Element A1

VOLUNTEER WATER QUALITY MONITORING OF THE KINGS RIVER WATERSHED IN ARKANSAS

by
Kings River Watershed Partnership
and the
Arkansas Water Resources Center

Quality Assurance Project Plan

Marc Nelson, Ph.D.
Principal Investigator

Marc Nelson, Ph.D.
Principal Investigator
AWRC

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Signature
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Date

Sam Davis
Chairman
KRWP-Water Monitoring Committee

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Signature
_____
Date

Floyd Gilzow
Executive Director
Upper White River Basin Foundation

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Signature
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Date

Diane E. Harris
Quality Assurance Manager
Region VII USEPA

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Signature
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Date

Jaci Ferguson
Region VII USEPA
Project Officer

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Signature
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Date
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Effective Date:_____

Element A2

Table of Contents

Element	C1	Assessments and Response Actions	1
Element	C2	Reports to Management	0
Element	D1	Data Review, Validation, and Verification Requirements	0
Element	D2	Validation and Verification Methods	0
Element	D3	Reconciliation with Data Quality Objectives	1

Element A3

Distribution

The following list of individuals and their respective organizations will receive a finalized, signed, USEPA Region VII approved QAPP, and copies of subsequent revisions:

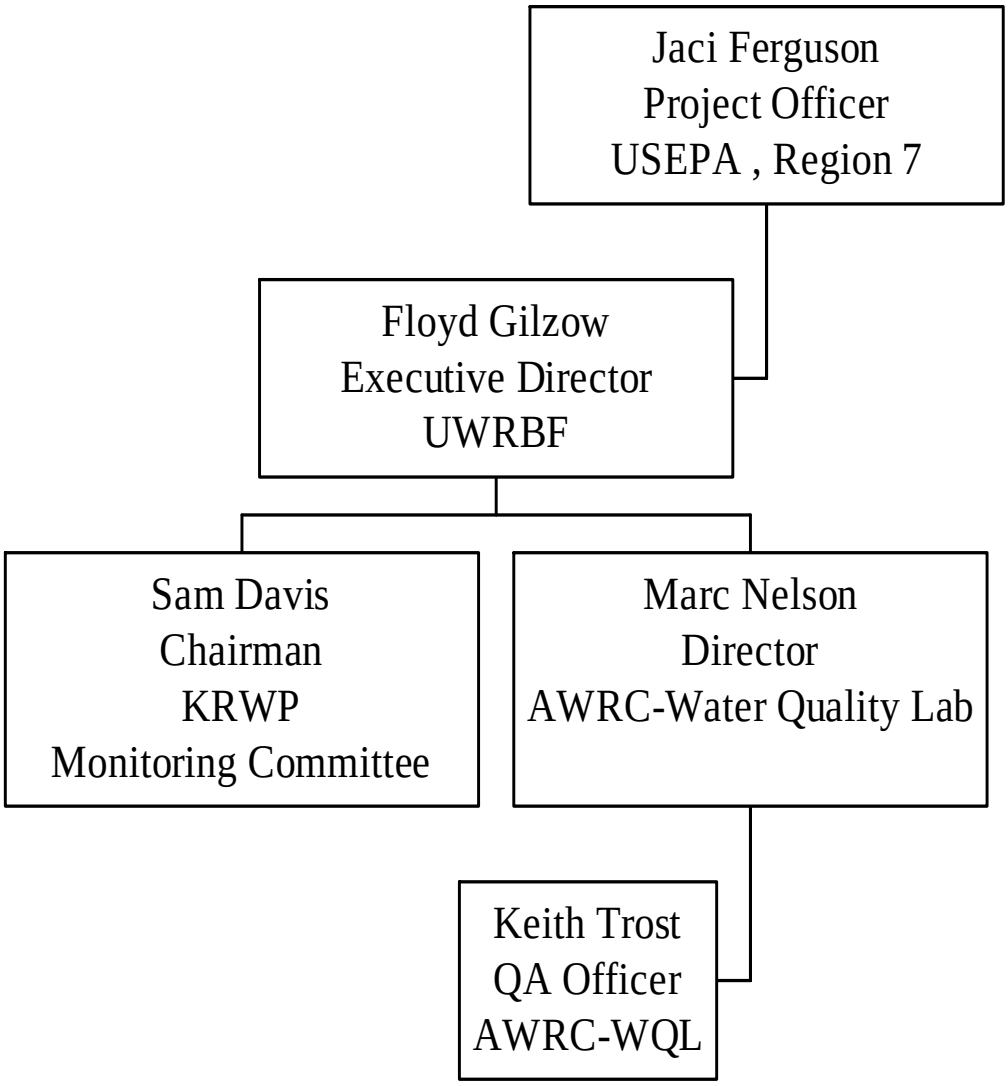
Individual	Associated Agency
Diane E. Harris	U. S. Environmental Protection Agency
Jaci Ferguson	U. S. Environmental Protection Agency
Floyd Gilzow	Upper White River Basin Foundation
Sam Davis	Kings River Watershed Partnership
Marc Nelson	Arkansas Water Resources Center

