QUALITY ASSURANCE PROJECT PLAN (QAPP)

Revision 1 (Draft)

INCOG

Water Quality Study of 303(d) Listed Segment of Lower Bird Creek

Prepared By
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Task 202
FY-2005 604(b)
FY-2004 104(b)(3)

Revisions

Revision 1 on 12/6/07 addressed comments received during the initial public comment period. This draft report was available for review from 11/19/07 to 12/03/07. The comments received and INCOG's responses are available by request.

Quality Assurance Project Plan

Water Quality Study of 303(d) Listed Segment of Lower Bird Creek

Development of Pathogen Total Maximum Daily Loads (TMDLs), Turbidity Study and Microbial source tracking for Lower Bird Creek

Task 202
FY-2005 604(b)
FY-104(b)(3)

Approvals

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INCOG Quality Assurance Officer: _____
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EPA Approving Official – Office of Water Quality, Region 6 U.S. Environmental Protection Agency: _____
(Donna R. Miller) (Date)

Oklahoma Office of Secretary Of Environment: _____
(Jennifer Myers Wasinger) (Date)

Foreword:

This Quality Assurance Project Plan (QAPP) outlines the monitoring and data review process to be used in the development of a pathogen TMDL, turbidity study and microbial source tracking project for lower Bird Creek. This study is being performed by the Indian Nations Council of Governments (INCOG) with assistance from the Environmental Protection Agency (EPA), numerous state agencies, the City of Tulsa and other cities and individuals.

QAPP Format:

The format for this QAPP follows EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5, March 2001). In addition, the following documents were consulted in the development of this QAPP:

- Guidance for Quality Assurance Project Plans (EPA QA/G-5, December 2002)
- Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4, February 2006)
- Guidance on Choosing a Sampling Design for Environmental Data Collection (EPA QA/G-5S, December 2002
- OWRB Technical Report 99-3, Standard Operating Procedures For Stream Assessments and Biological Collections Related to Biological Criteria in Oklahoma, April 5, 1999
- Water Quality Monitoring Program, Field Sampling Protocol for Water Quality Assessment of Streams and Rivers (OWRB Draft Copy), April 27, 2004
- Volunteer Water Quality Monitoring Handbook, Oklahoma Water Watch (OWRB, Sixth Edition), January 2005
- Monitoring Water Quality, EPA 841-B-97-003

Acknowledgments:

Many thanks to the following individuals for the roles they played in the development of this QAPP:

Roy Foster, Quality Assurance Manager, City of Tulsa.
Scott VanLoo, Environmental Compliance Supervisor, City of Tulsa.
Ken Burman, Laboratory Manager, City of Tulsa.
Graham Brannin, Intergovernmental Programs Coordinator, City of Tulsa.

Disclaimer:

Any reference to trade names, commercial products or any manufacturers in this QAPP does not constitute endorsement.

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List of Acronyms:

BST	Bacterial Source Tracking (same as MST)
BUMP	Beneficial Use Monitoring Program
COE	United States Corps of Engineers
CPP	Continuing Planning Process
DL	Detection Limit
DO	Dissolved Oxygen
DQO	Data Quality Objective
EPA	United States Environmental Protection Agency
FWP	Fish and Wildlife Propagation
INCOG	Indian Nations Council of Governments
MST	Microbial Source Tracking (same as BST)
NRCS	Natural Resources Conservation Service
NWS	National Weather Service
OCC	Oklahoma Conservation Commission
ODEQ	Oklahoma Department of Environmental Quality
OSE	Oklahoma Office of Secretary of Environment
OWQS	Oklahoma Water Quality Standards
OWRB	Oklahoma Water Resources Board
PPCP	Pharmaceuticals and Personal Care Products
PQL	Practical Quantification Limit

QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAO	Quality Assurance Officer
QAPP	Quality Assurance Project Plan
SOP	Standard Operating Procedure
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TVSS	Total Volatile Suspended Solids
USAP	Use Support Assessment Protocols
USGS	United States Geological Survey
WBID	Waterbody Identification System
WQMP	Water Quality Management Plan
WQS	Water Quality Standards
WWAC	Warm Water Aquatic Community

List of Units

cfs	cubic feet per second
cfu	colony forming unit
mg/Kg	milligram per kilogram
mg/L	milligram per liter
mg/m^3	milligram per cubic meter
mi^2	square mile
mL	milliliter
SU	standard unit

A3. Distribution List

The following individuals and groups will receive a copy or have been made aware of this QAPP and will be given the opportunity to review it and offer comments.

Individual	Organization
Roy Foster	City of Tulsa
Scott VanLoo	City of Tulsa
Chris Armstrong	ODEQ Laboratory
Gayle Bartholomew	Office of Secretary of Environment

A4 PROGRAM DESCRIPTION & ORGANIZATION

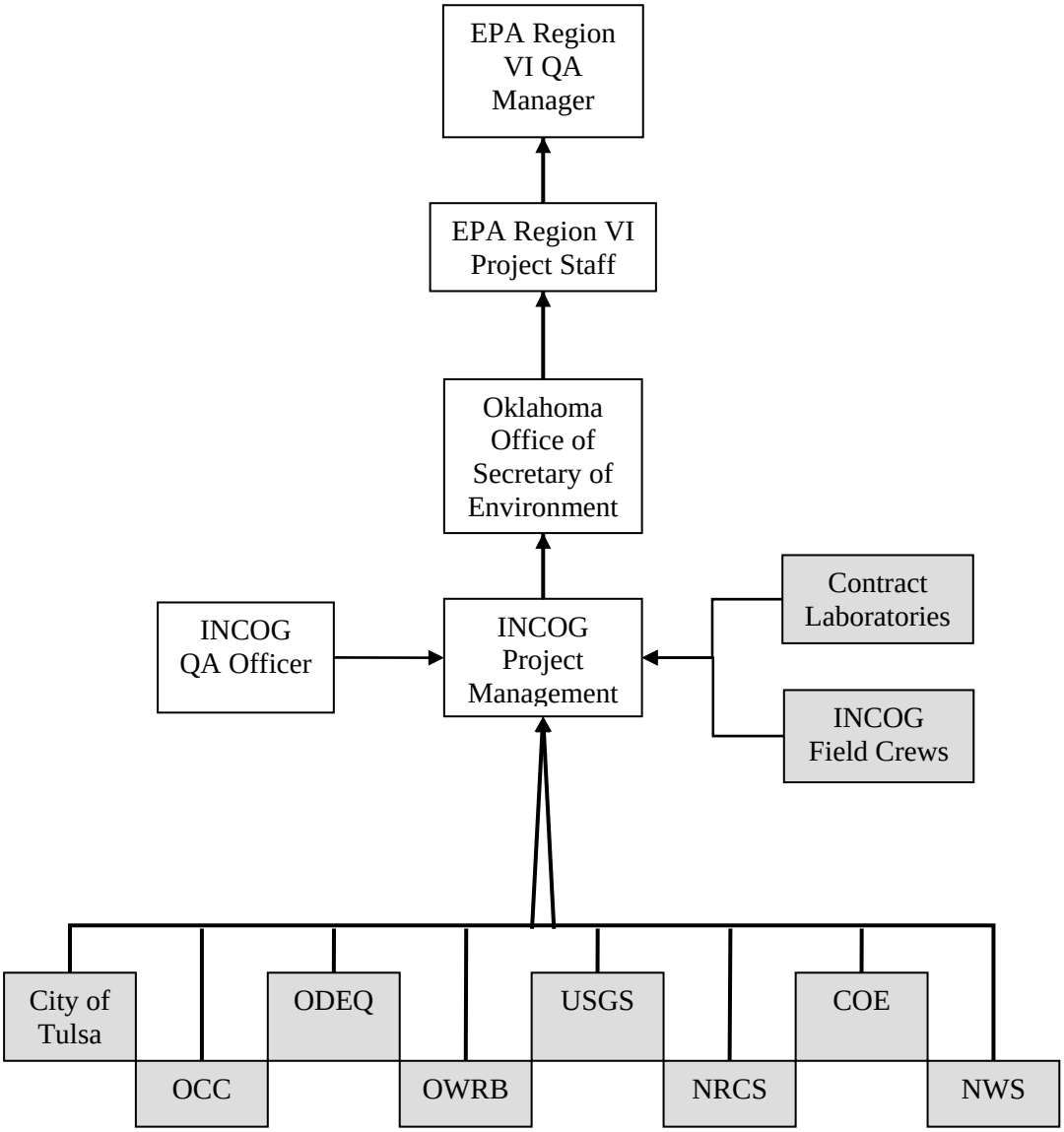
The Indian Nations Council of Governments (INCOG) is responsible for a variety of programs focused on assisting local governments with compliance issues in the protection of natural resources in portions of eastern Oklahoma. INCOG has received funding from a FY-2005 604(b) and a FY-2004 104(b)(3) grant to provide project management, quality assurance development and support, conduct field studies and collect samples, secure laboratory services for sample analyses, compile and reduce data from various sources, and prepare draft and final project reports.

INCOG is responsible for data collection activities including physical, chemical and land use data within the watershed. Potential data sources include the Oklahoma Water Resources Board (OWRB), the Natural Resources Conservation Service (NRCS), the United States Corps of Engineers (COE), the United States Geological Survey (USGS), the Oklahoma Conservation Commission (OCC), the National Weather Service Tulsa Office (NWS), The Oklahoma Climatological Survey, the City of Tulsa, and the Oklahoma Department of Environmental Quality (ODEQ). INCOG will partner with local, State and Federal agencies to optimize sampling methods and coordinate monitoring activities and data sharing. The Oklahoma Office of Secretary of Environment (OSE) and the United States Environmental Protection Agency Region VI (EPA) will coordinate and provide review and approval of the INCOG Quality Assurance Project Plan (QAPP) and all FY-2005 604(b) and FY-2004 104(b)(3) grant supported activities. Figure 1 shows the project organization chart and how these data sources are linked to INCOG. Figure 2 shows the project area and sampling sites.

Richard Smith, as Manager of the INCOG Environmental and Engineering Services Division, will act as Project Manager for this project. Vernon Seaman, INCOG Senior Environmental Planner, will act as Quality Assurance (QA) Officer and principal investigator, and will be responsible for maintaining the approved QAPP. John McElhenney, P.E., INCOG Senior Engineer and Richard Smith, will assist with data collection and analysis. INCOG GIS personnel will assist with mapping as necessary. Jerry Lasker, INCOG Executive Director, will have final authority over all INCOG programs and policies. Mr. Lasker will retire effective December 31, 2007. Rich Brierre was approved by the INCOG Board as the new Executive Director effective January 1, 2008. This transition will not require a renewal of signatures or modification to the QAPP.

INCOG will coordinate all input and data submittals from each data source. As grantee, INCOG will coordinate all grant-supported activities through the OSE. EPA Region VI project staff will have informal communication with INCOG as well as formal written communication with INCOG through the OSE. INCOG has a small technical water quality staff. In most INCOG studies, the INCOG QA Officer is also the principal technical investigator out of staffing necessity. This arrangement has been acceptable to ODEQ and EPA Region VI QA staff in past studies.

