# Geographic Information System Analysis and Computer Modeling

## EPA FY 02 319(h) Program
## C9-996100-10, Project 10

## Quality Assurance Project Plan

Oklahoma Conservation Commission
Water Quality Division
2800 N. Lincoln Blvd., Room 160
Oklahoma City, OK  73105

## A1 TITLE AND SIGNATURE PAGE

Oklahoma Conservation Commission Water Quality Division
Quality Assurance Project Plan for *Protecting Water Quality in the Illinois River Basin through Establishment of Riparian Easements*

# Geographic Information System Analysis and Computer Modeling

Approving Officers:

Name: **Brooks Tramell** – Monitoring Coordinator, Oklahoma Conservation Commission, Water Quality Division

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Signature:______________________________ Date:____________

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Signature:______________________________ Date:____________

Name: **Approving Officer**, Region VI United States Environmental Protection Agency

Signature:______________________________ Date:____________

# A2: TABLE OF CONTENTS

## A3: DISTRIBUTION LIST:

Finalized, signed, and U.S. EPA Region VI approved copies of the Quality Assurance Project Plan (QAPP) will be distributed to the following persons:

1. Greg Kloxin — Oklahoma Conservation Commission, Water Quality Division
2. Jennifer Wasinger — Office of the Secretary of the Environment
3. Nikole Witt — U.S. EPA Region VI

## A4: PROJECT / TASK ORGANIZATION

### A41: Objectives and Purpose

Geographic Information System (GIS) analysis and computer modeling are used for many purposes which are always specified in project workplans. Purposes of GIS analysis and computer modeling include:

- Identifying likely sources of pollution in a watershed,
- Characterizing landuse in a watershed,
- Tracking implementation of Best Management Practices (BMPs)
- Targeting implementation of BMPs towards most significant sources
- Estimating load contribution from various sources or landuses in a watershed,
- Selecting monitoring locations, and
- Estimating load reductions due to BMP implementation in a watershed.

### A42: Roles and Responsibilities

This section describes the overall organization of the modeling and GIS analysis that will be completed by OCC. The project management, quality program, and modeling activities are included in this quality assurance project plan (QAPP). Duties and responsibilities of personnel for various aspects of GIS, modeling, and reporting are described.

The organizational aspects of the program provide the framework for conducting tasks and facilitate project performance and adherence to quality control procedures and quality assurance requirements. Key project roles are filled by those persons responsible for overseeing GIS analysis and modeling and ensuring that it is technically sound and scientifically defensible. The following OCC Personnel and their specific responsibilities related to this QAPP are listed below:

**OCC Personnel and specific GIS/Modeling Responsibilities**

Shellie Willoughby- GIS Technician

Greg Kloxin- Senior Technical Writer and Quality Assurance Officer
Stacey Day- Environmental Manager and Technical Writer

Responsibilities:
- Collect and process model input data.
- Model Calibration.
- Targeting pollutions sources such as high erosion areas, feedlots, or non-existent riparian area.
- Selecting possible monitoring sites
- Characterizing landuse in a watershed
- Identifying likely and significant sources of pollution in a watershed
- Estimating load contributions from sources in the watershed
- Estimating load reductions from implementation of BMPs in a watershed
- Reporting on results

Brooks Tramell- Monitoring Coordinator
Jason Ramming- Water Quality Specialist
Jean Lemmon- Blue Thumb Quality Assurance Officer

Responsibilities:
- Collect and process model input data.
- Ground-truthing data.
- Selecting monitoring sites
- Characterizing landuse in a watershed
- Identifying likely sources of pollution in a watershed

Marti Mefford- Honey Creek Project Coordinator and Plan Writer
Monty Ramming- Fort Cobb Project Coordinator

Responsibilities:
- Tracking BMP implementation
- Identifying likely sources of pollution in a watershed.