Element A4

Project/Task Organization

Floyd Gilzow Upper White River Basin Foundation Executive Director	Project Leader Responsible for final report approval
Jaci Ferguson USEPA Region VI USEPA Project Officer	Responsible for grant administration from USEPA Region VII, QAPP review & approval, and final report approval.
Sam Davis KRWP Chairman- Water Monitoring Committee	Responsible for coordinating volunteer monitoring and compiling results.
Keith Trost AWRC-WQL QA Officer	Responsible for adherence to QAPP QA/QC procedures.
Marc Nelson, PhD AWRC-WQL Principal Investigator	Responsible for laboratory analysis - QA/QC.

Project - Task Organization



Element A5

Problem Definition/Background

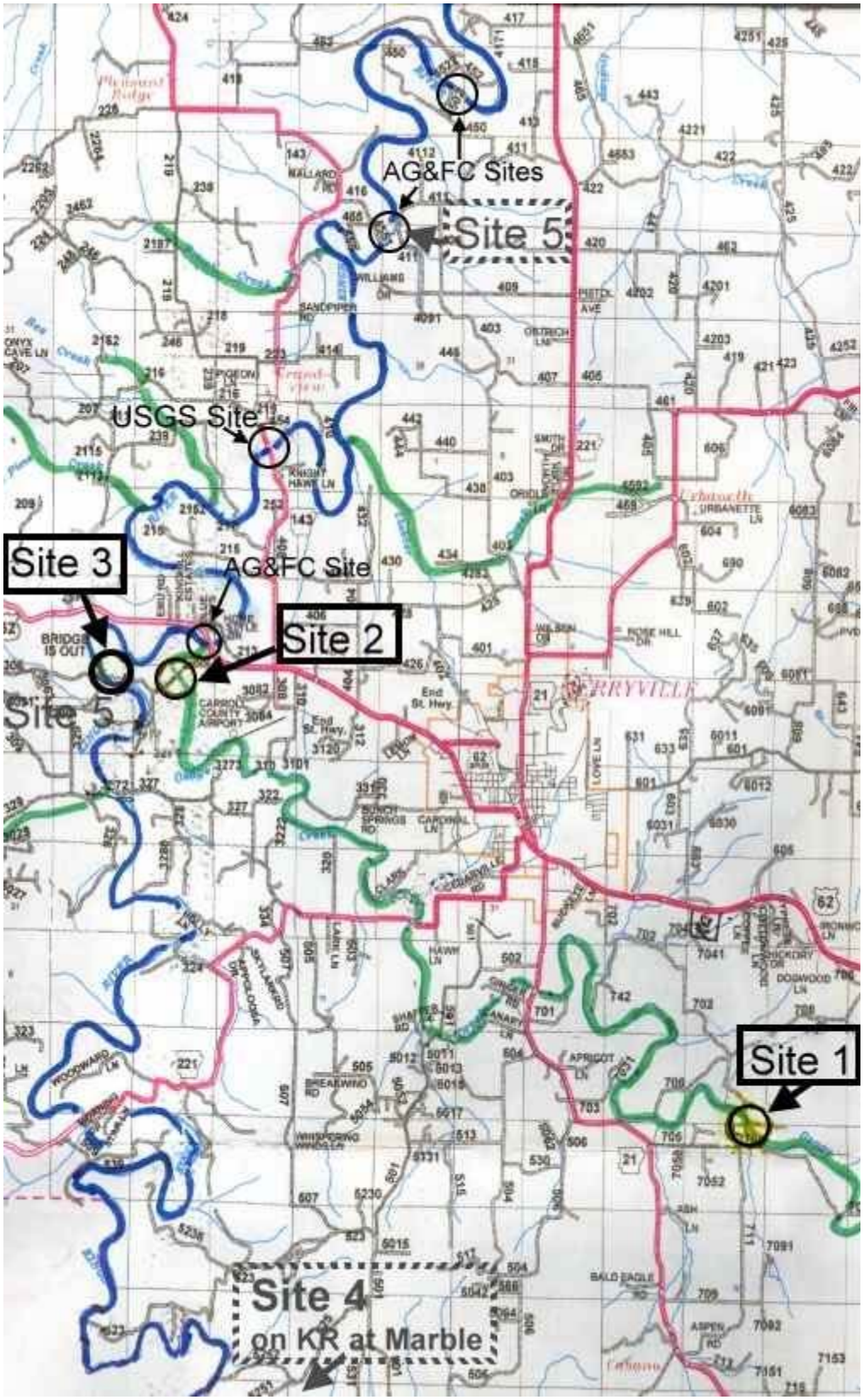
The Kings River Watershed Partnership non-profit citizens group has formed to take local control over water quality issues in the Kings River watershed in Arkansas. One of the first items the group would like to address is water quality monitoring of the Kings River and Osage creek. To this end they have formed a water quality monitoring committee that is charged with the development of a water quality monitoring plan. The objectives of the plan they have developed are: 1) to characterize both spatial and temporal variability in water quality parameters throughout the watershed during each year, 2) to utilize volunteers to monitor the water quality, and 3) to institute QA/QC procedures that will insure the quality of the data collected and allow its use in development of a Watershed Management plan.