Figure 1: Project Organization Chart



Shaded boxes represent potential sources of project data.

Figure 2: Site Location Map

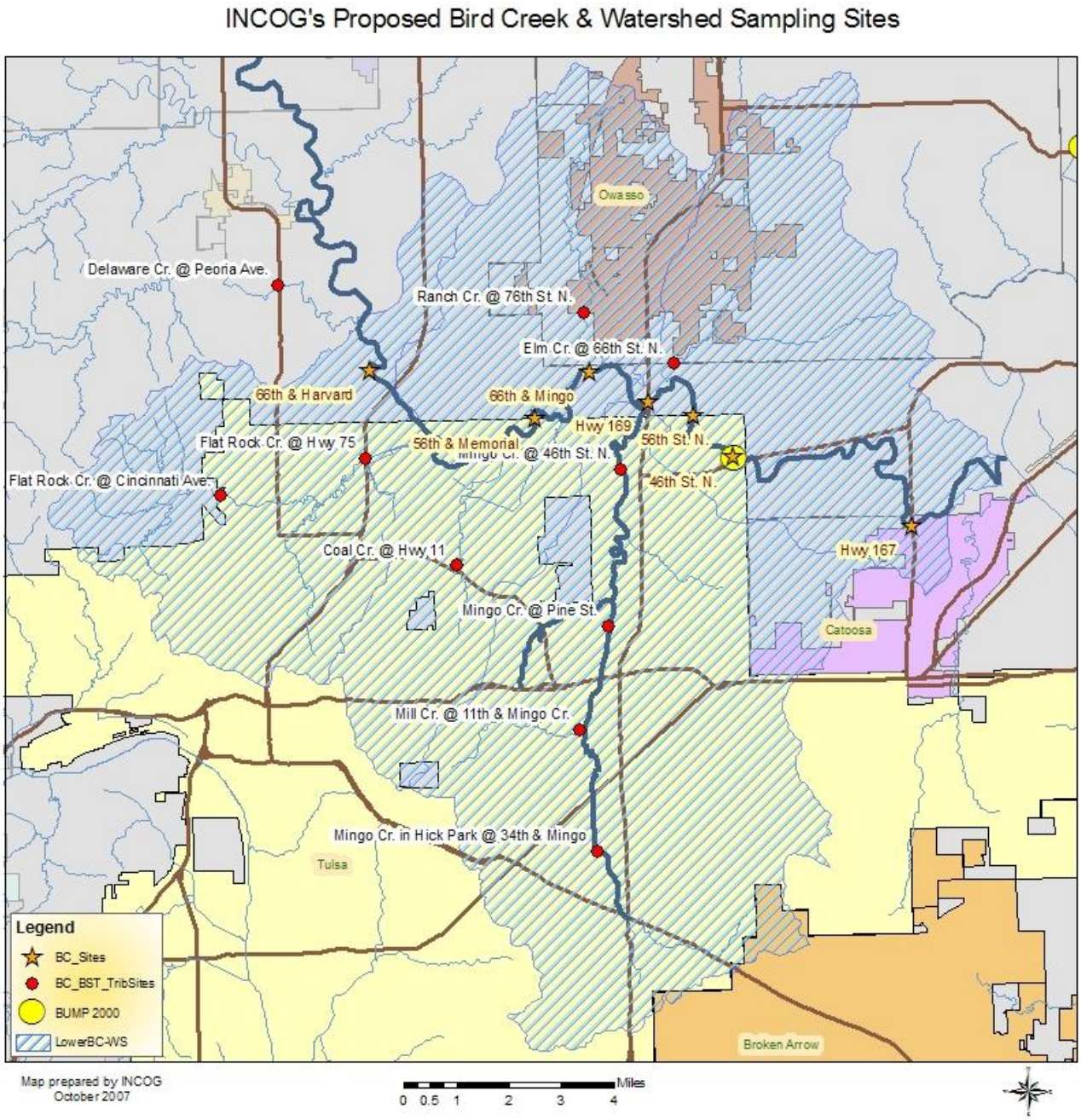


Table 1: Roles and Responsibilities Related to Monitoring and Data Use

Title and Affiliation	Roles and Responsibilities
Richard Smith, INCOG Project Manager	Responsible for overall management of administrative and technical work. Responsible for modeling activities, final data assessment and TMDL recommendations.
Vernon Seaman, INCOG QA Officer and Principal Technical Investigator	Responsible for collecting existing data and the planning and coordination of environmental monitoring. Responsible for the calibration and maintenance of field equipment and onsite analyses. Will assist in final data review. Responsible for overall QA/QC program, including the QAPP, INCOG SOPs, data validation and coordinating with contract laboratories.
John McElhenney, INCOG Senior Engineer	Responsible for engineering aspects and assistance in the field.
Jena Davis (microbiology) and Bill Orrick (wet chemistry),City of Tulsa laboratory; Chris Armstrong, ODEQ Laboratory	Responsible for laboratory operations and analyses performed at the City of Tulsa and ODEQ Laboratories.

A5 PROBLEM DEFINITION/BACKGROUND

Under the Clean Water Act, States are required to submit a list of impaired waterbodies, commonly referred to as the 303(d) List. In 1998 the State of Oklahoma placed the Bird Creek segment OK121300010010 on the 303(d) List for impairment due to pesticides, nutrient enrichment, dissolved oxygen (DO) and metals. Subsequent data were collected under Oklahoma's Beneficial Use Monitoring Program (BUMP) using a fixed monitoring site (Station AT178050) west of the Port of Catoosa on State Highway 266. The station is positioned near the terminal end of stream segment 121300010010 and is classified within the Bird Creek 8-digit HUC watershed (11070107). Water enters the stream system from Lake Yahola, Delaware Creek, Flat Rock Creek, Owasso Creek, and Mingo Creek, among others.

For the 2002 Integrated Water Quality Assessment Report, the Use Support Assessment Protocols (USAP) for Oklahoma was used to evaluate the recent BUMP data. As a result, this segment of Bird Creek was listed as Category 5 impaired for metals (lead only), pathogens, DO and turbidity. The 2004 Integrated Assessment Report states that the DO and metals Category 5 listings should be removed because of more recent data showing beneficial use attainment. Thus neither a DO nor a metals TMDL is required based upon the 2004 Assessment Report. This segment of Bird Creek is still listed as impaired for turbidity and pathogens, therefore TMDLs are still required. INCOG will complete the tributary sampling for pathogens and the turbidity study in 2008/2009 under the FY-04 104(b)(3) grant.

INCOG is the designated Water Quality Management Planning (WQMP) agency having responsibility for TMDLs in its area and for amending the state's WQMP for the INCOG area. The TMDL for

pathogens has been scheduled by the Oklahoma Department of Environmental Quality (ODEQ) to be performed by INCOG. During this project, INCOG will also collect some of the data necessary for turbidity TMDL work. In order to assist bacteria TMDL development, data will be collected to attempt to characterize the sources of bacteria within tributary watersheds as being primarily human or non-human in origin.

This Bird Creek segment receives point source discharges and nonpoint source runoff from Tulsa metropolitan urban areas as well as agricultural and mineral extraction activities. Characterization of nonpoint sources for pathogens and turbidity will require target monitoring of key tributaries. Both runoff and base flow conditions will be sampled. To help differentiate between human and non-human sources of bacteria, INCOG will use a portable field fluorometer to measure optical brighteners in the water and will also deploy absorbent pads concurrently with bacterial collections. Analysis for specific organic wastewater compounds, pharmaceuticals and personal care products (PPCPs) will also be used. INCOG will consult with the ODEQ on the best analytical approach to perform the pathogen TMDL. The ODEQ is presently developing EPA based TMDL methods for turbidity and pathogens using a Load Duration Curve. Turbidity data from the Phase I study will be used by INCOG in the future to develop the turbidity TMDL.

Oklahoma does not have numerical water quality standards (WQS) for suspended solids. The State's numerical standard for turbidity can apply to stream conditions dominated by organic constituents (e.g. phytoplankton) or inorganic particulates (e.g. due to stream bank erosion) or soil loss from construction, cultivation or agricultural grazing activities. It is therefore necessary to first establish the nature of the turbidity that has resulted in the 303(d) listing. For turbidity, a Phase I study will first be undertaken to characterize turbidity and suspended solids in Bird Creek before a TMDL can be developed to address this impairment cause. The Phase II TMDL for turbidity will be developed in the future by INCOG subsequent to this grant.

In order to accomplish the pathogen TMDL, existing data will be collected to develop the Load Duration Curve model. Fluorescent indicator/optical brightener testing and selected organic compounds will be used to differentiate, as much as possible, between human and non-human sources of bacteria. If specific human sources of bacteria are identified, they can then be addressed in the discharge permitting process and in the Phase I and Phase II storm water programs implemented for urbanized areas. It is recognized that the science and technology is not yet fully developed to easily and economically characterize human versus non-human bacterial sources.

To aid in this determination, fluorometric monitoring for optical brighteners and testing for caffeine, 1-4 Dichlorobenzene, cholesterol, coprostanol, b-Estradiol, phenol, Triclosan, para-nonylphenol and tri (2-chloroethyl) phosphate will be used in conjunction with bacterial testing. Individual chemical MST methods have strengths and weaknesses, so this approach is considered more successful when multiple methods are used and the weight of evidence relied upon. In this case we will use optical brighteners coupled with some organic wastewater compounds and pharmaceuticals and personal care products (PPCP) frequently found in wastewater effluents.

There are numerous alternatives, all having merit, but no one technique or combination of techniques is universally accepted. Most chemical methods and genetic sequencing methods are too expensive for use in many studies and library dependent genetic based tests require a library of bacteria

genotypes to be established within each watershed prior to stream sampling thus increasing costs further. It is hoped that utilization of less expensive chemical MST monitoring will provide an effective means to help differentiate between human and non-human sources of bacteria. This portion of the study will be conducted under the FY-2005 604(b) grant.

Table 2 summarizes the 2004 Integrated Report 303(d) impairment causes for this section of Bird Creek. The designated Beneficial Uses assigned in the Oklahoma Water Quality Standards (OWQS) for Lower Bird Creek are summarized in Table 3. This section of Lower Bird Creek (WBID OK121300010010) remains a Category 5 waterbody. As defined in this report, "*The water quality standard is not attained. The waterbody is impaired or threatened for one or more designated uses by a pollutant(s), and requires a TMDL. This category constitutes the Section 303(d) list of waters impaired or threatened by a pollutant(s) for which one or more TMDL(s) are needed.*" This segment is not supporting its designated use as a warm water aquatic community or for primary body contact recreation. There is insufficient information to determine support of its aesthetic or fish consumption designated uses. As a result, additional data needs to be collected and assessed along with any existing available data.

