms drought spill reg. flow spg breakup snowmelt ice cover

Other ______ **Ice Thickness** ______ **Ice cover** ______

Stream color(s): brown green blue gray other ______

Stream mixing: Excellent Good Fair Poor **Clarity** ______

Sample processed in collection end preservation chambers ? Yes No

Sample in contact with: atmosphere, oxygen, nitrogen, other ______ **Ssmple processed under** ☐ oxygenated ☐ nonoxygenated conditions

Sample medium: surface water, not determined, artificial, QA -artificial, QA -surface water, QA -suspended sediment, QA bottom material, other ______

Sample type: composite, spike, blank, reference, blind, reference material, replicate, spike solution, regular, other ______

Sampler type: DH-81, DH-81 w/ teflon cap/nozzle, bag sampler, teflon bag sampler, weighted bottle, D-77TM, D-77TM bag sampler, D-74, D-74 AL, D-74AL-TM w/teflon gasket/nozzle, DH-48 Other ______

Sampler ID ______ **Sampler material** Stainless Steel Brass PVC Teflon Other ______

INORGANIC Filtering information: method; vacuum tortuous path, **type of filter used**: plate filter, capsule filter, ultrafiltration, and filter brand ______

membrane material: cellulose acetate cellulose nitrate glass fiber other ______ **Filter pore size:** 0.1 µm, 0.2 µm, 0.45 µm, other ______

Filter diameter: 147 mm, 47 mm, 600 cm^2, 700 cm^2

ORGANIC Filtering information: method; vacuum tortuous path, **type of filter used**: plate filter, capsule filter, ultrafiltration, and filter brand ______

membrane material: cellulose acetate cellulose nitrate glass fiber other ______ **Filter pore size:** 0.1 µm, 0.2 µm, 0.45 µm, other ______

Filter diameter: 147 mm, 47 mm, 600 cm^2, 700 cm^2

Weather: Clear Partly Cloudy Cloudy est % cover light medium steady intermittent rain snow sleet fog calm light breeze very gusty

Laboratory Schedules		Laboratory Schedules	
lab-codes	added/ deleted	lab-codes	added/ deleted

SAMPLES COLLECTED WICHITA LABORATORY

Table 2: 1-500 RU, 1-1L-RU, 1-500-FA, 1-125-FC, 1-500-FU, 2-250-FC, 2-250-BACT : 9 TOTAL

Table 3: 1-500-RA, 1-125-RC, 2-250-RC, 1-500-RU: 5 TOTAL

Table 4: bottles for Table 1 plus: 2-250-FAM, 1-125-TOC, 1-1L, CN-: 15 TOTAL

Table 5: bottles for Table 1b plus: 2-250-RAM, 1-1L-CN-: 10 TOTAL

Thurman Laboratory

Table 2: 2-125-ELISA Table 3: 2-125-ELISA Table 4: 2-125-ELISA Table 5: 2-125-ELISA

USGS LABORATORY

Table 6: 1-1L- FILT GCC SC2001 Table 7: 1-1L-RAW GCC SC1389 Table 8: 1-1L-FILT GCC

Table 9: 2-1L- RAW GCC SC79 SC1359 Table 10: 3-VOC SC1390 Table 11: 2-1L-FAR SC 456

Table 12: 1-1L-RAW GCC SC 1334 Table 13: 1-1L-RAW GCC SC 1383

Comp by **Chkd by** **Date**

Figure 5. Example of surface-water field sheet.

TEMPERATURE

Lab tested thermometer used? ☐ Yes ☐ No If NO, explain in remarks

Thermometer checked w/ASTM within + 0.5 °C; Date Time ________

AMPULE LOT NUMBERS:

nitric acid 1ML ________________ Nitric Acid 2 ML ________________

ultrapure nitric acid ________________

potassium dichromate + nitric acid ________________

sulfuric acid 1ml/2ml ________ / ________ sodium hydroxide ________

phosphoric acid/copper sulfate

pH

pH Mtr W-no. .

METER Make/Model

elec. no./type

pH value at buffer temp.	pH Buffer Temp °C	Initial Reading	Adj. Reading	Remarks
___ . ___				
___ . ___				
___ . ___				
___ . ___				

☐ unfiltered sample ☐ filtered sample

Temp correction factors for buffers applied? ☐ YES ☐ NO

stirrer used? ☐ YES ☐ NO

if yes, ☐ magnetic stirrer ☐ manually stirred

pH subsample from or pH measurement location : Chum sample bottle flow-through single point at ______sta______depth vertical avg of ______ points

x-sec average of ______points

Sample Temp = ________ °C Slope ________ % Time ________

FIELD pH = ______ ______ ______ USE :

SPECIFIC CONDUCTANCE

Mtr W-no. METER Make/Model probe no. and type

standard value	Temp Std °C	Initial Reading	Adj. Reading	Remarks

correction factor applied? ☐ YES ☐ NO

☐ auto temp compensated meter

☐ manual temp compensated meter

corr. factor = ________

SC subsample from or SC measurement location : Churn sample bottle single point at ______sta______depth vertical avg of ______ points

x-sec avg of ______points Time ________

FIELD CONDUCTANCE = USE :

DISSOLVED OXYGEN W-no. ________________ METER Make/Model ________________ probe no. ________

Calibration : Time ________

☐ Air Calibration in Water ☐ Air Calibration Chamber in Air ☐ Air-Saturation Deionized Water ☐ Calibration by Winkler Titration (attach Supplementary Winkler page)

Battery check: redline ________ range________ Zero meter reading________ Adj. to ________ Thermister Check ☐ YES ☐ NO

D.O. Zero Check ☐ YES ☐ NO Zero D.O solution reading = ______ mg/L

Barometer Calibrated ☐ YES ☐ NO

stirrer used? ☐ YES ☐ NO

D.O. measurement location or D.O. subsample from : BOD bottle single point at ______sta______depth vertical avg of ______ points x-sec avg of ______ points

H_2O Temp. ________ °C Chart D.O. Sat. ________ mg/L Salinity Corr. Factor ________ BAR. PRESS ________ mm Hg (mm = in.X25.4)

Meter D.O. Sat. ________ mg/L; Adjusted to ________ (if corr. factor applicable)

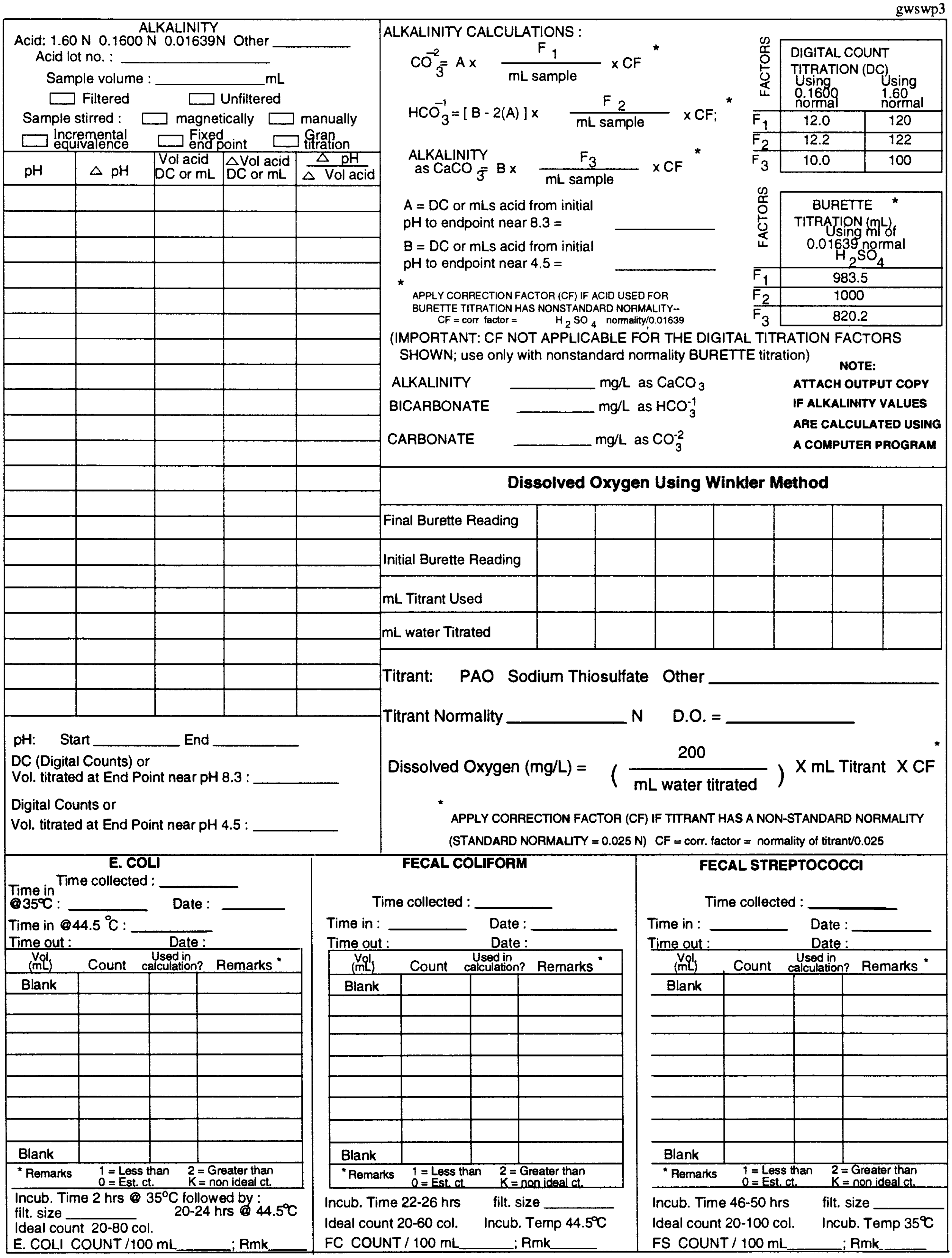
DISSOLVED OXYGEN IN STREAM =

Miscellaneous Section (Notes/Sketches/Calculations/X-Sec. & Etc.)

CROSS SECTIONAL MEASUREMENTS

STA	FT FROM L. BANK or R. BANK	TIME	DEPTH	pH	T°C	SC	DO	DO Sat	GHT	SUB Q (INST)

Figure 5. Example of surface-water field sheet—Continued.



gwswp3

ALKALINITY

Acid: 1.60 N 0.1600 N 0.01639N Other __________

Acid lot no. : ______________________

Sample volume : ________________mL

☐ Filtered ☐ Unfiltered

Sample stirred : ☐ magnetically ☐ manually

☐ Incremental equivalence ☐ Fixed end point ☐ Gran titration

pH	△ pH	Vol acid DC or mL	△Vol acid DC or mL	△ pH / △ Vol acid

pH: Start __________ End __________

DC (Digital Counts) or
Vol. titrated at End Point near pH 8.3 : __________

Digital Counts or
Vol. titrated at End Point near pH 4.5 : __________

ALKALINITY CALCULATIONS :

$$CO_3^{-2} = A \times \frac{F_1}{\text{mL sample}} \times CF^{*}$$

$$HCO_3^{-1} = [B - 2(A)] \times \frac{F_2}{\text{mL sample}} \times CF;^{*}$$

$$\text{ALKALINITY as } CaCO_3 = B \times \frac{F_3}{\text{mL sample}} \times CF^{*}$$

FACTORS	DIGITAL COUNT TITRATION (DC) Using 0.1600 normal	Using 1.60 normal
F_1	12.0	120
F_2	12.2	122
F_3	10.0	100

A = DC or mLs acid from initial pH to endpoint near 8.3 = __________

B = DC or mLs acid from initial pH to endpoint near 4.5 = __________

FACTORS	BURETTE TITRATION (mL) * Using ml of 0.01639 normal H_2SO_4
F_1	983.5
F_2	1000
F_3	820.2

* APPLY CORRECTION FACTOR (CF) IF ACID USED FOR BURETTE TITRATION HAS NONSTANDARD NORMALITY--
CF = corr factor = H_2SO_4 normality/0.01639

(IMPORTANT: CF NOT APPLICABLE FOR THE DIGITAL TITRATION FACTORS SHOWN; use only with nonstandard normality BURETTE titration)

ALKALINITY __________ mg/L as $CaCO_3$

BICARBONATE __________ mg/L as HCO_3^{-1}

CARBONATE __________ mg/L as CO_3^{-2}

NOTE:
ATTACH OUTPUT COPY IF ALKALINITY VALUES ARE CALCULATED USING A COMPUTER PROGRAM

Dissolved Oxygen Using Winkler Method

Final Burette Reading							
Initial Burette Reading							
mL Titrant Used							
mL water Titrated							

Titrant: PAO Sodium Thiosulfate Other ____________________

Titrant Normality ______________ N D.O. = ______________

$$\text{Dissolved Oxygen (mg/L)} = \left(\frac{200}{\text{mL water titrated}}\right) \times \text{mL Titrant} \times CF^{*}$$

* APPLY CORRECTION FACTOR (CF) IF TITRANT HAS A NON-STANDARD NORMALITY
(STANDARD NORMALITY = 0.025 N) CF = corr. factor = normality of titrant/0.025

E. COLI

Time collected : __________

Time in @35°C : __________ Date : __________

Time in @44.5 °C : __________

Time out : Date :

Vol. (mL)	Count	Used in calculation?	Remarks *
Blank			
Blank			

* Remarks 1 = Less than 2 = Greater than 0 = Est. ct. K = non ideal ct.

Incub. Time 2 hrs @ 35°C followed by : 20-24 hrs @ 44.5°C

filt. size __________

Ideal count 20-80 col.

E. COLI COUNT /100 mL______; Rmk_____

FECAL COLIFORM

Time collected : __________

Time in : __________ Date : __________

Time out : Date :

Vol. (mL)	Count	Used in calculation?	Remarks *
Blank			
Blank			

* Remarks 1 = Less than 2 = Greater than 0 = Est. ct K = non ideal ct.

Incub. Time 22-26 hrs filt. size __________

Ideal count 20-60 col. Incub. Temp 44.5°C

FC COUNT / 100 mL______; Rmk_____

FECAL STREPTOCOCCI

Time collected : __________

Time in : __________ Date : __________

Time out : Date :

Vol. (mL)	Count	Used in calculation?	Remarks *
Blank			
Blank			

* Remarks 1 = Less than 2 = Greater than 0 = Est. ct. K = non ideal ct.

Incub. Time 46-50 hrs filt. size __________

Ideal count 20-100 col. Incub. Temp 35°C

FS COUNT / 100 mL______; Rmk_____

Figure 5. Example of surface-water field sheet—Continued.

swp4

QUALITY ASSURANCE SAMPLES

Were quality assurance samples collected? ☐ YES ☐ NO Start Date and Time for QA Sample ____________ End Date and Time for QA Sample ____________

If YES indicate type(s):

	Organic-free	DI	water from sampling site
Replicate	☐	☐	☐
Spike	☐	☐	☐
Field blank	☐	☐	☐
Trip blank	☐	☐	☐

Other ☐ Indicate type(s):

Sample processed in collection and preservation chambers ? Yes No

Sample in contact with: atmosphere, oxygen, nitrogen, other ____________

Sample processed under ☐ oxygenated ☐ nonoxygenated conditions

Sample medium: surface water, not determined, artificial, QA -artificial, QA -surface water, QA -suspended sediment, QA bottom material, other ______

Sample type: composite, spike, blank, reference, blind, reference material, replicate, spike solution, regular, other ____________

Sampler type: DH-81, DH-81 w/ teflon cap/nozzle, bag sampler, teflon bag sampler, weighted bottle, D-77TM, D-77TM bag sampler, D-74, D-74 AL, D-74AL-TM w/teflon gasket/nozzle, DH-48 Other ____________

QA DATA TYPE (S) ASSOCIATED WITH SAMPLE: blank, blind samples, replicate sample, spike sample, more than one type of QA, Other ______

Blank, type of solution: distilled/deionized water, standard reference water sample, matched matrix, organic-free water, other ______

Blank, type of sample: shelf, refrigerator, trip, sampler, splitter, filter, preservation, field, ambient, lab, annual equipment, other ______

Blank, source of solution: USGS (Lab), EPA, SRWS (USGS), NIST, District Lab, Natural sample, Ocala Lab, Chemical supplier, unknown, Other ___

Reference material source: USGS (Lab), EPA, SRWS (USGS), NIST, District Lab, Natural sample, Ocala Lab, Chemical supplier, unknown, Other

Spike source: USGS (Lab), EPA, SRWS (USGS), NIST, District Lab, Natural sample, Ocala Lab, Chemical supplier, unknown, Other

Replicate Type: concurrent, sequential, split, split-concurrent, split-sequential, Other ____________

Spike Type: field, laboratory, surrogate, internal standards, other

INORGANIC Filtering information: method; vacuum tortuous path, **type of filter used**: plate filter, capsule filter, ultrafiltration, and filter brand ____

membrane material: cellulose acetate cellulose nitrate glass fiber other ____________ **Filter pore size:** 0.1 µm, 0.2 µm, 0.45 µm, other _____

Filter diameter: 147 mm, 47 mm, 600 cm^2, 700 cm^2

ORGANIC Filtering information: method; vacuum tortuous path, **type of filter used**: plate filter, capsule filter, ultrafiltration, and filter brand ______

membrane material: cellulose acetate cellulose nitrate glass fiber other ____________ **Filter pore size:** 0.1 µm, 0.2 µm, 0.45 µm, other _____

Filter diameter: 147 mm, 47 mm, 600 cm^2, 700 cm^2

Weather: Clear Partly Cloudy Cloudy est % cover light medium steady intermittent rain snow sleet fog calm light breeze very gusty

Laboratory Schedules		Laboratory Schedules	
lab-codes	added/ deleted	lab-codes	added/ deleted

SAMPLES COLLECTED WICHITA LABORATORY

Table 2: 1-500 RU, 1-1L-RU, 1-500-FA, 1-125-FC, 1-500-FU, 2-250-FC, 2-250-BACT : 9 TOTAL
Table 3: 1-500-RA, 1-125-RC, 2-250-RC, 1-500-RU: 5 TOTAL
Table 4: bottles for Table 1 plus: 2-250-FAM, 1-125-TOC, 1-1L, CN-: 15 TOTAL
Table 5: bottles for Table 1b plus: 2-250-RAM, 1-1L-CN-: 10 TOTAL

Thurman Laboratory

Table 2: 2-125-ELISA Table 3: 2-125-ELISA Table 4: 2-125-ELISA Table 5: 2-125-ELISA

USGS LABORATORY

Table 6: 1-1L- FILT GCC SC2001 Table 7: 1-1L-RAW GCC SC1389 Table 8: 1-1L-FILT GCC
Table 9: 2-1L- RAW GCC SC79 SC1359 Table 10: 3-VOC SC1390 Table 11: 2-1L-FAR SC 456
Table 12: 1-1L-RAW GCC SC 1334 Table 13: 1-1L-RAW GCC SC 1383

Comp by **Chkd by** **Date**

Other Observations/Notes:

Figure 5. Example of surface-water field sheet—Continued.

total were replicates split from the sample compositing container. These samples were submitted as blind to the laboratory. Acceptance criteria are similar to those described in the section "Data Review, Validation, and Reporting."

