

# National Wetland Inventory Map Digitization

Compiled by:

Oklahoma Conservation Commission Oklahoma Water Resources Board

As required by: EPA FY 2003 104(b)(3) Wetlands CD976400-01-0, Project 1

> September 2008 Draft Final Report

#### I. INTRODUCTION

Comprehensive wetland management in the State of Oklahoma is hindered by the limited accessibility of pertinent information. Wetland maps are available from the US Fish & Wildlife Service (USFWS), but accessing the information can be inconvenient and the usability is somewhat limited. The National Wetlands Inventory (NWI) maps are housed at only one agency in Oklahoma. This inaccessibility hampers planning and management of wetland resource for the public and private sectors. Furthermore, this information is only available in hard copy, which constrains the utility of the data for in depth evaluation and detailed management applications.

As the USFWS states on their web page, the NWI maps are a critical management tool used by scores of agencies and groups. These maps are widely viewed as a determinant factor in identification and subsequent management of wetland resources. This point alone illustrates the importance of unfettered accessibility to the resource.

"Users of NWI maps and digital data are as varied as are the uses. Maps are used by all levels of government, academia, Congress, private consultants, land developers, and conservation organizations. The public makes extensive use of NWI maps in a myriad of applications including planning for watershed and drinking water supply protection; siting of transportation corridors; construction of solid waste facilities; and siting of schools and other municipal buildings. Resource managers in the Service and the States are provided with maps which are essential for effective habitat management and acquisition of important wetland areas needed to perpetuate migratory bird populations....for fisheries restoration; floodplain planning; and endangered species recovery plans. Regulatory agencies use the maps to help in advanced wetland identification procedures, and to determine wetland values and mitigation requirements. Private sector planners use the maps to determine location and nature of wetlands to aid in framing alternative plans to meet regulatory requirements. The maps are instrumental in preventing problems from developing and in providing facts that allow sound business decisions to be made quickly, accurately, and efficiently. Good planning protects the habitat value of wetlands for wildlife, preserves water quality, provides flood protection, and enhances ground water recharge, among many other wetland values."

The Emergency Wetland Resources Act of 1986 requires the development of a digital wetland database. However, due to the number of maps to be digitized and "the 100% user-pay basis on which NWI digitizes most of the wetland maps," a number of government and private agencies have initiated in-house digitization of NWI maps. In order to be able to accept NWI maps digitized by other entities, USFWS prepared a guidance document titled "*Procedures for Acceptance and Testing of Digital Data from Other Producing Agencies.*" The document details procedures and quality assurance requirements for data to be included in USFWS national wetlands digital database.

With the creation of the digital wetlands data, users within the state, as well as around the country and world, can access the information. By making the digitized wetland maps available through a web based mapping system, such as Arc Internet Map Server (ArcIMS), the public can access this information through a user-friendly interface. The

ArcIMS site allows users to combine the wetland information with other data layers currently available in the State of Oklahoma such as the digital orthophotography. This not only allows the public access to the important wetland data but also the ability to view this data with other information that would give the general user the ability to make informed decisions about their specific area of interest in Oklahoma. As an educational tool this site can be combined with wetland related information to not only allow people to locate the wetlands in Oklahoma but also educate them about the precious resource that is so valuable to the state.

Numerous federal, state, local, and private organizations have supported the conversion of wetland information to digital data across the country, but Oklahoma has lagged behind. However, with the completion of this project, the Oklahoma Conservation Commission (OCC) with its partner Oklahoma State University (OSU) have digitized the NWI maps for approximately 40% of the state; the NWI maps for the entire state will be digitized in early 2009. This project digitized 340 maps and will address the accessibility of those maps from two perspectives. First it allows for the creation of digital information, and second it provides the public and private sectors access to the information necessary to make informed decisions as well as provide computer interface features to interact with the data. The digital maps produced through this project have met the USFWS *"NWI Technical Specifications for Digitizing"*.

The OCC and the Oklahoma Water Resource Board (OWRB) worked jointly in both of these endeavors under the guidance and oversight of the Office of the Secretary of the Environment (OSE). The OCC entered into agreement with the USFWS to digitize the NWI maps according to their specifications. In return, the digital information was provided to the USFWS for incorporation into their NWI system. The OWRB and the OCC worked together in developing a user-friendly access system that allows Oklahomans, as well as anyone else with web access, to directly interact with maps and several other information layers regarding wetlands within the state. The Oklahoma wetlands mapping system allows for an in-depth analysis of wetlands and using USFSW codes it creates wetland maps by type and analyzes the relationship of type to natural features such as geology, streams, aquifers, etc. Some examples of other data layers included are digital orthophotography, streams, lake, roads, cities and towns, water quality data, cultural, agricultural, etc.

#### II. PROJECT DIGITIZING PROCEDURES

OSU was contracted by OCC to perform the procedures to convert the NWI maps into a digital format. In most cases, two different formats of copies of finalized NWI maps were obtained from the USFWS for 340 1:24,000-scale quadrangle map completed for the project (Appendix C). One format of the maps was a stable base, contact film copy only containing the NWI features for the map. The other format of the maps was a paper copy of the NWI map, complete with NWI features and labels as well as the underlying USGS topographic map features. In some cases, a third format or overlay was also received from USFWS. This third layer contained only the labels for the various wetland features and was generally not used by the project, since all of the necessary information was contained on the first two map formats.

It is important to note, that none of the copies and formats of NWI maps were in "polygon only" format. In fact, all NWI maps contained all features. This condition meant that the project had to process all polygon features as well as all line features. This increased number of features as well as the spatial inter-relationship of the line and polygon features resulted in a significant amount of effort and time to process the project maps as opposed to maps that would have only contained polygon features.

For each quadrangle map area, the stable base, contact film copy was scanned at 800 dots per inch in a standard tiff format on an Altek optical scanner. The scanned output was then imported in a raster to vector conversion software package named R2V. After importation, the scanned image was registered to a geographic coordinate system (i.e., Latitude and Longitude) by using the four corners of the quadrangle as registration points. The data was then saved as a Geotiff image.