Table 2: 2004 Integrated Report Listing

Stream	WB-ID	2004 Integrated Report 303(d) Impairments		
		Description (Impairment ID)		
Lower Bird Creek	OK121300010010	Turbidity (413)	Enterococcus (215)	Total Fecal Coliform (400)

Table 3: Designated Uses of Stream Segment

Use ID	Description	Status
124	Aesthetic	I – Insufficient Information
125	Agriculture	F – Fully Supporting
133	Warm Water Aquatic Community	N – Not Supporting
135	Industrial and Municipal Process and Cooling Water	F – Fully Supporting
137	Primary Body Contact Recreation	N – Not Supporting
138	Public and Private Water Supply	F – Fully Supporting
1003	Fish Consumption	I – Insufficient Information

A6 PROJECT/TASK DESCRIPTION

The objective is to conduct some chemical monitoring and prepare a bacterial TMDL for lower Bird Creek with a FY 104(b)(3) grant and conduct microbial source tracking (MST) concurrently with an existing FY-604(b)(3) grant. The FY-05 604(b) study will allow the use of cost effective methods to try differentiating between human and non-human bacterial contributions. This field work will be conducted in 2008 and 2009. The combined approaches will be used in the development of a bacterial TMDL for the lower Bird Creek watershed.

This workplan will achieve environmental results under EPA Order 5700.7 and meet EPA's Strategic Plan for Oklahoma, Goal 2 Sub-objective 2.2.1 PAM 52, "Percentage of the TMDLs required for waters currently on the 303(d) list that are established or approved by EPA…" INCOG will partner with local, State and Federal agencies to optimize sampling methods and coordinate monitoring activities and data sharing.

The first task will be to review the existing data, particularly the data used to determine the not supporting status for the warm water aquatic community (turbidity) and primary body contact recreation (pathogens). This data review will determine justification of the turbidity TMDL requirement. Land use and urban storm drain data will be obtained as needed and available from agency and municipal sources, maps and aerial photos. Flow and rainfall data will be collected from the closest monitoring sites. Rainfall data will also be obtained from the National Weather Service office in Tulsa and The Oklahoma Climatological Survey.

The second phase will include the collection and analysis of additional samples to determine existing conditions. In addition, microbial source tracking methods will be used in an attempt to determine bacterial sources and where control measures will be the most effective if necessary. A portable field fluorometer and absorbent pads will be used to measure optical brighteners in water. Bacterial and chemical testing for by-products of human activities will aid in source determination. These methods along with traditional testing methods for fecal coliforms and Enterococci will help reveal current conditions and may help determine whether the bacteria are from human or non-human sources. Land use and urban stormwater drainage data will also be evaluated to help identify potential microbial sources.

Field work and sample collection activities will be conducted by INCOG with help from City of Tulsa personnel. Turbidity will be determined with a HACH portable turbidity meter on site and a split sample will be sent to the City of Tulsa Labs for analysis as well. Field measurements for dissolved oxygen, pH, temperature and conductivity will be made using a Hydrolab or YSI 556 MPS Multi Probe System during all sampling events. Total Suspended Solids (TSS) and Total Volatile Suspended Solids (TVSS) analyses will be conducted to help determine the amount and origin of the suspended solids and what percentage can be assigned to organic and inorganic sources. If TSS concentrations will allow the testing of chlorophyll-a, it will be performed to help determine the amount of algae present. All instruments and test kits will be calibrated and used according to the manufacturer's instructions.

Equipment blanks and duplicates will be collected in the field. Duplicate and blank samples will be analyzed with the appropriate water samples. Bacteria and some of the chemical testing will be performed by contract laboratories.

As often as possible, the analytical detection limit will be at or lower than the lowest WQS or accepted standard for each parameter. To maintain consistency of significant figures, all field data will be reported to the field instrument's displayed decimal place. Mathematical operations involving values having different significant figures will follow the recommended mathematical rules presented in "Standard Methods for the Examination of Water and Wastewater" (APHA, AWWA, WEF).

Experienced field personnel will be used throughout the project. Requirements for field personnel are discussed in Section A8, Special Training Requirements/Certification. INCOG will use sampling methods and equipment that are widely used in similar Federal grant supported projects in which formal Quality Assurance practices are required. Field methods to be used for collecting water samples and field measurement data are presented in the INCOG Standard Operating Procedures (SOPs). Contract laboratories will provide collection containers as necessary. The analytical methods used by the laboratory are discussed in Section B4 and specified in Tables 9, 10 and 11. Tables 7 and 8 specify the type of sample containers to be used and the sample preservation and holding times. Contract laboratories will be accredited by the State of Oklahoma for all analyses requiring certification and have a formal Quality Assurance program. This is discussed more fully in the section on Data Generation and Data Acquisition.

Each grant output will be submitted in draft form to the Oklahoma Office of Secretary of Environment (OSE) for technical review by state agencies and the U.S. EPA. INCOG will respond to all comments, and the Final Project Report will incorporate these comments as modifications to the draft.

Tables 18 and 19 in Section D3 show the project schedules for INCOG's FY-04 104(b)(3) and FY-05 604(b) Program commitments. INCOG will maintain all raw data records from the field surveys and laboratory analyses. Stored data will also include land use information, maps, photos, records of stakeholder contacts, etc. that will be used to assess the chemical and physical condition of the sampled waterbody.

Changes in sample collection sites after reconnaissance, review of existing data or due to environmental conditions will not require QAPP revisions. Additional sampling activities needed to confirm findings or provide necessary data to help answer questions raised during this study will also not require QAPP revisions.

A7 DATA QUALITY OBJECTIVES AND CRITERIA

DQO 1: State the Problem

The lower section of Bird Creek (OK121300010010) is impaired for turbidity, Enterococcus and fecal coliforms. A review of the existing data used to determine this impaired status needs to be performed. Microbial source tracking is necessary to attempt differentiation between human and non-human sources. Bird Creek water levels vary considerably with the season and rain events so the seasonal variations and fluctuating water levels will need to be considered.

The INCOG planning team will consist of Richard Smith, as Project Manager and Vernon Seaman as principal investigator and Quality Assurance Officer (QAO). Richard Smith will be the final technical decision-maker at INCOG concerning this project, and Jerry Lasker, INCOG Executive Director, will provide overall INCOG executive management. Upon Mr. Lasker's retirement December 31, 2007, Rich Brierre will become the new executive Director of INCOG.

Agricultural operations, mining activities, residential areas, industrial sites and a large urban area all drain into this portion of the creek. In addition, there are a number permitted discharges and the effects of streambed erosion are readily apparent in many areas. Residential areas within the

watershed and not served by a public wastewater system are on individual septic systems. Microbial sources could include agricultural animals, wildlife, waterfowl, domestic pets and humans. Rainfall events may flush additional pathogens into the waterway if nonpoint sources are a significant contributor. If point sources are the primary contributor and their discharges remain constant, rain events may result in a dilution, thus lowering the pathogen concentrations. Turbidity is likely due to suspended sediment, algae and decaying organic material.

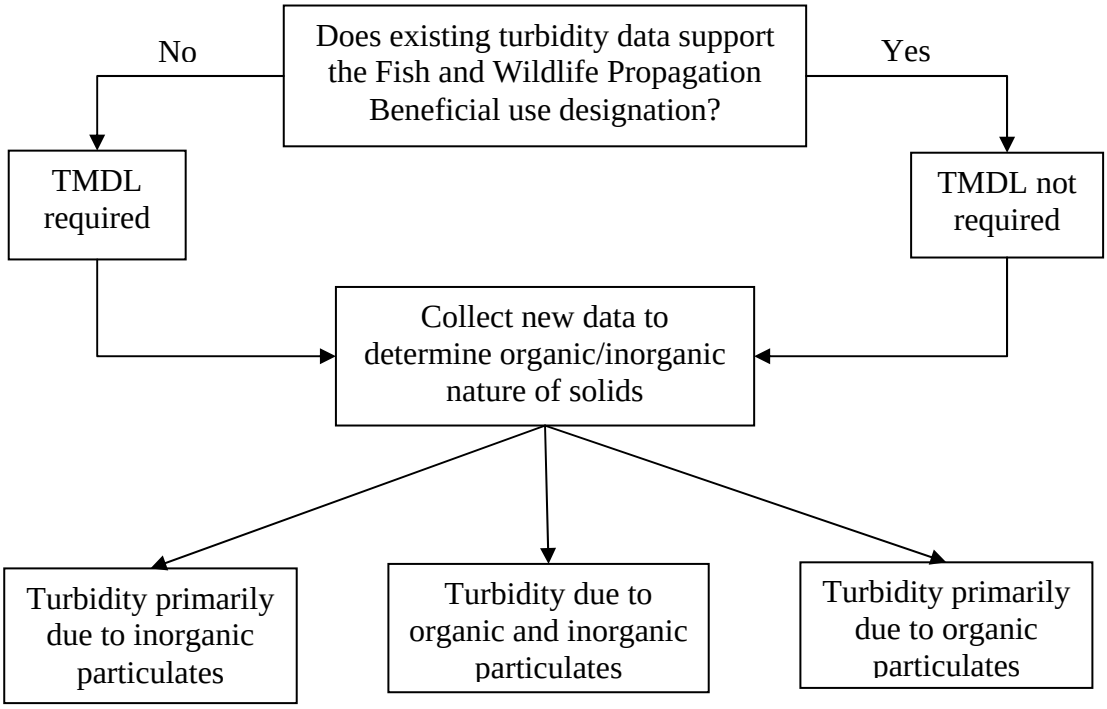
As a Primary Body Contact Recreation water, high Enterococcus and fecal coliform concentrations are considered a potential health hazard. These are indicator organisms that may indicate the presence of pathogenic organisms commonly associated with them.

Cost constraints will limit the microbial source tracking methods available. DNA testing and the construction of a library are beyond the scope of this project and will be out of reach for many communities. Therefore, the analytical methods selected will be tried to see if they can be used collectively to differentiate between human and non-human sources. Due to the complexity of some of the analytical methods, a contract laboratory will be used for some of the analyses. Properly trained field crews will perform the remainder of the analyses onsite.

DQO 2: Identify the Goals of the Study

For the primary goal for turbidity, the data used to make the turbidity 303(d) listing will be reviewed to determine if values influenced by significant rain events were included in the data set used to establish the turbidity impairment. The revised dataset, if any, will then be used to re-assess 303(d) impairment. The second turbidity goal is to determine the nature of the particulates contributing to the turbidity.

Figure 3 Goals of the Study



Samples will be analyzed for chlorophyll-a to help determine the portion of organic material due to photosynthetic forms.