## A5: PROBLEM DEFINITION / BACKGROUND

As it becomes increasingly important to document water quality success due to implementation of programs, more and more efforts rely upon GIS analysis and computer modeling for program planning and measurements of success. Water quality and other environmental monitoring should always be the backbone of planning and success measurement, but environmental monitoring is often expensive and requires collection of long-term data sets to demonstrate statistically valid results. Supplementing traditional environmental monitoring with GIS analysis and computer modeling can help increase the efficiency of environmental monitoring and implementation efforts but can also be used to make reasonable predictions about the long-term effects of project activities. For instance, computer models can be used to estimate the long-term effects of installation of best management practices which may require 5 – 15 years to become evident with traditional water quality monitoring data. Or GIS analysis of a watershed can be used to estimate areas in the watershed most likely contributing significantly to loading such that restoration efforts can be concentrated in those areas.

## A6: PROJECT / TASK DESCRIPTION

### A6.1: Purpose/Background

Simple layers of data can be analyzed in a GIS environment through simple visual analysis or layering of data relative to some of the purposes listed above. Characterizing landuse in a watershed, selecting monitoring locations, tracking implementation of BMPs, or identifying potential sources of pollution in a watershed are tasks which can be accomplished through simple GIS.

In other cases, it becomes necessary to incorporate sets of data into GIS based models such as SWAT, BASINS, STEPL, AVGWLF, PreDICT, and others. Estimating load contribution from various sources in a watershed, targeting implementation of BMPs, estimating load reductions due to BMPs in a watershed, and identifying the most significant sources of pollution in a watershed require the use of GIS-based models.

In many cases, the amount of processing time, and the expertise necessary to complete water quality modeling exercises necessitates that these activities be contracted out to entities that specialize in water quality modeling. An example of a situation that would be contracted out would be the water quality modeling necessary to develop the NPS portion of a TMDL. However, in some cases, OCC staff will complete these activities. This QAPP is intended to cover the GIS analyses and computer modeling completed by OCC staff in accordance with the objectives and goals of specific projects.

### A6.2: Description of Work to be Performed

The following objectives are required to meet the purposes listed above:

#### A6.2.1 Collect and process data.

Geographic Information System (GIS) data for topography, soils, land cover, and streams are required by computer models such as SWAT, BASINS, STEPL, PreDICT, and other similar models. An ArcView GIS interface is available to summarize the GIS data and convert it to a form usable by the model. The GIS data can also be used in an ArcView environment for simple applications such as calculating the amount of pasture land on a slope greater than 2%, tracking BMP implementation, or estimating the total area of pasture in a watershed.

#### <u>A6.2.2 Collect Ground Truth Data</u>
Ground truth data are required to perform accurate land cover classifications and to verify existing maps or GIS data.

#### <u>A6.2.3 Model Calibration.</u>
In the event that the data will be modeled, the model must be calibrated. Calibration is the process by which a model is adjusted to more closely match observed data. Calibration greatly improves the accuracy of a model. The SWAT model will be calibrated on observed streamflow from all suitable US Geologic Survey (USGS) gages. The PREDICT model, which uses output from another model such as SWAT to predict potential load reductions and implementation costs will be calibrated based on implementation costs in similar areas of the State or load reduction efficiencies in similar projects.

#### <u>A6.2.4 Targeting High Erosion Areas or other significant sources of pollutants- Predicting loading from different areas of the watershed.</u>
The SWAT model can be used to predict erosion rates. Based on SWAT's predicted erosion rates, problematic combinations of soils, land cover, and slope will be used to target critical areas. In this case, the final product will be a basin map showing highest erosion areas shaded by severity. Models such as SWAT and Basin will estimate loading from certain subwatersheds or from certain land use types. Other models, such as STEPL or AVGWLF estimate the load of sediment or nutrients from different land use categories.

#### <u>A6.2.5 Using model to predict potential reductions in loading due to BMP installation.</u>
Models such as SWAT, PreDICT, and others can be used to estimate changes in loading due to changes in landuse, such as those that would result from installation of BMPs.

Specific, project specific details on planned tasks and activities to be accomplished under different projects can be found in project workplans, and in project-specific appendices to this QAPP.