Initial processing of the image included visually inspecting the raster image and identifying areas of concern. Areas in which the image was manually edited included any information present on the image that was outside of the guadrangle boundary as well as areas within the guadrangle boundary that needed further attention. Such areas in this latter category include locations where lines have 'bled together' on the image due to the large dpi at which the data was scanned. Similarly, the scans resulted in most small water bodies being represented as a large 'blob' or area that had to be edited to produce a circle or boundary of the water body. In addition, lines and polygon boundaries were often incomplete or merged together where they should not have touched, resulting in other areas that required manual editing of the image. After the most notable problem areas were edited, the software was then used to employ a series of commands in order to vectorize the raster image. That is, the raster image was converted to numerous vector features. Again, all obvious errors (i.e., locations where features touched each other and they should not or locations where features did not touch when they should connect) were then edited as needed. The vectorized data (line and area features) were then converted to polygons and another round of quality control commands were executed to identify errors in the data. A series of editing steps followed to ensure that all area features had been captured and were topologically (spatially related) correct.

At this point the paper map that contained the features, labels and background quadrangle information for the quadrangle was scanned at 200 dpi in a tiff format. This image was imported into the conversion software, geographically registered, and used as a 'back drop' image, over which the newly created vector data was overlaid. All linear features where then labeled, using the image of the background map for identification. Finally, the vector data was exported from the R2V Conversion software into an ESRI Shape File Format.

The shape file was imported into ESRI's ArcGIS software. The projection system was defined and the precision was set for double precision. All features were 'edge-matched' to the features of adjoining quadrangles. The line and polygon features were separated into the Geodatabase. The appropriate NWI attribute or code value was added to each polygon. And finally, the USFWS QA/QC software was executed on the entire geodatabase. Any errors identified by the QA/QC software were then corrected by editing of the data until no identified errors existed within the geodatabase.

Finally, copies of the geodatabase containing all features (lines and polygons) for all quadrangles were then sent to OCC, OWRB, and USFWS, Albuquerque, NM.

In summary, all responsibilities, tasks and objectives stated in the Project Agreement and the Quality Assurance Project Plan (Appendix B) have been successfully completed.

# III. DEVELOPMENT OF THE INTERACTIVE WEB PAGE MAPPING SYSTEM & EDUCATIONAL FEATURES

#### A) Hardware and Software Environment

The Interactive Wetlands Mapping System (IWMS) was built using ESRI's ArcIMS 9.1. This software is a web server based application for delivering interactive maps data. The application is hosted on a Dell PowerEdge 2850 running Windows 2000 Server. The server is equipped with 2 dual-core Xenon processors and 3GB of RAM. Map files are stored on an external disk array. Equipment and software was provided by OWRB and is housed at the OWRB's main office.

#### B) Interactive Wetlands Mapping System Development

Given the wide-ranging audience for this viewer there was concern that new GIS users would not be able to understand how to use IWMS. While professional and researcher likely have had previous exposure to the specialized tools available in GIS systems, the average person has not.

The standard ArcIMS user interface was extensively customized to increase usability. The user interface was developed using HTML and JavaScript. This allows the maps to be accessed using most common Web browsers including Mozilla, Firefox, and Internet Explorer. No special downloads or plug-ins are needed to view the maps.

The wetlands mapping system consists of over 40 GIS data layers. The user can control what layers are displayed by turning them on and off in the GIS Layers List. Some of the GIS layers automatically turn on and off depending on the aerial extent of the map.

Base Layers include: cities, municipal boundaries, counties, school districts, state house districts, state senate districts, U.S. congressional districts, government lands, highways, county roads, and the public land survey system's townships and sections.

Groundwater layers include reported well logs and major aquifers.

Land cover layers include: surficial geology, hydric soils, and watershed boundaries.

Wetland layers include: Virtual tour stop locations, NWI wetlands status, wetlands quad index, NWI wetland points, NWI wetland linear features, and NWI wetland area features.

Surface water layers include: Real-time surface water gages, OWRB surface water monitoring sites, lake and streams.

Background images include: digital aerial photography, digital topographic maps, and digital shaded relief maps.

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make visible.

The active layer.

LAVEDE



Standard IMS Viewer

### **Customized Wetland IMS Viewer**



The standard ArcIMS user interface was customized to increase usability and to add query and analysis tools. To increase the site's usability, an interactive help page was developed. The help page can be accessed by clicking on the "Help" button at the upper-right corner of the viewer. The page contains interactive demonstrations of the tools and features, answers to common questions, solutions to error messages, and a contact link to email questions for additional help.



The non-descriptive navigation, selection and query tools icons found in the standard viewer were replaced with buttons containing descriptive text. A mouse-over help system was also created to display a description of the tool when the user places the mouse pointer over the tool button.

### Standard Tool Bar

#### **Customized Tool Bar**

Zoom / Pan	Select By	Selection	Query Tools	Distance
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Identify a single feature on the active layer				

The table of contents, or GIS layers list, was customized to resemble a traditional Windows Explorer look with folders and subfolders to organize the GIS layers in the viewer. The folder icons can be clicked to expand or contract the list of available GIS layers in that folder.

#### **Customized GIS Layers List**

LAYERS



### C) Educational Course, Virtual Tours and Cowardin Lookup Development

Several interactive web-based features were added to support the maps and facilitate learning about wetlands and the wetland maps. These include:

- An online course, "Exploring Wetlands for Professionals"
- Eight wetland virtual tours
- A Cowardin-system classification code lookup

To simplify the creation of online courses, an open-source learning-management system, ATutor, was installed on OWRB's Web server. This software enables course creators to build courses using an intuitive web-based interface. Authors do not need to know how to code HTML.

The multi-page wetlands virtual tours were developed using HTML, JavaScript and the web-scripting language PHP. These were built to function as a slide show and each one has a numbered slide navigation menu. To allow maximum flexibility, they were designed to be self-contained and independent of the main site's navigation.

The content for the tours was derived from "The Oklahoma Wetlands Reference Guide (James E. Henley and Mark S. Harrison, authors) by Oklahoma Conservation

Commission, Oklahoma City, Oklahoma". Images used in the virtual tours came from both the OCC and the USFWS's online digital media library.

An interactive Cowardin-System classification code lookup was built to simplify determining map codes from within the mapping system. The lookup was created using an HTML form and a PHP script. After selecting a system and subsystem code combination from a dropdown box, the script displays a table with corresponding class information. It also operates independently of the main site's navigation.

Both the virtual tours and the Cowardin-system lookup can be opened in a popup window from within the map layer without leaving the mapping system or disturbing the underlying map view.

All of the supporting features described in this section can be accessed using nearly any web browser that supports JavaScript.

The wetlands maps, online course, Cowardin lookup and virtual tours can be accessed from the NWI Mapping Project page at: <a href="http://www.owrb.ok.gov/learn/wetlands/NWImaps.php">http://www.owrb.ok.gov/learn/wetlands/NWImaps.php</a>



#### **IV. FEATURES AND USES**

#### A) Features

#### A.1) GIS Mapping Features

In addition to the features provided by the software, custom features were added to make the IWMS system more user-friendly.