The objective of the FY-04 104(b)(3) Workplan is:

1. Develop a sampling plan for Bird Creek and some of its tributaries.
2. Prepare a Quality Assurance Project Plan (QAPP) that will cover all monitoring and analytical activities including TMDL modeling and analysis.
3. Conduct monitoring of Bird Creek for turbidity, TSS, TVSS and chlorophyll-a to help identify the turbidity sources.
4. Develop a pathogen TMDL for Lower Bird Creek and assign loads for point and nonpoint sources.
5. As part of the Phase I TMDL for turbidity, analyze monitoring data related to particulates to characterize the organic and inorganic nature of turbidity in Bird Creek (the actual turbidity TMDL will be developed by INCOG subsequent to the Phase I effort conducted under this grant).
6. Prepare draft and final TMDL pathogen reports.
7. Prepare draft and final reports of the Phase I TMDL data evaluation for turbidity.

The objective of the FY-05 604(b) Workplan is:

1. Use optical brighteners, bacterial testing and selected organic compounds for microbial source tracking (MST) and attempt to differentiate between human and non-human inputs.
2. Perform bacterial testing in selected tributaries under base flow and runoff conditions to determine bacterial loading from selected areas within the Lower Bird Creek watershed.

DQO 3: Identify Information Inputs

A portion of this study will involve the collection of new data. The chemical and biological parameters will be used to assess conditions at the time of the study. Map data, visual site assessment of stream conditions during monitoring, and land use activities will be qualitative assessments. As such, there are no quantitative goals for these data. The data will be, as often as possible, cross-checked against more than one data source. For example, an assessment of land use activities can include examination of aerial photos, visual inspection during field trips, discussions with property owners and agency personnel familiar with the area, and examination of other land use data and maps.

The methodology for the chemical and biological analyses will follow 40 CFR, part 136 or equivalent requirements whenever possible. Detection limits should be low enough to allow the generation of useful data. Analytical procedures for PPCPs and optical brighteners are relatively new. Available methods will be used, although not all of them are universally accepted at this time. Detection limits for these parameters may be an issue.

Table 4 New and Existing Data To Be Collected During the Project

Chemical	Biological	Land Use Evaluations
Turbidity	Enterococcus	Residential
Total Suspended Solids	Fecal Coliforms	Industrial and Commercial
Total Volatile Suspended Solids		Agricultural Pasture
Chlorophyll a		Forest
Dissolved Oxygen		Crop Land
pH		Quarries / Rock Mining
Temperature		Major Roadways
Conductivity		Stormwater Systems
Caffeine		Landfills
1-4 Dichlorobenzene		NPDES Dischargers
Cholesterol		Airports
Coprostanol		
b-Estradiol		
Phenol		
Triclosan		
Para-Nonylphenol		
Tri (2-chloroethyl) Phosphate		
Optical Brighteners		

Existing data will be used to establish a pathogen TMDL. Existing data, as well as new data, will be used in land use evaluations and characterization of potential pollution sources in the watershed.

Table 5 Existing Data Sources	
Natural Resources Conservation Service	Oklahoma Department of Environmental Quality
Beneficial Use Monitoring Program	City of Tulsa
Oklahoma Conservation Commission	National Weather Service
Oklahoma Water Resources Board	The Oklahoma Climatological Survey
United States Geological Survey	Natural Resources Conservation Service
United States Environmental Protection Agency	United States Corps of Engineers
US Census Data Sources	

DQO 4: Define the Boundaries of the Study

The geographical range of the project area, in general, includes the Lower Bird Creek main channel from the confluence of Delaware Creek in north central Tulsa County to the confluence of Bird Creek and the Verdigris River in southwest Rogers County a total of approximately 24 miles. Figure 2 shows the lower portion of Bird Creek included in this study. Other than absorbent patches used to analyze optical brighteners, the sample matrix will be water. Seven sampling sites on Bird Creek have been identified at bridge crossings to ensure location consistency and minimize access issues. Ten sampling sites on seven tributaries to Bird Creek have also been identified.

At least two sampling events for turbidity, TSS, TVSS and chlorophyll-a will occur in each of the three defined seasons. The sampling seasons will be determined as follows: spring season (4/1/08 to 6/15/08), summer (6/16/08 to 10/15/08) and winter (10/16/08 to 3/31/09). All of these sampling events will occur during baseflow conditions. The exact timing of these sampling events will depend upon stream and weather conditions. No sampling will occur during electrical storms, dangerous flooding conditions or at locations considered to be physically unsafe due to traffic, weather or environmental conditions.

For source tracking work, seven tributaries representing different land use practices and areas within the Bird Creek watershed have been identified. These tributaries will also be sampled at bridge crossings. Two separate sampling events will be conducted on the selected seven tributaries of Bird Creek. One sampling event will occur during a low flow (base) period. The other sampling event will occur during a runoff event. Both of these sampling events will occur during the recreational season, May 1 through September 30, 2008. Samples collected for microbial source tracking purposes will be tested for Enterococcus , fecal coliforms and fluorescent whitening agents (optical brighteners). The organic wastewater compounds and PPCPs will be collected at six of the tributary locations.

Dissolved oxygen, pH, temperature and conductivity will be determined at all sampling sites during each sampling event with a Hydrolab or YSI 556 MPS Multi Probe System. Some tributaries may not have flow during a planned sampling event or may not exhibit runoff following a storm event. In this case, a future attempt will be made to collect samples at that location during the desired conditions.

DQO 5: Develop the Analytical Approach

Table 2 shows the three 303(d) List impairment causes to be studied. These are: turbidity (Code 413), Enterococcus (Code 215), and total fecal coliforms (Code 400). Each of these categories has separate

Decision Rules. While all of these parameters are used to protect OWQS Beneficial Uses, there are different criteria depending upon the beneficial use.

The criteria that constitute the Decision Rule for each parameter are based upon the USAP as currently defined. If, at the end of the study, the USAP criteria have changed, then the latest USAP criteria will be used. Therefore, the Decision Rule values and process as presented in this QAPP may be amended during data analysis. Because the USAP process is formally adopted in the OWQS and the Oklahoma Continuing Planning Process (CPP), and because the use of the USAP decision process is formally adopted in this QAPP, it will not be necessary to revise the QAPP if the USAP procedures are modified before the end of the project.

Title 785, Chapter 45 states: *"(7) Turbidity. (A) Turbidity from other than natural sources shall be restricted to not exceed the following numerical limits: … (iii) Other surface waters: 50 NTUs."* Bird Creek is not (i) a cool water aquatic community/trout fishery or (ii) a lake, so the 50 NTU standard will be applied to determine whether it meets the Fish and Wildlife Propagation criteria. Chapter 45 also states in (7) Turbidity. (C) *"Numerical criteria listed in (A) of this paragraph apply only to seasonal base flow conditions. (D) Elevated turbidity levels may be expected during, and for several days after, a runoff event."* Therefore, the turbidity data used to determine impairment will be reviewed and compared to weather service data and stream flow conditions. If non-base flow data or data influenced by rain events was included in the calculations used to determine impairment, these data points will be excluded and the calculations performed again. The turbidity tests for use support shall follow the default protocol in 785:46-15-4(b).

Existing bacterial data will be used to establish a pathogen TMDL. Criteria for this determination is found in the Oklahoma Water Resources Board 785:46-15-6 and will be followed.

The pathogen testing in the tributaries and source tracking work will only be used as a screening mechanism to help determine the bacterial sources. The supplementary testing will be used to help determine the current conditions.

DQO 6: Specify Performance or Acceptance Criteria

There are no limits on decision error as the USAP criteria specify exact cut-offs for decision making. Therefore, decision-making will depend only upon whether the data are less than or greater than the criterion. For example, in evaluating the turbidity data with respect to the Fish and Wildlife Propagation (FWP) beneficial use for the Warm Water Aquatic Community (WWAC) subcategory, 785:46-15-3 states: *"Data shall be collected and analyzed in a manner consistent with testing procedures provided in 785:45-1-4 or practices that are institutionally recognized and appropriate for the parameter of concern and documented in accordance with 785:46-15-3(g)."* Default protocols for turbidity under 785:46-15-4 state that *"The criteria for turbidity stated in 785:45-5-12(f)(7) shall constitute the screening levels for turbidity. The tests for use support shall follow the default protocol in 785:46-15-4(b)."* This section states: *"A beneficial use shall be deemed to be fully supported for a given parameter whose criterion is based upon a short term average if 10% or less of the samples for that parameter exceed the applicable screening level prescribed in this Subchapter."* It does not matter how close the data are to the criterion, only whether the criterion is exceeded or not.

The microbial source tracking study is using relatively new techniques and recognized standards are not in place at this time. If the results indicate the techniques could provide a quick and cost effective method for source identification, further studies would be required to make a sound decision. The number of samples to be collected for this study during two sampling events will be inadequate to make statistically valid decisions, but may indicate whether this approach holds merit.

DQO 7: Develop the Plan for Obtaining Data

Existing pertinent data collected by other agencies for turbidity and pathogens will be reviewed and used when appropriate. See Table 5 in DQO3 section for more information on potential data sources. Several factors were considered in designing the stream sampling scope. These were: wet weather versus dry weather sampling, recreational versus non-recreational seasons, the spring, summer and winter regulatory seasons, point discharge versus non-point discharge, sampling site accessibility, and selecting tributaries that best represent the Lower Bird Creek watershed.

Once sampling sites and conditions were determined, the sampling method was considered. Two types of samples will be collected. One water sample will be collected by horizontally integrating three grab samples from Bird Creek. Another grab sample will be collected at the deepest point of the channel. If depth allows, samples will be collected at least 0.1 meters below the surface and no greater than one-half of the total depth. Turbidity data will be collected during six sampling events at seven sites (forty two sets of data) from the Bird Creek main channel. The seven locations will allow the comparison of turbidity and TSS data along the course of the creek studied in this project

Bacteria and optical brighteners will be tested at ten locations on seven tributaries during two sampling events. Selected organic wastewater compounds and PPCPs will be tested during two sampling events at six sites on the seven tributaries to be studied. Additional samples may be collected as deemed necessary as the study progresses. The tributaries will be sampled by wading and direct filling containers unless water levels are too high. In that case, samples will be collected with a pole sampler from the bank or the upstream side of the bridge with a pole sampler or a bucket on a rope.

Flows in Lower Bird Creek and its tributaries are primarily from a combination of springs and groundwater seeps, surface runoff, Skiatook Lake discharges, urban storm drainage, and point discharges (ex: wastewater treatment plants, industrial sites, etc.). Samples collected during wet weather, under high flow conditions, are not representative of normal baseflow conditions in Lower Bird Creek. The turbidity/particulate work will be confined to baseflow conditions. Both baseflow and runoff conditions will be sampled for the bacteria source tracking work.

Defining baseflow for Bird Creek is complicated because there are three upstream dams that regulate flows (Birch, Skiatook and Blue Stem reservoirs). Releases from these dams can result in high flows during non-rainfall events or for attenuated flows during high rainfall events. For the National Pollutant Discharge Elimination System (NPDES) storm water program, the EPA has defined measurable storm flow events as when there has been > 0.1 inches of rainfall (40 CRF Part 122.26(d)(2)(iii)(A)(2). The City of Tulsa reports that there is measurable runoff within the city's storm sewer system with the regulatory 0.1 inches or more of rainfall. Since the Lower Bird Creek watershed contains much of north Tulsa's urbanized area, it is reasonable to assume that there will be storm water impacts when there is 0.1 inches of rainfall or more. A 0.25 inch limit (as used for some

other studies) may be appropriate for a less urbanized area with high soil permeability and less runoff, but in an urbanized area, this limit would be too high.