## A7: QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

### A7.1 Purpose/Background
The purpose of this element is to document the data quality objectives of the project and to establish performance criteria for the measurement system that will be employed in generating the data. For this QAPP, the data being generated are the GIS analysis and water quality modeling results.

### A7.2 Data Quality Objectives

Use of water quality modeling and GIS analysis requires simulations of the natural environment to provide accurate representations of existing conditions. This computer generated representation of existing condition may be used to select the optimum, most representative monitoring site, to estimate potential results of proposed changes, or to estimate changes over time. The computer simulations should appropriately represent the chemical, physical, and biological conditions of the natural system.

Assessment of calibration of the exercises generally begins by making sure some central component of the model or analysis are properly represented. In the case of GIS analysis, peer-reviewed and widely used data layers such as soils and hydrography data sets are used. When “new”, untested, or otherwise out of the norm data sets are used, qualifications for the acceptability of those data sets will be addressed in project-specific appendices to this QAPP. In the case of many computer watershed models, models are generally calibrated to the most basic, and data-rich real world data set to represent model conditions, which is often hydraulics.

In the case of these calibrations, predicted and observed concentrations are generally developed, then appropriate weighting factors in the model are adjusted to improve the precision and accuracy of the predictions. These weighting factors are generally suggested by model developers in model support guidance documents as the appropriate factors for adjustment.

Calibration is not intended to perfectly match predicted and observed concentrations, but to appropriately represent processes in the waterbody based on the use of the analyses, generally making conservative, resource-protective choices. In other words, if we were attempting to model NPS nutrient delivery to a lake, we would want to most closely match hydraulics during high flow events, when the bulk of loading occurs to lakes. In the case of evaluating the effects of point source controls on a river, base flow hydraulics would be most important to match. Differences between predicted and observed greater than 30% will be explained in final reports, along with an explanation or justification of the limitations then accepted for the uses of the modeling results.

## A8. SPECIAL TRAINING CERTIFICATION

Personnel performing modeling and GIS analysis under this QAPP will be familiar with its contents and requirements and will have previous experience using the software and data in a similar manner. In addition, personnel will have received training in the use of ArcView software.

## A9. DOCUMENTS AND RECORDS

## A9.1 Purpose/Background

This element describes the following:

- process for ensuring that appropriate project personnel have the most current approved version of the QAPP;
- information and records to be included in the report package;
- other records and reports that will be produced; and
- requirements for disposition of records and documents.

## A9.2 QAPP Distribution

Upon approval of the QAPP, the technical writers, GIS Technician, Assistant Director, and any other staff working on the specific project will be notified that it has approved, that a signed copy is filed in the project file in the OCCWQ Oklahoma City office, and that an electronic copy of the QAPP is stored on the OCCWQ server under the project file. In addition, the aforementioned personnel will be provided with a hard copy of the approved document upon their request. Project personnel will also be notified of subsequent revisions to the QAPP, and notified when these revisions have been approved.

## A9,3 Information in Modeling or GIS Analysis Reporting Packages

The reports will provide a summary of the data used in the analysis or modeling exercises and will contain thorough documentation of assumptions, calibration, results and calculations associated with the exercise. As appropriate, summaries will include printouts of model inputs and outputs, data graphs, maps, spreadsheet printouts, and data tables.

## A9.4 Documentation Control and Management

It is anticipated that a majority of the internal documentation and record transfer within the project will be completed electronically. Hard copy and electronic copy submittals of deliverables to EPA Region 6 will be submitted to the Oklahoma Secretary of Environment for peer review as appropriate, then delivery to EPA. Electronic and Hard copy documentation version control, updates, storage, tracking, and distribution will be the responsibility of the Environmental Projects Coordinator, Tech Writers and QA Officer. Examples of electronic documentation include data collected from field surveys, model input and output files, spreadsheet files, and word processing files as necessary for data analysis and report development. Because existing software will be used for all phases of this project, it is not necessary to develop any new file types or protocols.