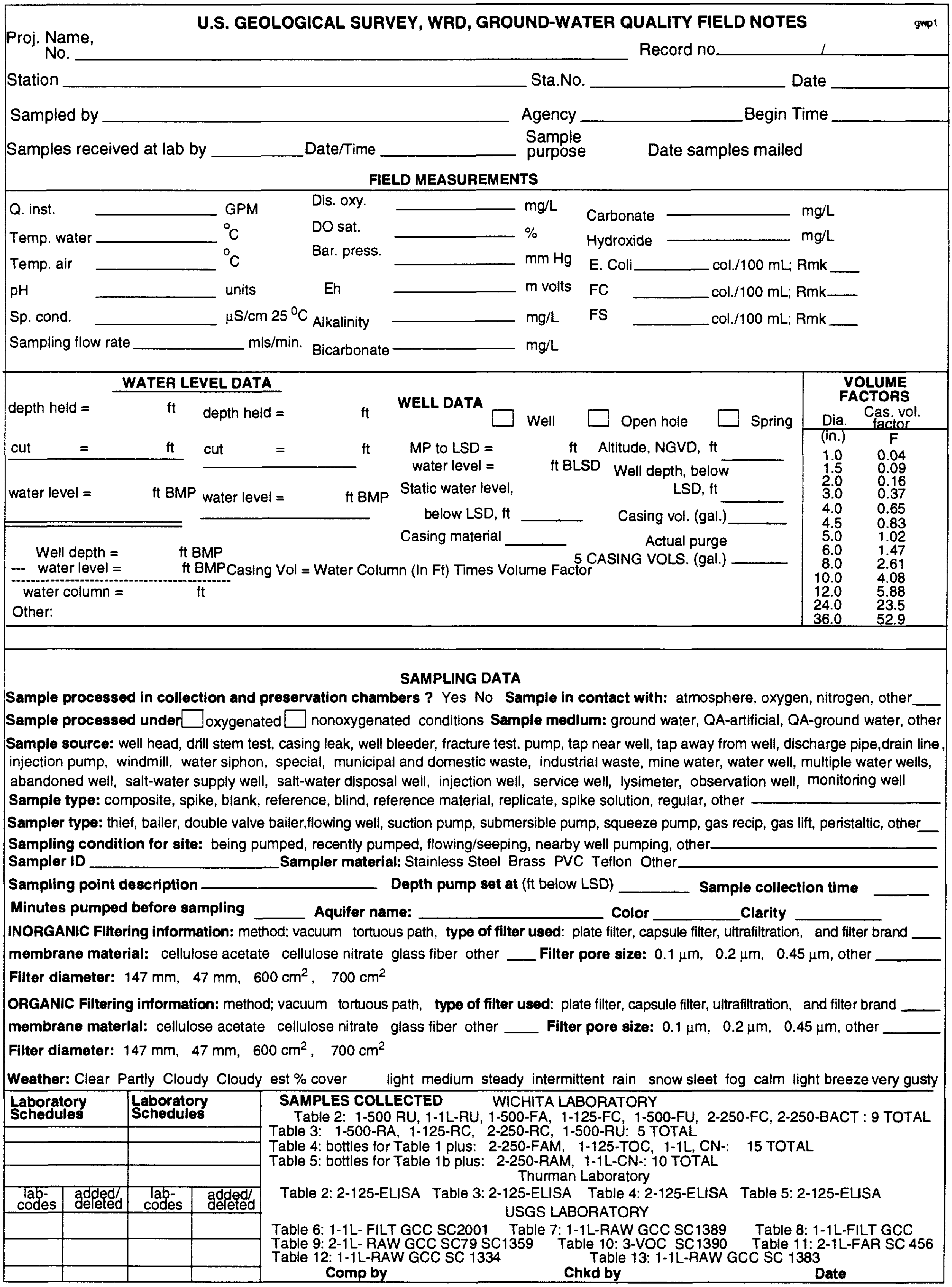
Autosample bottles were collected from the sampler, labeled, chilled to 4 °C, and transported to the USGS office in Wichita, Kansas, for processing. Samples were filtered through 0.45-µm (micrometer) glass-fiber filters that had been baked at 450 °C to eliminate organic contamination. Filters were rinsed three times with 100 mL (milliliters) of deionized water, and then 50 mL of sample water were passed through the filters and discarded. Two 125-mL bottles were filled for analysis, depending on the availability of water from the autosampler. These samples then were chilled to 4 °C and shipped to the USGS laboratory in Lawrence, Kansas, for analysis. Results of samples collected by automated samplers were compared to results from samples collected using equal-width sample-collection techniques.

Surface-water samples were collected by two USGS personnel using depth- and width-integrating techniques (Ward and Harr, 1990; Wells and others, 1990) with samplers constructed of polytetrafluoroethylene (PTFE). Samples for analysis of inorganic and radiochemical constituents were composited in a polyethylene churn splitter, and aliquots were withdrawn and preserved for the analysis of total recoverable concentrations according to requirements for the analytical methods (Appendix A, table 16). Samples for analysis of filtered (dissolved) concentrations of inorganic and radiochemical constituents were filtered from the churn splitter through a 0.45-µm pore-size cellulose acetate filter and preserved according to the requirements for the analytical methods (Appendix A, table 16). Filters and equipment were rinsed with 1 liter (about 1 quart) of deionized water before filtering the water sample. Bacteriological samples were collected from the midpoint of the stream in a sterile container. Samples for analysis of volatile organic compounds (Appendix A, table 10) were collected from the midpoint of the stream and sealed under water. Samples for analysis of the remaining organic constituents were composited in a stainless-steel container, and aliquots were collected for analysis of total recoverable or filtered concentrations. Samples for analysis of filtered concentrations of organic constituents were filtered through a glass-fiber filter previously baked at 450 °C. All organic sample aliquots were collected in 1-liter glass amber bottles previously baked at 450 °C. Caps for organic sample bottles were lined with PTFE. Caps for inorganic samples were lined with noncontaminating plastic. All equipment used in the filtering process was constructed of PTFE. Samples were processed and preserved inside isolation chambers to prevent ambient air contamination.

Ground-water samples were collected by three USGS personnel using methods described by Wood (1976), Koterba and others (1995), and Puls and Barcelona (1996). Samples were collected by using a noncontaminating submersible pump constructed of PTFE and stainless steel. At least five well volumes were purged before samples were collected. During purging, specific conductance, pH, water temperature, turbidity, and dissolved oxygen were measured and recorded on ground-water field sheets (fig. 6). Samples were collected only if the values of these properties and constituents were within 10 percent for three consecutive readings made at least 5 minutes apart and if the turbidity was less than 10 NTU (nephlometric turbidity units). The flow rate during sampling was 0.5 to 1.0 liter per minute (0.13 to 0.26 gallon per minute), similar to the method described by Puls and Barcelona (1996). Purged water was conveyed far enough away from the wells so as not to affect the recharge area. Ground-water sampling generally occurred from upgradient to downgradient sites or from sites with the smallest concentrations of water-quality constituents to those with the largest concentration. Between sites, the sampling equipment was cleaned as described previously. Samples were collected in-line and processed and preserved inside isolation chambers to prevent ambient air contamination. The general order for filling of sample bottles was organic, inorganic, radiochemical, and bacteriological.

Sample Containers, Preservation, and Holding Times

All sample containers and preservatives were obtained from the USGS Water-Quality Supply Unit in Ocala, Florida. All containers and preservatives were quality assured by processing blank water for each bottle type and analyzing for possible contamination. All bottles and caps used for the collection of metal and radiological concentrations were acid rinsed to prevent contamination. Bottles for nutrients were made of non-light-penetrating material to prevent sample degradation by ultraviolet (UV) light. Bottles for organic analyses were made of amber glass to prevent UV light



U.S. GEOLOGICAL SURVEY, WRD, GROUND-WATER QUALITY FIELD NOTES gwp1

Proj. Name, No. ____ Record no.____/____

Station ____ Sta.No. ____ Date ____

Sampled by ____ Agency ____ Begin Time ____

Samples received at lab by ____ Date/Time ____ Sample purpose Date samples mailed

FIELD MEASUREMENTS

Q. inst. ____ GPM

Temp. water ____ °C

Temp. air ____ °C

pH ____ units

Sp. cond. ____ µS/cm 25 °C

Sampling flow rate ____ mls/min.

Dis. oxy. ____ mg/L

DO sat. ____ %

Bar. press. ____ mm Hg

Eh ____ m volts

Alkalinity ____ mg/L

Bicarbonate ____ mg/L

Carbonate ____ mg/L

Hydroxide ____ mg/L

E. Coli ____ col./100 mL; Rmk ____

FC ____ col./100 mL; Rmk ____

FS ____ col./100 mL; Rmk ____

WATER LEVEL DATA

depth held = ft depth held = ft

cut = ft cut = ft

water level = ft BMP water level = ft BMP

Well depth = ft BMP

--- water level = ft BMP

water column = ft

Other:

WELL DATA ☐ Well ☐ Open hole ☐ Spring

MP to LSD = ft

water level = ft BLSD

Static water level, below LSD, ft ____

Casing material ____

Altitude, NGVD, ft ____

Well depth, below LSD, ft ____

Casing vol. (gal.) ____

Actual purge 5 CASING VOLS. (gal.) ____

Casing Vol = Water Column (In Ft) Times Volume Factor

VOLUME FACTORS

Dia. (in.)	Cas. vol. factor F
1.0	0.04
1.5	0.09
2.0	0.16
3.0	0.37
4.0	0.65
4.5	0.83
5.0	1.02
6.0	1.47
8.0	2.61
10.0	4.08
12.0	5.88
24.0	23.5
36.0	52.9

SAMPLING DATA

Sample processed in collection and preservation chambers ? Yes No **Sample in contact with:** atmosphere, oxygen, nitrogen, other____

Sample processed under ☐ oxygenated ☐ nonoxygenated conditions **Sample medium:** ground water, QA-artificial, QA-ground water, other

Sample source: well head, drill stem test, casing leak, well bleeder, fracture test, pump, tap near well, tap away from well, discharge pipe, drain line, injection pump, windmill, water siphon, special, municipal and domestic waste, industrial waste, mine water, water well, multiple water wells, abandoned well, salt-water supply well, salt-water disposal well, injection well, service well, lysimeter, observation well, monitoring well

Sample type: composite, spike, blank, reference, blind, reference material, replicate, spike solution, regular, other ____

Sampler type: thief, bailer, double valve bailer, flowing well, suction pump, submersible pump, squeeze pump, gas recip, gas lift, peristaltic, other____

Sampling condition for site: being pumped, recently pumped, flowing/seeping, nearby well pumping, other____

Sampler ID ____ **Sampler material:** Stainless Steel Brass PVC Teflon Other____

Sampling point description ____ **Depth pump set at** (ft below LSD) ____ **Sample collection time** ____

Minutes pumped before sampling ____ **Aquifer name:** ____ **Color** ____ **Clarity** ____

INORGANIC Filtering information: method; vacuum tortuous path, **type of filter used**: plate filter, capsule filter, ultrafiltration, and filter brand ____

membrane material: cellulose acetate cellulose nitrate glass fiber other ____ **Filter pore size:** 0.1 µm, 0.2 µm, 0.45 µm, other ____

Filter diameter: 147 mm, 47 mm, 600 cm^2, 700 cm^2

ORGANIC Filtering information: method; vacuum tortuous path, **type of filter used**: plate filter, capsule filter, ultrafiltration, and filter brand ____

membrane material: cellulose acetate cellulose nitrate glass fiber other ____ **Filter pore size:** 0.1 µm, 0.2 µm, 0.45 µm, other ____

Filter diameter: 147 mm, 47 mm, 600 cm^2, 700 cm^2

Weather: Clear Partly Cloudy Cloudy est % cover light medium steady intermittent rain snow sleet fog calm light breeze very gusty

Laboratory Schedules		**Laboratory Schedules**	
lab-codes	added/deleted	lab-codes	added/deleted

SAMPLES COLLECTED WICHITA LABORATORY

Table 2: 1-500 RU, 1-1L-RU, 1-500-FA, 1-125-FC, 1-500-FU, 2-250-FC, 2-250-BACT : 9 TOTAL

Table 3: 1-500-RA, 1-125-RC, 2-250-RC, 1-500-RU: 5 TOTAL

Table 4: bottles for Table 1 plus: 2-250-FAM, 1-125-TOC, 1-1L, CN-: 15 TOTAL

Table 5: bottles for Table 1b plus: 2-250-RAM, 1-1L-CN-: 10 TOTAL

Thurman Laboratory

Table 2: 2-125-ELISA Table 3: 2-125-ELISA Table 4: 2-125-ELISA Table 5: 2-125-ELISA

USGS LABORATORY

Table 6: 1-1L- FILT GCC SC2001 Table 7: 1-1L-RAW GCC SC1389 Table 8: 1-1L-FILT GCC

Table 9: 2-1L- RAW GCC SC79 SC1359 Table 10: 3-VOC SC1390 Table 11: 2-1L-FAR SC 456

Table 12: 1-1L-RAW GCC SC 1334 Table 13: 1-1L-RAW GCC SC 1383

Comp by **Chkd by** **Date**

Figure 6. Example of ground-water field sheet.

gwp2

TEMPERATURE

Lab tested thermometer used? ☐ Yes ☐ No If NO, explain in remarks

Thermometer checked w/ASTM within + 0.5 °C; Date Time ________

pH

AMPULE LOT NUMBERS:

nitric acid 1ML ____________ Nitric Acid 2 ML ____________

ultrapure nitric acid ____________

potassium dichromate + nitric acid ____________

sulfuric acid 1ml/2ml ________ / ________ sodium hydroxide ________

phosphoric acid/copper sulfate

pH Mtr W-no. METER Make/Model elec. no./type

pH value at buffer temp.	pH Buffer Temp °C	Initial Reading	Adj. Reading	Remarks
___.___ ___				
___.___ ___				
___.___ ___				
___.___ ___				

☐ unfiltered sample ☐ filtered sample

Temp correction factors for buffers applied? ☐ YES ☐ NO

stirrer used? ☐ YES ☐ NO

if yes, ☐ magnetic stirrer ☐ manually stirred

pH subsample from or pH measurement location : Churn sample bottle flow-through

Flow through chamber off for final pH ? Yes No

Sample Temp = ______ °C Slope ________ % Time ________

Average or median of ________ points

FIELD pH = ______ ______ ______ **USE :** ______

SPECIFIC CONDUCTANCE

Mtr W-no. METER Make/Model probe no. and type

standard value	Temp Std °C	Initial Reading	Adj. Reading	Remarks

correction factor applied? ☐ YES ☐ NO

☐ auto temp compensated meter

☐ manual temp compensated meter

corr. factor = ________

SC subsample from or SC measurement location : Churn sample bottle flow through

Time ________

Average or median of ________ points

FIELD CONDUCTANCE = ______ **USE :** ______

DISSOLVED OXYGEN W-no. ____________ METER Make/Model ____________ probe no. ________

Calibration :

☐ Air Calibration in Water ☐ Air Calibration Chamber in Air ☐ Air-Saturation Deionized Water ☐ Calibration by Winkler Titration (attach Supplementary Winkler page)

Battery checkredline________ range ________ Zero meter reading ________ Adj. to ________

D.O. Zero Check ☐YES ☐ NO Zero D.O solution reading = ________ mg/L

Thermister Check ☐ YES ☐ NO

Barometer Calibrated ☐ YES ☐ NO

stirrer used? ☐ YES ☐ NO

D.O. measurement location or D.O. subsample from : BOD bottle Flow through Chamber downhole

H_2O Temp. ____________ °C Chart D.O. Sat. ____________ mg/L

Salinity Corr. Factor ________ Meter D.O. Sat. ____________ mg/L;

Average or median of ________ points

Adjusted to ____________ mg/L (if corr. factor applicable)

BAR. PRESS ____________ mm Hg (mm = in.X25.4) Time ________

DISSOLVED OXYGEN = ______

Miscellaneous Section (Well Purge Log/Notes/Calculations & Etc.)

Time	Water level blw MP LS	Draw down feet	Well yield gpm cfs	Volume Removed (gallons)	pH	T °C	SC	DO	Turbidity		

Figure 6. Example of ground-water field sheet—Continued.

gwswp3

ALKALINITY

Acid: 1.60 N 0.1600 N 0.01639N Other ________

Acid lot no. : ______________

Sample volume : ______________mL

☐ Filtered ☐ Unfiltered

Sample stirred : ☐ magnetically ☐ manually

☐ Incremental equivalence ☐ Fixed end point ☐ Gran titration

pH	△ pH	Vol acid DC or mL	△Vol acid DC or mL	△ pH / △ Vol acid

pH: Start __________ End __________

DC (Digital Counts) or
Vol. titrated at End Point near pH 8.3 : __________

Digital Counts or
Vol. titrated at End Point near pH 4.5 : __________

ALKALINITY CALCULATIONS :

$$CO_3^{-2} = A \times \frac{F_1}{\text{mL sample}} \times CF^*$$

$$HCO_3^{-1} = [B - 2(A)] \times \frac{F_2}{\text{mL sample}} \times CF;^*$$

$$\text{ALKALINITY as } CaCO_3 = B \times \frac{F_3}{\text{mL sample}} \times CF^*$$

A = DC or mLs acid from initial pH to endpoint near 8.3 = __________

B = DC or mLs acid from initial pH to endpoint near 4.5 = __________

* APPLY CORRECTION FACTOR (CF) IF ACID USED FOR BURETTE TITRATION HAS NONSTANDARD NORMALITY--
CF = corr. factor = H_2SO_4 normality/0.01639

FACTORS	DIGITAL COUNT TITRATION (DC) Using 0.1600 normal	Using 1.60 normal
F_1	12.0	120
F_2	12.2	122
F_3	10.0	100

FACTORS	BURETTE TITRATION (mL) Using ml of 0.01639 normal H_2SO_4 *
F_1	983.5
F_2	1000
F_3	820.2

(IMPORTANT: CF NOT APPLICABLE FOR THE DIGITAL TITRATION FACTORS SHOWN; use only with nonstandard normality BURETTE titration)

ALKALINITY __________ mg/L as $CaCO_3$

BICARBONATE__________ mg/L as HCO_3^{-1}

CARBONATE __________ mg/L as CO_3^{-2}

NOTE:
ATTACH OUTPUT COPY IF ALKALINITY VALUES ARE CALCULATED USING A COMPUTER PROGRAM

Dissolved Oxygen Using Winkler Method

Final Burette Reading							
Initial Burette Reading							
mL Titrant Used							
mL water Titrated							

Titrant: PAO Sodium Thiosulfate Other ______________

Titrant Normality __________ N D.O. = __________

$$\text{Dissolved Oxygen (mg/L)} = \left(\frac{200}{\text{mL water titrated}}\right) \text{ X mL Titrant X } CF^*$$

* APPLY CORRECTION FACTOR (CF) IF TITRANT HAS A NON-STANDARD NORMALITY
(STANDARD NORMALITY = 0.025 N)CF = corr. factor = normality of titrant/0.025

E. COLI

Time collected : __________

Time in @ 35°C : __________ Date : ________

Time in @ 44.5°C : __________

Time out : Date :

Vol (mL)	Count	Used in calculation?	Remarks *
Blank			
Blank			

*Remarks 1 = Less than 0 = Est. ct. 2 = Greater than K = non ideal ct.