Element A6

Project/Task Description

The Kings River Watershed Partnership has formed a water monitoring committee and developed a water quality monitoring plan. The plan will use citizen volunteer monitors to collect water quality samples throughout the Kings River Watershed. The plan calls for the collection of water samples and measurement of water quality parameters at 5 sites once per month (see Figure 1). In addition, once or twice per year volunteers will collect samples and measure water quality at approximately twelve sites distributed throughout the watershed at the same time. The decision as to where to sample will be made at the sampling time. It will be determined by the chairman of the monitoring committee based upon the number of volunteers present, access to sites and the logistics involved. All sites will have the same test parameters measured either on-site or transported immediately to a central location for analysis. All volunteer monitors will be trained to perform the analyses and will be certified as capable of performing water testing according to the KRWP training manual. The parameters measured in-situ will be: air temperature, water temperature, pH and TDS. The parameters measured after sample collection using Hach test kits will be dissolved oxygen, turbidity, nitrate-N, phosphate-P, hardness and alkalinity. In addition, field logs will include the following information: date, time, sampling person, and depth of water. Once per quarter and once during the watershed wide sampling event, a duplicate water sample will be collected at one of the sampling sites and transported to the Arkansas Water Resources Center – Water Quality Lab (WQL) for analysis. The WQL is a certified lab located on the campus of the University of Arkansas that specializes in analyzing water samples. The lab is certified by the Arkansas Department of Environmental Quality for analysis of surface water samples, by the Louisiana Department of Health for analysis of drinking water samples under the NELAC standards and by the USGS for analysis of major nutrients.

Figure 1. Map of the Kings River Watershed sampling sites.


AG&FC Sites
Site 5
USGS Site
Site 3
AG&FC Site
Site 2
Site 1
Site 4
on KR at Marble

Quarterly quality assurance assessment and progress reports will be prepared and submitted electronically to the Project Leader. These reports will document all QA problems and corrective actions as well as all significant occurrences during the quarter. Annual reports will be prepared and submitted electronically and on hard copy. These reports will document the date and times samples were taken, the analytical results for the samples, laboratory and field QA/QC results.