#### A.1.1) Custom Zoom

The "Zoom to County" and "Zoom to Tour" custom zoom tools were added to allow the user to quickly zoom to a selected county or wetlands tour stop. The user simply clicks the drop-down arrow and then selects the county or tour stop they would like to visit and the viewer automatically zooms to that location. In the example below the user is going to zoom to the "Okmulgee Oxbow" tour stop.



The user selects the "Okmulgee Oxbow" wetland tour stop



The viewer automatically zooms into the "Okmulgee Oxbow" tour stop

The user can now utilize the customized tools to identify the wetland types and to see representative photographs and information about the "Okmulgee Oxbow" wetland. The virtual tours can be accessed not only from the project page but also from within the IWMV system. To access the virtual tour stop information the user,

- 1) Clicks on the "Virtual Tour Stops" layer to make it the active layer.
- 2) Selects the "Hotlink" tool.
- 3) Clicks on the tour stop icon on the map.



A new web browser window will open displaying the virtual tour information.



#### A.1.2) Wetland Identification

The user can query for the Cowardin information by:

- 1) Selecting the "NWI Wetlands (Area)" layer and making it the active layer.
- 2) Selecting the "Identify" tool.
- 3) Clicking on the wetland area.



A new window will open displaying the information about the selected NWI wetland area.



The "Classification" field is the Cowardin system lookup code for the NWI wetland type. The explanation for the code can be found by clicking on the linked value in the "System" field. This will open the Cowardin system lookup tool.

For this example the NWI wetland type for classification "PFO1A" is: (P)-Palustrine (FO)-Forested (1)-Broad-Leaved Deciduous (A)-Temporarily Flooded

#### A.2) Educational Features

In addition to the wetland mapping features, the web page provides opportunities to learn about wetlands and NWI maps with various educational features.

#### A.2.1) Exploring Wetland for Professionals Course

The course was developed for consultants, engineers and municipal planners since they are the most frequent users of the paper maps. The course contains an introduction and four sections covering wetlands delineation, hydrology, vegetation and soils. Definitions of key wetlands terminology are provided as well. Wetland guidance documents from U.S. Environmental Protection Agency (EPA), U.S. Army Corps of Engineers (USACOE) and U.S. Department of Agriculture Natural Resources Conservation Service (NRCS) are referenced with links to the materials on each agency's site.

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The course will be useful to engineers, city planners and others new to wetlands projects and especially those involved in section 401 and 404 CWA activities. By completing the course they will gain understanding of how the maps were created, how to use them and their limitations.

#### A.2.2) Wetlands Virtual Tours

Eight web-based wetland virtual tours were developed by OWRB in collaboration with OCC. The tours cover the major types of wetlands found in Oklahoma including: closed depression, riparian corridor, playa lake, forested wetland, swamp/marsh and oxbow. All virtual tours contain eight slides. The tours contain the same sections:

- 1. A general description of the wetland
- 2. Wetland functions and values
- 3. Vegetative community
- 4. Hydrology
- 5. Hydrologic indicators
- 6. Soils
- 7. Wetland dependent wildlife species
- 8. A final slide containing a description of the map viewer functionality with a link to the viewer.



It is hoped that the public will use the mapping system to locate and visit wetlands in the area where they live. For those that are unable to do so, the virtual tours were designed to be an alternative way to learn about Oklahoma's wetlands. The tour slides can be printed out and used as a guide by wetland visitors.

#### A.2.3) Cowardin Lookup

To assist the user in understanding the classification codes used on the maps, an interactive Cowardin-system classification code lookup was developed. After selecting the system + subsystem codes from the dropdown box, a table appears showing the corresponding classes and modifiers.

Cowardin System Lookup Tool					
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Cowardin System <sup>1</sup> Example:					
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Note:Subsytem, Subclass and Modifiers may not always be pre-					
To learn more about Wetlands visit our Wetlands online courses.					
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1 - Cowardin, L. M., V. Cather, F. C. Golds, E. T. LaRce. 1979. Clossification of welfands and deepwater habitatio of the Undeed Stabes, U. S. Department of the Interior, Fish and Wildlife Service, Washington, D.C. Jamestown, ND: Northern Prairie Mildlife Research Cather Control (1980) And Control

P:Palustrine Classes			Modifiers		
Class	Subclass			A=temporarily flooded	
RB=rock bottom	1=bedrock 2=rubble			B=Saturated C=seasonally flooded	
UB=unconsolidated bottom	1=cobble gravel 2=sand 3=mud 4=organic		Non-tidal	D=seasonally flooded, well drained E=seasonally flooded, saturated F=semi-permanently flooded G=intermittently exposed H=permanently flooded	
AB=aquatic bed	1=algal 2=aquatic moss 3=rooted vascular 4=floating vascular	Water		J=intermittently flooded K=artificially flooded W=intermittently flooded, temporary Y=saturated, semi-permanent, seasonal	

### B) Uses

The overall goal of this project is to create an Oklahoma specific wetland mapping system, which will provide increased analytical opportunities for the public as well as the private sector. The examples below demonstrate the analytical capabilities of the wetland mapping system.

#### B.1) Locate Wetlands on Public Land

To encourage users to visit wetland areas, a custom "Buffer" tool was created to allow users to select a GIS layer feature and locate wetlands within a defined distance from the selected GIS feature. An example of this application is illustrated below.

The user wants to find all of the wetland areas on publicly accessible lands within 5 miles of the Yukon public school district.

- 1) The user would turn on the "School Districts" layer and make it active.
- 2) Next the user would click the "Find" tool.
- 3) Enter "Yukon" in the text box and click "Find String".
- 4) The results window opens with Yukon district record. Click the "Rec" 1 value to select and zoom to the Yukon school district.



Now that the school district is selected, find all of the publicly accessible lands within 5-miles of the district.

- 1) Click the "Buffer" tool.
- 2) Click the drop-down button, scroll down and select "Government Boundaries".
- 3) Enter a "5" for the number of Miles around the selected features of School Districts.
- 4) Check the box to "Display Attributes".
- 5) Click the "Create Buffer" button.
- 6) The three records returned are publicly accessible government lands within 5-miles of the Yukon school district.



The next step is to select the "Government Lands" that the user would like to visit. In this example the user will select the "Stinchcomb Wildlife Refuge".