All data files, input and output files, spreadsheet, database, and word processing files will be stored in an appropriate format for the software used. Current and widely used software packages will be used for electronic spreadsheets (Excel) and word processing (MS Word). If necessary, files for these software packages can be converted back and forth between formats without a loss of data.

Electronic documentation and data will be stored on a central network server with weekly full backups and daily incremental backups.  The backup data are archived on digital tape and/or optical disc for easy recover.

### A9.5 Disposition of Records and Documents

EPA is the governmental authority for storage, access, and disposal of all records. Relevant records and data pertaining to the project will be sent to EPA in the final report.  In addition, all hard copy project files will be stored in the OCCWQ office for at least five years after the project's termination, then moved to the OCC warehouse indefinitely.  All electronic files will be maintained on the OCC electronic server indefinitely.

# SECTION B: DATA GENERATION AND ACQUISITION

## B1. MODEL CALIBRATION

The first step in model calibration or GIS analysis is making sure that the electronically depicted system accurately represents the natural system.   Calibration is completed using data that was not originally included in the development of analysis or model.  In the case of GIS analysis, calibration may rely on ground truthing, comparison to similar layers, and/or review by knowledgeable sources.

For computer modeling, this comparison is made using a sound, comparatively rich data set such as hydrology (stream flow).  In many cases, a secondary calibration is performed once the hydrologic data (observed and predicted) matches up.  This secondary calibration is often performed using the parameter of concern, such as phosphorus or turbidity.

Some model or GIS analysis data for calibration will be obtained directly from field studies, while others will be obtained from other modeling studies or literature.

Specifics about calibration and parameters of focus will be detailed in project specific QAPP-addendums.  Criteria for an acceptable calibration and verification are discussed in Section A7.

# B2. NON-DIRECT MEASUREMENTS (DATA ACQUISITION REQUIREMENTS)

As mentioned in the previous section, some model input values will be obtained from non-direct measurements such as other modeling studies, model user manuals, or published literature. These parameters include items that cannot be easily estimated from field or laboratory data, such as organic nitrogen decay rate, algal growth rates, etc. In addition, models such as STEPL and PreDICT require input data such as nutrient and sediment loading from different land uses in the watershed. These input parameters are the output of models such as SWAT.

### Data Sources and Selection

Basin scale hydrologic modeling requires a vast amount of data. Final reports will detail all data sources and references. These data come from a variety of sources. Often there are several data sets available from which to choose for a particular modeling task. These data are evaluated based on the following criteria:

**GIS data detail.**
GIS data come in a variety detail levels, the level of detail may be expressed as a resolution or map scale. White (2001) found that the detail of input GIS data has a significant impact on SWAT model output.

**Age of data set.**
Some data used are more time sensitive than others. For example, land cover may change dramatically over the span of a decade, where as soils typically change only over geologic time.

**Accuracy.**
Accuracy information is seldom available. In these cases the accuracy is assessed by professional judgment.

**Temporal continuity.**
Temporal continuity is of great importance when selecting weather, streamflow, or water quality data. Weather and streamflow should ideally be continuous on a daily basis, although it is possible to estimate missing days based on other data. These data are seldom continuous for long period of time.

**Spatial Consistency.**
Spatial consistency is often sacrificed to use the most current data available. Most data sets cover only a limited area such as a state or county. A basin is typically not limited to those same boundaries, and often cross both state and county lines. This leads to the use of multiple GIS data sets to define a single model input layer and may create a lack of consistency across the basin.

**Quality and Limitations of Model Data**

It is not currently possible to comprehensively quantify the error in model predictions, thus there are no quantitative data quality requirements. It is, however, possible to list limitations. Model limitations may be the result of data used in the model, inadequacies in the model, or using the model to simulate situations for which it was not designed. Hydrologic models will always have limitations, because the science behind the model is neither perfect nor complete. A model by definition is a simplification of the real world. Different models have different limitations. Limitations not listed below will be discussed in detail in the final report. The following is a list of notable model limitations:

**Weather**

Weather is the driving force for any hydrologic model. Data collected at a few points is applied to an area of thousands of square miles. Rainfall can be quite variable, especially in the spring when convective thunderstorms produce precipitation with a high degree of spatial variability. It may rain heavily at a weather station, but may be dry a short distance away. On an average annual or average monthly basis, these errors have may cancel. This limitation among others, caution us against using model output on a daily or monthly basis.