Element A7

Data Quality Objectives for Measurement Data

The objective of this project is to insure the quality of the data collected by the KRWP volunteer monitoring program. The data quality objective is to provide a data set that can be used by the citizens of the watershed as well as develop a Watershed Management plan (WMP).

The usability of the data will be assured by implementing the following procedures:

1) All volunteer monitors will be trained to perform each water test and will follow written SOPs.

2) All analyses will be performed using standard approved test methods.

3) Written records will be kept documenting the sample collection and analysis.

4) The quality of the data collection will be assessed by analyzing duplicate samples at a certified laboratory. Each of five sites will have one duplicate analysis performed each year of the project.

The completeness criteria is that 100% of the data collected was collected by following the above procedures. Any data collected that does not use these procedures will not be used to develop the WMP. In addition, the performance criteria are that the duplicate analyses are within +/-20% RPD of the analytical lab results for at least 85% of the samples. Any data collected that does not meet this criteria will not be used to develop the WMP.

Element A8

Special Training Requirements/Certification

All volunteer monitoring persons will be required to attend training sessions provided by the Arkansas Game and Fish - Stream Teams representatives. These training sessions will cover sample collection as well as sample analyses using the Hach test kits provided. Each volunteer monitor will be certified by either the AGF stream team representative or by the KRWP monitoring committee chairperson as to whether they have successfully completed the required training.

Element A9

Documentation and Records

Sample collection will be documented in a bound field logbook. Sample collection entries will include: date and time of sample collection, name of person collecting samples, depth, pH, dissolved oxygen, turbidity, nitrate-n, phosphate-p, TDS, hardness, alkalinity, air temp, water temp and all calibration/ accuracy check results. Logbook will be kept at the KRWP offices except when in the field. Copies will be made of all entries once per quarter.

Duplicate analyses results will be provided to the KRWP once per quarter. Quarterly Quality Assurance Assessment Reports will be prepared and submitted electronically to the Project Leader and QA Officer. These reports will document all QA problems and corrective actions.

Annual reports will be prepared and submitted electronically and on hard copy. These reports will document the date and times samples were taken, the analytical results for the samples, laboratory and field QA/QC results. Annual reports will be submitted to the project leader and copies will be maintained at the KRWP office for a period of at least five years.

The QAPP will be reviewed and updated as needed, but at least annually. AWRC will be responsible for review and renewal of the QAPP. Signature page with required updates will be submitted annually to EPA Project Officer.

Element B1

Sampling Process Design

Samples will be collected and analyzed monthly from five sampling sites across the Kings River Watershed. These samples will be analyzed for the following parameters: pH, dissolved oxygen, turbidity, nitrate-n, phosphate-p, TDS, hardness, alkalinity, air temp and water temp. Once per year each site will have a duplicate sample collected and transported to the AWRC-WQL for analyses. These samples will be used to determine the base-flow concentrations of the above parameters and the temporal and spatial variation of those results. In addition, once or twice per year samples will be collected at the same time at approximately 12 sites throughout the watershed. The decision as to where to sample will be made at the sampling time. It will be determined by the chairman of the monitoring committee based upon the number of volunteers present, access to sites and the logistics involved. These results will be used to characterize the spatial variability of the concentrations throughout the watershed.

Element B2

Sampling Methods Requirements

The KRWP monitoring plan will use citizen volunteer monitors to collect water quality samples throughout the Kings River Watershed. The plan calls for the collection of water samples and measurement of water quality parameters at 5 sites distributed throughout the watershed once per month (see Figure 1). In addition, once or twice per year volunteers will collect samples and measure water quality at approximately twelve sites distributed throughout the watershed at the same time. The decision as to where to sample will be made at the sampling time. It will be determined by the chairman of the monitoring committee based upon the number of volunteers present, access to sites and the logistics involved. All sites will have the same test parameters measured either on-site or transported immediately to a central location for analysis. All volunteer monitors will be trained to perform the analyses and will be certified as capable of performing water testing according to the KRWP training manual. The parameters measured in-situ will be: air temperature, water temperature, pH and TDS. The parameters measured after sample collection using Hach test kits will be dissolved oxygen, turbidity, nitrate-N, phosphate-P, hardness and alkalinity. In addition, field logs will include the following information: date, time, sampling person, and depth of water. The methods, instrument and data units are listed in the following table:

FIELD ANALYTICAL METHODS

PARAMETER	METHOD	INSTRUMENT	UNITS
pH		Hach pocket pal probe	pH units
Dissolved oxygen	Hach 8166	Hach DR850	mg/l
Turbidity	Hach 8237	Hach DR850	FAU
Nitrate-nitrogen	Hach 8039	Hach DR850	mg/l
Phosphate-phosphorus	Hach 8048	Hach DR850	mg/l
Total dissolved solids		Hach pocket pal probe	mg/l
Hardness		Hach 5-EP	mg/l as CaCO3
Alkalinity		Hach AL-AP	mg/l as CaCO3

Once per quarter, a duplicate water sample will be collected at one of the sampling sites and transported along with a field blank to the Arkansas Water Resources Center – Water Quality Lab (WQL) for analysis. The sampling sites to be duplicated will be rotated among the five sites and the KRWP Monitoring committee chairman will determine which site to duplicate each quarter. The following table lists the parameter, method, preservation and holding times for the parameters that will be measured in the WQL.

LABORATORY ANALYTICAL METHODS

PARAMETER	METHOD	PRESERVATION	HOLDING TIME
pH	EPA 150.1	NONE	48 HOURS

Turbidity	EPA 180.1	NONE	48 HOURS
Nitrate-nitrogen	EPA 300.0	NONE	48 HOURS
Phosphate-phosphorus	EPA 365.2	NONE	48 HOURS
Total dissolved solids	EPA 160.1	NONE	7 DAYS
Hardness	EPA 130.2	HNO3	6 Months
Alkalinity	APHA 2320 B	NONE	14 DAYS

The duplicate lab analyses will be used to ascertain the accuracy and precision of the field methods. The accuracy of each field method will be determined acceptable if the relative percent difference between the field and lab samples is less than +/- 20% for the project as a whole. If a single sampling events results exceed this value for any parameter, corrective actions will be recommended and applied. If corrective actions are required, AWRC and the KRWP Monitoring Committee Chairman will determine the appropriate remedial action and KRWP will apply the changes to the sampling protocol. The precision of the sampling will be determined annually for each parameter and reported to the project manager.

Element B3

Sample Handling and Custody Requirements

KRWP volunteer monitors will collect all samples in the field and enter all information in a field sample collection form. Sample collection entries will include: samples attempted, samples taken successfully, date and time of samples, date and time of collection, name of person collecting samples, problems encountered and maintenance performed. Samples will be analyzed in the field immediately or transported to a central location for analyses.

All sampling equipment will be cleaned before each use using a dilute acid (0.02N sulfuric) and lab cleanser solution. They will be rinsed after cleaning with three rinses of de-ionized water. Duplicate samples for lab analysis will be collected in HDPE cleaned sample bottles with appropriate preservative(see table in Element B2). AWRC will provide the cleaned sample containers.

Samples for lab analysis will be transported within 24 hours to the WQL and will be logged in as soon as they arrive. They will be accompanied by a chain of custody sheet provided by the lab and all chain of custody requirements will be adhered to. The log in sheets will document field identification numbers, date and time of sampling, corresponding lab identification numbers, date and time of log in, name of field technician and name of lab technician accepting samples. The AWRC Water Quality Laboratory Supervisor is responsible for samples received at the laboratory after log in. The AWRC water Quality Laboratory has their own chain of custody procedure and sample tags. The chain of custody will follow the procedure described in the QA plan for the lab that is on file at Arkansas Soil And Water Conservation Commission (ASWCC).