- 1) Make the "Government Lands" layer visible and active.
- 2) Click the "Find" button
- 3) Enter the text "Stinchcomb" and click "Find String".
- 4) Click the "Rec" 1 link to zoom to the wildlife refuge.



- 5) Click the "Buffer" tool.
- 6) Click the drop-down button, scroll down and select "NWI Wetlands (Area)".
- 7) Enter a "0" for the number of Miles around the selected features of NWI Wetlands (Area).

- 8) Check the box to "Display Attributes".
- 9) Click the "Create Buffer" button.
- 10) The records displayed are NWI wetland areas in the Stinchcomb Wildlife Refuge.



### B.2) Identify Wetlands in Developing Areas

The Wetlands Viewer was also designed to aid professionals when working with wetlands. In the next example, a land developer is interested in purchasing land for a new neighborhood. The developer can use the Wetlands Viewer as a tool to identify potential areas of concern when building around wetland areas. The area of interest is located north of the town of Luther, in Northeast Oklahoma County. The legal description for the land is Section 22, Township 14N, Range 01EI.

- 1) Zoom to Oklahoma County using the "Zoom to County" tool.
- 2) Turn on the "PLSS Layers" group folder from the GIS layer list.
- 3) Select the "In" tool.
- 4) Hold the left mouse button down and draw a rectangle around Township 14N, Range 01EI.



5) The "PLSS Sections" layer is now visible. Using the "In" tool, draw a rectangle around Section 22.



Use the available land cover GIS layers to get a better understanding of land's characteristics

- 6) Turn on the "2003 Color Aerials" layer.
- 7) Turn on the "Municipal Boundaries" GIS layer. The area of land is within the Luther municipal boundary. The developer would now know he/she could contact the Town of Luther for development and building codes.
- Turn off the "Municipal Boundaries" GIS layer and verify that the NWI wetland layers are visible. There are several NWI wetland areas in this section of land.
- 9) Turn on the "Hydric Soils" GIS layer. There is a large area on the Eastern edge of the section that is classified as being hydric soils.



- 10) Turn on the "Surficial Geology" GIS layer. The majority of the surficial geology of this section is alluvium material.
- 11) Turn on the "Topographic Maps" GIS layer. This GIS layer can be used to see changes in surface elevation and other key features.



These examples demonstrate how the wetlands interactive viewer increases analytical opportunities for both the pubic and private sectors. There are many other possible uses for the mapping system by education, professionals and the public. These could include:

#### Research

By digitizing the maps and making them available as a GIS layer, researchers gain additional analytical capabilities. The wetlands layers can be viewed over other layers such as orthophotos, geology, aquifer boundaries and urban areas. This will help to enhance their understanding of relationships between the wetlands and these layers. For instance, a hydrogeologist may be able to use the wetlands maps overlain on the geology or aquifer boundaries to locate areas groundwater discharge such as springs.

#### Education

Teachers and students in primary, secondary and higher education can utilize the system for locating wetlands for classroom activities. The interactive nature of the mapping system will be a powerful way to engage students to learn about wetlands.

PRIMARY AND SECONDARY EDUCATORS:

- Use the distance tool to locate nearby wetlands on state and federal land for field trips.
- Incorporate virtual tours and maps into lesson plans and student exercises.

- Understand wetlands in a larger context by viewing relationships with data on other layers.
- Encourage students to visit wetlands, be proactive in protecting wetlands in their community.

#### HIGHER EDUCATION:

Many disciplines will be able to use this to locate wetlands for classroom activities or research projects in areas such as environmental science, biology, chemistry, hydrology, soils, and forestry. The system can also be used to study relationships between wetlands and data on the other layers.

#### Professionals

The educational course helps the new wetlands professional understand wetlands and wetlands maps. The maps can be used to assist them in developing 401 and 404 CWA permit applications.

#### Volunteer Monitoring

Volunteer monitoring groups such as Oklahoma Water Watch and Blue Thumb could use this to locate and determine valuable sites to monitor.

#### Public Access to Information

Implementation of this web-based system is giving citizens unprecedented access to mapping technology and data. Only a few years ago, they could only view it by visiting an agency that had the desktop software to view the maps. However, they would not be able to directly interact with the software. Making wetlands maps available online allows the public to interact with the mapping system. This helps them develop a first-hand understanding of the issues. They become more empowered to participate in decisions impacting wetlands than ever before.

#### V. CONCLUSION AND FUTURE PLANS

This project was a great success on several levels by utilizing partnerships among state and federal agencies, creating a usable digital format for wetlands maps, providing online access to wetland maps, enabling varied use of the maps through ArcIMS tools, and offering educational material to help users better understand wetland maps and wetland systems. This project served as a foundation on which to build a statewide digital wetland coverage, which will be completed in early 2009. In addition, the digital wetland coverage will be utilized by the state as a tool for tracking wetland status and trends, wetland monitoring, watershed planning, protecting and avoiding wetlands during development, locating areas for restoration, and updating the digital wetland coverage.

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### APPENDIX A (Project Workplan)

Agency:

In Cooperation with: Oklahoma Conservation Commission Oklahoma Water Resources Board Oklahoma State University US Fish & Wildlife Service

Title:

National Wetland Inventory Map Digitization

#### Background:

Comprehensive wetland management in the State of Oklahoma is hindered by the limited accessibility of pertinent information. Wetland maps are available from the US Fish & Wildlife Service (USFWS), but accessing the information can be inconvenient and the usability is somewhat limited. The National Wetlands Inventory (NWI) maps are housed at only one agency in Oklahoma. This inaccessibility hampers planning and management of wetland resource for the public and private sectors. Furthermore, this information is only available in hard copy, which constrains the utility of the data for in depth evaluation and detailed management applications.

As the USFWS states on their web page, the NWI maps are a critical management tool used by scores of agencies and groups. These maps are widely viewed as a determinant factor in identification and subsequent management of wetland resources. This point alone illustrates the importance of unfettered accessibility to the resource.

"Users of NWI maps and digital data are as varied as are the uses. Maps are used by all levels of government, academia, Congress, private consultants, land developers, and conservation organizations. The public makes extensive use of NWI maps in a myriad of applications including planning for watershed and drinking water supply protection; siting of transportation corridors; construction of solid waste facilities; and siting of schools and other municipal buildings. Resource managers in the Service and the States are provided with maps which are essential for effective habitat management and acquisition of important wetland areas needed to perpetuate migratory bird populations....for fisheries restoration; floodplain planning; and endangered species recovery plans. Regulatory agencies use the maps to help in advanced wetland identification procedures, and to determine wetland values and mitigation requirements. Private sector planners use the maps to determine location and nature of wetlands to aid in framing alternative plans to meet regulatory requirements. The maps are instrumental in preventing problems from developing and in providing facts that allow sound business decisions to be made quickly, accurately, and efficiently. Good planning protects the habitat value of wetlands for wildlife, preserves water quality, provides flood protection, and enhances ground water recharge, among many other wetland values."