Incub. Time 2 hrs @ 35°C followed by : 20-24 hrs @ 44.5°C

filt. size __________

Ideal count 20-80 col.

E. COLI COUNT /100 mL________; Rmk______

FECAL COLIFORM

Time collected : __________

Time in : __________ Date : __________

Time out : Date :

Vol (mL)	Count	Used in calculation?	Remarks *
Blank			
Blank			

* Remarks 1 = Less than 0 = Est. ct. 2 = Greater than K = non ideal ct.

Incub. Time 22-26 hrs filt. size ________

Ideal count 20-60 col. Incub. Temp 44.5 C

FC COUNT / 100 mL________; Rmk______

FECAL STREPTOCOCCI

Time collected : __________

Time in : __________ Date : __________

Time out : Date :

Vol (mL)	Count	Used in calculation?	Remarks *
Blank			
Blank			

* Remarks 1 = Less than 0 = Est. ct. 2 = Greater than K = non ideal ct.

Incub. Time 46-50 hrs filt. size __________

Ideal count 20-100 col. Incub. Temp 35°C

FS COUNT / 100 mL________; Rmk______

Figure 6. Example of ground-water field sheet—Continued.

QUALITY ASSURANCE SAMPLES

Were quality assurance samples collected? ☐ YES ☐ NO Start Date and Time for QA Sample __________ End Date and Time for QA Sample __________

If YES indicate type(s):

	Organic-free	DI	water from sampling site
Replicate	☐	☐	☐
Spike	☐	☐	☐
Field blank	☐	☐	☐
Trip blank	☐	☐	☐

Other ☐ Indicate type(s):

Sample processed in collection and preservation chambers ? Yes No

Sample in contact with: atmosphere, oxygen, nitrogen, other __________

Sample processed under ☐ oxygenated ☐ nonoxygenated conditions

Sample medium: ground water, QA-artificial, QA-ground water, other __________

Sample type: composite, spike, blank, reference, blind, reference material, replicate, spike solution, regular, other __________

Sample aource: well head, drill stem test, casing leak, well bleeder, fracture test, pump, tap near well, tap away from well, discharge pipe, drain line, injection pump, windmill, water siphon, special, municipal and domestic waste, industrial waste, mine water, water well, multiple water wells, abandoned well, salt-water supply well, salt-water disposal well, injection well, service well, lysimeter, observation well, monitoring well

Sampler type: thief, bailer, double valve bailer, flowing well, suction pump, submersible pump, squeeze pump, gas recip., gas lift, peristaltic, other ____

Sampler ID __________ **Sampler materia**Stainless Steel Brass PVC Teflon Other __________

QA DATA TYPE (S) ASSOCIATED WITH SAMPLE: blank, blind samples, replicate sample, spike sample, more than one type of QA, Other _____

Blank, type of solution: distilled/deionized water, standard reference water sample, matched matrix, organic-free water, other __________

Blank, type of sample: shelf, refrigerator, trip, sampler, splitter, filter, preservation, field, ambient, lab, annual equipment, other ________

Blank, source of solution: USGS (Lab), EPA, SRWS (USGS), NIST, District Lab, Natural sample, Ocala Lab, Chemical supplier, unknown, Other ___

Reference material source: USGS (Lab), EPA, SRWS (USGS), NIST, District Lab, Natural sample, Ocala Lab, Chemical supplier, unknown, Other

Spike source: USGS (Lab), EPA, SRWS (USGS), NIST, District Lab, Natural sample, Ocala Lab, Chemical supplier, unknown, Other

Replicate Type: concurrent, sequential, split, split-concurrent, split-sequential, Other __________

Spike Type: field, laboratory, surrogate, internal standards, other __________

INORGANIC Filtering information: method; vacuum tortuous path, **type of filter used:** plate filter, capsule filter, ultrafiltration, and filter brand ____

membrane material: cellulose acetate cellulose nitrate glass fiber other _____ **Filter pore size:** 0.1 µm, 0.2 µm, 0.45 µm, other _____

Filter diameter: 147 mm, 47 mm, 600 cm^2, 700 cm^2

ORGANIC Filtering information: method; vacuum tortuous path, **type of filter used:** plate filter, capsule filter, ultrafiltration, and filter brand _____

membrane material: cellulose acetate cellulose nitrate glass fiber other _____ **Filter pore size:** 0.1 µm, 0.2 µm, 0.45 µm, other _____

Filter diameter: 147 mm, 47 mm, 600 cm^2, 700 cm^2

Weather: Clear Partly Cloudy Cloudy est % cover light medium steady intermittent rain snow sleet fog calm light breeze very gusty

Laboratory Schedules		**Laboratory Schedulea**	
lab-codes	added/ deleted	lab-codes	added/ deleted

SAMPLES COLLECTED WICHITA LABORATORY

Table 2: 1-500 RU, 1-1L-RU, 1-500-FA, 1-125-FC, 1-500-FU, 2-250-FC, 2-250-BACT : 9 TOTAL

Table 3: 1-500-RA, 1-125-RC, 2-250-RC, 1-500-RU: 5 TOTAL

Table 4: bottles for Table 1 plus: 2-250-FAM, 1-125-TOC, 1-1L, CN-: 15 TOTAL

Table 5: bottles for Table 1b plus: 2-250-RAM, 1-1L-CN-: 10 TOTAL

Thurman Laboratory

Table 2: 2-125-ELISA Table 3: 2-125-ELISA Table 4: 2-125-ELISA Table 5: 2-125-ELISA

USGS LABORATORY

Table 6: 1-1L- FILT GCC SC2001 Table 7: 1-1L-RAW GCC SC1389 Table 8: 1-1L-FILT GCC

Table 9: 2-1L- RAW GCC SC79 SC1359 Table 10: 3-VOC SC1390 Table 11: 2-1L-FAR SC 456

Table 12: 1-1L-RAW GCC SC 1334 Table 13: 1-1L-RAW GCC SC 1383

Comp by **Chkd by** **Date**

Oxygen Demand (BOD) (CBOD)

Blanks

Bottle #	Initial BOD	D.O. or CBOD	5-Day BOD	D.O. or CBOD	BOD	CBOD	Average BOD	Average CBOD

Sample

Bottle #	Sample Size (Dilution)	Initial BOD	D.O. or CBOD	5-Day BOD	D.O. or CBOD	BOD	CBOD

Residual Chlorine

	Positive/Negative	Sodium Sulfite Added	Sodium Sulfite Normality
Field Test	+ / -		
Lab Test	+ / -		
After 5-day BOD/CBOD	+ / -		

Other observations

Figure 6. Example of ground-water field sheet—Continued.

degradation and baked at 450 °C to eliminate organic contamination. Bacteriological sample bottles were sterilized using an autoclave to prevent contamination. Sample bottles, holding times, preservatives for key, key-plus, limited, and full EPA water-quality constituent analyses are listed in Appendix A, table 16.

Preservation was performed, and holding times of samples were assessed according to the method requirements of the city of Wichita laboratory (city of Wichita, written commun., 1994, revised 1996), U.S. Environmental Protection Agency (1995, p. 643–645), the USGS laboratory in Lawrence, Kansas (Thurman and others, 1990), and the USGS National Water-Quality Laboratory in Arvada, Colorado. Methods used for analyses were those required by EPA or USGS as noted in Appendix A, tables 2 through 13. Metals and radiochemical samples were preserved with concentrated nitric acid. Samples for anions and other inorganic constituents were not preserved. Samples for nutrients were either chilled or preserved with concentrated sulfuric acid. Organic samples were chilled. If holding times were exceeded, the analyses were used only in a semiquantitative manner and were reported as having exceeded the holding time.

Sample Custody

The management of samples collected onsite used specific procedures to ensure their integrity. The possession of samples also was traceable from the time the samples were collected.

Samples analyzed by the city of Wichita laboratory and the USGS laboratory in Lawrence, Kansas, were transported or shipped directly to the laboratory and logged in. A copy of the field sheet (fig. 5 or 6) accompanied the samples, and the receipt of the samples and date and time of receipt were acknowledged on the form. Samples analyzed at the USGS National Water-Quality Laboratory (NWQL) in Arvada, Colorado, were shipped in a sealed cooler by an overnight carrier. Inside the cooler, a form outlining the request for analytical services and requestor for the services was sealed in a plastic bag. After receipt at all of the laboratories, the internal laboratory information management system tracked the custody of the samples.

An example of the NWQL analytical services request form is shown in figure 7. This form uniquely identifies the sample, the office requesting the analysis, the determinations requested, onsite measurements, and any special sample information. Each sample and its request form were assigned a unique NWQL identification number that encodes the date of receipt, the sample type, and a serial number. The request form was routed to the data-processing section at NWQL, which entered all sample information, analytical requests, and analytical results into a data base. Analytical results were sent to the submitting office after all analytical work was completed.

Sample Packaging and Shipping to the National Water-Quality Laboratory

The sample packaging and shipping containers were constructed to meet the following requirements:

1. Samples are not released to the environment.
2. Inner containers that are breakable are packaged to prevent breakage and leakage. The cushioning material is not reactive with sample contents.

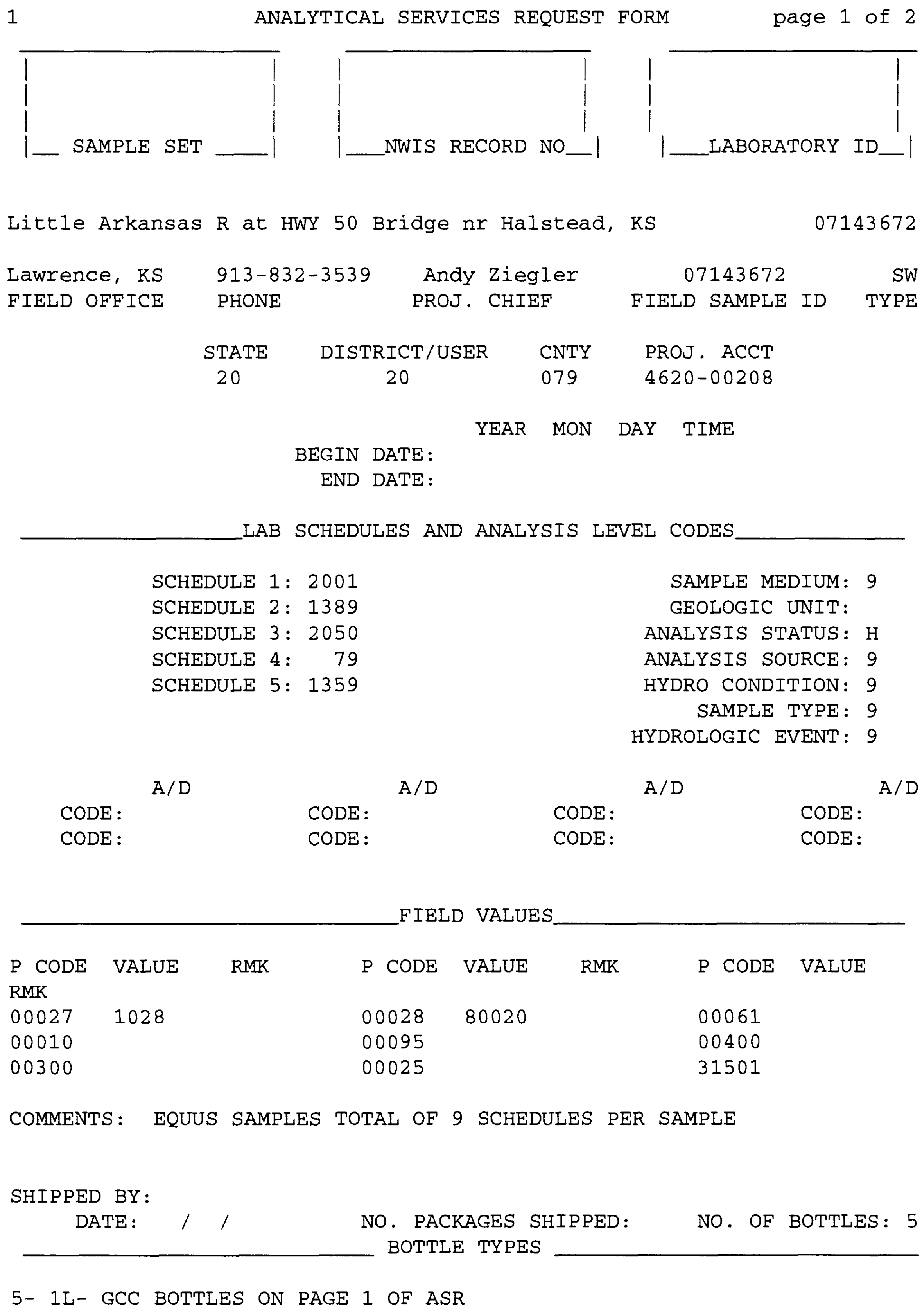
The packaging procedures were in compliance with U.S. Department of Transportation and commercial carrier regulations. Only waterproof ice chests or coolers were used as shipping containers.

Samples were packaged as follows:

1. Seal drain plug in cooler.
2. Place plastic bag inside cooler.
3. Wrap glass bottles with bubble wrap; place inside sealable plastic bags, and place in cooler. Place other sample bottles inside sealable plastic bags and place in cooler.
4. Add ice in plastic bags (will also act as cushioning material).
5. Place name and address of laboratory in position clearly visible on outside of cooler.
6. Secure lids of cooler with fiber tape.
7. Ship coolers overnight from Wichita, Kansas, to laboratory.

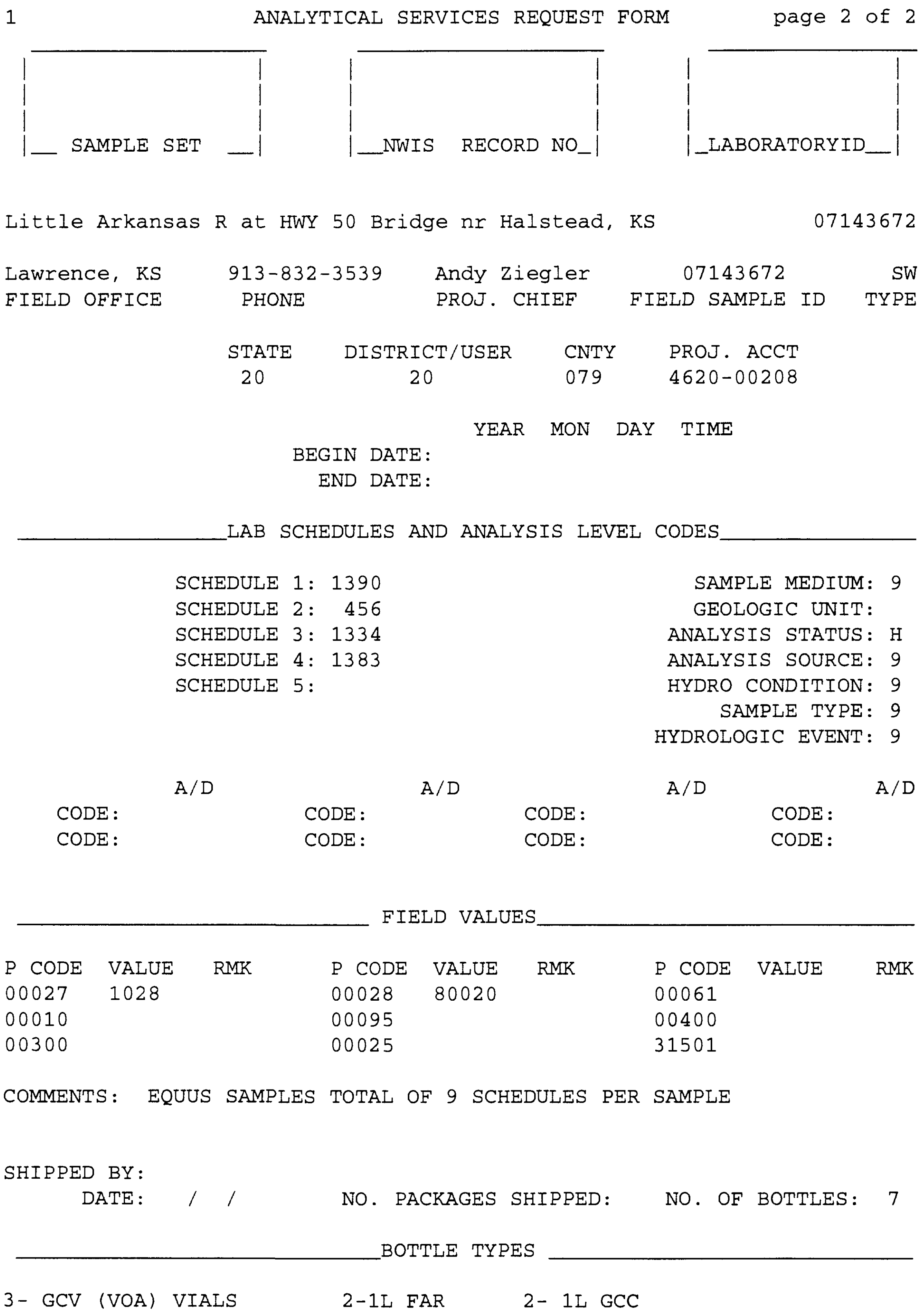
Aquifer Testing

A 30-day aquifer test began on April 2 and concluded on May 2, 1996, at the test well at site TH–04–95 near Halstead, Kansas (fig. 4). A subsequent 75-day aquifer test began on May 13 and ran through July 24, 1996. These tests will be used to help determine aquifer and riverbed hydraulic characteristics and will be used to evaluate aquifer-river interaction and to investigate ground-water-quality changes resulting from an extended period of induced infiltration during which river water is moving into the aquifer.



```
1                    ANALYTICAL SERVICES REQUEST FORM          page 1 of 2
 ____________________      ____________________      ____________________
|                    |    |                    |    |                    |
|                    |    |                    |    |                    |
|                    |    |                    |    |                    |
|__ SAMPLE SET ____|      |___NWIS RECORD NO__|     |___LABORATORY ID__|


Little Arkansas R at HWY 50 Bridge nr Halstead, KS             07143672

Lawrence, KS     913-832-3539    Andy Ziegler       07143672        SW
FIELD OFFICE     PHONE          PROJ. CHIEF      FIELD SAMPLE ID   TYPE

                 STATE     DISTRICT/USER    CNTY     PROJ. ACCT
                 20            20           079      4620-00208

                                     YEAR   MON   DAY   TIME
                      BEGIN DATE:
                        END DATE:

 _________________LAB SCHEDULES AND ANALYSIS LEVEL CODES_____________

              SCHEDULE 1: 2001                     SAMPLE MEDIUM: 9
              SCHEDULE 2: 1389                     GEOLOGIC UNIT:
              SCHEDULE 3: 2050                   ANALYSIS STATUS: H
              SCHEDULE 4:   79                   ANALYSIS SOURCE: 9
              SCHEDULE 5: 1359                   HYDRO CONDITION: 9
                                                     SAMPLE TYPE: 9
                                                HYDROLOGIC EVENT: 9

              A/D                 A/D                 A/D                A/D
         CODE:              CODE:              CODE:              CODE:
         CODE:              CODE:              CODE:              CODE:


 ____________________________FIELD VALUES____________________________

P CODE   VALUE    RMK       P CODE   VALUE    RMK        P CODE   VALUE
RMK
00027    1028               00028    80020               00061
00010                       00095                        00400
00300                       00025                        31501

COMMENTS:  EQUUS SAMPLES TOTAL OF 9 SCHEDULES PER SAMPLE


SHIPPED BY:
     DATE:   /  /           NO. PACKAGES SHIPPED:     NO. OF BOTTLES: 5
 __________________________ BOTTLE TYPES ___________________________

5- 1L- GCC BOTTLES ON PAGE 1 OF ASR
```