**Radical Parameter Changes**

Scenarios involving radical changes to the basin result in greater uncertainty. The SWAT model is calibrated using estimates of what is presently occurring in the basin. Large departures from calibration conditions raise the level of uncertainty in model predictions.

**Small Land Covers**

Land uses that cover very small areas are not represented in most models. Land uses that occupy limited areas such as unpaved roads, bare areas, construction sites, and some row crops may not be simulated. In addition, most of these features may not be depicted in the available land cover. Some of these small areas may contribute many times more sediment on a per unit area basis than rangeland. Although significant, they may not be able to be simulated with the currently available data.

**Hydrologic Response Unit (HRU) Characteristics**

Each HRU in a particular subbasin is assumed to have the same characteristics by most models. For instance, the same slope is used for all rangeland and agricultural HRUs in a single subbasin. Agricultural land is generally located in valleys or other flat areas. Rangeland generally occupies land that is unsuitable for row crop production.

**Management Uncertainty**

There is a great deal of uncertainty associated with management. In reality, management varies significantly from field to field. It is not possible to easily determine what is happening where, or to simulate all these activities in the model. Therefore, categories are created to cover reasonable managements choices only.

**Unidentified Point Sources**
There are many point sources in the basin; these could be significant. Potential point sources include household septic systems, CAFOs, and municipalities.

**Instream Process**
SWAT models in-stream processes based, in large part, on unvalidated assumptions of channel and stream-bank properties. Therefore these processes will be turned off and not utilized.

## B3. DATA MANAGEMENT AND HARDWARE/SOFTWARE CONFIGURATION

No special hardware is necessary for these tasks. Software needed for GIS analysis and computer modeling include ArcView, ArcInfo, SWAT, PreDICT, STEPL, BASINS, Excel, and other similar programs. These packages have been well tested and generally require no special modifications. Specific programs used for various projects will be specified in QAPP appendices.

As mentioned in section A9.4, data management will include storing all electronic data on a central network server with daily incremental backups and weekly full backups. The backup data will be archived on digital tape or optical disc for easy recovery. All input and output files, spreadsheet, database, and word processing files will be stored in file format appropriate for the specific software. Index files will be generated as necessary to identify and organize files.

# SECTION C: ASSESSMENT AND OVERSIGHT

## C1. ASSESSMENT AND RESPONSE ACTIONS

### C1.1 Purpose/Evaluation

The purpose of this element is to describe internal and external checks that ensure that:

- all elements of the QAPP are correctly implemented as prescribed;
- the quality of the data generated by implementation of the QAPP is adequate; and
- corrective actions are implemented as necessary in a timely manner and documentation of effectiveness is completed.

### C1.2 Assessment and Project Activities

No formal external audits will be conducted for project activities prior to submission of results to EPA. However, final reports will be peer reviewed by a State peer review committee prior to submission to EPA. In addition, internal checking of output results will be performed by the QA Officer, Technical Writers, and Division Assistant Director, checking each others work. This internal review will be conducted throughout the project period and will be used to verify that proper input values and calibration and validation procedures are being used. The QA Officer/Senior Technical Writer will be responsible for a final check of the results before submission to the peer review council. In the event that the QA Officer is the primary modeler and/or analyst, the Assistant Director will be responsible for the final check.

### C1.3 Reporting and Resolution of Issues

Findings of practices and procedures that do not conform with this QAPP will be reported to the QA Officer. Upon conferring with the Division Assistant Director, appropriate action will be taken. Corrective action will be initiated or modified as needed.

A final report will be prepared for every project. The report will include sufficient information to meet the project objectives. As mentioned previously, the report will undergo internal review, followed by a peer review by a State review group. The report will detail the QA process as necessary and any corrective actions that needed to be made.