The Emergency Wetland Resources Act of 1986 requires the development of a digital wetland database. However, due to the number of maps to be digitized and "the 100% user-pay basis on which NWI digitizes most of the wetland maps," a number of

government and private agencies have initiated in-house digitization of NWI maps. In order to be able to accept NWI maps digitized by other entities, USFWS prepared a guidance document titled "*Procedures for Acceptance and Testing of Digital Data from Other Producing Agencies.*" The document details procedures and quality assurance requirements for data to be included in USFWS's national wetlands digital database.

With the creation of the digital wetlands data, users within the state, as well as around the country and world, will be able to access the information. By making the digitized wetland maps available through a web based mapping system, such as ArcIMS, the public would be able to access this information through a user-friendly interface. The ArcIMS site would allow users to combine the wetland information with other data layers currently available in the State of Oklahoma such as the Digital Orthophotography. This would not only allow the public access to the important wetland data but also the ability to view this data with other information that would give the general user the ability to make informed decisions about their specific area of interest in Oklahoma. As an educational tool this site could be combined with wetland related information to not only allow people to locate the wetlands in Oklahoma but also educate them about the precious resource that is so valuable to the state.

Numerous state, federal, local, and private organizations have supported the conversion of wetland information to digital data across the country, but Oklahoma lags behind. The Oklahoma Conservation Commission (OCC) is currently digitizing over 100 maps; however, this equates to only ~10% of the state. This project will digitize 340 maps and will address the accessibility of those maps from two perspectives. First it would allow for the creation of digital information, and second it would provide the public and private sectors access to the information necessary to make informed decisions as well as provide computer interface features to interact with the data. The digital maps produced through this project will meet USFWS's *"NWI Technical Specifications for Digitizing"*.

The OCC and the Oklahoma Water Resource Board (OWRB) would work jointly in both of these endeavors under the guidance and oversight of the Office of the Secretary of the Environment (OSE). The OCC would enter into agreement with the USFWS to digitize the NWI maps according to their specifications. In return, the digital information would be provided to the USFWS for incorporation into their NWI system. The OWRB and the OCC would work together in developing a user-friendly access system that would allow Oklahomans, as well as anyone else with web access, to directly interact with maps and several other information layers regarding wetlands within the State. The Oklahoma wetlands mapping system will allow an in-depth analysis of wetlands and using USFSW codes it will also be possible to create wetland maps by type and to analyze the relationship of type to natural features such as geology, streams, aquifers, etc. Other data layers would include, but would not be limited to, Digital Orthophotography, streams, lake, roads, cities and towns, water quality data, cultural, agriculture, etc.

#### Goal:

To create an Oklahoma specific interactive wetland mapping system, which will provide increased analytical opportunities for the public as well as the private sectors.

#### Measures of Success:

- 1. Generation of 340 digital wetland maps meeting USFWS standards.
- 2. Creation of a multi-page web-based wetland educational tool.
- 3. Development of an interactive web-based GIS mapping tool allowing the public to:

a) View the location of wetlands in Oklahoma

b) Discover relationships between wetlands and the environment by creating maps using the digitized Oklahoma wetland maps coverage overlaid on Oklahoma specific coverages such as digital orthophotos, stream systems, geology, watershed maps, water quality data, etc.

#### Workplan:

October 2003 through September 2006

#### Task 1: Digitization of NWI Maps

The Oklahoma Conservation Commission will enter into agreement with the USFWS for assistance in digitizing the NWI maps. The USFWS will supply the necessary materials (overlays and bluelines) for the 340 NWI maps and the OCC will digitize the maps with the help of the Oklahoma State University or other entities. The digitization will meet all specifications as required by the USFWS. Selection of the 340 maps would be based on immediate need (scheduled and active projects involving wetlands resources), USFWS priorities, watershed boundaries, as well as from input from other agencies and Wetlands Working Group members. As a result of this project, approximately 1/3 of the NWI maps would be digitized for Oklahoma.

Milestone Date:	January 2006
Deliverable:	MOA with USFWS
	Letter stating that the USFWS has accepted the digitized products
	as complete and accurate.
Costs:	\$100,836 (\$75,627 federal)

#### Task 2: Development of Interactive Web Page Mapping System

ESRI's Internet Mapping System (Arc/IMS) will be utilized to create an interactive wetlands mapping and analysis tool. The system will provide the opportunity for users to display and query coverages along with pre-existing Oklahoma GIS coverages. The ability to create maps of the wetlands overlaid on Oklahoma coverages such as digital orthophotos, stream systems, etc. will provide increased analytical opportunities for the public. The site will be dynamic in nature allowing for the addition of coverages as they become available. The cost of this task includes a consulting fee to setup and implement Arc/IMS with customization.

Visitors to this site will be guided through a multi-page wetland education section structured to help them understand wetlands and their importance to wildlife and the environment. The last part of web site will encourage them to visit a wetland. Two options to do this will be provided: "Visit a wetland on Public land" – there will be maps, pictures and information on wetlands on Federal and state lands and "Visit a wetland in their area" – using the interactive wetlands mapping and analysis tool they will be able to locate wetlands in their area.

Milestone Date:	September 2008
Deliverable:	Letter report describing the features of the web page and a link to
	the web page for EPA review.
Costs:	\$62,831 (\$47,123 federal)

#### Task 3: Quarterly and Final Reports

Milestone Date:<br/>Deliverable:December 2003 through September 2008<br/>Quarterly reports will be written to provide an update on the status<br/>of the project. A final report will be submitted to EPA, which<br/>summarizes all the activities associated with this project as well as<br/>a section that documents the utility of this effort.Costs:\$3,000 (\$2,250 federal)

#### **Budget Categories:**

	Federal	State	Total
Personnel	\$24,662	\$8,220	\$32,882
Fringe Benefits	\$9,782	\$3,260	\$13,042
Equipment			0
Travel	\$2,303	\$768	\$3,071
Supplies	\$5,612	\$1,871	\$7,483
Contracting*	\$70,753	\$23,584	\$94,337
Total Direct Charges	\$114,967	\$38,322	\$153,289
Indirect Charges @ 20%	\$11,888	\$3,963	\$15,851
Total	\$125,000	\$41,666	\$166,666