Figure 7. Example of U.S. Geological Survey National Water-Quality Laboratory analytical services request form.



```
1                  ANALYTICAL SERVICES REQUEST FORM        page 2 of 2
   __________________      ___________________      ________________
  |                  |    |                   |    |                |
  |                  |    |                   |    |                |
  |                  |    |                   |    |                |
  |__ SAMPLE SET  __|    |__NWIS  RECORD NO_|    |_LABORATORYID__|


Little Arkansas R at HWY 50 Bridge nr Halstead, KS            07143672

Lawrence, KS     913-832-3539    Andy Ziegler       07143672        SW
FIELD OFFICE      PHONE          PROJ. CHIEF    FIELD SAMPLE ID   TYPE

                  STATE     DISTRICT/USER     CNTY      PROJ. ACCT
                   20            20           079       4620-00208

                                    YEAR   MON   DAY   TIME
                       BEGIN DATE:
                         END DATE:

   _______________LAB SCHEDULES AND ANALYSIS LEVEL CODES_____________

               SCHEDULE 1: 1390                   SAMPLE MEDIUM: 9
               SCHEDULE 2:  456                  GEOLOGIC UNIT:
               SCHEDULE 3: 1334                ANALYSIS STATUS: H
               SCHEDULE 4: 1383                ANALYSIS SOURCE: 9
               SCHEDULE 5:                     HYDRO CONDITION: 9
                                                   SAMPLE TYPE: 9
                                               HYDROLOGIC EVENT: 9

               A/D                  A/D                 A/D          A/D
    CODE:                CODE:              CODE:              CODE:
    CODE:                CODE:              CODE:              CODE:


   ___________________________ FIELD VALUES___________________________

P CODE   VALUE    RMK        P CODE   VALUE    RMK       P CODE  VALUE     RMK
00027    1028                00028    80020              00061
00010                        00095                       00400
00300                        00025                       31501

COMMENTS:  EQUUS SAMPLES TOTAL OF 9 SCHEDULES PER SAMPLE


SHIPPED BY:
      DATE:   /  /        NO. PACKAGES SHIPPED:    NO. OF BOTTLES:  7

   ____________________________BOTTLE TYPES ___________________________

3- GCV (VOA) VIALS         2-1L FAR       2- 1L GCC
```

Figure 7. Example of U.S. Geological Survey National Water-Quality Laboratory analytical services request form—Continued.

The aquifer test involved construction of a test well and installation of 22 piezometers surrounding the test well to measure changes in ground-water levels. The test well was constructed of stainless-steel screen and gravel pack with 24-inch diameter screen and casing. Screen length, slot size, and setting depth were based on analysis of site-specific drill-test data. The well was designed for a 900- to 1,000-gallons-per-minute capacity, depending on site geology. The pump was an electric-driven, vertical turbine type. Pumped water was discharged to the river after measurement of flow.

The piezometers were installed surrounding the test well to measure the response of the water-table surface during pumping. Strings of piezometers were constructed parallel and perpendicular to the river.

During the aquifer test, water-level measurements, pump discharge, river stage, specific conductance, pH, water temperature, and dissolved oxygen were recorded at least hourly. Ground-water-level measurements were recorded using a combination of electronic data-logging units and manual methods. The hydrogeologic characteristics evaluated with this test were transmissivity, specific yield, hydraulic conductivity, and riverbed conductance.

Water-level measurements were made using the methods described by Stallman (1971). Water-level measurements were verified with an electric or steel tape that had been previously verified to be accurate to the nearest 0.01 foot. Pump discharge was measured by a calibrated, totalizing water meter with a calibrated orifice weir, and an automated data-logging unit was used to record the discharge at 15-minute intervals.

Aquifer and water-quality testing procedures for the 30-day test of the deep part of the *Equus* beds aquifer are described in the following paragraph.

The test well was located approximately 200 feet north-northwest from the original boring at well EB–145–A1 (fig. 4). The geological conditions at the selected test-well site vary and were used to design the screened intervals for the test well. The boring at well EB–145–A1 encountered a shallow sand zone, a 15-foot thick silty-clay layer, and a deeper sand and gravel aquifer zone. Testing included a 30-day pumping test of the deep aquifer zone and use of clustered shallow and deep piezometers to measure aquifer response in the shallow and deep zones. Aquifer response in both the shallow and deep aquifer zones was recorded using automated data loggers. The general sequence of activities was:

1. Test hole drilling at well location.
2. Develop final well design and piezometer spacing.
3. Construct well and piezometers.
4. Develop well by surging and pumping.
5. Perform 24-hour acceptance test to verify well development and proper construction.
6. Set test pump and instrumentation.
7. Conduct 30-day aquifer test.
8. Evaluate water-level data and available water-quality data to determine if the deep aquifer zone is responding as a confined system. Review information with Groundwater Management District No. 2.
9. Conduct a 75-day pumping test during spring and summer to evaluate atrazine fate through induced infiltration and to confirm the river/aquifer interconnection.
10. Secure test-well site and equipment until construction of other demonstration recharge facilities near Wichita Well No. 4 and No. 36 (fig. 3) is complete.

Test Well

The test well was constructed as a full-scale production well. The conceptual well design was determined from the boring logs from well EB–145–A1 (fig. 3). Final design was determined from a pilot hole drilled as part of a well-construction contract. Final construction was with a 24-inch casing and 60 feet of 60-slot, stainless-steel screen from 71 to 131.5 feet below land surface, with a zone from 110 to 114 feet blanked out because of fine-grained sand. Screen setting and slot size were determined from grain-size determinations from split-spoon samples and boring logs from the pilot hole.

Discharge of Pumped Water

The 30- and 75-day aquifer tests were accomplished using a pump equipped with an electric motor. The test well was pumped at a rate of approximately 900 to 1,000 gallons per minute. The pump discharge was directed to the river using polyvinyl chloride (PVC) pipe and corrugated metal roofing used as a splash abutment to prevent bank erosion. Flow was controlled with a gate valve supplied by the drilling contractor.

Review of data from the USGS streamflow-gaging station at Halstead, Kansas (station 07143680), and the gaging station at U.S. Highway 50 (station 07143672) showed that the 1,000-gallon-per-minute pumping rate caused a 0.05-foot rise in the river stage at the test location. This increase in river stage was considered negligible and is not anticipated to interfere or cause additional infiltration to the aquifer.

Monitoring Wells and Piezometers

Six monitoring wells were installed as part of a line of monitoring wells perpendicular to the river and were instrumented by the USGS at site TH–04–95 shown in detailed data-collection area A (fig. 4). Water-level data from these monitoring wells were collected at 15-minute intervals with data loggers. The monitoring wells and piezometers were completed with 10 feet of 2-inch diameter PVC screen. Most monitoring wells and piezometers were constructed in deep-shallow clusters except for the six shallow monitoring wells located near the test well. The boring for the deep monitoring well (PD5) was completed first and electric logged. Screen settings for both the deep and shallow monitoring wells and piezometers were determined on the basis of geologic and electric logs from the deep monitoring well (PD5) and the test well.

Monitoring-well and piezometer distances originally were established as multiples of the aquifer saturated thickness. Some distance adjustments were required after the pilot hole was drilled and actual well design was completed.

Instrumentation and Measurements

In addition to ground-water-level and flow-discharge measurements, several other types of data also were collected to document conditions at the time of the aquifer test and to provide additional information for the analysis of the data. This information included the following:

- Precipitation data and river-stage data were collected at 15-minute intervals at the USGS streamflow-gaging station on the Little Arkansas River at Halstead, Kansas (station 07143680).
- Hourly readings of barometric pressure were obtained from the National Weather Service station at Halstead, Kansas.
- A staff gage was installed in the farm pond near the test well to document any change in pond level.
- Surface-water temperature was recorded at least twice per week at streamflow-gaging station 07143680 and periodically in each of the monitoring wells. Specific conductance, pH, water temperature, and dissolved oxygen were measured in the test well with a multiprobe and recorded every 30 minutes with a data-logging unit. The multiprobe unit was recalibrated once per week.

Selected piezometers were instrumented with transducers connected to a data-logging unit to record water-level measurements at 15-minute intervals. The water level in the pumping test well was measured manually using an electric sounding tape. Water levels in the instrumented piezometers were checked weekly with the electric sounding tape to verify automated readings.

Automated water-level measurements were collected frequently at the beginning of the aquifer test (1 minute or less). After approximately 4 to 6 hours, the automated measurements were collected at 1-hour intervals for the remainder of the test. Six to eight hours of manual water-level measurements were made at selected monitoring wells and piezometers during the beginning of the aquifer test and at initial recovery after the aquifer test to provide backup for the automated system. Water levels for the monitoring wells at detailed data-collection area A (TH–04–95, fig. 4) instrumented by USGS were retrieved every week.

The drilling contractor installed and maintained an orifice weir for measuring flow from the test well. A transducer was connected to the electronic data logger to measure the water level behind the orifice in addition to a manual manometer.

Record Keeping

All manual depth-to-water measurements were maintained on ground-water field sheets located at a gage house at area A (fig. 4). An example field sheet is shown in figure 6. Other information was maintained in a test diary at the site and was available for all authorized personnel to record site visits and findings. A master record was maintained at the Groundwater Management District No. 2 office in Halstead, Kansas, and updated daily. The master record contained photocopies of the field sheets, originals of the field diary, and electronic files of all retrievals from electronic data loggers.

Field Supervision

The aquifer test was conducted under the supervision of Burns & McDonnell, consulting engineers (Kansas City, Missouri), with assistance from Ground-water Management District No. 2, USGS, and city of Wichita staff. Burns & McDonnell coordinated the overall test procedure and performed weekly site inspections and manual measurements to verify data-logger readings.

Groundwater Management District No. 2 performed daily site security and conditions inspections. Groundwater Management District No. 2 staff also transferred the field notes to the master file maintained in the Groundwater Management District No. 2 office. USGS supervised collection of water-quality samples.

Water-Quality Testing

The schedule for water-quality sampling and analysis for the 30-day aquifer test is shown in Appendix A, table 17. Daily 2-liter grab samples of river water and test-well water were collected with automated samplers. Specific conductance, pH, water temperature, and dissolved oxygen were measured manually twice per week when samples were manually collected. These constituents were recorded hourly from the test well with the multiprobe data-logging unit.

LABORATORY PROCEDURES

Inorganic, total organic carbon, and bacteriological samples were analyzed at the city of Wichita laboratory using EPA methods for drinking water. These methods are described in detail in the "City of Wichita Laboratory Quality Assurance Manual" (city of Wichita, written commun., 1994, revised 1996). Calibration procedures and frequency and the laboratory quality-control plans are included in the "City of Wichita Laboratory Quality Assurance Manual." The city of Wichita laboratory is reviewed annually by the Kansas Department of Health and Environment. In December 1994, the laboratory was reviewed by USGS and approved by USGS for entry of data into the USGS National Water Information System (NWIS) (Erdmann, 1991). The laboratory performs a semiannual audit of sample analyses submitted by USGS.

The USGS laboratory in Lawrence, Kansas, analyzed samples for concentrations of triazine herbicides using both enzyme-linked immunosorbent assay (ELISA) and gas chromatography/mass spectrometry (GC/MS). The laboratory is approved for use by the USGS. Methods used are described by Thurman and others (1990).

Organic and radiochemical analyses were performed by the USGS National Water-Quality Laboratory (NWQL) in Arvada, Colorado. Methods for analysis are described in Fishman and others (1994). Specific analytes and methods used are referenced in Appendix A, tables 2–13. Organic constituents include volatile organic compounds, pesticides, and acid and base/neutral organic compounds. The NWQL participates in many quality-assurance evaluations, including EPA drinking-water certification testing. The general quality-assurance plan for the laboratory is described by Pritt and Raese (1995). Friedman and Erdmann (1982) describe the internal quality assurance and quality control used at the NWQL.

All laboratory methods included the use of internal blind duplicates, spikes, and standard reference samples as part of each laboratory's quality-assurance plan and standard operating procedures. The method detection limits and minimum reporting limits of all of the laboratories were sufficient to quantify concentrations of constituents for MCLs or HALs and are listed in Appendix A, tables 2–13. Acceptance criteria and percentage completeness goals also are listed in these tables.

DATA REVIEW, VALIDATION, AND REPORTING

Streamflow and surface- and ground-water-level data were reviewed and verified using methods of the USGS. Data were processed and stored in the USGS National Water Information System (NWIS). After data were approved, they were transmitted to EPA's STOrage and RETrieval (STORET) system. Data were made available to the project sponsor as requested. A paper copy of all data was presented annually to the project sponsor and forwarded to the Bureau of Reclamation.

Surface- and ground-water-quality data were validated by reviewing the data-collection operations and field notes and by determining that they were appropriate for the hydrologic conditions. Validation included the review of onsite and laboratory quality-control sample results from equipment blanks, trip blanks, standard reference water samples, and field spikes to isolate any contaminants that may have been introduced onsite or in laboratory methods. Results of internal spike recoveries were within the guidelines for the methods, usually 80- to 120-percent recovery (Appendix A, tables 2–13). Validation was determined by review of holding times, comparing the quality-control sample results to the criteria for precision and accuracy for onsite and laboratory results (Appendix A, tables 2–13). For most constituents, an onsite or laboratory replicate analytical result within 10 percent was acceptable. Precision was defined from replicate measurements by the following equation:

$$RPD = \frac{(C_1 - C_2)\,x100}{\frac{(C_1 + C_2)}{2}}\,, \qquad (1)$$

where

RPD = relative percentage difference;
C_1 = larger of two concentration values; and
C_2 = smaller of two concentration values.

Acuracy of onsite and laboratory methods were defined by results of analyses of field and laboratory spikes and results of standard reference water samples. Accuracy for spikes was defined by the following equation:

$$Percentage\ recovery = \frac{C\ spiked - C\ environmental}{C\ expected}x100\,, \qquad (2)$$

where

C spiked = the measured concentration of the spiked environmental sample;
C environmental = the measured concentration of the unspiked environmental sample; and
C expected = the theoretical concentration of the spiked sample.

Accuracy for reference water samples was defined by the following equation:

$$Percentage\ recovery = \left[\frac{C\ measured}{C\ actual}\right]x100\,, \qquad (3)$$

where

C measured = the measured concentration of the constituent; and
C actual = the actual concentration of the reference water sample.

Acceptable precision and accuracy for each analyte are presented in Appendix A, tables 2–13. In tables 2–13, the relative standard deviation is given for selected constituents on the basis of the laboratory analytical technique.

Relative standard deviation, in percent, was used in tables 2–13 because these values were based on results from three or more replicate results. The relative standard deviation (RSD) was defined by the following equation:

$$RSD = \left(\frac{S}{\bar{y}}\right)x100\,, \qquad (4)$$

where

RSD = relative standard deviation, in percent;
S = standard deviation; and
$\bar{y}$ = mean of replicate analyses.

The standard deviation (S) is defined by the following equation:

$$S = \sqrt{\sum_{i=1}^{n} \frac{(y_1 - \bar{y})^2}{n-1}}\,, \qquad (5)$$

where

y_i = measured value of the ith replicate;
$\bar{y}$ = mean of replicate measurements; and
n = number of replicates.

Representativeness of samples to meet the objective of determining the baseline water quality was accomplished through the selection of sampling sites, sampling methods, timing of sampling, and validation and completeness of the data. Comparability of the data was evaluated on the basis of the representativeness of the samples and comparison of individual sampling results to the results from all samples collected.

Aquifer-test data were reviewed, verified, and analyzed by a Burns and McDonnell hydrogeologist. Analysis of the data was made considering any fluctuation of river stage, pumping rates, and weather conditions. Narrative descriptions of the aquifer test, data collection, data analysis, and results were contained in a summary memorandum. The information also was included in the first annual report (Burns and McDonnell, written commun., 1996) following completion of the analysis.

Water-quality data were reviewed by USGS upon receipt from the laboratories. If any constituent concentrations in the recharge water exceeded EPA MCLs, the project sponsor was notified immediately. If concentrations exceed the project "action levels," the city of Wichita may decide to execute a plan for mitigation.

The city of Wichita, in consultation with the Kansas Department of Health and Environment, EPA, and Bureau of Reclamation, developed a mitigation plan (Burns and McDonnell, written commun., 1996) on the basis of evaluation of the baseline data. Both planned recharge sites include a large-capacity city of Wichita well capable of pumping recharged water from the well field to the Wichita water-treatment plant if contamination were to occur. Additionally, the minor quantities of water and concentrations of constituents in the water that will be recharged in this demonstration project are expected to be diluted to acceptable levels by the water present in the aquifer.

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APPENDIX A

Supplemental information related to sampling sites, sample analytes, sampling frequency and sample preservation, and holding times.