Element B4

Analytical Methods Requirements

Field sampling will be performed by volunteer monitors that are trained and certified to perform all analytical methods. Field analytical procedures will be performed on Hach DR850 portable spectrophotometers, Hach pocket probes, Hach hardness testers, or Hach alkalinity testers. Analytical procedures will be those specified by the Hach company for use with their equipment. The following methods and instruments will be used:

FIELD ANALYTICAL METHODS

PARAMETER	METHOD	INSTRUMENT	UNITS
pH		Hach pocket pal probe	pH units
Dissolved oxygen	Hach 8166	Hach DR850	mg/l
Turbidity	Hach 8237	Hach DR850	FAU
Nitrate-nitrogen	Hach 8039	Hach DR850	mg/l
Phosphate-phosphorus	Hach 8048	Hach DR850	mg/l
Total dissolved solids		Hach pocket pal probe	mg/l
Hardness		Hach 5-EP	mg/l as CaCO3
Alkalinity		Hach AL-AP	mg/l as CaCO3

Laboratory duplicate analyses will be performed by the AWRC- Water Quality Lab (WQL) at their certified laboratory facilities at the University of Arkansas Engineering Research Center in Fayetteville, Arkansas. The WQL is certified by the Arkansas Department of Environmental Quality (ADEQ) for environmental analyses of water. All procedures used for analyzing chemical parameters of water quality for reporting purposes will follow Standard Methods for the Examination of Water and Wastewater 20th edition or later. USEPA approved methodology is also acceptable.

Analytical methods are listed below, along with specific performance requirements. All analytical methods will be conducted under the AWRC-WQL Quality Assurance Plan in which there is a specific SOP for each method. ADEQ and the Arkansas Soil and Water Conservation Commision keep the WQL Quality Assurance Plan on file. All methods fall under the specific quality control requirements outlined in the Quality Assurance Plan. Any failure in the analytical systems will be the responsibility of the AWRC-WQL for corrective action.

The project officer will be informed by the AWRC-WQL of any failure in the analytical system. The Laboratory Director is responsible for correcting and reporting and problems to the project Officer. The analytical methods as well as current PQL values and the acceptance criteria used by the lab are listed in the following table.

LABORATORY ANALYTICAL METHODS

PARAMETER	METHOD	Practical Quantitation Limit	% Recovery of outside Standards
pH	EPA 150.1	NONE	100±10%
Dissolved oxygen	APHA 4500-C	NONE	100±10%
Turbidity	EPA 180.1	1 NTU	100±10%
Nitrate-nitrogen	EPA 300.0	0.005 mg/l	100±10%
Phosphate-phosphorus	EPA 365.2	0.006 mg/l	100±10%
Total dissolved solids	EPA 160.1	14 mg/l	100±10%
Hardness	EPA 130.2	0.15 mg/l	100±10%
Alkalinity	APHA 2320 B	0.05 mg/l	100±10%

Element B5

Quality Control Requirements

Once per quarter and once during the watershed wide sampling event, a duplicate water sample will be collected at one of the sampling sites and transported to the Arkansas Water Resources Center – Water Quality Lab (WQL) for analysis.

Specific laboratory quality control requirements for each analytical method are addressed in the AWRC-WQL Quality Assurance Laboratory Plan on file at the ASWCC. The lab uses certified outside standards in each analytical run and they must have a 100 +/- 10% recovery for the run to be acceptable. Percent recovery is defined as standard certified concentration minus measured standard concentration divided by the standard certified concentration times 100.

PARAMETER	METHOD	Practical Quantitation Limit	% Recovery of outside Standards
pH	EPA 150.1	NONE	100±10%
Dissolved oxygen	APHA 4500-C	NONE	100±10%
Turbidity	EPA 180.1	1 NTU	100±10%
Nitrate-nitrogen	EPA 300.0	0.005 mg/l	100±10%
Phosphate-phosphorus	EPA 365.2	0.006 mg/l	100±10%
Total dissolved solids	EPA 160.1	14 mg/l	100±10%
Hardness	EPA 130.2	0.15 mg/l	100±10%
Alkalinity	APHA 2320 B	0.05 mg/l	100±10%

Element B6

Instrument/Equipment Testing, Inspection, and Maintenance Requirements

Records of maintenance of field sampling equipment will be kept in a bound field book that lists the name of technician, date and type of maintenance. All field probes will be tested against certified standards once per quarter in the field. If the results are greater than +/- 15% from the standard value, the sensor will be cleaned and recalibrated according to manufactures directions. If the sensors require recalibration on two successive inspections, inspection frequency will be increased by 50% until two successive inspections pass.