The INCOG goal of defining a practical baseflow will be based upon defining a stream condition in which the flows are not due significantly to rainfall runoff impacts. INCOG will not perform baseflow sampling within 24 hours of a rainfall event of 0.1 inches or greater. However, visual observations must also be made to assess whether there are currently any runoff impacts. Depending upon the severity of the rain event, runoff conditions could persist for days in lower Bird creek, so 24 hours may not be long enough to allow the stream to settle back to baseflow conditions. Signs of runoff flows will include higher than expected water levels, excess leaves and floating plant material, floating trash that might have come from parking lot or street runoff, significant eddy currents, and obvious signs of silt and soil in locations that otherwise would have more clarity.

INCOG will also attempt to define baseflow conditions for Bird Creek. To do this, regulated flow data from the USGS will be obtained for the Owasso and Catoosa gages and then ranked and graphed for each location. If there is a noticeable change in the slope of the flow duration curve, then this corresponding percentile might be useable as a benchmark that represents baseflow. Visual observations and the 0.1 inch sampling criteria would still be used along with the flow duration curve cutoff to ensure confidence in baseflow conditions.

Most reaches of Lower Bird Creek have wooded, steep banks with large stream widths making sampling from either bank difficult without compromising representativeness of the main body of water. However, there are a number of bridge crossings that allow direct access to the main channel in representative areas. Bridge sites are also relatively safe and provide constancy in site location throughout the sampling period. Sampling will occur from the upstream side of the bridge if safety issues and stream conditions allow it. Figure 2 shows the location of all sampling sites.

Other DQO Considerations

Data quality requirements, such as analytical detection and reporting limits for each parameter and acceptable procedures for precision and accuracy, are specified in Section B4 and Section B5 of this QAPP. These sections also discuss quality control samples to be used, both in the field and in the laboratory. Numerical criteria for quality control for all field measurements are discussed in Section B5. A goal of 90% is established for completeness of data acquisition. Laboratory acceptance criteria for precision and accuracy of lab data will be based upon the application of the laboratory's internal Quality Control Charts and other QA procedures utilized by the laboratory.

Data comparability will be ensured by maintaining consistent and well documented sampling procedures, using systematic methods for all field data collection activities, utilizing fixed sampling sites and site-specific sampling procedures, development of formal procedures for the activities of field personnel, and developing consistent reporting requirements of all quantitative data. Consistent reporting refers to the use of standardized field data sheets and other raw data sheets for future reference, as well as the use of similar data tabulation and organization methods for all report writing.

The purpose of this QAPP is to establish acceptable Data Quality Objectives and data handling procedures. The INCOG QA Officer has the day-to-day responsibility of ensuring that all data handling activities for the project are in accordance with the procedures specified in the QAPP.

Section C and Section D of the QAPP describe in more detail how INCOG will evaluate data quality throughout the project.

A8 SPECIAL TRAINING / CERTIFICATION

All participants involved in the study have been selected based upon their specific areas of expertise. All INCOG technical and managerial staff have at least ten years direct experience with field surveys, sample collection, data reduction and analysis, resource development, environmental assessment, and familiarity with regulatory programs.

All field personnel will have adequate working knowledge of all field equipment and sampling techniques. INCOG has developed Standard Operating Procedures (SOPs) for all field instrumentation and sample and data collection activities. The INCOG Quality Assurance Officer (QAO) will ensure that all field personnel are familiar with the use of all instruments and the methods for conducting all field activities by providing copies of the relevant SOP and reviewing SOP procedures with field personnel. Training records, certificates of accomplishment and documentation of attendance at related conferences are all kept in each INCOG staff person's office files in paper form. Any problems encountered during the data collection process will be reported immediately to the sampling team leader and the INCOG QAO. Contract laboratories will be accredited by the State of Oklahoma for all parameters requiring laboratory certification.

A9 DOCUMENTATION AND RECORDS

A Project Report will be prepared as a grant output requirement. The types of data contained in the draft and final Project Reports are shown below.

Table 6 Data in Draft and Project Reports

Data Type	Typical Report Format
Visual inspection of typical stream sections	Text description, tables, maps, photographs
Visual inspection of point and nonpoint sources	Text description, tables, maps, photographs
Chemical data	Text description, tables, maps
Land use data	Text description, tables, maps, photographs
Historic data	Text description, tables, maps, photographs, appendices
Quality assurance data	Text description, tables

All raw data from printouts, lab reports, field data sheets, maps, agency reports and documents, aerial photos and other such data will be kept at INCOG with the project files in the INCOG main offices for a period of at least five years. INCOG maintains a separate storage room for all field equipment, calibrations standards and records, Material Safety Data Sheets (MSDS), and chemicals and supplies used for all fieldwork. INCOG SOPs and all QA files are kept in the INCOG QA Officer's office for easy reference. The draft and final Project Reports and supporting maps and data will be distributed in

hard copy, as CD-ROM disks and electronically as computer files attached to email messages as requested by the recipients.

INCOG will use a contract or fee for services agreement for all laboratory services. The laboratory will have an existing Quality Assurance / Quality Control program that meets the requirements of State Rule 252:300 Subchapter 17: Quality Assurance / Quality Control for accredited laboratories.

The laboratory will be State accredited and submit to INCOG the necessary project-related laboratory quality control data generated during the analytical process. INCOG will request that the lab notify INOCG about or submit a written description of any laboratory difficulties, if encountered, and the methods used to rectify the problems.

All project records will be maintained in the main INCOG office files for a period of at least five years from the date of project completion. After this time, all project files may be stored in INCOG long – term record storage for future reference. At present, storage time is indefinite; however, files will not be destroyed in less than five years. The INCOG QA Officer will ensure that the QAPP is updated, as needed, and that the latest copies are distributed to the OSE for distribution and to INCOG staff and management.

B. DATA GENERATION AND ACQUISITION

B1 SAMPLING PROCESS DESIGN

Secondary turbidity data will be reviewed to confirm the required turbidity TMDL study. The turbidity data generated in this study may be used in a future TMDL study if a TMDL is necessary. The bacterial data, fluorometer work and testing for the selected organic wastewater compounds and PPCPs will be used to help determine tributary bacterial sources and access the practicality of using these methods in source tracking work. The additional chemical analyses will be used to support the turbidity and source tracking work and help determine general stream conditions. INCOG has formal Standard Operating Procedures (SOPs) applicable to field collection and field instrument techniques. A description of data collection activities is presented in B2, Sampling Methods.

The recommendation for listing or delisting turbidity in the Final Project Report may be used by the ODEQ, OSE and other agencies to modify the Oklahoma 303(d) List during subsequent revisions. The microbial source tracking work may be used by governmental agencies and in municipal stormwater management programs. INCOG will use the City of Tulsa and Oklahoma DEQ Laboratories for all laboratory analyses not performed in the field. The City of Tulsa and ODEQ Laboratories will supply all sample containers and INCOG will obtain reagent grade deionized (D.I.) water from the City of Tulsa labs prior to each sampling event for preparation of equipment blanks and onsite cleaning activities.

The sampling sites on Bird Creek are as follows:

1. 66th Street North at Harvard
2. 56th Street North at Memorial
3. 66th Street North at Mingo Road
4. Hwy 169
5. 56th Street North at 129th East Avenue
6. 46th Street North at 145th East Avenue
7. Hwy 167 (193rd East Avenue)

Each sampling site on Bird Creek will be sampled a minimum of six times. At least two sampling events will occur during the spring season (4-1-08 to 6-15-08), the summer season (6-16-08 to 10-15-08) and the winter season (10-16-08 to 3-31-09). All of these sampling events will occur during baseflow conditions. Samples collected for TSS, TVSS, turbidity and Chlorophyll-a will be delivered to the City of Tulsa Labs for analysis. Analysis will be performed onsite for turbidity, dissolved oxygen, pH, temperature and conductivity.

The sampling sites for the Bird Creek tributaries are as follows:

1. Lower end of Mill Creek at 11th and Mingo Creek
2. Mingo Creek at 34th Street and Mingo (in Hick Park)
3. Mingo Creek at Pine Street
4. Mingo Creek at 46th Street North
5. Coal Creek at Hwy 11
6. Flat Rock Creek at Cincinnati Avenue
7. Flat Rock Creek at Hwy 75
8. Delaware Creek at Peoria Avenue
9. Ranch Creek at 76th Street North
10. Elm Creek at 66th Street North

Each sampling site on these tributaries will be sampled a minimum of two times. At least one sampling event will occur during low flow (base flow) conditions and one will occur during a runoff event. Both sampling events will occur during the recreational season (5-1-08 to 9-30-08). Some tributaries may not have flow during a planned sampling event or may not exhibit runoff following a rain event. In this case, a future attempt will be made to collect samples at that location during the desired conditions. Samples collected for Enterococcus and fecal coliforms will be delivered to the City of Tulsa Labs for analysis. The selected organic wastewater and PPCP parameter samples will be delivered to the ODEQ Laboratory in Oklahoma City. Analysis will be performed onsite for optical brighteners (in water), dissolved oxygen, pH, temperature and conductivity. Absorbent cotton pads will be brought back to the City of Tulsa Labs and examined under a black light (415-422 nm) to determine the presence of fluorescing agents.

The most current USAP guidance, as presented in the OWQS, will be used to analyze data and make any listing-delisting decisions. As part of data interpretation, current land uses will be evaluated (e.g. presence of major storm drain outlets, industrial and commercial activities, agricultural activities, point source discharges, and other potential sources of pollutants).

Rainfall data will be obtained from the National Weather Service monitoring site at the Tulsa International Airport , located in the lower Bird Creek watershed. Oklahoma Mesonet weather data and The Oklahoma Climatological Survey will also be accessed via the internet (http://okmesonet.ocs.ou.edu/) to evaluate rainfall conditions that will indicate acceptable sampling conditions within this watershed. OWRB maintains a Beneficial Use Monitoring Program (BUMP) site, AT178050, on lower Bird Creek west of the Port of Catoosa on State Highway 266 and the USGS maintains gauge stations in this segment of Bird Creek, so flow data will be available.

Site locations were made based upon safety considerations, accessibility, land use and the representativeness of the locations. The USAP specifies that a sampling site on a non-wadeable stream can represent no more than 25 miles. This section of Bird Creek is approximately 24 miles with seven sampling sites.

B2 SAMPLING METHODS

Water column sampling and field measurement techniques, including decontamination methods, are discussed below. Sampling will be restricted to runs and pools because a significant portion of Lower Bird Creek is run and pool dominated. A Chain-of-Custody form (see Figure 5) will be submitted to the laboratory along with each sample set. All sampling will be performed during daylight hours and under the appropriate conditions.