Table 1. Data-collection sites used during baseline data collection for the *Equus* Beds Ground-Water Recharge Demonstration Project, 1995–96

[S, streamflow-gaging station; W, monitoring well; Q, surface-water sampling site; T, test well; --, information not available]

Data-collection site (fig. 3 or 4)	U.S. Geological Survey site identification no.	Site name	Type of site	Legal description	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Gage or well datum (feet above sea level)
07143665	07143665	Little Arkansas River at Alta Mills, Kansas	S	22S–02W–30BBC	38°06’44"	97°35’30"	1,391.40
Monitoring well at 07143665	380644097353001	Well at Alta Mills gage	W	22S–02W–30BBC	38°06’44"	97°35’30"	1,391.40
TH–10–95	380424097343801	Well TH–10 near Alta Mills, Kansas	W	23S–02W–06DDD	38°04’24"	97°34’38"	--
TH–02–95	380237097324401	Well TH–02	W	23S–02W–16CDD	38°02’37"	97°32’44"	--
07143672	07143672	Little Arkansas River at Highway 50 near Halstead, Kansas	S, Q	23S–02W–28AABB	38°01’43"	97°32’25"	1,370.55
07143680	07143680	Little Arkansas River at Halstead, Kansas	S	23S–02W–34ADDD	38°00’27"	97°30’52"	1,371.00
EB–145–A1	380028097311001	Well #1 at TH–04–95	W	23S–02W–34ADDA	38°00’28"	97°30’52"	1,371.00
PD–5	380028097311002	Piezometer well	W	23S–02W–34ADDA	38°00’28"	97°31’07"	1,371.00
EB–145–A2	380028097310901	Well #2 at TH–04–95	W	23S–02W–34ADDA	38°00’28"	97°31’09"	1,371.00
EB–145–A3	380028097311101	Well #3 at TH–04–95	W	23S–02W–34ADDB	38°00’28"	97°31’11"	1,371.00
EB–145–A4	380027097311401	Well #4 at TH–04–95	W	23S–02W–34ADCD	38°00’27"	97°31’14"	1,371.00
EB–145–A5	380025097312701	Well #5 at TH–04–95	W	23S–02W–34ACDC	38°00’25"	97°31’27"	1,371.00
Test well	380031097311001	Test well at TH–04–95	T	23S–02W–34ADDA	38°00’31"	97°31’10"	--
07143770	07143770	Black Kettle Creek near Halstead, Kansas	Q	24S–01W–21CCC	38°01’43"	97°31’13"	--
TH–06–95	375304097291301	Well TH–06 near Halstead, Kansas	W	24S02W–01DCC	37°53’04"	97°29’13"	--
07143930	07143930	Kisiwa Creek near Halstead, Kansas	Q	24S–02W–14DDD	30°57’25"	97°30’05"	--
07144050	07144050	Emma Creek near Sedgwick, Kansas	Q	24S–01W–21CCC	37°56’28"	97°26’39"	--
07143950	07143950	Little Arkansas River at SW 84th Street near Sedgwick, Kansas	S, Q	24S–01W–29ABAB	37°56’28"	97°27’04"	1,345.00

Table 1. Data-collection sites used during baseline data collection for the *Equus* Beds Ground-Water Recharge Demonstration Project, 1995–96—Continued

Data-collection site (fig. 3 or 4)	U.S. Geological Survey site identification no.	Site name	Type of site	Legal description	Latitude (degrees, minutes, seconds)	Longitude (degrees, minutes, seconds)	Gage or well datum (feet above sea level)
TH–08–A1	375628097270201	Well #1 at TH–08–95	W	24S–01W–29ABAA	37°56’28"	97°27’02"	1,345.00
TH–08–A2	375628097270401	Well #2 at TH–08–95	W	24S–01W-29ABAB	37°56’28"	97°27’04"	1,345.00
TH–08–A3	375628097270801	Well #3 at TH–08–95	W	24S-01W–29ABAB	37°56’28"	97°27’08"	1,345.00
TH–08–A4	375628097271001	Well #4 at TH–08–95	W	24S–01W–29ABBA	37°56’28"	97°27’10"	1,345.00
TH–08–A5	375628097271701	Well #5 at TH–08–95	W	24S–01W–29BAAA	37°56’28"	97°27’17"	1,345.00
07144090	07144090	Sand Creek near Sedgwick, Kansas	Q	24S–01W–34BCB	37°55’19"	97°25’36"	--
07144100	07144100	Little Arkansas River at Fry Bridge near Sedgwick, Kansas	S, Q	25S–01W–15BBAA	37°52’59"	97°25’27"	1,340.00
EB–142	375259097252701	Well #1 at 07144100	W	25S–01W–15BBAA	37°52’59"	97°25’27"	1,340.00
EB–142–A1	375300097253101	Well #2 at 07144100	W	25S–01W–10CCCD	37°53’00"	97°25’31"	1,340.00
EB–142–A2	375300097253301	Well #3 at 07144100	W	25S–01W–10CCCC	37°53’00"	97°25’33"	1,340.00
EB–142–A3	375300097253501	Well #4 at 07144100	W	25S–01W–10CCCC	37°53’00"	97°25’35"	--
EB–142–A4	375300097254201	Well #5 at 07144100	W	25S–01W–9DDDC	37°53’00"	97°25’42"	
TH–12–95	375140097243301	Well TH–12 near Valley Center, Kansas	W	24S–01W–23BCC	37°51’40"	97°24’33"	--
07144200	07144200	Little Arkansas River at Valley Center, Kansas	S	25S–01W–36CBA	37°49’56"	97°23’16"	1,325.66
Monitoring well at 07144200	374956097231601	Well at Valley Center gage	W	25S–01W–36CBA	37°49’56"	97°23’16"	1,325.66

Table 2. Key water-quality constituents analyzed for all samples

[U.S. Geological Survey (USGS) collects the samples, and the city of Wichita provides analysis for all constituents except the triazine herbicide screen. USGS determines specific conductance, pH, and water temperature during sample collection. MCL, Maximum Contaminant Level for drinking water; HAL, recommended health advisory level; SMCL, Secondary Maximum Contaminant Level; MCL, HAL, and SMCLs are based on total recoverable concentrations in water samples. µS/cm, microsiemens per centimeter; EPA, U.S. Environmental Protection Agency; SM, standard methods; I, U.S. Department of Interior; mg/L, milligrams per liter; µg/L, micrograms per liter; mL, milliliters; --, not applicable]

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL, HAL, or SMCL[2]	Analytical method number[2] or reference	Minimum reporting level	Mean recovery goal (percent)	Completeness goal (percent)
00095	Specific conductance (µS/cm at 25 °C)	--	EPA 120.1	1	--	90
00400	pH[3,7] (standard units)	6.5–8.5	EPA 150.1	.1	--	90
00010	Water temperature[3] (degrees Celsius, °C)	--	EPA 170.1	--	--	90
00076	Turbidity[7] (nephalometric turbidity units)	0.5–1.0	SM 214A	.1	--	90
00300	Dissolved oxygen (mg/L)	--	I-1576–78	.1	--	90
00900	Hardness (mg/L)	--	EPA 200.7	1.0	80–120	90
00421	Alkalinity, dissolved (mg/L)	--	SM 2320B	2.0	80–120	90
70300	Dissolved solids[7] (mg/L)	500	EPA 160.1	10.0	80–120	90
00915	Calcium[4], dissolved (mg/L)	--	EPA 200.7	.03	80–120	90
00925	Magnesium[4], dissolved (mg/L)	--	do.	.05	80–120	90
00930	Sodium[6], dissolved (mg/L)	20	do.	.05	80–120	90
00935	Potassium, dissolved (mg/L)	--	do.	.07	80–120	90
29804	Bicarbonate, dissolved (mg/L)	--	SM 2320B	2.0	80–120	90
29807	Carbonate, dissolved (mg/L)	--	do.	1.0	80–120	90
00945	Sulfate[7], dissolved (mg/L)	250	EPA 300.0	5	80–120	90
00940	Chloride[7], dissolved (mg/L)	250	do.	5	80–120	90
00631	Nitrite plus nitrate[5], dissolved, (mg/L)	10	do.	.02	80–120	90
00608	Ammonia[6], dissolved (mg/L)	30	EPA 350.3	.007	80–120	90
00671	Orthophosphate, dissolved (mg/L)	--	EPA 300.0	.01	80–120	90
01046	Iron[7], dissolved (µg/L)	300	EPA 200.7	10.0	80–120	90
01056	Manganese, dissolved (µg/L)	--	do.	5.0	80–120	90
34756	Triazine herbicide screen, dissolved (µg/L)	--	Thurman and others (1990)	.05	80–120	90
31504	Total coliform bacteria[7] (colonies/100 mL)	0	SM 909A	1	80–120	90
31625	Fecal coliform bacteria (colonies/100 mL)	--	SM 909C	1	80–120	90
00530	Suspended solids (mg/L)	--	EPA 160.2	4.0	80–120	90

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[1] U.S. Environmental Protection Agency data STOrage and RETrieval system (STORET).

[2] U.S. Environmental Protection Agency (1995).

[3] Must be analyzed immediately after sample collection.

[4] Required for calculation of hardness.

[5] On U.S. Environmental Protection Agency (1995) MCL list.

[6] HAL.

[7] SMCL.

Table 3. Key water-quality constituents analyzed for comparison of total and dissolved concentrations

[U.S. Geological Survey (USGS) collects the samples, and the city of Wichita provides analysis for all constituents except the triazine herbicide screen. USGS determines specific conductance, pH. and water temperature during sample collection. MCL, Maximum Contaminant Level for drinking water; HAL, recommended health advisory level; SMCL, Secondary Maximum Contaminant Level; MCL, HAL, and SMCLs are based on total recoverable concentrations in water samples. µS/cm, microsiemens per centimeter; EPA, U.S. Environmental Protection Agency; SM, standard methods; I, U.S. Department of Interior; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL, HAL, or SMCL[2]	Analytical method number[2] or reference	Minimum reporting level	Mean recovery goal (percent)	Completeness goal (percent)
00416	Alkalinity, total (mg/L)	--	SM 2320B	2.0	80–120	90
00916	Calcium, total (mg/L)	--	EPA 200.7	.03	80–120	90
00927	Magnesium[4], total (mg/L)	--	do.	.05	80–120	90
00929	Sodium[7], total (mg/L)	20	do.	.05	80–120	90
00937	Potassium, total (mg/L)	--	do.	.07	80–120	90
00450	Bicarbonate, total (mg/L)	--	SM 2320B	2.0	80–120	90
00447	Carbonate, total (mg/L)	--	do.	1.0	80–120	90
00945	Sulfate[7], total (mg/L)	250	EPA 300.0	5	80–120	90
00940	Chloride[7], total (mg/L)	250	do.	5	80–120	90
00630	Nitrite plus nitrate[5], total (mg/L)	10	do.	.02	80–120	90
00610	Ammonia[6], total (mg/L)	30	EPA 350.3	.007	80–120	90
00665	Total phosphorus (mg/L)	--	EPA 365.2	.03	80–120	90
01045	Iron[7], total (µg/L)	300	EPA 200.7	10	80–120	90
01055	Manganese, total (µg/L)	--	do.	5.0	80–120	90
34757	Triazine herbicide screen, total (µg/L)	--	Thurman and others (1990)	.05	80–120	90

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[1] U.S. Environmental Protection Agency data STOrage RETrieval system (STORET).

[2] U.S. Environmental Protection Agency (1995).

[3] Must be analyzed immediately after sample collection.

[4] Required for calculation of hardness.

[5] On U.S. Envionrmental Protection Agency (1995) MCL list.

[6] HAL.

[7] SMCL.

Table 4. Key-plus water-quality constituent analysis for dissolved inorganic constituent concentrations and bacteria

[U.S. Geological Survey (USGS) collects the samples, and the city of Wichita provides analysis for all constituents except the triazine herbicide screen. USGS determines specific conductance, pH, and water temperature during sample collection. MCL, Maximum Contaminant Level for drinking water; HAL, recommended health advisory level; SMCL, Secondary Maximum Contaminant Level; MCL, HAL, and SMCLs are based on total recoverable concentrations in water samples. µS/cm, microsiemens per centimeter; mg/L, milligrams per liter; EPA, U.S. Environmental Protection Agency; SM, standard methods; I, U.S. Department of Interior, µg/L, micrograms per liter; mL, milliliters; --, not applicable]

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL, HAL, or SMCL[2]	Analytical method number[2] or reference	Minimum reporting level	Mean recovery goal (percent)	Completeness goal (percent)
00095	Specific conductance (µS/cm at 25 °C)	--	EPA 120.1	1	--	90
00400	pH[3,7] (standard units)	6.5–8.5	EPA 150.1	.1	--	90
00010	Water temperature[3] (degrees Celsius, °C)	--	EPA 170.1	--	--	90
00076	Turbidity[7] (nepholmetric turbidity unit)	.5–1.0	SM 214A	.1	--	90
00300	Dissolved oxygen (mg/L)	--	I-1576-78	.1	--	90
00900	Hardness (mg/L)	--	EPA 200.7	1.0	80–120	90
00421	Alkalinity, dissolved (mg/L)	--	SM 2320B	2.0	80–120	90
70300	Dissolved solids[7] (mg/L)	500	EPA 160.1	10	80–120	90
00915	Calcium[4], dissolved (mg/L)	--	EPA 200.7	.03	80–120	90
00925	Magnesium[4], dissolved (mg/L)	--	do.	.05	80–120	90
00930	Sodium[7], dissolved (mg/L)	20	do.	.05	80–120	90
00935	Potassium, dissolved (mg/L)	--	do.	.07	80–120	90
29804	Bicarbonate, dissolved (mg/L)	--	SM 2320B	2.0	80–120	90
29807	Carbonate, dissolved (mg/L)	--	do.	1.0	80–120	90
00945	Sulfate[7], dissolved (mg/L)	250	EPA 300.0	5	80–120	90
00940	Chloride[7], dissolved (mg/L)	250	do.	5	80–120	90
00950	Fluoride[7], dissolved (mg/L)	4.0	do.	.01	80–120	90
71870	Bromide, dissolved (mg/L)	--	do.	.1	80–120	90
00955	Silica, dissolved (mg/L)	--	EPA 200.7	.05	80–120	90
00613	Nitrite[5] (mg/L), dissolved	1.0	EPA 300.0	.01	80–120	90
00631	Nitrite plus nitrate[5], dissolved (mg/L)	10	do.	.02	80–120	90
00608	Ammonia[6], dissolved (mg/L)	30	EPA 350.3	.007	80–120	90
00671	Orthophosphate, dissolved (mg/L)	--	EPA 300.0	.01	80–120	90
01106	Aluminum[7], dissolved (µg/L)	50–200	EPA 200.7	10	80–120	90
01095	Antimony[5], dissolved (µg/L)	6	EPA 200.9	2.5	80–120	90
01000	Arsenic[5], dissolved (µg/L)	50	EPA 200.9	1.0	80–120	90

Table 4. Key-plus water-quality constituent analysis for dissolved inorganic constituent concentrations and bacteria—Continued

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL, HAL, or SMCL[2]	Analytical method number[2] or reference	Minimum reporting level	Mean recovery goal (percent)	Completeness goal (percent)
01005	Barium[5], dissolved (µg/L)	2,000	EPA 200.7	5.0	80–120	90
01010	Beryllium[5], dissolved (µg/L)	4	do.	1.0	80–120	90
01020	Boron[6], dissolved (µg/L)	600	do.	10	80–120	90
01025	Cadmium[5], dissolved (µg/L)	5	EPA 213.2	.1	80–120	90
01030	Chromium[5], dissolved (µg/L)	100	EPA 200.7	8	80–120	90
01040	Copper[5], dissolved (µg/L)	1,300[8]	do.	5	80–120	90
01046	Iron[7], dissolved (µg/L)	300	do.	10	80–120	90
01049	Lead[5], dissolved (µg/L)	15[8]	EPA 200.9	1	80–120	90
01056	Manganese, dissolved (µg/L)	--	EPA 200.7	5	80–120	90
71890	Mercury[5], dissolved (µg/L)	2	EPA 245.1	.02	80–120	90
01065	Nickel[5], dissolved (µg/L)	100	EPA 200.9	1.0	80–120	90
01147	Selenium[5], dissolved (µg/L)	50	EPA 270.2	2.0	80–120	90
01075	Silver[6], dissolved (µg/L)	100	EPA 200.7	10	80–120	90
01080	Strontium[6], dissolved (µg/L)	17,000	do.	1.0	80–120	90
01057	Thallium[5], dissolved (µg/L)	2.0	EPA 200.9	1.7	--	90
01085	Vanadium, dissolved (µg/L)	--	EPA 200.7	9.0	80–120	90
01090	Zinc[6], dissolved (µg/L)	2,000	do.	5.0	80–120	90
00680	Total organic carbon (mg/L)	--	EPA 415.2	.1	--	90
00723	Cyanide[5], dissolved (µg/L)	200	SM 4500–CN	1.0	80–120	90
34756	Triazine herbicide screen, dissolved (µg/L)	--	Thurman and others (1990)	.1	--	90
31504	Total coliform bacteria[7] (colonies/100 mL)	0	SM 909A	1.0	80–120	90
31625	Fecal coliform bacteria (colonies/100 mL)	--	SM 909C	1.0	80–120	90
00530	Suspended solids (mg/L)	--	EPA 160.2	4.0	--	90

[1] U.S. Environmental Protection Agency data STOrage and RETrieval system (STORET).

[2] U.S. Environmental Protection Agency (1995).

[3] Must be analyzed immediately after sample collection.

[4] Required for calculation of hardness.

[5] On U.S. Environmental Protection Agency (1995) MCL list.

[6] HAL.

[7] SMCL.

[8] TT, Treatment technique.