All AWRC-WQL equipment maintenance will be conducted and reported as outlined in the AWRC-WQL Quality Assurance Plan on file with the ASWCC.

Element B7

Instrument Calibration and Frequency

All field analytical equipment will be calibrated before use. Each will be calibrated according to the manufactures operation manual. All calibration results will be recorded in the field log book.

All AWRC-WQL analytical equipment is calibrated according to the procedures outlined in the Quality Assurance Plan on file with the ASWCC.

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Element B8

Inspection/Acceptance Requirements for Supplies and Consumables

Supplies and consumables used for this project will include sample bottles, laboratory reagents necessary for the tests performed and calibration standards. All supplies and consumables will be purchased new. All field supplies and consumables will be approved for purchased by the KRWP monitoring committee chairman. All Lab supplies and consumables will be approved by the AWRC-WQL Director. All chemicals and reagents will be dated and inspected for proper expiration date when purchased and prior to use. All supplies will be inspected when purchased and any damaged or open containers or packaging will be refused.

Element B9

Data Acquisition Requirements (Non-direct Measurements)

All field data will be entered into spreadsheets by KRWP personnel. The AWRC Lab Director will be responsible for checking all lab data. All data obtained from any outside source that is used in any report will be accompanied by an appropriate citation.

Element B10

Data Management

The KRWP is responsible for the compilation of all analytical data. WQL analytical results as well as QA/QC results will be reported to the KRWP once per quarter. The results will be stored in spreadsheet format on magnetic media at the KRWP office for a minimum of five years.

Element C1

Assessments and Response Actions

The duplicate lab analyses will be used to ascertain the accuracy and precision of the field methods. The accuracy of each field method will be determined acceptable if the relative percent difference between the field and lab samples is less than +/- 20% for the project as a whole. If a single sampling events results exceed this value for any parameter, corrective actions will be recommended and applied. The precision of the sampling will be determined annually for each parameter and reported to the project manager.

Laboratory performance will be checked using external audit samples. Results will be kept on file at the ASWCC office of all performance evaluations. The WQL Director will be responsible for detecting any errors or malfunctions and performing corrective actions. If errors are detected or anomalous data is suspected, the data will be traced back through the acquisition process until the error is found. In the advent that no error is found the data will be considered appropriate for use. If an error is found and cannot be resolved, then the effected data will be discarded.

Element C2

Reports to Management

Quarterly progress reports will be made to the project manager by the AWRC-WQL detailing significant occurrences related to the project including number of samples taken, operational problems and corrective actions. Quarterly Quality Assurance reports will be made to the EPA Project Officer by AWRC detailing all QA problems and corrective actions. Annual progress reports will be made to the project manager by AWRC documenting the date and times samples were taken, the analytical results for the samples, laboratory and field QA/QC results.

Element D1

Data Review, Validation, and Verification Requirements

Laboratory analytical results will be rejected if they fall outside of the standard deviation for the respective parameter as outlined in Element A7. The review, validation and verification of the analytical data are the responsibility of the AWRC-WQL and the procedures used are detailed in the Laboratory's QA plan on file with ASWCC.

The review, validation and verification of data related to field sampling and analysis are the responsibility of the KRWP monitoring committee.

Element D2

Validation and Verification Methods

Field sampling and analytical results will be validated and verified by the KRWP monitoring committee chairperson for each sampling event. Validation will be accomplished by certifying that each result is entered into the official database correctly. Verification will be accomplished by certifying that each analysis was performed by a trained monitor following the procedures outlined in the KRWP training and sampling manual.

Element D3

Reconciliation with Data Quality Objectives

The objective of this project is to assure that volunteer collected water quality data is of high enough quality to be used to develop a Watershed Management plan. To this end, all data will be reported with certification of collection techniques, analytical methods and training as well as QC check results from a certified lab. If any data cannot be certified as to techniques, methods and training, it will not be reported in the annual data reports. If any data does not meet QC acceptance criteria for a single event, corrective actions will be recommended and implemented and the data will be flagged in the annual report. If any data does not meet QC acceptance criteria after corrective actions have been established, the data will not be reported in the annual report.