### Personnel:

	Person Years	Amount
000		
Executive Director	0.01	\$ 557.00
Assistant Director	0.01	\$ 580.00
Administrative Officer	0.01	\$ 550.00
Administrative Assistant	0.01	\$ 420.00
Wetlands Program Coordinator	0.11	\$ 3,320.00
GIS Specialist	0.08	\$ 3,000.00
OWRB		
GIS Developer	0.14	\$ 11,282.00
Web Developer	0.09	\$ 9,896.00
System Administrator	0.02	\$ 1,237.00
IT Manager	0.01	\$ 1,050.00
Database Administrator	0.01	\$ 990.00
Total		\$ 32,882.00

### Supplies:

	Amount	
000		
Office Supplies (paper, pen, printer ink, etc)	\$	350.00
Resource Materials	\$	317.00
OWRB		
128 GB Disk Array	\$	4,480.00
24U Rack	\$	2,336.00
Total	\$	7,483.00

### **Contractual:**

	Amount	
000		
OSU for digitizing and training	\$	90,667.00
OWRB		
Training Courses		
Intro into ARC/IMS (1 person to attend)	\$	1,200.00
ARC/IMS Administration (1 person to attend)	\$	900.00
Learning ARC/IMS (Web based training - 3 people)	\$	180.00
Customizing ARC/IMS (Advanced - 1 person to attend)	\$	1,350.00
Customizing ARC/IMS Basic (Web based training - 1 person)	\$	40.00
Total	\$	94,337.00

### APPENDIX B (Quality Assurance Project Plan)

# **National Wetland Inventory Map Digitization**

### Oklahoma's FY 03 104(b)(3) Wetlands Program CA#CD-976400-01

# **Quality Assurance Project Plan**

Submitted by:

Oklahoma Conservation Commission Water Quality Division P. O. Box 53134 Oklahoma City, Oklahoma 73152

Phone: (405) 522-4525

June 2004

# National Wetland Inventory Map Digitization Quality Assurance Project Plan Approval Page June 2004

Approving Of	fficers:	
Name:	<b>Lawrence R. Edmison</b> – Program Director, Commission, Water Quality Division	Oklahoma Conservation
	Signature:	Date:
Name:	<b>Christopher R. DuBois</b> – Project Manager, Commission, Water Quality Division	Oklahoma Conservation
	Signature:	Date:
Name:	<b>Shanon Phillips</b> – Quality Assurance Officer, Oklaho Commission, Water Quality Division	oma Conservation
	Signature:	Date:
Name:	Reymundo F. Aragón – Contracting Officer, US Fish	and Wildlife Service
	Signature:	Date:
Name:	<b>Mark Gregory</b> – Department of Plant and Soil University	Science, Oklahoma State
	Signature:	Date:
Name:	<b>Jennifer Myers Wasinger</b> – Environmental Oklahoma Office of the Secretary of the Environ	Program Administrator, ment
	Signature:	Date:
Name:	<b>Tyrone M. Hoskins</b> – Project Officer, Region VI L Protection Agency	Inited States Environmental
	Signature:	Date:
Name:	<b>Approving Officer</b> – Office of Water Quality, Environmental Protection Agency	Region VI United States
	Signature:	Date:

### **Project Objectives and Responsibilities**

### **Objectives and Purpose**

The purpose of this project is to use the US Fish and Wildlife Service's National Wetland Inventory (NWI) maps to create an Oklahoma specific interactive wetland mapping system, which will provide increased analytical opportunities for the public as well as the private sectors. The following objectives are required to meet that goal:

### • Digitization of NWI Maps

The USFWS NWI maps are hard copies of the wetlands in the United States. To make them available to a larger number of users, they must be digitized.

### • Development of an Interactive Web Page Mapping System

Through ESRI's Internet Mapping System (Arc/IMS), the digitized NWI maps will be used to create an interactive wetlands mapping and analysis tool.

### Project Participants

# US Fish and Wildlife Service

Reymundo F. Aragón, Chief, DCGS, Region 2

Responsibilities:

- Provide the NWI maps specified in the appendix and all developed materials necessary for digitizing to the contractor, Oklahoma State University
- Provide access to the USFWS secure web site to download NWI software for quality assurance/quality control
- Provide the most current digitizing conventions of the NWI
- Perform final data checks for quality assurance
- Send OCC the final digital file for each quadrangle once accepted by the NWIC

# **Oklahoma Conservation Commission**

Christopher DuBois, Wetland Coordinator

Responsibilities:

- Provide consultation and advice to OSU on the digitization process
- Deliver to USFWS digital files for the 1:24,000-scale map areas specified in the appendix
- Deliver the final USFWS-approved digitized NWI maps to the Oklahoma Water Resources Board for development of the interactive web site

### Oklahoma State University

Mark Gregory, Department of Plant and Soil Science

Responsibilities:

- Digitization of the NWI maps included in the appendix according to USFWS established procedures as established in the USFWS document *Procedures for Acceptance and Testing of Digital Data from Other Producing Agencies*
- Access the USFWS web site to download inventory software for quality assurance/quality control

- Perform quality control and provide quality assurance to OCC for all digital files
- Correct deficiencies in the digital files as deemed necessary by USFWS

### **Oklahoma Water Resources Board**

Ed Eckenstein, Application Specialist, Information Services Department

Responsibilities:

Develop and host interactive web page wetland mapping system

### Data Sources and Selection

As they are the only agency to have compiled wetland maps of the United States, the USFWS will provide the sole source of data in this project. This data is the National Wetland Inventory maps for Oklahoma. The specific maps to be digitized are included in the appendix. The majority of these maps were selected in order to obtain digitized maps of the wetter area of the state. The southeastern corner of Oklahoma supports many types of wetlands including oxbows, cypress swamps and seeps. Additional sites were selected across the state from the panhandle to the eastern border to obtain as much statewide coverage, while focusing on the wettest portion of the state. In this way, more of a statewide mapping effort can be initiated in the web design.

This source of secondary data will be identified in all project deliverables.

### Quality of Secondary Data

The US Fish and Wildlife Service developed their hard copy wetland maps of Oklahoma from aerial photographs taken in 1981. "The purpose of this survey was not to map all wetlands and deepwater habitats of the United States, but rather to use aerial photointerpretation techniques to produce thematic maps that show, in most cases, the larger ones and types that can be identified by such techniques. The objective was to provide better geospatial information on wetlands than found on the U.S. Geological Survey topographic maps. It was not the intent of the NWI to produce maps that show exact wetland boundaries comparable boundaries derived from ground to surveys. Boundaries are therefore generalized in most cases. Consequently, the quality of the wetland data is variable mainly due to source photography, ease or difficulty of interpreting specific wetland types, and survey methods (e.g., level of field effort and state-of-the-art of wetland delineation)" (USFWS, 1981).