Table 5. Key-plus water-quality constituents analysis for total inorganic constituent concentrations and bacteria analyzed for comparison of total and dissolved concentrations

[U.S. Geological Survey (USGS) collects the samples, and the city of Wichita provides analysis for all constituents except the triazine herbicide screen. USGS determines specific conductance, pH, and water temperature during sample collection. MCL, Maximum Contantminant Level for drinking water; HAL, recommended health advisory level; SMCL, Secondary Maximum Contaminant Level; MCL, HAL, and SMCLs are based on total recoverable concentrations in water samples. µS/cm, microsiemens per centimeter; EPA, U.S. Environmental Protection Agency; SM, standard methods; I, U.S. Department of Interior; mg/L, milligrams per liter; µg/L, micrograms per liter; --, not applicable]

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL, HAL, or SMCL[2]	Analytical method number[2] or reference	Minimum reporting level	Mean recovery goal (percent)	Completeness goal (percent)
00900	Hardness, total (mg/L)	--	EPA 200.7	1.0	80–120	90
00416	Alkalinity, total (mg/L)	--	SM 2320B	2.0	80–120	90
00916	Calcium[4], total (mg/L)	--	EPA 200.7	.03	80–120	90
00927	Magnesium[4], total (mg/L)	--	do.	.05	80–120	90
00929	Sodium[7], total (mg/L)	20	do.	.05	80–120	90
00937	Potassium, total (mg/L)	--	do.	.07	80–120	90
00450	Bicarbonate, total (mg/L)	--	SM 2320B	2	80–120	90
00447	Carbonate, total (mg/L)	--	do.	1	80–120	90
00945	Sulfate[7], total (mg/L)	250	EPA 300.0	5	80–120	90
00940	Chloride[7], total (mg/L)	250	do.	5	80–120	90
00951	Fluoride[5], total (mg/L)	4.0	do.	.1	80–120	90
71870	Bromide, total (mg/L)	--	do.	.1	80–120	90
00956	Silica, total (mg/L)	--	EPA 200.7	.05	80–120	90
00615	Nitrite[5], total (mg/L)	1.0	EPA 300.0	.02	80–120	90
00630	Nitrite plus nitrate[5], total (mg/L)	10	do.	.02	80–120	90
00610	Ammonia[6], total (mg/L)	30	EPA 350.3	.007	80–120	90
00665	Total phosphorus (mg/L)	--	EPA 365.2	.03	80–120	90
00678	Orthophosphate, total (mg/L)	--	EPA 300.0	.01	80–120	90
01104	Aluminum[7], total (µg/L)	50–200	EPA 200.7	10	80–120	90
01097	Antimony[5], total (µg/L)	6	EPA 200.9	2.5	80–120	90
01002	Arsenic[5], total (µg/L)	50	do.	1.0	80–120	90
01007	Barium[5], total (µg/L)	2,000	EPA 200.7	5.0	80–120	90
01012	Beryllium[5], total (µg/L)	4	do.	1.0	80–120	90
01022	Boron[6], total (µg/L)	10	do.	10	80–120	90
01027	Cadmium[5], total (µg/L)	5	EPA 213.2	.1	80–120	90

Table 5. Key-plus water-quality constituents analysis for total inorganic constituent concentrations and bacteria analyzed for comparison of total and dissolved concentrations—Continued

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL, HAL, or SMCL[2]	Analytical method number[2] or reference	Minimum reporting level	Mean recovery goal (percent)	Completeness goal (percent)
01034	Chromium[5], total (µg/L)	100	EPA 200.7	8	80–120	90
01042	Copper[5], total (µg/L)	1,300[8]	do.	5	80–120	90
01045	Iron[7], total (µg/L)	300	do.	10	80–120	90
01051	Lead[5], total (µg/L)	15[8]	EPA 200.9	1	80–120	90
01055	Manganese, total (µg/L)	--	EPA 200.7	5	80–120	90
71901	Mercury[5], total (µg/L)	2	EPA 245.1	.02	80–120	90
01067	Nickel[5], total (µg/L)	100	EPA 200.9	1.0	80–120	90
01147	Selenium[5], total (µg/L)	50	EPA 270.2	2.0	80–120	90
01077	Silver[6], total (µg/L)	100	EPA 200.7	10	80–120	90
01082	Strontium[6], total (µg/L)	17,000	do.	1.0	80–120	90
01059	Thallium[5], total (µg/L)	2	EPA 200.9	1.7	--	90
01087	Vanadium, total (µg/L)	--	EPA 200.7	9.0	80–120	90
01092	Zinc[6], total (µg/L)	2,000	do.	5.0	80–120	90
00680	Total organic carbon (mg/L)	--	EPA 415.2	.01	--	90
00720	Cyanide[5], total (µg/L)	200	SM 4500–CN	1.0	80–120	90
34757	Triazine herbicide screen, total (µg/L)	--	Thurman and others (1990)	.05	--	90

[1] U.S. Environmental Protection Agency data STOrage and RETrieval system (STORET).

[2] U.S. Environmental Protection Agency (1995).

[3] Must be analyzed immediately after sample collection.

[4] Required for calculation of hardness.

[5] On U.S. Environmental Protection Agency (1995) MCL list.

[6] HAL.

[7] SMCL.

[8] TT, Treatment technique.

Table 6. Key-plus water-quality constituents and limited U.S. Environmental Protection Maximum Contaminant Level analysis for dissolved concentrations of selected pesticides

[U.S. Geological Survey (USGS) collects the samples. USGS provides sampling bottles, preservatives, and analysis (schedule 2001). MCL, Maximum Contaminant Level for drinking water; HAL, recommended health advisory level; MCL and HAL are based on total recoverable concentrations in water samples. µg/L, micrograms per liter; %, percent; --, not applicable]

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	U.S. Geological Survey analytical method number	Minimum reporting level	Mean recovery[5] (percent)	Relative standard deviation[5] (percent)	Completeness goal (percent)
		Schedule 2001					
49260	Acetochlor, dissolved (µg/L)	--	0–1126–95[5]	0.009	93	13	90
46342	Alachlor[3], dissolved (µg/L)	2	do.	.009	89	13	90
04038	Atrazine, deisopropyl, dissolved (µg/L)	--	do.	.05	--	--	90
04040	Atrazine, deethyl, dissolved (µg/L)	--	do.	.007	--	--	90
39632	Atrazine[3], dissolved (µg/L)	3	do.	.017	86	8	90
82686	Azinphos, methyl, dissolved (µg/L)		do.	.038	--	--	90
82673	Benfluralin, dissolved (µg/L)		do.	.013	72	21	90
04028	Butylate[4], dissolved (µg/L)	350	do.	.008	89	11	90
82680	Carbaryl[4], dissolved (µg/L)	700	do.	.046	90	34	90
82674	Carbofuran[3], dissolved (µg/L)	40	do.	.013	112	11	90
38933	Chlorpyrifos[4], dissolved (µg/L)	20	do.	.005	97	12	90
04041	Cyanazine[4], dissolved (µg/L)	1	do.	.013	94	14	90
82682	DCPA[4], dissolved (µg/L)	4	do.	.004	--	--	90
34653	DDE *p,p'*, dissolved (µg/L)	--	do.	.01	56	16	90
39572	Diazinon[4], dissolved (µg/L)	.6	do.	.008	88	3	90
39381	Dieldrin[4], dissolved (µg/L)	2.0	do.	.008	71	26	90
82660	Diethylaniline, dissolved (µg/L)	--	do.	.006	82	15	90
82677	Disulfoton[4], dissolved (µg/L)	.3	do.	.028	93	33	90
82668	EPTC, dissolved (µg/L)	--	do.	.005	89	13	90
82663	Ethalfluralin, dissolved (µg/L)	--	do.	.013	79	16	90
82672	Ethoprop, dissolved (µg/L)	--	do.	.012	83	5	90
04095	Fonofos[4], dissolved (µg/L)	10	do.	.008	93	4	90
34253	HCH *alpha*-, dissolved (µg/L)	--	do.	.007	71	16	90
91065	HCH *alpha* D_6-surrogate %, dissolved (µg/L)	--	do.	--	93	16	90
39341	HCH *gamma*-, Lindane[3], dissolved (µg/L)	.2	do.	.011	71	23	90
82666	Linuron, dissolved (µg/L)	--		.039	78	47	90
39532	Malathion[4], dissolved (µg/L)	200	do.	.01	90	18	90
82667	Methyl parathion[4], dissolved (µg/L)	2	do.	.035	82	23	90
39415	Metolachlor[4], dissolved (µg/L)	70	do.	.009	97	14	90
82630	Metribuzin[4], dissolved (µg/L)	100	do.	.012	75	17	90

Table 6. Key-plus water-quality constituents and limited U.S. Environmental Protection Maximum Contaminant Level analysis for dissolved concentrations of selected pesticides—Continued

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	U.S. Geological Survey analytical method number	Minimum reporting level	Mean recovery[5] (percent)	Relative standard deviation[5] (percent)	Completeness goal (percent)
		Schedule 2001—Continued					
82671	Molinate, dissolved (µg/L)	--	[5]0–1126–95	0.007	91	10	90
82684	Napropamide, dissolved (µg/L)	--	do.	.01	87	14	90
39542	Parathion, ethyl, dissolved (µg/L)	--	do.	.022	89	25	90
82669	Pebulate, dissolved (µg/L)	--	do.	.009	88	13	90
82683	Pendimethalin, dissolved (µg/L)	--	do.	.018	77	12	90
82687	Permethrin-*cis*, dissolved (µg/L)	--	do.	.019	43	6	90
82664	Phorate, dissolved (µg/L)	--	do.	.011	77	24	90
04037	Prometon[4], dissolved (µg/L)	100	do.	.018	32	86	90
82676	Pronamide[4], dissolved (µg/L)	50	do.	.003	79	4	90
04024	Propachlor[4], dissolved (µg/L)	90	do.	.015	97	17	90
82679	Propanil, dissolved (µg/L)	--	do.	.016	100	12	90
82685	Propargite I & II, dissolved (µg/L)	--	do.	.006	63	22	90
38535	Propazine[4], dissolved (µg/L)	10	do.	.01	--	--	90
04035	Simazine[3], dissolved (µg/L)	4.0	do.	.008	83	6	90
82670	Tebuthiuron[4], dissolved (µg/L)	500	do.	.015	107	13	90
82665	Terbacil[4], dissolved (µg/L)	90	do.	.03	81	13	90
82675	Terbufos[4], dissolved (µg/L)	.9	do.	.012	85	20	90
91064	Terbuthylazine, dissolved (µg/L)	--	do.		94	16	90
82681	Thiobencarb, dissolved (µg/L)	--	do.	.008	94	8	90
82678	Triallate, dissolved (µg/L)	--	do.	.008	80	5	90
82661	Trifluralin[4], dissolved (µg/L)	5	do.	.012	77	14	90
99856	Volume sample (schedule 2001 D)		--		--	--	90
99807	Set number (schedule 2001)		--		--	--	--

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[1] U.S. Environmental Protection Agency data STOrage and RETrieval system (STORET).

[2] U.S. Environmental Protection Agency (1995).

[3] On U.S. Environmental Protection Agency (1995) MCL list.

[4] HAL.

[5] Sandstrom and others (1992).

Table 7. Key-plus water-quality constituents and limited U.S. Environmental Protection Agency Maximum Contaminant Level analysis for total organonitrogen pesticides

[U.S. Geological Survey (USGS) collects the samples. USGS provides sampling bottles, preservatives, and analysis (schedule 1389). MCL, Maximum Contaminant Level for drinking water; HAL, recommended health advisory level; MCL and HAL are based on total recoverable concentrations in water samples. µg/L, micrograms per liter; --, not applicable]

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	U.S. Geological Survey analytical method number	Minimum reporting level	Mean recovery[5] (percent)	Relative standard deviation[5] (percent)	Completeness goal (percent)
		Schedule 1389					
77825	Alachlor[3], whole water (µg/L)	2	0–3106–83[5]	0.10	--	--	90
82184	Ametryn[4], whole water (µg/L)	60	do.	.10	101	9	90
39630	Atrazine[3], whole water (µg/L)	3	do.	.10	96	8	90
30234	Bromacil[4], whole water (µg/L)	90	do.	.20	--	--	90
30235	Butachlor, whole water (µg/L)	--	do.	.100	--	--	90
30236	Butylate[4], whole water (µg/L)	350	do.	.10	--	--	90
30245	Carboxin[4], whole water (µg/L)	700	do.	.20	-	--	90
81757	Cyanazine[4], whole water (µg/L)	1	do.	.20	--	--	90
30254	Cycloate, whole water (µg/L)	--	do.	.10	--	--	90
75981	Deethylatrazine, whole water (µg/L)	--	do.	.20	--	--	90
75980	Deisopropylatrazine, whole water (µg/L)	--	do.	.20	--	--	90
30255	Diphenamide[4], whole water (µg/L)	200	do.	.10	--	--	90
30264	Hexazinone[4], whole water (µg/L)	200	do.	.20	--	--	90
82612	Metolachlor[4], whole water (µg/L)	70	do.	.20	-	--	90
82611	Metribuzin[4], whole water (µg/L)	100	do.	.10	--	--	90
39056	Prometon[4], whole water (µg/L)	100	do.	.20	95	6	90
39057	Prometryn, whole water (µg/L)	--	do.	.10	98	5	90
30295	Propachlor[4], whole water (µg/L)	90	do.	.10	--	--	90
39024	Propazine[4], whole water (µg/L)	10	do.	.10	96	6	90
39055	Simazine[3], whole water (µg/L)	4	do.	.10	97	5	90
39054	Simetryn, whole water (µg/L)	--	do.	.10	99	7	90
30311	Terbacil[4], whole water (µg/L)	90	do.	.20	--	--	90
39030	Trifluralin[4], whole water (µg/L)	5	do.	.10	--	--	90
30324	Vernolate, whole water (µg/L)	--	do.	.10	--	--	90
99861	Sample volume (milliliters, schedule 1389)	--	--	1.0	--	--	90

[1] U.S. Environmental Protection Agency data STOrage and RETrieval system (STORET).

[2] U.S. Environmental Protection Agency (1995).

[3] On U.S. Environmental Protection Agency (1995) MCL list.

[4] HAL.

[5] Markovchick and others (1994).

Table 8. Limited U.S. Environmental Protection Agency Maximum Contaminant Level analysis for dissolved concentrations of pesticides

[U.S. Geological Survey (USGS) collects the samples. USGS provides sampling bottles, preservatives, and analysis (schedule 2050). MCL, Maximum Contaminant Level for drinking water; HAL, recommended health advisory level; MCL and HAL are based on total recoverable concentrations in water samples. µg/L, micrograms per liter; %, percent; --, not applicable; DNOC, Dinitrocresol; MCPA, (4-chloro-2-methylphenoxy) acetic acid]

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	U.S. Geological Survey analytical method number	Minimum reporting level	Mean recovery[5] (percent)	Relative standard deviation[5] (percent)	Completeness goal (percent)
		Schedule 2050					
38746	2,4-DB, dissolved (µg/L)	--	0–1131–95[5]	0.05	44	8	90
39732	2,4-D[3], dissolved (µg/L)	70	do.	.05	71	13	90
39742	2,4,5-T[4], dissolved (µg/L)	70	do.	.05	77	17	90
49315	Acifluorfen[4], dissolved (µg/L)	400	do.	.05	83	18	90
49312	Aldicarb[3], dissolved (µg/L)	7	do.	.05	61	9	90
49313	Aldicarb sulfone[3], dissolved (µg/L)	7	do.	.05	53	20	90
49314	Aldicarb sulfoxide[3], dissolved (µg/L)	7	do.	.05	100	15	90
38711	Bentazon[4], dissolved (µg/L)	20	do.	.05	75	17	90
04029	Bromacil[4], dissolved (µg/L)	90	do.	.05	82	24	90
49311	Bromoxynil, dissolved (µg/L)	--	do.	.05	74	7	90
49310	Carbaryl[4], dissolved (µg/L)	700	do.	.05	61	7	90
49309	Carbofuran[3], dissolved (µg/L)	40	do.	.05	80	20	90
49308	Carbofuran, 3-hydroxy-, dissolved (µg/L)	--	do.	.05	--	12	90
49307	Chloramben[4], dissolved (µg/L)	100	do.	.05	60	24	90
49306	Chlorothalonil[4], dissolved (µg/L)	500	do.	.05	11	15	90
49305	Clopyralid, dissolved (µg/L)	--	do.	.05	60	10	90
49304	Dacthal, mono-acid-, dissolved (µg/L)	--	do.	.05	74	12	90
38442	Dicamba[4], dissolved (µg/L)	200	do.	.05	64	15	90
49303	Dichlobenil, dissolved (µg/L)	--	do.	.05	34	9	90
49302	Dichlorprop (2,4-DP), dissolved (µg/L)	--	do.	.05	73	26	90
49301	Dinoseb[3], dissolved (µg/L)	7	do.	.05	69	9	90
49300	Diuron[4], dissolved (µg/L)	10	do.	.05	61	11	90
49299	DNOC, dissolved (µg/L)	--	do.	.05	35	7	90
49298	Esfenvalerate, dissolved (µg/L)	--	do.	.05	17	47	90
49297	Fenuron, dissolved (µg/L)	--	do.	.05	66	36	90

Table 8. Limited U.S. Environmental Protection Agency Maximum Contaminant Level analysis for dissolved concentrations of pesticides—Continued

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	U.S. Geological Survey analytical method number	Minimum reporting level	Mean recovery[5] (percent)	Relative standard deviation[5] (percent)	Completeness goal (percent)
		Schedule 2050—Continued					
38811	Fluometron[4], dissolved (µg/L)	90	0–1131–95[5]	0.05	78	17	90
38478	Linuron, dissolved (µg/L)	--	do.	.05	74	12	90
38482	MCPA[4], dissolved (µg/L)	10	do.	.05	66	8	90
38487	MCPB, dissolved (µg/L)	--	do.	.050	39	25	90
38501	Methiocarb, dissolved (µg/L)	--	do.	.050	59	26	90
49296	Methomyl[4], dissolved (µg/L)	200	do.	.050	79	27	90
49295	1-Naphthol, dissolved (µg/L)	--	do.	.050	--	11	90
49294	Neburon, dissolved (µg/L)	--	do.	.050	69	19	90
49293	Norflurazon, dissolved (µg/L)	--	do.	.050	78	12	90
49292	Oryzalin, dissolved (µg/L)	--	do.	.050	68	21	90
38866	Oxamyl[3], dissolved (µg/L)	200	do.	.050	56	20	90
49291	Picloram[3], dissolved (µg/L)	500	do.	.050	55	17	90
49236	Propham[4], dissolved (µg/L)	100	do.	.050	64	9	90
38538	Propoxur, dissolved (µg/L)	--	do.	.050	76	11	90
39762	Silvex (2,4,5-TP)[3], dissolved (µg/L)	50	do.	.050	73	11	90
49235	Triclopyr, dissolved (µg/L)	--	do.	.050	63	18	90
99848	Sample volume (milliliters, schedule 2050)	--	--	1.0	--	--	90

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[1] U.S. Environmental Protection Agency data STOrage and RETrieval system (STORET).

[2] U.S. Environmental Protection Agency (1995).

[3] On U.S. Environmental Protection Agency (1995) MCL list.

[4] HAL.

[5] Werner and others (1996).