# SECTION D: DATA VALIDATION AND USABILITY

## D1. DEPARTURES FROM VALIDATION CRITERIA

The purpose of this element is to stat the criteria for deciding the degree to which each data item has met its quality specifications as described in Group B. This decision will be based on the investigator’s estimate of the effect that each deviation from the QAPP will have on the usability of the associated item, its contribution to the quality of the reduced and analyzed data, and its effect on the decision.

Quantitative criteria for acceptance of the calibration were listed in Section A.7. Calibration results will be evaluated against these criteria by the modeler/analyst and double checked by either the QA Officer and/or the Assistant Director.

**Data Reduction.**

GIS Analysis and computer models, such as SWAT, may generate a vast amount of data that must be summarized. A great deal of these data are of no interest to the user and are discarded. These data are so varied in type, format, and resolution, that summarizing techniques are selected on a case by case basis using best professional judgment.

## D2. VALIDATION METHODS

Validation is the process of verifying the ability of a calibrated model to make predictions outside the calibration period. A portion of the available stream flow record is withheld during calibration and later used to validate the model. Computer models may be validated depending on the amount of available stream flow data. If little observed stream flow are available, no model validation will be performed.

In some instances, validation of model results may be secondarily confirmed by comparison to results of similar models. For instance, SWAT model runs completed by OCC may be compared to SWAT model runs completed by ODEQ or OSU Biosystems and Agricultural Engineering. In other cases, PreDICT model results may be compared to multiple SWAT model results to verify that predictions are reasonable.

## D3. RECONCILIATION WITH USER REQUIREMENTS

Results will be reviewed internally and externally, as described to assess usability in the context of their specific intended use (identified in project specific QAPP appendices). In general, results are deemed usable if acceptance criteria are met. However, if performance criteria do not meet the project's requirements for DQO's as outlined in this QAPP, the data may be discarded and resampling may occur. The cause of failure will be evaluated, if possible, and the decision to discard and re-generate the results will be made by the QA officer.

# APPENDIX C:

FY 2002 319(h), *Protecting Water Quality in the Illinois River Basin through Establishment of Riparian Easements*

## A3: DISTRIBUTION LIST:

In addition to standard distribution list on in Section A3, signed copies of the QAPP will be delivered to Ed Fite, Oklahoma Scenic Rivers Commission, upon approval from EPA.

## A4. PROJECT/TASK ORGANIZATION

## A4.2 ROLES AND RESPONSIBILITIES

Activities for this project will involve both GIS analysis and computer modeling in order to target poor riparian areas and to estimate loading reductions that could be achieved from implementation of riparian easements.

The GIS Technician will use digital orthoquad photography to pinpoint areas in the Oklahoma portion of the Illinois River Watershed lacking riparian vegetation. These areas will be presented to the Oklahoma Scenic Rivers Commission to aid them in targeting establishment of easements. The GIS Technician will provide a digital layer of these areas that can be mapped and/or input into watershed models. In addition, the GIS technician will provide summary data of these areas including miles of insufficient riparian area, landuse along the degraded riparian area, and slope of the degraded area.

The Senior Technical Writer will utilize information from the Oklahoma Scenic Rivers Commission about the location and size of riparian easements enrolled in the program to estimate potential loading reduction due to the protection of those sites. These calculations will be performed using several models, including STEPL and PreDICT.

The Tech Writers will also prepare the final project report.

## A5. PROBLEM DEFINITION/BACKGROUND

The Illinois River and Lake Tenkiller Watershed is one of the highest priorities for protection and restoration in the State. The Illinois is one of our few State Scenic Rivers, and as such, is the focus of numerous monitoring, education, and restoration efforts. The river and lake are listed on the 2002 Integrated Report as being impaired by nutrients (phosphorus), pathogens, and turbidity. Previous studies have indicated that streambank erosion and riparian area degradation are significant impacts in the watershed.