"NWI maps are compiled through manual photointerpretation of NHAP or NAPP aerial photography supplemented by Soil Surveys

and field checking of wetland photo signatures. Delineated wetland boundaries are manually transferred from interpreted photos to USGS 7.5 minute topographic quadrangle maps and then manually labeled. Quality control steps occur throughout the photointerpretation, map compilation, and map reproduction processes" (USFWS, 1981).

The maps received from the US Fish and Wildlife Service will be reviewed for completeness to ensure that all maps requested were received.

# Data Reporting and Data Validation

A final report will be prepared for this project. The report will include sufficient information to meet project objectives. Additionally, an interactive web site mapping system will be produced.

The final maps will be verified for accuracy by the US Fish and Wildlife Service. Minor corrections will be performed by the US Fish and Wildlife Service. Major corrections will be performed by Oklahoma State University.

### References

U. S. Fish and Wildlife Service. 1981. National Wetlands Inventory website. U.S. Department of the Interior, Fish and Wildlife Service, St. Petersburg, FL. http://www.nwi.fws.gov.

### APPENDIX C (Digitized NWI Quadrangle Maps)

### Oklahoma digitizing

<u>Oklahoma digi</u>	itizing				POLYGON	PAPER
1:100K UNIT	NAME	STATE1	STATE2	INDEX_CODE	OVERLAY	COMP
		01/		0.4000 00		
		OK		34096-G6	1	1
ARDMORE NE	AHLUSU	0K		34096-F6	1	1
ARDMORE NE	ALLEN	0K		34096-H4	1	1
ARDMORE NE	ASHER	OK		34096-H8	1	1
ARDMORE NE	ASHLAND	OK		34096-G1	1	1
ARDMORE NE	CALVIN EAST	OK		34096-H2	1	1
ARDMORE NE	CALVIN WEST	OK		34096-H3	1	1
ARDMORE NE	CENTRAHOMA	OK		34096-E3	1	1
ARDMORE NE	COALGATE	OK		34096-E2	1	1
ARDMORE NE	COALGATE SE	OK		34096-E1	1	1
ARDMORE NE	FITTSTOWN	OK		34096-E6	1	1
ARDMORE NE	FRANCIS	OK		34096-G5	1	1
ARDMORE NE	GERTY	OK		34096-G3	1	1
ARDMORE NE	HARDEN CITY	OK		34096-E5	1	1
ARDMORE NE	HART	OK		34096-F8	1	1
ARDMORE NE	KONAWA	OK		34096-H7	1	1
ARDMORE NE	LULA	OK		34096-F4	1	1
ARDMORE NE	NON	OK		34096-G2	1	1
ARDMORE NE	PARKER	OK		34096-F2	1	1
ARDMORE NE	ROFF NORTH	OK		34096-F7	1	1
ARDMORE NE	ROFF SOUTH	OK		34096-E7	1	1
ARDMORE NE	SASAKWA	OK		34096-H5	1	1
ARDMORE NE	STEEDMAN	OK		34096-G4	1	1
ARDMORE NE	STONEWALL	OK		34096-F5	1	1
ARDMORE NE	STRATFORD	OK		34096-G8	1	1
ARDMORE NE	STUART	OK		34096-H1	1	1
ARDMORE NE	SULPHUR NORTH	OK		34096-E8	1	1
ARDMORE NE	TUPELO	OK		34096-E4	1	1
ARDMORE NE	TUPELO NE	OK		34096-F3	1	1
ARDMORE NE	VAMOOSA	OK		34096-H6	1	1
ARDMORE NE	VANOSS	OK		34096-G7	1	1
ARDMORE NE	WARDVILLE	OK		34096-F1	1	1
ARDMORE NW	BYARS	ОК		34097-G1	1	1
ARDMORE NW	BYARS SW	OK		34097-G2	1	1
ARDMORE NW	DAVIS	OK		34097-E1	1	1
ARDMORE NW	JOY	OK		34097-E2	1	1
ARDMORE NW	PAULS VALLEY	ОК		34097-F2	1	1
ARDMORE NW	PAULS VALLEY NE	ОК		34097-F1	1	1
ARDMORE NW	ROSEDALE	OK		34097-H2	1	1
ARDMORE NW	WANETTE	ОК		34097-H1	1	1
ARDMORE SE	BENNINGTON NORTH	ОК		34096-A1	1	1
ARDMORE SE	BENTLEY	ОК		34096-B1	1	1
ARDMORE SE	BOGGY DEPOT	ОК		34096-C3	1	1
ARDMORE SE	BOKCHITO	OK		34096-A2	1	1
ARDMORE SE	BRUNO	OK		34096-C1	1	1