Table 9. Limited U.S. Environmental Protection Agency Maximum Contaminant Level analysis for total recoverable concentrations of organochlorine and carbamate pesticides

[U.S. Geological Survey (USGS) collects the samples. USGS provides sampling bottles, preservatives, and analysis (schedules 79 and 1359). MCL, Maximum Contaminant Level for drinking water; HAL, recommended health advisory level; MCL and HAL are based on total recoverable concentrations in water samples. µg/L, micrograms per liter; --, not applicable]

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	U.S. Geological Survey analytical method number	Minimum reporting level	Mean recovery[5,6] (percent)	Relative standard deviation[5,6] (percent)	Completeness goal (percent)
	Schedule 79						
39730	2,4-D[3], total, water (µg/L)	70	0–3105–83[5]	0.01	67	8	90
82183	2,4-DP, total, water (µg/L)	--	--	.01	--	--	90
39740	2,4,5-T[4], total, water (µg/L)	70	--	.01	69	8	90
82052	Dicamba[4], total (µg/L)	200	--	.01	43	6	90
39720	Picloram[3], total (µg/L)	500	--	.01	51	15	90
39760	Silvex (2,4,5-TP)[3], total (water) (µg/L)	50	--	.01	77	5	90
99859	Sample volume (milliliters, schedule 79)	--	--	1.0	--	--	90
	Schedule 1359						
82619	Aldicarb[3], whole water (µg/L)	7	0–3123–93[6]	.50	67	11	90
39750	Carbaryl[4], whole water (µg/L)	700		.50	64	8	90
82615	Carbofuran[3], whole water (µg/L)	40	--	.50	76	9	90
30282	Methiocarb, whole water (µg/L)	--	--	.50	63	5	90
39051	Methomyl[4], whole water (µg/L)	200	--	.50	58	5	90
77441	1-Naphthol, whole water (µg/L)	--	--	.50	63	11	90
39052	Propham[4], whole water (µg/L)	100	--	.50	64	3	90
30296	Propoxur, whole water (µg/L)	--	--	.50	67	13	90
99869	Sample volume (milliliters, schedule 1359)	--	--	1.0	--	--	90

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[1] U.S. Environmental Protection Agency data STOrage and RETrieval system (STORET).

[2] U.S. Environmental Protection Agency (1995).

[3] On U.S. Environmental Protection Agency (1995) MCL list.

[4] HAL.

[5] Wershaw and others (1987).

[6] Werner and Johnson (1994).

Table 10. Limited U.S. Environmental Protection Agency Maximum Contaminant Level analysis for total recoverable volatile organic compounds

[U.S. Geological Survey (USGS) collects the samples. USGS provides sampling bottles, preservatives, and analysis. After the first sampling, the schedule analyzed was changed from schedule 1390 to schedule 1380, which has a smaller minimum reporting level of 0.2 micrograms per liter. MCL, Maximum Contaminant Level for drinking water; HAL, recommended health advisory level; MCL and HAL are based on total recoverable concentrations in water samples. µg/L, micrograms per liter; --, not applicable]

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	U.S. Geological Survey analytical method number	Minimum reporting level (schedule 1390/ schedule 1380)	Mean recovery[5] (percent)	Relative standard deviation[5] (percent)	Completeness goal (percent)
34030	Benzene[3], total (µg/L)	5	0–3127–94[5]	3.0/0.2	104	3.0	90
81555	Bromobenzene, total (µg/L)	--	do.	3.0/.2	110	4.3	90
77297	Bromochloromethane[4], total (µg/L)	90	do.	3.0/.2	114	7.2	90
32101	Bromodichloromethane, total (µg/L)	--	do.	3.0/.2	98	6.9	90
32104	Bromoform[3], total (µg/L)	100	do.	3.0/.2	92	7.8	90
34413	Bromomethane[4], total (µg/L)	10	do.	3.0/.2	116	6.1	90
77342	*n*-Butylbenzene, total (µg/L)	--	do.	3.0/.2	104	4.6	90
77350	*sec*-Butylbenzene, total (µg/L)	--	do.	3.0/.2	104	6.3	90
77353	*tert*-Butylbenzene, total (µg/L)	--	do.	3.0/.2	106	4.7	90
32102	Carbon tetrachloride[3], total (µg/L)	5	do.	3.0/.2	110	5.4	90
34301	Chlorobenzene, total, (µg/L)	--	do.	3.0/.2	102	9.8	90
34311	Chloroethane, total (µg/L)	--	do.	3.0/.2	119	4.5	90
34576	2-Chloroethylvinylether, total (µg/L)	--	do.	3.0/.2	82	7.2	90
32106	Chloroform[3], total (µg/L)	100	do.	3.0/.2	116	5.0	90
34418	Chloromethane[4], total (µg/L)	3	do.	3.0/.2	98	5.7	90
77275	2-Chlorotoluene[4], total (µg/L)	100	do.	3.0/.2	110	4.7	90
77277	4-Chlorotoluene[4], total (µg/L)	100	do.	3.0/.2	100	13	90
82625	1,2-Dibromo-3-chloropropane[3], total (µg/L)	.2	do.	3.0/.2	70	12	90
77651	1,2-Dibromoethane, total (µg/L)	--	do.	3.0/.2	86	13	90
32105	Dibromochloromethane[3], total (µg/L)	100	do.	3.0/.2	86	4.9	90
30217	Dibromomethane, total (µg/L)	--	do.	3.0/.2	120	21	90
34536	1,2-Dichlorobenzene[3], total (µg/L)	600	do.	3.0/.2	114	5.0	90
34566	1,3-Dichlorobenzene[3], total (µg/L)	600	do.	3.0/.2	100	3.9	90
34571	1,4-Dichlorobenzene[3], total (µg/L)	75	do.	3.0/.2	96	7.0	90
34668	Dichlorodifluoromethane[4], total (µg/L)	1,000	do.	3.0/.2	98	10	90

Table 10. Limited U.S. Environmental Protection Agency Maximum Contaminant Level analysis for total recoverable volatile organic compounds—Continued

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	U.S. Geological Survey analytical method number	Minimum reporting level (schedule 1390/ schedule 1380)	Mean recovery[5] (percent)	Relative standard deviation[5] (percent)	Completeness goal (percent)
34496	1,1-Dichloroethane, total (µg/L)	--	0–3127–94[5]	3.0/0.2	118	4.6	90
32103	1,2-Dichloroethane[3], total (µg/L)	5.0	do.	3.0/.2	126	7.7	90
34501	1,1-Dichloroethene[3], total (µg/L)	7	do.	3.0/.2	120	6.1	90
77093	*cis*-1,2-Dichloroethene[3], total (µg/L)	70	do.	3.0/.2	112	3.4	90
34546	*trans*-1,2-Dichloroethene[3], total (µg/L)	100	do.	3.0/.2	116	4.8	90
34541	1,2-Dichloropropane[3], total (µg/L)	5	do.	3.0/.2	108	5.7	90
77173	1,3-Dichloropropane, total (µg/L)	--	do.	3.0/.2	100	12	90
77170	2,2-Dichloropropane, total (µg/L)	--	do.	3.0/.2	72	4.8	90
77168	1,1-Dichloropropene, total (µg/L)	--	do.	3.0/.2	108	3.8	90
34704	*cis*-1,3-Dichloropropene[3], total (µg/L)	10	do.	3.0/.2	77	5.4	90
34699	*trans*-1,3-Dichloropropene[3], total (µg/L)	10	do.	3.0/.2	64	9.7	90
34371	Ethylbenzene[3], total (µg/L)	700	do.	3.0/.2	102	4.0	90
39702	Hexachlorobutadiene[4], total (µg/L)	1	do.	3.0/.2	114	5.3	90
77223	Isopropylbenzene, total (µg/L)	--	do.	3.0/.2	102	4.1	90
77356	*p*-Isopropyltoluene, total (µg/L)	--	do.	3.0/.2	104	4.4	90
78032	Methyl tert-butylether[4], total (µg/L)	1	do.	3.0/.2	--	--	90
34423	Methylene chloride[3], total (µg/L)	5	do.	3.0/.2	108	5.1	90
34696	Naphthalene[4], total (µg/L)	20	do.	3.0/.2	100	4.2	90
77224	*n*-Propylbenzene, total (µg/L)	--	do.	3.0/.2	102	6.7	90
77128	Styrene[3], total (µg/L)	100	do.	3.0/.2	92	7.8	90
34516	1,1,2,2-Tetrachloroethane[4], total (µg/L)	70	do.	3.0/.2	100	30	90
77562	1,1,1,2-Tetrachloroethane[4], total (µg/L)	70	do.	3.0/.2	110	4.6	90
34475	Tetrachloroethene[3], total (µg/L)	5	do.	3.0/.2	108	2.9	90
34010	Toluene[3], total (µg/L)	1,000	do.	3.0/.2	114	4.5	90
77652	1,1,2-Trichloro 1,2,2,-trifluoroethane, total (µg/L)	--	do.	3.0/.2	--	--	90
77613	1,2,3-Trichlorobenzene, total (µg/L)	--	do.	3.0/.2	110	2.9	90
34551	1,2,4-Trichlorobenzene[3], total (µg/L)	70	do.	3.0/.2	100	6.6	90

Table 10. Limited U.S. Environmental Protection Agency Maximum Contaminant Level analysis for total recoverable volatile organic compounds—Continued

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	U.S. Geological Survey analytical method number	Minimum reporting level (schedule 1390/ schedule 1380)	Mean recovery[5] (percent)	Relative standard deviation[5] (percent)	Completeness goal (percent)
34506	1,1,1-Trichloroethane[3], total (μg/L)	200	0–3127–94[5]	3.0/0.2	108	3.1	90
34511	1,1,2-Trichloroethane[3], total (μg/L)	5	do.	3.0/.2	116	13	90
39180	Trichloroethylene[3], total (μg/L)	5	do.	3.0/.2	--	--	90
34488	Trichlorofluoromethane, total (μg/L)	--	do.	3.0/.2	92	6.2	90
77443	1,2,3-Trichloropropane[4], total (μg/L)	40	do.	3.0/.2	94	6.7	90
77222	1,2,4-Trimethylbenzene, total (μg/L)	--	do.	3.0/.2	108	4.0	90
77226	1,3,5-Trimethylbenzene, total (μg/L)	--	do.	3.0/.2	112	6.8	90
39175	Vinyl chloride[3], total (μg/L)	2	do.	1.0/.2	98	6.2	90
81551	Xylene[3], total (μg/L)	10,000	do.	3.0/.2	101	4.8	90

[1] U.S. Environmental Protection Agency data STOrage and RETrieval system (STORET).

[2] U.S. Environmental Protection Agency (1995).

[3] On U.S. Environmental Protection Agency (1995) MCL list.

[4] HAL.

[5] Rose and Schroeder (1995).

Table 11. Full U.S. Environmental Protection Agency Maximum Contaminant Level analysis for dissolved radionuclides

[U.S. Geological Survey (USGS) collects the samples. USGS provides sampling bottles, preservatives, and analysis (schedule 456). MCL, Maximum Contaminant Level for drinking water; MCL is based on total recoverable concentrations in water samples; mrem/yr, millirems per year; pCi/L, picocuries per liter; --, not applicable]

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	Analytical method number[2]	Minimum reporting level	Completeness (percent)
	Schedule 456				
80050	Gross beta[3], dissolved (pCi/L as strontium 90)	4 mrem/yr	EPA 900.0	0.6	90
03515	Gross beta[3], dissolved (pCi/L as cesium 137)	4 mrem/yr	do.	.6	90
80030	Gross alpha[3], dissolved (pCi/L as uranium)	15 pCi/L	do.	.6	90
04126	Gross alpha[3], dissolved (pCi/L as thorium-230)	15 pCi/L	do.	.6	90

[1] U.S. Environmental Protection Agency data STOrage and RETrieval system (STORET).

[2] U.S. Environmental Protection Agency (1995).

[3] On U.S. Envimomental Protection Agency (1995) MCL list.

Table 12. Full U.S. Environmental Protection Agency Maximum Contaminant Level analysis for total recoverable concentrations of organochlorine and organophosphate pesticides

[U.S. Geological Survey (USGS) collects the samples. USGS provides sampling bottles, preservatives, and analysis (schedule 1334). MCL, Maximum Contaminant Level for drinking water; HAL, recommended health advisory level; MCL and HAL are based on total recoverable concentrations in water samples; µg/L, micrograms per liter; --, not applicable]

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	U.S. Geological Survey analytical method number	Minimum reporting level	Relative standard deviation (percent)	Completeness goal (percent)
		Schedule 1334				
39330	Aldrin[4], total, water (µg/L)	1	0–3104–83[5]	0.01	17	90
39350	Chlordane[3], total, water (µg/L)	2	do.	.10	13	90
38932	Chlorpyrifos[4], total (µg/L)	20	do.	.01	--	90
39360	DDD, *p,p'*-, total, water (µg/L)	--	do.	.01	13	90
39365	DDE, *p,p'*, total, water (µg/L)	--	do.	.01	19	90
39370	DDT, *p,p'*, total, water (µg/L)	--	do.	.01	19	90
39040	DEF, total (µg/L)	--	do.	.01	--	90
39570	Diazinon[4], total, water (µg/L)	.6	do.	.01	20	90
39380	Dieldrin[4], total, water(µg/L)	2	do.	.01	--	90
39011	Disulfoton, total (µg/L)	--	do.	.01	--	90
39388	Endosulfan I, total (µg/L)	--	do.	.01	8.9	90
39390	Endrin[3], total, water (µg/L)	2	do.	.01	--	90
39398	Ethion, total, water (µg/L)	--	do.	.01	7.4	90
82614	Fonofos[4], total (µg/L)	10	do.	.01	--	90
39410	Heptachlor[3], total, water (µg/L)	.4	do.	.01	15	90
39420	Heptachlor epoxide[3], total, water (µg/L)	.2	do.	.01	--	90
39340	Lindane[3], total, water (µg/L)	.2	do.	.01	12	90
39530	Malathion[4], total, water (µg/L)	200	do.	.01	32	90
39480	Methoxychlor[3], *p,p'*, total, water (µg/L)	40	do.	.01	8.5	90
39600	Methylparathion[4], total (µg/L)	2	do.	.01	9.2	90
39755	Mirex, total (µg/L)	--	do.	.01	34	90
39540	Parathion, total (µg/L)	--	do.	.01	6.3	90
39516	PCB's[3], gross, total, water (µg/L)	.5	do.	.10	--	90
39250	PCN's, gross, total, water (µg/L)	--	do.	.10	--	90
39034	Perthane, total (µg/L)	--	do.	.10	9.4	90
39023	Phorate, total (µg/L)	--	do.	.01	--	90
39400	Toxaphene[3], total , water (µg/L)	3	do.	1.0	--	90
39786	Trithion, total (µg/L)	--	do.	.01	7.6	90

[1] U.S. Environmental Protection Agency data STOrage and RETrieval system (STORET).

[2] U.S. Envirnomental Protection Agency (1995). [3] On U.S. Envirnomental Protection Agency (1995) MCL list.

[4] HAL. [5] Wershaw and others (1987).

Table 13. Full U.S. Environmental Protection Agency Maximum Contaminant Level analysis for total recoverable concentrations of acid and base/neutral organic compounds

[U.S. Geological Survey (USGS) collects the samples. USGS provides sampling bottles, preservatives, and analysis (schedule 1383). MCL, Maximum Contaminant Level for drinking water; HAL, recommended health advisory level; MCL and HAL are based on total recoverable concentrations in water samples. µg/L, micrograms per liter; --, not applicable]

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	U.S. Geological Survey analytical method number	Minimum reporting level	Mean recovery[5] (percent)	Relative standard deviation[5] (percent)	Completeness goal (percent)
		Schedule 1383					
34205	Acenaphthene, total (µg/L)	--	0–3116–87[5]	5.0	--	--	90
34200	Acenaphthylene, total (µg/L)	--	do.	5.0	--	--	90
34220	Anthracene, total (µg/L)	--	do.	5.0	--	--	90
39120	Benzidine, total (µg/L)	--	do.	40	--	--	90
34526	Benzo(*a*)anthracene[4], total (µg/L)	0.2	do.	10	--	--	90
34230	Benzo(*b*)fluoranthene[4], total (µg/L)	.2	do.	10	--	--	90
34242	Benzo(*k*)fluoranthene[4], total (µg/L)	.2	do.	10	--	--	90
34247	Benzo(*a*)pyrene[3], total (µg/L)	.2	do.	10	--	--	90
34521	Benzo(*ghi*)perylene, total (µg/L)	--	do.	10	--	--	90
34278	Bis-(2-Chlorethoxy)methane, total (µg/L)	--	do.	5.0	--	--	90
34273	Bis-(2-Chlorethyl)ether[4], total (µg/L)	--	do.	5.0	--	--	90
34283	Bis-(2-Chlorisopropyl)ether, total (µg/L)	300	do.	5.0	--	--	90
39100	Bis-(2-Ethlyhexyl)phthalate[3], total (µg/L)	6.0	do.	5.0	--	--	90
34636	4-Bromophenylphenylether, total (µg/L)	--	do.	5.0	--	--	90
34292	Butylbenzylphthalate[1], total (µg/L)	100	do.	5.0	--	--	90
34452	4-Chloro-3-methylphenol, total (µg/L)	--	do.	30	80	27	90
34581	2-Chloronaphthalene, total (µg/L)	--	do.	5.0	--	--	90
34586	2-Chlorophenol[4], total (µg/L)	40	do.	5.0	73	25	90
34641	4-Chlorophenylphenylether, total (µg/L)	--	do.	5.0	111	--	90
34320	Chrysene[3], total (µg/L)	.2	do.	10	42	46	90
34556	1,2,5,6-Dibenz(*a,h*)anthracene[3], total (µg/L)	.3	do.	10	--	--	90
34536	1,2-Dichlorobenzene[3], total (µg/L)	600	do.	5.0	56	43	90
34566	1,3-Dichlorobenzene[3], total (µg/L)	600	do.	5.0	97	30	90
34571	1,4-Dichlorobenzene[3], total (µg/L)	75	do.	5.0	51	--	90
34631	3,3-Dichlorobenzidine, total (µg/L)	--	do.	20	--	--	90
34601	2,4-Dichlorophenol[4], total (µg/L)	20	do.	5.0	84	21	90
34336	Diethylphthalate[4], total (µg/L)	5,000	do.	5.0	69	37	90
34606	2,4-Dimethylphenol, total (µg/L)	--	do.	5.0	74	23	90
34341	Dimethylphthalate, total (µg/L)	--	do.	5.0	19	--	90
39110	Di-*n*-butylphthalate[4], total (µg/L)	4,000	do.	5.0	--	--	90

Table 13. Full U.S. Environmental Protection Agency Maximum Contaminant Level analysis for total recoverable concentrations of acid and base/neutral organic compounds—Continued

Storet[1] code	Constituent (unit of measurement)	U.S. Environmental Protection Agency MCL or HAL[2]	U.S. Geological Survey analytical method number	Minimum reporting level	Mean recovery[5] (percent)	Relative standard deviation[5] (percent)	Completeness goal (percent)
		Schedule 1383—Continued					
34657	4,6-Dinitro-2-methylphenol, total (μg/L)	--	0–3116–87[5]	30	--	--	90
34616	2,4-Dinitrophenol, total (μg/L)	--	do.	20	67	26	90
34611	2,4-Dinitrotoluene[4], total (μg/L)	100	do.	5.0	63	19	90
34626	2,6-Dinitrotoluene[4], total (μg/L)	40	do.	5.0	--	--	90
34596	Di-*n*-octylphthalate, total (μg/L)	--	do.	10	--	--	90
82626	1 2-Diphenylhydrazine (μg/L)	--	do.	5.0	--	--	90
34376	Fluoranthene, total (μg/L)	--	do.	5.0	98	--	90
34381	Fluorene, total (μg/L)	--	do.	5.0	99	11	90
39700	Hexachlorobenzene[3], total (μg/L)	1	do.	5.0	91	--	90
39702	Hexachlorobutadiene[4], total (μg/L)	1	do.	5.0	94	--	90
34386	Hexachlorocyclopentadiene[3], total (μg/L)	50	do.	5.0	--	--	90
34396	Hexachloroethane[3], total (μg/L)	1	do.	5.0	--	--	90
34403	Indeno(1,2,3-*cd*)pyrene[3], total (μg/L)	.4	do.	10	104	--	90
34408	Isophorone[4], total (μg/L)	100	do.	5.0	--	--	90
34696	Naphthalene[4], total (μg/L)	20	do.	5.0	81	17	90
34447	Nitrobenzene, total (μg/L)	--	do.	5.0	50	--	90
34433	N-Nitrosodiphenylamine, total (μg/L)	--	do.	5.0	48	--	90
34591	2-Nitrophenol, total (μg/L)	--	do.	5.0	78	32	90
34646	4-Nitrophenol, total (μg/L)	--	do.	30	61	44	90
34428	N-Nitrosodi-*n*-propylamine, total (μg/L)	--	do.	5.0	--	--	90
34438	N-Nitrosodimethlyamine, total (μg/L)	--	do.	5.0	68	--	90
39032	Pentachlorophenol[3], total (μg/L)	1	do.	30	77	31	90
34461	Phenanthrene, total (μg/L)	--	do.	5.0	94	--	90
34694	Phenol[4], total (μg/L)	4	do.	5.0	53	44	90
34469	Pyrene, total (μg/L)	--	do.	5.0	94	16	90
34551	1,2,4-Trichlorobenzene[3], total (μg/L)	70	do.	5.0	78	24	90
34621	2,4,6-Trichlorophenol, total (μg/L)	--	do.	20	17	31	90
99855	Sample volume (milliliters, schedule 1383)	--	--	1.0	--	--	90

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[1] U.S. Environmental Protection Agency data STOrage and RETrieval system (STORET).