Tables 7 and 8 list the parameters to be submitted to the laboratory for analysis and show the required preservation, container type, holding time, volumes and container cleanliness.

Table 7 Chemical Sampling Requirements

	TSS	TVSS	Turbidity	Chlorophyll-a
Preservation Requirement	< 6° C	< 6° C	< 6° C	< 10° C
Sample Container Type/Size	Plastic 500 mL	Sample taken from TSS container	Plastic 500 mL	Amber Glass 1 Liter
Maximum Holding Time	7 Days	7 Days	48 Hours	Filter immediately
New, Precleaned Container Y/N	Yes	Yes	Yes	Yes

Table 8 Bacterial Sampling Requirements		
	Enterococcus	Total Fecal Coliforms
Preservation Requirement	< 10° C	< 10° C
Sample Container Type/Size	Sterile Plastic 100 mL	Sterile Plastic 100 mL
Maximum Holding Time	6 Hours	6 Hours
New, Precleaned Container Y/N	Yes	Yes

Absorbent pads for optical brightener testing will be placed in a 2” x 6” pipelet holder and secured at the site for the required contact time. Initial studies will be used to determine optimal contact times. Exposed absorbent pads will be transported to the City of Tulsa Labs and viewed under a black light (415-422nm) for the presence of fluorescence. An unexposed absorbent pad will be used as a blank. Water column samples will be tested onsite for the presence of optical brighteners with a handheld fluorometer.

Turbidity samples will be collected and analysis will be performed during six sampling events at the seven Bird Creek sampling sites from the Bird Creek main channel. INCOG uses a HACH model 2100P Portable Turbidimeter for field analysis and a split sample will be sent to the City of Tulsa Labs for analysis as well. Bacteria and optical brighteners will be tested at ten locations on seven tributaries during two sampling events. The organic wastewater compounds and PPCPs will be collected at six of the tributary locations during two sampling events. Additional samples may be collected as deemed necessary as the study progresses.

Dissolved oxygen, pH, temperature and conductivity measurements will be taken at all sampling locations each time a sample is collected. INCOG uses Hydrolab equipment or a YSI 556 MPS Multi Probe System for these parameters.

Sampling requirements, container type, preservation technique, holding times and required volumes for the organic wastewater compounds and PPCPs will be determined by the ODEQ Laboratory personnel. They are still developing this methodology and INCOG personnel will collect these samples according to their instructions.

Most reaches of Lower Bird Creek have wooded, steep banks with large stream widths making sampling from either bank difficult without compromising representativeness of the main body of water. However, there are a number of bridge crossings that allow direct access to the main channel. Bridge sites are also relatively safe and provide a consistent site location throughout the sampling period. Sampling will occur from the upstream side of the bridge if safety issues and stream conditions allow it. Figure 2 shows the location of all sampling sites.

Two man crews wearing talc-free latex gloves will collect all water samples. The field crew will use a Van Dorn sampler and composite three grab samples from each sampling site on Bird Creek. One

grab sample will come from the center of the channel. The other two grab samples will be collected one quarter of the channel width from each bank. These three grab samples will be emptied into a Churn Sample Splitter to ensure adequate mixing before filling sample containers and taking field measurements. Containers for TSS, TVSS, turbidity and chlorophyll-a will be quickly, but carefully, filled from the Churn Sample Splitter. Container labels will be filled out before going to the field so only the time and date will need to be recorded onsite. A sample will then be collected for the field turbidity reading. Next, a grab sample will be collected by lowering a bucket from the upstream side of the bridge into the deepest portion of the channel to collect a sample for the Hydrolab or YSI 556 MPS Multi Probe. The probe will be placed in the bucket and swirled gently to obtain the dissolved oxygen, conductivity, pH and temperature readings. The bucket will be rinsed with water from the site being sampled before the sample is collected for analysis.

Samples for the optical brightener test and the selected organic wastewater and PPCP parameters from the tributaries will be collected by wading and direct filling of the containers. While standing in the stream approximately 1/4 stream width distance from the bank and facing upstream, the container will be placed under the water surface allowing it to partially fill about 1/3 full with minimum turbulence. After this partial filling, the sampler will move to the center of the channel and repeat another 1/3 filling by direct bottle immersion. Finally, the sampler will move to 3/4 stream width and fill the last 1/3 of the container.

If flows are too low and the tributary is too shallow to collect the required volume in the manner stated above, multiple grab samples will be collected and composited. This composite sample will then be used to fill the required containers. If compositing of grab samples is required, care will be taken to ensure that one grab sampling event does not stir up sediment that could skew the composition of another grab sample. Successive grab samples will be collected by moving upstream or laterally across the current each time. If flows are too high for wading or the bottom is too muddy, a container will be lowered from the upstream side of the bridge to collect samples.

Bacterial samples will be collected by wading into the tributary and filling a sterile container near the center of the channel. If flows are too swift, the bottom is too muddy or the water is too deep for wading, bacterial samples will be collected directly into sterile containers with a pole sampler either from the bank or the upstream side of the bridge. This procedure will avoid the collection of near shore samples. Samples for fecal coliforms and Enterococcus will be collected directly into sterile containers supplied by the laboratory. Sodium thiosulfate preservation will not be required.

The INCOG field crews will carry laboratory reagent water (supplied by the contract labs) into the field. This reagent grade water will be used to prepare equipment blanks onsite which will be submitted to the lab for analysis. The reagent grade water will also be used to rinse glassware and field instruments between sampling events as necessary.

All containers supplied by the lab will either be purchased pre-cleaned and certified to EPA standards or cleaned by the lab according to their SOP and meeting EPA's requirements. Any required chemical preservation will be added to the sample containers at the lab if possible. All sample containers used at each site will be transported to the field in a closed plastic bag with container caps in place. Once the sample has been collected the sample container will be placed back in the plastic bag, sealed and placed in a cooler on ice. All samples will be stored and then transported to the lab in a cooler on ice.

Field duplicates will be collected with the same equipment, in the same manner, and at the same location as the original sample. The elapsed time between the two sampling events will be minimized to avoid heterogeneity from temporal and spatial effects.

Turbidity will be measured using a HACH portable nephelometric turbidity instrument calibrated with an EPA approved standard such as formazin or HACH's StablCal standards. All field instruments will be calibrated prior to field use per manufacturer's instructions.

All sample site locations will be located on the most current digital aerial photographs using ArcView GIS software. Locating sampling sites on aerials in GIS is sufficient to provide accuracy of a few meters. Latitude / longitude coordinates for each of these sites will be obtained using ArcView software and checked with a handheld GPS. INCOG will enter field and chemical data into Excel spreadsheet format and join these data to map features in GIS format using ArcView software.

B3 SAMPLE HANDLING AND CUSTODY

Immediately upon collection, all water samples will be preserved as discussed in Section B2. Arrangements for lab analysis and sample delivery to the lab will be made in advance to ensure prompt attention by lab staff. All samples will be transported on ice in a cooler.

Field forms will be used to record sample collection information and field measurement data (Figure 4). The Field Form will be retained by INCOG and made a part of the project data files. An INCOG Project Number may be assigned to this project and used on all project forms and bottle labels to easily identify the project.

A Chain-of-Custody form (Figure 5) will be used by INCOG to track all laboratory samples from the time of sample collection to final delivery to the laboratory. Each person that takes possession of the samples will enter the date and time they accept and relinquish custody and sign the form. All sample custody records will be kept in the INCOG Project Quality Assurance files. INCOG will also fill out the ODEQ Lab's sample tracking form for each bottle at the time of sample delivery.

All sample collection containers will have an attached water-resistant label containing the following information that will be referenced on the field forms:

A. "INCOG" and project code number
B. Sampled date and time
C. INCOG sample site number
D. Preservative
E. Names/initials of field crew members

The contract lab will maintain records of all samples received. The contract laboratory sample log contains such information as:

A. INCOG sample number and project
B. Laboratory sample number
C. Date and time of receipt
D. Name of person delivering samples
E. Name of lab person logging in samples
F. Analyses to be performed
G. Preservatives used
H. Sample volumes

Figure 4 INCOG Field Data Form

PROJECT: _____ DATE: _____

Sample Location/Site Number	Sample Time	Turbidity	D.O.	Temp.	pH	Cond.	Optical Brighteners	Comments

ENVIRONMENTAL CONDITIONS DURING SAMPLING

Time	Cloud Cover	Air Temp (F)	Wind Speed/Dir.	Comments

Figure 5 INCOG Chain-of-Custody Form

Collector(s):	Date Sampled:	
Address: INCOG 201 W. 5th Street, Tulsa, OK 74103	Phone: 918-579-9451	Fax: 918-579-9551
Project:	Project Number:	

Lab Sample Number	INCOG Sample Number	Analysis Requested	P=Plastic G=Glass Volume	Pres.	Time of Sampling

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:

B4 ANALYTICAL METHODS

The Tulsa Labs will use the analytical methods specified in Tables 9, 11 and 12. Analytical methods for the GC/MS parameters in Table 10 are still being developed and refined by the ODEQ Laboratory personnel. The Laboratory analytical detection limits (DL) and practical quantification limits (PQL) are the result of extensive research and will be as low as their instrumentation and preparation methods will allow. In most cases they are lower than the most stringent water quality standards. Title 785, Chapter 46 of the OWQS also describes how to evaluate laboratory results that are greater than or less than the PQL with respect to the WQS criterion. INCOG will use the most recent Chapter 46 guidance to evaluate data.

Table 9 Chemical Analytical Methods				
	TSS	TVSS	Turbidity	Chlorophyll-a
Analytical Method	SM 2540D	EPA 160	SM 2130B	SM 10200H

Table 10 GC/MS Parameters	
Caffeine	Phenol
1-4 Dichlorobenzene	Triclosan
Cholesterol	Para-Nonylphenol
Coprostanol	Tri (2-chloroethyl) Phosphate
b-Estradiol	

Table 11 Bacterial Analytical Methods		
	Enterococcus	Fecal Coliforms
Analytical Method	Enterolet ASTM D6503-99	SM 9222D

Table 12 Field Measurement Analytical Methods					
	Turbidity	DO	Conductivity	pH	Temperature
Analytical Method	2130B	4500G	2510B	4500H-B	-----

An AquaFluor handheld fluorometer (Serial No. 800322), made by Turner Designs will be used to measure optical brighteners in water samples. The manufacturer's User's Manual describes calibration and sample analysis methods and these methods will be followed.

All field measurements will follow the instrument manufacturer's methodology and acceptable practices normally utilized in field analysis.

The contract laboratories will supply the appropriate containers with the required chemical preservatives necessary to preserve the samples until they can be delivered to the laboratory for analysis. All laboratory supplied containers and preservatives will be free of interfering agents.

Quality assurance requirements for field measurements and laboratory analysis, including how to address data quality problems are described in Section B5.