Recent studies have also suggested that in many systems, streambank erosion contributes as much as 90% of the sediment load measured in a stream (Sekely et. al. 2002). Given that streambank sediment sampling in this watershed has shown streambank sediments have extremely high nutrient concentrations, streambank erosion could also contribute significantly to nutrient loading in a stream. Riparian protection is one of the most effective practices to promote streambank stability, and at the same time reduce runoff driven phosphorus loading from upland areas by as much as 80%.

A 1999 319(h) project focused on education and demonstration of best management practices in the watershed. One of the highest priority practices supported by the program was riparian area protection. However, the program only required a five-year commitment to riparian protection. Although this is sufficient time for a riparian area to begin to stabilize and function to protect water quality, it may still be relatively easy for landowners to revert to riparian area misuse. In addition, environmental variability may overshadow any water quality impacts that could be measured in the stream over a five year period, thereby preventing the measurement of water quality improvement related to BMP implementation.

However, if riparian areas were protected for a longer period of time, there is an increased likelihood of perpetual protection and measurable water quality impacts. A thirty-year old relatively unmanaged tract of land in this area would contain many mature trees as well as well-developed ground cover with soil-stabilizing roots. To clear this area of this vegetation would be labor intensive and likely less appealing to the landowner. In addition, the landowner would have thirty years worth of observed benefits such as lack of land loss due to erosion and healthier livestock to encourage them not to revert to riparian misuse. Also, with more than a five year data set and long-term, continued protection of these areas, year-to-year variability in water quality data is likely to be overshadowed and clearer affects of implementation should be possible to measure.

Although additional potential funding opportunities such as CRP or CREP exist through NRCS and FSA to promote long-term establishment of easements in the Illinois River, manpower limitations do not allow NRCS to focus much beyond the existing programs they have. NRCS and FSA have not observed much interest from locals toward implementing riparian practices or establishing easements through programs such as EQIP or CRP in the watershed, which they attribute to lack of promotion and lack of locally demonstrable success of long-term riparian protection. In other words, they believe that a person who could go “door-to-door” to promote the program, as well as some landowners who had converted to long-term riparian protection would go a long way towards widespread riparian protection through a program such as the Conservation Reserve Enhanced Program (CREP).

The successful protection of riparian areas through OCC’s 319 Programs have suggested that this might be true. Our placement of a project coordinator in the watershed, or salesman for the program, has allowed us to promote riparian areas while NRCS programs have been less successful in that area. In addition, the Oklahoma Scenic Rivers Commission (OSRC) has had indications from several landowners that they would be interested in implementing long-term riparian easements, if they could get financial help with installation of practices.

In 2003, FSA and NRCS approached OCC with the idea of promoting a CREP program in the Illinois River Watershed. Preliminary estimates suggest that as much as $12,000,000 would be necessary to implement a CREP program in the watershed. However, without local interest, NRCS cannot devote State NRCS funds towards a CREP program, nor can we ask the State legislature to provide the required match for such a program.

# A6. PROJECT/TASK DESCRIPTION

## A6.1 Purpose/Background

The objective of this project is to effectively bridge the gap between short-term and long-term riparian protection in the Illinois River Watershed. A local riparian “salesman” will be employed to promote long-term riparian easements, many long-term easements will be established, a targeting mechanism will be developed to identify areas where riparian protection is most needed and focus efforts in those areas, and local interest in long-term riparian easements could be documented.

Specifically, the short, and longer-term goal of this project is to increase the amount of protected riparian area in the Illinois River Watershed and effectively decrease bedload and sediment and nutrient concentrations in the River, and eventually, in Lake Tenkiller. Increasing riparian area coverage should also decrease streambank erosion and improve streambank stability and instream habitat in the river. These improvements in water quality will be difficult to measure during the project period, although estimated load reductions can be modeled.

A secondary goal of the project is to determine the factors that are limiting wide-spread implementation of riparian buffer establishment such that future programs can be developed to implement significant riparian protection in the watershed.