[2] U.S. Environmental Protection Agency (1995).

[3] On U.S. Environmental Protection Agency (1995) MCL list.

[4] HAL.

[5] Fishman (1993).

Table 14. Schedule for baseline and event sampling from February through September 1995

[SW, surface water; GW, ground water; QC, quality control. Quality-control samples include blanks, spikes, reference water samples, and replicates]

		07143672 near Halstead, Kansas		Wells TH–02, 06, 10 and 12		07144100 near Sedgwick, Kansas			
Month	**Analysis group[1]**	**SW**	**GW (2 wells)**	**SW**	**GW**	**SW**	**GW (2 wells)**	**QC samples**	**Totals**
February	Key	1				1		1	3
March	Full EPA	1			4	1	2	1	9
	tables 3, 5, 7, 9	1			4	1	2	1	9
April	Key	1				1			2
	Full EPA	1	1		4	1	1	2	10
	tables 3, 5, 7, 9	1	1		4	1	1	1	9
May	Key	1				1		1	3
	Key-plus	1				1		1	3
	Limited EPA	1				1		1	3
	tables 3, 5, 7, 9	1				1		1	3
	ELISA	72				72		20	164
	GC/MS	12				12	1		25
June	Key	2				2		1	5
	Key-plus	1				1			2
	ELISA	72	1		6	72	1	20	172
July	Key	1				1		1	10
	Key-plus	1				1		2	8
	Limited EPA	1	1		4	1	1	1	9
	tables 3, 5, 7, 9	1	1		4	1	1	1	9
	ELISA	72				72		20	164
	GC/MS	12				12	1		25
August	Key	2				2		1	5
	ELISA	15				15		3	33
September	Key	2				2		1	5
	ELISA	15				15		3	33
			Summary of sample totals during FY95						
	Key	9			0	9	0	6	24
	Key-plus	3			0	3	0	1	7
	Limited EPA	2	1		4	2	1	2	12
	tables 3, 5, 7, 9	2	1		4	2	1	2	12
	Full EPA	2	1		8	2	3	3	19
	tables 3, 5, 7, 9	2	1		8	2	3	2	18
	ELISA	246	1		6	246	1	66	566
	GC/MS	24				24	2	0	50
Totals		290	5	0	30	290	11	82	708

[1] Analysis group:

Key; analyzed for constituents listed in table 2.

Key-plus; analyzed for constituents listed in tables 2–7.

Limited EPA ; analyzed for constituents listed in tables 2–10.

Full EPA ; analyzed for constituents listed in tables 2–13.

Tables 3, 5, 7, 9; analyzed for total concentrations.

ELISA; event and aquifer-test samples analyzed for triazine herbicide concentrations by enzyme-linked immunosorbent assay (ELISA).

GC/MS; gas chromatography/mass spectrometry confirmation analysis of ELISAs.

Table 15. Schedule for baseline, event, and aquifer-test sampling from October 1995 through September 1996

[SW, .surface water; GW, ground water; QC, quality control. Quality-control samples include blanks, spikes, reference water samples, and replicates]

		07143672 and TH–04 wells near Halstead, Kansas		07143950 near Sedgwick, Kansas		07144100 near Sedgwick, Kansas		Aquifer test; test well at TH–04 at Halstead, Kansas			
Month	**Analysis group[1]**	**SW**	**GW**	**SW**	**GW**	**SW**	**GW**	**SW**	**Test well**	**QC**	**Total**
October	Key	1				1				1	3
	Limited-EPA+rad	1	3		1	1	1			2	9
	ELISA	1		1		1					3
November	Key	1			1	1				1	4
	ELISA			1							1
December	Key	1				1				1	3
	ELISA	1				1				0	2
January	Key	1	3		2	1	2			1	10
	ELISA	1		1		1				1	4
February	Key	1	4		1	1	1			1	9
	ELISA	1		1		1				0	3
March	Full EPA	1	4		2	1	1			1	10
	ELISA	60				60				12	132
April	Key	3	8		1	3	1	3	3	3	25
	table 3		8					3	3	1	15
	Key-plus	1	4		1	2	2	4	4	1	19
	tables 3, 5, 7, 9	1	4		1	2	2	4	4	1	19
	pH, SC, T, DO, majors							30	30	5	65
	ELISA	60	6	1		60			30	16	173
May	Key	2				2				1	5
	Key-plus	1	4		2	1	2			2	12
	ELISA	60	6	2		60			30	15	173
June	Key	3	4		1	3	1			2	14
	ELISA	60		1		60			30	15	165
July	Key	2	4		1	2	1			2	12
	ELISA	30		1		30			30	10	100
August	Key	1				1				1	3
	Key-plus	1	4		2	1	2			1	11
	ELISA	15		1		15				3	34
September	Key	1	4			1	1			1	8
	ELISA	1		1		1				0	3
	Summary of sample totals during FY96										
	Key	16	31	0	7	16	7	3	3	14	97
	table 3	0	8	0	0	0	0	3	3	1	15
	Key-plus	3	12	0	5	3	5	4	4	6	42
	tables 3, 5, 7, 9	0	4	0	1	0	1	4	4	1	15
	Full EPA	1	4		2	1	2			1	11
	Limited EPA+rad	1	3		1	1	1			2	9
	ELISA	291	0	11	0	291	0	4	94	70	761
	GC/MS	30	0	0	0	30	0	1	9	--	70
	pH, SC, T, DO, majors	0	0					30	30	5	65

Table 15. Schedule for baseline, event, and aquifer-test sampling from October 1995 through September 1996—Continued

		07143672 and TH–04 wells near Halstead, Kansas		07143950 near Sedgwick, Kansas		07144100 near Sedgwick, Kansas		Aquifer test; test well at TH–04 at Halstead, Kansas			
Month	**Analysis group**[1]	**SW**	**GW**	**SW**	**GW**	**SW**	**GW**	**SW**	**Test well**	**QC**	**Total**
Totals		342	62	11	16	342	16	49	147	100	1,085

[1] Analysis group:

Key; analyzed for constituents listed in table 2.

Key-plus; analyzed for constituents listed in tables 2–7

Limited EPA+rad; analyzed for constituents listed in tables 2–10.

Full EPA ; analyzed for constituents listed in tables 2–13.

Tables 3, 5, 7, 9; analyzed for total concentrations.

ELISA; event and aquifer-test samples analyzed for triazine herbicide concentrations by enzyme-linked immunosorbent assay (ELISA).

GC/MS; gas chromatography/mass spectrometry confirmation analysis of ELISAs.

pH, SC, T, DO, majors; analyzed for field constituents by the U.S. Geological Survey and calcium, magnesium, sodium, potassium, iron, manganese, chloride, sulfate, nitrate, ammonia, and dissolved solids analyzed by city of Wichita laboratory.

Table 16. Sample bottles, treatment, and preservatives for key, key-plus, limited, and full U.S. Environmental Protection analyses of water-quality constituents

[ml, milliliters; L, liters; HNO_3, nitric acid; °C, degrees Celsius; H_2SO_4, sulfuric acid; ELISA, enzyme-linked immunosorbent assay; NaOH, sodium hydroxide; NWQL, U.S. Geological Survey National Water-Quality Laboratory (Arvada, Colo.)]

Number of sample bottles	Volume and bottle type	Label	Maximum study holding time	Treatment and preservatives
Key water-quality constituents (table 2)				
1	500-mL clear polyethylene	Specific conductance, pH, turbidity	28 days immediately 2 days	Raw, untreated, from churn
1	1,000-mL clear polyethylene	Total suspended solids	7 days	Raw, untreated, from churn
1	500-mL acid rinsed	Filtered metals, 2 mL HNO_3	6 months	Capsule filter, rinse 50 mL, fill, add 2 mL HNO_3, from churn
1	125-mL brown polyethylene	Filtered nutrients nitrate, nitrite, orthophosphate	 28 days 2 days	Capsule filter, rinse bottle three times, chill maintain 4 °C, from churn
1	500-mL clear polyethylene	Filtered anions, alkalinity, dissolved solids	14 days	Capsule filter, rinse bottle three times, untreated, from churn
1	250-mL brown polyethylene	Filtered ammonia, 1 mL H_2SO_4	28 days	Capsule filter, rinse bottle three times, 1 mL H_2SO_4, chill at 4 °C
1	250-mL brown polyethylene	Filtered phosphorous, 1 mL H_2SO_4	28 days	Capsule filter, rinse bottle three times, 1 mL H_2SO_4, chill at 4 °C
1	250-mL sterile	Total coliform	6 hours	Raw - single vertical, dip
1	250-mL sterile	Fecal coliform	6 hours	Raw - single vertical, dip
2	125-mL amber glass	Filtered triazines, ELISA	14 days	Filter glass fiber, chill at 4 °C, from stainless-steel container
Key water-quality constituents, total (table 3)				
1	500-mL acid rinsed	Total metals, 2 mL HNO_3	6 months	Raw, rinse bottle three times, 2 mL HNO_3, from churn
1	125-mL brown polyethylene	Total nutrients nitrate, nitrite orthophosphate	 28 days 2 days	Raw, rinse bottle three times, chill at 4 °C, from churn
1	250-mL brown polyethylene	Total ammonia, 1 mL H_2SO_4	28 days	Raw, rinse bottle three times, 1 mL H_2SO_4 chill at 4 °C, from churn
1	250-mL brown polyethylene	Total phosphorous, 1 mL H_2SO_4	28 days	Raw, rinse bottle three times, 1 mL H_2SO_4 chill at 4 °C, from churn
1	500-mL clear polyethylene	Total anions, total alkalinity	14 days	Raw, rinse bottle three times, untreated, from churn
2	125-mL amber glass	Total triazines, ELISA	14 days	Raw, chill at 4 °C

Table 16. Sample bottles, treatment, and preservatives for key, key-plus, limited, and full U.S. Environmental Protection analyses of water-quality constituents—Continued

Number of sample bottles	Volume and bottle type	Label	Maximum study holding time	Treatment and preservatives
Key-plus water-quality constituents (table 4)				
1	500-mL clear polyethylene	Specific conductance, pH, turbidity	28 days immediately 2 days	Raw, rinse bottle three times, untreated, churn
1	1,000-mL clear polyethylene	Total suspended samples	7 days	Raw, rinse bottle three times, untreated, churn
1	500-mL acid rinsed	Filtered metals, 2 mL HNO_3	6 months	Capsule filter, rinse 50 mL, fill, add 2 mL HNO_3, churn
2	250-mL acid-rinsed, glass	Filtered mercury, 1 mL HNO_3	28 days	Capsule filter, rinse 50 mL, fill, add 1 mL HNO_3 each bottle, churn
1	125-mL brown polyethylene	Filtered nutrients nitrate, nitrate orthophosphate	28 days 2 days	Capsule filter, chill at 4 °C, churn
1	500-mL clear polyethylene	Filtered anions, alkalinity, dissolved solids	14 days	Capsule filter, untreated, churn
1	250-mL brown polyethylene	Filtered phosphorous, 1 mL H_2SO_4	28 days	Capsule filter, rinse bottle three times, 1 mL H_2SO_4, chill at 4 °C, churn
1	250-mL brown polyethylene	Filtered ammonia, 1 mL H_2SO_4	28 days	Capsule filter, rinse bottle three times, 1 mL H_2SO_4, chill at 4 °C, churn
1	125-mL amber glass	Total organic carbon, 1 mL H_2SO_4	28 days	Raw, chill at 4 °C, no rinse, add 1 mL H_2SO_4, stainless-steel container
1	250-mL sterile	Total coliform	6 hours	Raw, chill at 4 °C, dip centroid
1	250-mL sterile	Fecal coliform	6 hours	Raw, chill at 4 °C, dip centroid
1	1,000-mL clear polyethylene	Filtered cyanide, 10 mL NaOH	14 days	Capsule filter, rinse bottle three times, 10 mL NaOH, chill at 4 °C, churn
2	125-mL amber glass	Filtered triazines, ELISA	14 days	Filter, vacuum, glass fiber, chill at 4 °C, stainless-steel container
Key-plus water-quality constituents, totals (table 5)				
1	500-mL acid rinsed	Total metals, 2 mL HNO_3	6 months	Raw, rinse bottle three times, add 2 mL HNO_3, churn
2	250-mL acid rinsed, glass	Total mercury, 1 mL HNO_3	28 days	Raw, rinse bottle three times, add 1 mL HNO_3 each bottle, churn
1	125-mL brown polyethylene	Total nutrients	2 days	Raw, rinse bottle three times, chill at 4 °C, churn
1	500-mL clear polyethylene	Total anions, alkalinity	14 days	Raw, rinse bottle three times, untreated, churn

Table 16. Sample bottles, treatment, and preservatives for key, key-plus, limited, and full U.S. Environmental Protection analyses of water-quality constituents—Continued

Number of sample bottles	Volume and bottle type	Label	Maximum study holding time	Treatment and preservatives
		Key-plus water-quality constituents, totals (table 5)—Continued		
1	250-mL brown polyethylene	Total phosphorous, 1 mL H_2SO_4	28 days	Raw, rinse bottle three times, 1 mL H_2SO_4, chill at 4 °C, churn
1	250-mL brown polyethylene	Total ammonia, 1 mL H_2SO_4	28 days	Raw, rinse bottle three times, 1 mL H_2SO_4, chill at 4 °C, churn
1	1,000-mL clear polyethylene	Total cyanide, 10 mL NaOH	14 days	Raw, rinse bottle three times, 10 mL NaOH, chill at 4 °C, churn
2	125-mL amber glass	Total triazines, ELISA	14 days	Raw, chill at 4 °C, stainless-steel container
		Key-plus water-quality constituents/Limited Maximum Contaminant Level (table 6)		
1	1,000-mL amber glass	Schedule 2001	14 days	Filter glass fiber, chill at 4 °C, NWQL, stainless-steel container
		Key-plus water-quality constituents/Limited Maximum Contaminant Level, totals (table 7)		
1	1,000-mL amber glass	Schedule 1389	14 days	Raw, chill—Teflon/dip, NWQL, stainless-steel container
		Limited Maximum Contaminant Level (table 8)		
1	1,000-mL amber glass	Schedule 2050	7 days	Filter glass fiber, chill—Teflon, NWQL, stainless-steel container
		Limited Maximum Contaminant Level, totals (table 9)		
1	1,000-mL amber glass	Schedule 79	14 days	Raw, chill—Teflon, stainless-steel container, NWQL
1	1,000-mL amber glass	Schedule 1359	14 days	Raw, chill—Teflon, stainless-steel container, NWQL
		Limited Maximum Contamiant Level (table 10)		
3	Three vials - 40-mL amber glass	Schedule 1390/1380 - volatile organic compounds	7 days	Raw, chill, dip, centroid, NWQL
		Full U.S. Environmental Protection Agency Maximum Contaminant Level, radionuclides (table 11)		
2	Two 1,000 mL acid rinsed, clear polyethylene	Schedule 456, 4 mL HNO_3	6 months	Capsule filter, 4 mL HNO_3 each, churn, NWQL
		Full U.S. Environmental Protection Agency, organochlorine and orthopohsphate pesticides(table 12)		
1	1,000-mL amber glass	Schedule 1334	14 days	Raw, chill at 4 °C—Teflon, stainless-steel container, NWQL
		Full U.S. Environmental Protection Agency, acid and base/neutral organic compounds (table 13)		
1	1,000-mL amber glass	Schedule 1383	14 days	Raw, chill at 4 °C—Teflon, stainless-steel container, NWQL

Table 17. Water-quality sampling and analysis for 30-day aquifer test

Source of water	Time	Constituent listings	Number of samples
River		Beginning, key-plus, and total count[1]	1
	Day 8	Table 2–7[2]	1
	Day 15	Table 2 and total count	1
	Day 22	Table 2	1
	End	Tables 2–13 and total count	1
	Daily	Onsite[3]	8
Test well		Beginning, tables 2–7, and total count	1
	Day 8	Table 2[2]	1
	Day 15	Table 2 and total count	1
	Day 22	Tables 2–7	1
	End	Tables 2–13, radon, and total count	1
	Daily	Onsite[3]	hourly

[1] Key water-quality constituents, table 2; radon sampled and analyzed by Kansas Department of Health and Environment; epifluorescent total count analyzed by Burns & McDonnell.

[2] Key-plus water-quality constituents (tables 2–7).

[3] Onsite analysis of specific conductance, pH, water temperature, and dissolved oxygen were done hourly. Daily samples were analyzed by city of Wichita laboratory for alkalinity, calcium, chloride, hardness, iron, magnesium, manganese, potassium, sodium, sulfate, dissolved solids, and by USGS laboratory (Lawrence, Kansas) for triazine herbicides analyzed by enzyme-linked immunosorbent assay (ELISA).