B5 QUALITY CONTROL

Laboratory QA Program: The laboratory will use an EPA based Quality Control Program for all analytical services. The laboratory QA Officer will provide QA supervision for this program. Laboratory Standard Operating Procedures (SOPs) for this program will be referenced by the laboratory QA Officer and used by laboratory staff. Quality Control statistics to be used by the laboratory are those presented in EPA (1979) "Handbook for Analytical Quality Control in Water and Wastewater Laboratories" or other methods specified in the Lab's QA program that have been reviewed and approved under the State's laboratory certification program as required in Oklahoma State Statute Title 252: Chapter 300 Laboratory Certification.

As part of the laboratory QA Program, records of all analytical precision and accuracy tests will be maintained for each parameter for which the lab is certified. Acceptability of laboratory performance will be based upon the analytical results falling within acceptable limits established in the laboratory QA Program.

The laboratory will ensure that all QC sample results fall within acceptable performance limits. In the event that a QC sample falls outside the performance range of acceptability, the laboratory will determine the nature of the problem and take appropriate corrective actions. When the nature of the problem cannot be easily corrected, the INCOG QA Officer should be notified. At that time, the laboratory and INCOG QA Officer will reach an agreement on whether or not to resample, discard samples, or accept some or all of the data from the analytical sequence in question.

INCOG will deliver an equipment blank and field duplicate to the laboratory for each sampling event (six sampling events) on Bird Creek. Ten sampling sites on seven tributaries have been identified and each site will be sampled two times. One sampling event at each site will be after a significant rain event, so weather and water conditions will determine which sites can be sampled and when. This may require more than one trip into the field. Six of the tributaries will be selected for the GC/MS source tracking work. Six samples, one trip blank and one field duplicate will be will be delivered to the laboratory for analysis during the dry weather sampling and six samples, one trip blank and one field duplicate will be delivered to the laboratory for analysis during the wet weather sampling for a total of 16 samples to be delivered to the laboratory.

Equipment blanks will be prepared by filling a regular sampling container with D.I. water (supplied by a contract laboratory) that has been rinsed through and/or over field sampling equipment. The equipment blanks will be transported along with the other samples to the contract laboratory. In addition to these field QA samples prepared by INCOG crews, the laboratory will prepare and analyze the necessary internal QA samples as specified in Title 252: 300-17-4 General Water Quality Accredited Laboratories.

Laboratory Blanks: The laboratory will process laboratory blanks through the laboratory sample handling, preparation and analytical processes. These blanks will consist of laboratory pure distilled

and/or deionized water. Results of these tests will verify acceptable decontamination of all analytical procedures.

Performance Test (PT) and Calibration Samples: The laboratory will process samples of known concentration for the project analytes or use surrogates as a means of verifying acceptable instrument calibration and accuracy of the analytical procedures. Results of these performance standards will be submitted to INCOG in the laboratory's data report.

Laboratory Spikes: When appropriate, the laboratory will process spiked matrix samples for analytical runs as specified in Title 252: 300-17-4.

Field Measurements: Duplicate field measurements will be performed for turbidity, optical brighteners and the multi-probe parameters of pH, temperature, dissolved oxygen and conductivity and will be made at least once during each sampling event. Field duplicate measurements will be made by collecting an additional sample from the stream immediately following and in an identical manner to the original sampling and measurement process. The accuracy of the field analytical equipment (multi-probe instrument, fluorometer and turbidimeter) will be based upon proper calibration practices. Duplicate precision will be acceptable if the relative percent difference is less than 20% for low level and 10% for high level field measured parameters. When differences in duplicates are greater, a third replicate sample will be collected and field measurements will be repeated. At each site, INCOG field crews will record observations of visible stream conditions (e.g. presence of oil sheens or other potential contaminants).

Table 13 Quality Control for Chemical Analyses

	TSS	TVSS	Turbidity	Chlorophyll-a
Practical Quantification Limit	4 mg/L	-----	0.5 NTU	0.05 mg/L
Detection Limit	4 mg/L	4 mg/L	0.16 NTU	0.02 mg/L
Method Precision (RPD)	10% RSD	-----	10%	-----
Method Accuracy (% Rec.)	90-110%	-----	90-110%	-----

Table 14 Quality Control for Bacterial Analyses

	Enterococcus	Fecal Coliforms
Practical Quantification Limit	1 cfu/100 ml	1 cfu/100 ml
Detection Limit	1 cfu/100 ml	1 cfu/100 ml

Table 15 Quality Control for Turbidity & Hydrolab Field Measurements					
	Turbidity	DO	Conductivity	pH	Temperature
Detection Limit	0.01 NTU	0.1 mg/L	1.0 uS/cm	0.05 s.u.	0.01° C
Method Precision (RPD)	20% (low) 10% (high)	20% (low) 10% (high)	20% (low) 10% (high)	20% (low) 10% (high)	20% (low) 10% (high)

Table 16 Quality Control for Turbidity & YSI 556 Field Measurements					
	Turbidity	DO	Conductivity	pH	Temperature
Detection Limit	0.01 NTU	0.01 mg/L	1.0 uS/cm	0.01 s.u.	0.01° C
Method Precision (RPD)	20% (low) 10% (high)	20% (low) 10% (high)	20% (low) 10% (high)	20% (low) 10% (high)	20% (low) 10% (high)

(low) is for low level field duplicates
(high) is for high level field duplicates

B6 INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

INCOG presently owns the following field measurement and sampling equipment that may be used for this project: Hydrolab Scout 2, YSI 556 MPS Multi Probe, HACH 2100P field nephelometric turbidimeter and an AquaFluor handheld fluorometer.

All sample collection containers will be provided by the contract laboratories prior to the sampling events. INCOG maintains sufficient quantities of fresh calibration standards and spare parts for the instruments that will be used for field activities. During extended periods of non-use, INCOG performs periodic inspections of the equipment listed above.

Prior to each sampling event, the equipment to be used is inspected to ensure proper functioning. Batteries are cheeked and recharged or replaced as needed. The multi probe unit to be used is calibrated and the calibration recorded in the INCOG Calibration and Maintenance Log. Any maintenance performed on the field instruments is also recorded, such as replacement of the pH reference solution or DO probe membrane. The instrument is calibrated and operated according to the manufacturer's Operations Manual which is referenced in the INCOG SOP.

If an instrument fails to meet calibration or perform properly, an initial examination is made to determine the cause. If possible, repairs are made and the instrument is calibrated and examined for operational status. All repair activities are recorded in the INCOG Calibration and Maintenance Log. If an instrument fails to respond after initial attempts at repair, then arrangements for repairs are made with and performed by the manufacturer. The repair history is also recorded in the INCOG Calibration and Maintenance Log.

INCOG maintains sufficient supplies and spare parts for all field instruments. Quantities and expiration dates of calibration standards are checked frequently, and supplies are replaced as needed. These include:

pH calibration standards
Conductivity calibration standards
Turbidity calibration standards
Spare batteries
D.O. probe solution
pH reference solution
pH junctions
D.O. probe membranes

B7 INSTRUMENT/EQUIPMENT CALIBRATION AND FREQUENCY

The field instruments listed in Section B6 are the only instruments requiring maintenance that INCOG will be using for this project. INCOG performs calibration of pH, D.O. and conductivity prior to the use of the multi-probe instrument per the manufacturer's instructions. The standards for pH and conductivity are purchased through reputable chemical supply sources, such as HACH, Corning, or Fisher, and records are kept of the purchase transaction. In addition, immediately upon receipt, each bottle is marked with the date of receipt. These standards are purchased as being traceable to EPA or the National Institute of Science and Technology (NIST) primary standards. Calibration information for the multi-probe instrument is recorded in the INCOG Calibration and maintenance Log.

B8 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

The inspection and inventory of in-house supplies is discussed in Section B6. Each project may require some unique supplies, mostly as consumables, such as chemical preservatives and sampling bottles. For such projects, INCOG either requires that the contract laboratory supply all such materials, or INCOG purchases these items with appropriate certifications of decontamination (Certificate of Analysis or COA). The verification of decontamination of such supplies is determined by the processing of laboratory and equipment blanks during the project. Analyte free deionized reagent water is supplied by a certified laboratory on a project specific basis in containers also supplied and/or cleaned by the laboratory. The INCOG QA Officer oversees the acquisition and documentation of these supplies.

B9 NON-DIRECT MEASUREMENTS

Some non-direct measurement data will be used in this study. Turbidity data currently available for Lower Bird Creek will be reviewed and the impairment decision will be evaluated. Several key sources of non-measurement data may be used in this project. These are:

1. Aerial photographs of the watershed.

2. USGS 7.5 minute quadrangle maps of the watershed and project area.
3. INCOG planning maps.
4. Arc-Info (GIS) generated maps and data summaries using database resources (See DQO 3, Table 5).
5. Records of visual observations and interviews with landowners and industry officials.
6. Reports from other agencies on characteristics within the project area or more general information concerning water quality.

The above information sources will be used throughout the project, and the data will be employed along with measured data to develop the project conclusions. All non-measured data will be considered acceptable if it meets the following criteria:

1. It represents the best available data.
2. It is readable in a format that is compatible with existing data analysis systems, or can be easily converted to such a format.
3. It has been derived through application of scientific data acquisition procedures.
4. It has been derived by the efforts of reputable professional sources (e.g. professional private and public agency staff).
5. It is not discredited by analysis using alternative data or information.

Non-measurement data not meeting the above criteria may still be used if the data are determined to have value, such as land use data based upon landowner interviews. Such data will be evaluated on a case by case basis, and the limitations of the data clearly stated in the project report. There may also be data uncertainties of a more technical nature, such as uncertain interpretation of an aerial photograph. This may occur due to the photograph's poor resolution of small details or poor quality. The uncertainties of such information will also be addressed in the project report.

B10 DATA MANAGEMENT

There will be many different types of data collected in this study (see Section B4). The overall project management structure and lines of communication between all participants is presented in Figure 1. INCOG will be responsible for all data collection activities during the project. INCOG will also be responsible for the quality of all data collected under its control. To this end, each project activity should be able to meet the data quality objectives and other requirements described in this QAPP. INCOG has a designated Quality Assurance Officer to ensure that this QAPP is implemented.

The data generated from the sampling events will be summarized in a Draft Project Report and submitted to the OSE for distribution to state and federal agencies for technical review and comments. The peer-reviewed draft report will then be amended to address comments and submitted to the OSE for distribution as a Final Project Report.

INCOG will maintain document files containing copies of all draft and final reports, along with all QA data reports and other relevant project data supporting the reports. The INCOG data files will be kept in the local office for at least a five year period before being moved to long term storage.

INCOG uses Microsoft Windows based personal computers and laptop computers. All computers use a Microsoft Windows operating system and Microsoft Office Suite software for word processing (MS Word), database (MS Access), and spreadsheet (MS Excel). Chemical and field numerical and descriptive data may be input into GIS data layers as geo-spatially referenced links to watershed sites. ArcView 9.2 software may be used to develop and maintain the GIS data.