## A6.2 Description of Work to be Performed

The Oklahoma Conservation Commission will review GIS coverages and satellite photography of the Illinois River basin in order to determine where short-term riparian protection contracts exist and where riparian protection is currently lacking. These areas will be targeted, based on certain factors, by the program.

Existing short-term protection contracts will be one focus, not only to prolong the effects of previous efforts, but also to hopefully sway producers who may have been unconvinced about the benefit of a riparian area after only a 5 year time period. The ultimate goal is continual protection of these areas into perpetuity. Many landowners are “sold” on their protected areas after only five years; however, some will languish into old habits after the incentive payments wear off. This program would prevent that from happening, and ultimately make riparian protection an "old" habit.

However, the main focus of the program will be on riparian areas that are currently lacking and in need of restoration. The goal of implementation will be that a minimum of 55% of the riparian easements implemented as part of the project would fall under this category.

**A6.2.1 Determine areas in the watershed where short-term riparian contracts exist, and where riparian areas are lacking**

Information collected will be largely based on digital orthophotos of the watershed and existing GIS data on riparian areas protected as part of the 1999 319(h) and similar projects. Estimate potential load reductions due to riparian area protection in the watershed.

Targeting will be directed towards areas where riparian protection is most needed. Riparian protection is most needed in areas where overland flow is most likely to flow into the stream (depressions and around small, intermittent flow channels), areas where riparian vegetation is completely denuded and significant streambank erosion is obvious, and in areas where the amount of contiguous protected riparian area can be most efficiently increased.

**A6.2.2 Employ part-time project coordinator to promote the project to targeted landowners, sign-up cooperators, and investigate why landowners in the targeted areas of the watershed are willing or unwilling to participate in the program.**

**A6.2.3 Sign-up cooperators, implement riparian practices, and determine why landowners in the targeted are were unwilling or willing to participate. Cooperators who agree to participate in the program will be given one year to implement their practices before the contracts are considered null and void. Failures to implement will result in a second sign-up period to utilize remaining available funds. It is estimated, based on similar projects implementing riparian improvements, that this project will involve between twenty and forty landowners in the area.**

**A.6.2.4 Estimating sediment and nutrient load reduction due to protected riparian areas and stabilized streambanks.- OCC will estimate the reduction in sediment and nutrient load using the PreDICT model. Initial estimates suggest that this will amount to at least a 6% reduction in sediment loading and a 4% reduction in phosphorus loading for the entire watershed. However, these are very conservative estimates, based on preliminary information.**

**A.6.2.5 Tracking implementation and reporting- The Project Coordinator will maintain a record of information on landowners contacted, reasons for willingness or unwillingness to participate, and extent of practices implemented.**

**This information will be presented in semi-annual reports, as available, as well as in the Final Project Report.**

# SECTION B: DATA GENERATION AND ACQUISITION

## B1. MODEL CALIBRATION

During the course of contacting landowners in targeted areas, the project coordinator will verify the accuracy of the GIS analysis towards predicting inadequate riparian areas. It is expected that the GIS analysis will be at least 90% accurate in predicting degraded riparian conditions. If the ground truthing reveals that the GIS analysis is less accurate, the QA Officer and Division Assistant Director will work with the GIS technician to correct sources of error, as possible.

Calibration of the PreDICT model will be accomplished by utilizing identical BMP-specific load reduction efficiency factors to those being used in the SWAT modeling exercise for the TMDL, which is nearing completion. In addition, landuse-specific loading from the TMDL SWAT model will be used as input data for the PreDICT model.

## B2. Data Acquisition Requirements

As mentioned previously, some model input will be obtained from non-direct measures such as other modeling studies, model user manuals, or published literature. The data sources that will be used include the PreDICT users manual, the SWAT user's manual, the SWAT output from the draft TMDL, and output from the STEPL model. The source of data will be documented in the final report.

## D2. Validation Methods

The modeling effort will be validated by verifying that correct input values have been used and appropriate procedures have been followed. Additionally, model results will be validated by comparing predicted loading reductions to those predicted by similar models such as STEPL and/or SWAT.