INCOG will create files of all GIS data for distribution by making copies of GIS data, project files and reports on CD-ROM disks when requested. Distribution of the project data on CD-ROMs or other data formats will be made to local, state and federal agencies and the general public upon request. Data transfers and paperwork errors will be corrected by using primary and secondary party checking for data entry errors, and review of technical interpretations and statistical analysis of project data.

INCOG uses hardware and software purchased from primary vendors and software that is widely accepted in the marketplace (e.g. Microsoft). All INCOG computers have virus-checking software installed and are frequently updated. All computers and data storage at INCOG are linked via a Local Area Network (LAN) system to facilitate data transfer and utilization. Central data storage at INCOG is periodically backed up for security and individual users also perform partial backup of important data as needed.

C. ASSESSMENT AND OVERSIGHT

C1 ASSESSMENTS AND RESPONSE ACTIONS

Section C1 discusses the types of assessment activities anticipated for this project. Table 17 summarizes the data management assessment activities to be used during the project. During the data collection activities, INCOG will conduct field verification, when possible, of the spatial data obtained from other agency records and from examination of aerial photographs and land use maps. These assessments will verify or allow for the correction of land use data and site conditions.

Peer review assessment is part of the 104(b)(3) grant process, in which all reports, as grant Workplan outputs, will be submitted as draft documents to OSE for distribution to ODEQ and EPA region 6 for formal review and comment. All written and oral comments will be addressed by INCOG during development of the Final Project Report. The OSE is the designated 104(b)(3) project-coordinating agency for Oklahoma. The EPA region 6 is the designated federal authority for distribution and management of Clean Water Act 104(b)(3) grant funded projects.

INCOG annually evaluates the technical needs of all departments and upgrades supplies and computer systems whenever possible. INCOG performs periodic maintenance and inspects all field equipment and maintains written logs of such inspections. These activities are addressed in the INCOG SOPs.

Before sampling will take place, INOCG will perform at least one site reconnaissance survey within the study area. The purpose of this reconnaissance survey will be to confirm representativeness of the

sampling sites, to evaluate sampling methods and efficiency and identify potential problems that may be encountered during the actual events.

INCOG performs periodic QA assessments of equipment and supplies. The purpose is to ensure operability and proper storage of all field equipment and to maintain adequate supplies for calibration and repair.

Data transferred by INCOG from one medium to another (e.g. written report data entered into a computer database) are immediately doubled-checked by the person performing the data transfer. All problems with data management are reported to the INCOG QA Officer.

Table 17 Data Management and Assessment Activities

Assessment Activity	Number	Frequency	Type
Site Reconnaissance	1	----	Visual verification of data from maps, aerials, land use reports
Peer Review	2	----	State and federal (EPA) reviews of Draft Project Report and Final Project Report
Management Systems Review	2	Annual	Annual evaluation of management needs and status, inventory of computer hardware and software upgrades
Readiness Review	----	Prior to each field event	Assess resources to be used during scheduled fieldwork
Technical Systems Audit	----	Bi-monthly	Bi-monthly inspection and maintenance of field equipment and supplies
Data Quality Assessment	----	As needed	Evaluate quality and adequacy of data processing systems and procedures

C2 REPORTS TO MANAGEMENT

Because the Water Quality Division of INCOG is small, project status reports to department management are frequent and usually verbal.

Department staff meetings are held periodically to discuss the status of all projects. Written Semi-Annual Progress Reports from the Division Director are submitted to OSE which report on the status of each grant project. Weekly INCOG executive staff meetings are held to discuss the status of all projects within each INCOG department.

The INCOG QA Officer makes periodic oral and written reports to INCOG management, including corrective actions decisions. All written records are kept with the project QA files. The INCOG QA Officer is responsible for ensuring that all equipment and supplies are ordered in a timely fashion, and that all equipment and supplies meet the specifications of each project. The INCOG QA Officer keeps a written record of all purchases relating to grant supported projects.

When problems arise concerning equipment, supplies, calibration, repairs, computer needs, data gathering and analysis, and other aspects of data quality, the INCOG QA Officer discusses the problem with the Division Manager. When the issue requires lengthy discussion or documentation, the INCOG QA Officer submits the issue in writing to the Manager via interoffice memo and/or electronic mail. The INCOG QA Officer also makes frequent memos to the file concerning project phone calls and the resolution of data quality issues.

Most data quality problems, such as loss of a computer data file, can be resolved quickly through verbal directions. Resolution of problems of this nature will be noted either on the appropriate data sheet as an attached note or with and attached interoffice memo. More difficult problems, such as equipment malfunctions that require manufacturer repairs, will have a more lengthy documentation.

In such cases, an interoffice memo from the INCOG QA Officer to the Project Manager will be generated along with a recommendation for appropriate corrective action. Resolution of such problems will be documented by the INCOG QA Officer and kept in the project QA files.

Semi-annual Progress Reports to OSE are made soon after the 15th of April and October of each year.

Project Final Report: A Draft Project Report will be prepared. It will be submitted upon completion of all sampling and data analysis to OSE for distribution to reviewing agencies. The Draft Project Report will present all field and laboratory data and will summarize the analysis and interpretation of these data. Graphs and maps will be used, where appropriate, to compliment data tables and text. Statistics to be used will include arithmetic mean, standard deviation, percent recovery, percent error and percent difference.

Chemical, bacterial and field measurement data may be entered into GIS data layers and geo-spatially referenced to data collection sites. The Final Project Report will include an evaluation of the data for TSS, TVSS, turbidity, chlorophyll-a, Enterococcus, fecal coliforms, microbial source tracking compounds, and optical brighteners. It will also include the pathogen TMDL for lower Bird Creek and a review of the existing data to determine whether a TMDL for turbidity is required or whether a recommendation to de-list turbidity is justified. The Final Report will also summarize all quality assurance data obtained during the study. The Draft Project Report will be submitted to OSE for distribution to reviewing agencies. INCOG will respond to all reviewers' comments and issue a Final Project Report.

D. DATA VALIDATION AND USABILITY

D1 DATA REVIEW, VERIFICATION, AND VALIDATION

Land use data for this project will be based upon interpretation of maps, aerial photographs, and existing GIS-based land use data from state and federal agencies. Any data from previous years will be evaluated with respect to the most recent data to determine its acceptability. If it is found that a given land use reported in an earlier data base has not been used within the past five years, then the

most current land use will replace it. If the difference is under three years, then both land use types will be considered.

Direct measurements of turbidity, pH, conductivity, dissolved oxygen and temperature will be made during the project. Field instrumentation will be calibrated prior to each sampling event. During sampling, the field crews will evaluate the instrument readings with respect to existing stream conditions. If an instrument parameter indicated an error in function, then the instrument will be recalibrated in the field. An acceptable calibration goal will have been met if, during calibration, the initial reading of the instrument is ± 10% from the calibration standard. All field calibrations and instrument operation notes will be recorded on the Field Data Form.

All field measurement data will be evaluated for precision by the criteria specified in Tables 13, 15 and 16. Accuracy of field measurements will be based upon compliance with sampling protocols, adherence to the QAPP and successful calibration of instruments. Field measurements for turbidity will be verified by ensuring that instrument calibrations are performed using fresh calibration standards, and that the equipment and supplies are in proper working condition. The HACH turbidity meter uses a secondary standard to check for accuracy, and this test will be performed prior to each sampling event.

D2 VERIFICATION AND VALIDATION METHODS

Land use data will be verified by comparing available data for each property with respect to the most recent data. For some properties, there will be only one data set (e.g. no historical data concerning land use practices). However, for those properties that have both historic data and most recent data (e.g. from site surveys), property land use data will be compared with respect to topography, drainage characteristics, current and recent commercial and industrial activities and other land use practices that may contribute monitored pollutants to the watershed.

Depending upon the nature of the problem in data management, there will be several levels of response to correcting data quality problems. Simple (direct) data problems (such as field instrument out of calibration) will be corrected in the field by data collection staff. The corrective action will be described on the Field Form and measurements will continue. For more complex problems, such as loss of hard drive data due to equipment malfunction, the INCOG QA Officer will take appropriate action to recover the lost data or decide to resample or substitute other data, if available.

The response action of the field crews and INCOG management will be documented on field forms and memos to the project files, as appropriate. Data validation will rely upon proper documentation of samples. This includes proper labeling of sample bottles, proper recording of field activities and measurements on field forms, proper use of Chain-of-Custody forms for sample transfers and reliance on careful interpretation of all QA sample data from field measurements and laboratory analysis.

Data validation will also rely upon observance by the INCOG QA Officer of proper use of QAPP procedures in all data collection activities, including sample storage and preservation, adequate detection limits and data management procedures.

All field data, such as multi-probe instrument measurements, will be recorded on the field forms used by the sampling crews. Field crews will record all information about samples taken for laboratory analysis on the Chain-of-Custody form. The Chain-of-Custody forms will accompany the samples when delivered to the laboratory and INCOG will keep a copy of all Chain-of-Custody forms. The INCOG QA Officer will maintain all project files, including the above records, in permanent INCOG files. The INCOG QA Officer will also maintain all secondary data files (mostly as computer data entries made from original field forms and laboratory reports) on a personal computer. The personal computer operated by the INCOG QA Officer is networked at INCOG via a Local Area Network (LAN) system whose hard drive storage is electronically backed up frequently. These tape backups are stored off site. The INCOG QA Officer will also be the principal data analyst and report writer. Therefore, the secondary electronic data will be maintained on his personal computer. The INCOG QA Officer will coordinate draft report reviews through the OSE. Any additional submittals of secondary electronic data to other interested parties will be coordinated by the INCOG QA Officer who will maintain copies of all communication and distribution of said data in the project files.

D3 RECONCILIATION WITH USER REQUIREMENTS

The Data quality Objectives (DQOs) describe the data uses for the project. The INCOG QA Officer will reconcile all collection activities with these DQOs and amend the collection activities as necessary. Section 2 describes how the data will be analyzed and specifies the decision making criteria. The Final Project Report will document the justification for 303(d) listing decisions, and the recommendations in the final report will summarize and explain the limitations on the use of the data as appropriate.

Project Schedules

Table 18 FY-04 104(b)(3) Activities

Item	Activity	2008 (Quarters)				2009 (Quarters)			
		1	2	3	4	1	2	3	4
Task 201	Semi-annual Progress Reports		X		X		X		X
Task 202	QAPP for TMDL Monitoring and Models				X				
Task 203	Draft Data Report and TMDL for Pathogens						X		
Task 204	Draft Report for Phase I of TMDL for Turbidity						X		
Task 205	Final Data Report and TMDL for Pathogens								X
Task 206	Final Report for Phase I of TMDL for Turbidity								X

Table 19 FY-05 604(b) Activities									
Item	**Activity**	**2008 (Quarters)**				**2009 (Quarters)**			
		1	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Task 201	Semi-annual Progress Reports		X		X		X		X
Task 202	QAPP				X				
Task 203	Data Summary Report						X		