					Page so d	01 44
ARDMORE SE	CADDO NORTH	OK		34096-B3	1	1
ARDMORE SE	CADDO NW	OK		34096-B4	1	1
ARDMORE SE	CADDO SOUTH	OK		34096-A3	1	1
ARDMORE SE	CANEY	OK		34096-B2	1	1
ARDMORE SE	CONNERVILLE	OK		34096-D6	1	1
ARDMORE SE	CONNERVILLE NE	ОК		34096-D5	1	1
ARDMORE SE	CONNERVILLE SE	OK		34096-C5	1	1
ARDMORE SE	DURANT NORTH	OK		34096-A4	1	1
ARDMORE SE	KINGSTON NORTH	OK		34096-A6	1	1
ARDMORE SE	LEHIGH	OK		34096-D2	1	1
ARDMORE SE	MADILL	OK		34096-A7	1	1
ARDMORE SE	MANNSVILLE	OK		34096-B8	1	1
ARDMORE SE	MCMILLAN	OK		34096-A8	1	1
ARDMORE SE	MILBURN	OK		34096-B5	1	1
ARDMORE SE	MILL CREEK	OK		34096-D7	1	1
ARDMORE SE	NEBO	ОК		34096-C8	1	1
ARDMORE SE	OLNEY	ОК		34096-D3	1	1
ARDMORE SE	RAVIA	ок		34096-B7	1	1
ARDMORE SE	REAGAN	OK		34096-C6	1	1
ARDMORE SE	STRINGTOWN	OK		34096-D1	1	1
ARDMORE SE	SULPHUR SOUTH	OK		34096-D8	1	1
ARDMORE SE	TROY	OK		34096-C7	1	1
ARDMORE SE	TUSHKA	OK		34096-C2	1	1
ARDMORE SE		OK		34096-D4	1	. 1
ARDMORE SE	WAPANUCKA SOUTH	OK		34096-C4	1	. 1
		on				
ARDMORF SW	ARDMORE FAST	ОК		34097-B1	1	1
ARDMORE SW	ARDMORE WEST	OK		34097-B2	1	. 1
ARDMORE SW	DOUGHERTY	OK		34097-D1	1	1
ARDMORE SW	GENE AUTRY	OK		34097-C1	1	. 1
ARDMORE SW		OK		34097-A1	1	. 1
ARDMORE SW	OVERBROOK	OK		34097-A2	1	. 1
ARDMORE SW	SPRINGER	OK		34097-C2	1	1
ARDMORE SW		OK		34097-D2	1	1
		on		CICCI DE		
CLINTON NW	ANTELOPE HILLS NE	OK		35099-H7	1	1
CLINTON NW	BUTIER	OK		35099-F2	1	1
	CARPENTER	OK		35099-E3	1	1
	CRAWFORD	OK		35099-G7	1	1
	FOSS DAM	OK		35099-E2	1	1
	ROLL	OK		35099-G6	1	1
	ROLL NE	OK		35099-45	1	1
	ROLL NW	OK		35099-H6	1	1
	ROLL SE	OK		35099-05	1	1
CEINTON NW	ROLL SE	OK		33033-03	I	'
CLINTON SW	BUILL CREEK (Frick SW)	OK		35090-48	1	1
	MINNOW CREEK (Frick SE)	OK		35000-47	1	י 1
	RETROP SE	OK		35000-43	1	1
		UN		000 <i>99</i> -A0	1	1
	HARDY	OK	KS	36096-47	1	1
		0.0	1.0	00000-117	1	

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					Fage 39	01 44
ENID NE	KAW CITY	OK		36096-G7	1	1
ENID NE	KAW CITY NW	OK	KS	36096-H8	1	1
ENID NE	UNCAS	OK		36096-G8	1	1
FORT SMITH NE	BLACKGUM	OK		35094-E8	1	1
FORT SMITH NE	BRUSHY	OK		35094-E6	1	1
FORT SMITH NE	MARBLE CITY	OK		35094-E7	1	1
FORT SMITH NE	NICUT	OK		35094-E5	1	1
FORT SMITH NE	UNIONTOWN	AR	OK	35094-E4	1	1
FORT SMITH NW	GORE	OK		35095-E1	1	1
FORT SMITH NW	WEBBERS FALLS	OK		35095-E2	1	1
	POKOSHE	OK		25004 D7	4	1
			OK	35094-D7	1	1
FORT SMITH SE	FORTSMITH	AR	ÜK	35094-D4	1	1
FORTSMITHSE	GANS	UK AR	01/	35094-D6	1	1
FORT SMITH SE		AR	OK	35094-B4	1	1
FORT SMITH SE	HARTFORD	AR	OK	35094-A4	1	1
FORT SMITH SE	MCCURTAIN	OK		35094-B8	1	1
FORT SMITH SE	MCCURTAIN SW	OK		35094-A8	1	1
FORT SMITH SE	MULDROW	OK		35094-D5	1	1
FORT SMITH SE	PANAMA	OK		35094-B6	1	1
FORT SMITH SE	POTATO PEAKS	OK		35094-A7	1	1
FORT SMITH SE	POTEAU EAST	OK		35094-A5	1	1
FORT SMITH SE	POTEAU WEST	OK		35094-A6	1	1
FORT SMITH SE	SALLISAW	OK		35094-D7	1	1
FORT SMITH SE	SPIRO	OK		35094-B5	1	1
FORT SMITH SE	VIAN	OK		35094-D8	1	1
FORT SMITH SW	BLOCKER	OK		35095-A5	1	1
FORT SMITH SW	CROWDER	OK		35095-A6	1	1
FORT SMITH SW	ENTERPRISE	OK		35095-B4	1	1
FORT SMITH SW	FEATHERSTON	OK		35095-A4	1	1
FORT SMITH SW	FORT COFFEE	OK		35094-C5	1	1
FORT SMITH SW	HOLT MOUNTAIN	OK		35095-D2	1	1
FORT SMITH SW	KEOTA	OK		35094-C8	1	1
FORT SMITH SW	KINTA	OK		35095-A2	1	1
FORT SMITH SW	LAFAYETTE	OK		35095-B1	1	1
FORT SMITH SW	LAKE MCALESTER	OK		35095-A7	1	1
FORT SMITH SW	LEQUIRE	OK		35095-A1	1	1
FORT SMITH SW	MULDROW SW	OK		35094-C6	1	1
FORT SMITH SW	QUINTON NORTH	OK		35095-B3	1	1
FORT SMITH SW	QUINTON SOUTH	OK		35095-A3	1	1
FORT SMITH SW	ROBERT S KERR DAM	OK		35094-C7	1	1
FORT SMITH SW	SANS BOIS	OK		35095-B2	1	1
FORT SMITH SW	SCIPIO	OK		35095-A8	1	1
FORT SMITH SW	SOUTH FORT SMITH	AR	OK	35094-C4	1	1
FORT SMITH SW	STIGLER EAST	OK		35095-C1	1	1
FORT SMITH SW	STIGLER NE	OK		35095-D1	1	1
FORT SMITH SW	STIGLER WEST	OK		35095-C2	1	1

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LAWTON NW	LAKE ALTUS	OK		34099-H3	1	1
LAWTON NW	MADGE	OK		34099-H8	1	1
LAWTON NW	VINSON	OK		34099-H7	1	1
McALESTER NE	BATES	AR	OK	34094-H4	1	1
McALESTER NE	BIG CEDAR	OK		34094-F6	1	1
McALESTER NE	BLACKJACK RIDGE	OK		34094-G8	1	1
McALESTER NE	HEAVENER	OK		34094-H5	1	1
McALESTER NE	HODGENS	OK		34094-G6	1	1
McALESTER NE	HONOBIA	OK		34094-E8	1	1
McALESTER NE	HONTUBBY	OK		34094-G5	1	1
McALESTER NE	LEFLORE	OK		34094-H8	1	1
McALESTER NE	LEFLORE SE	OK		34094-G7	1	1
McALESTER NE	LOVING	AR	OK	34094-G4	1	1
McALESTER NE	LUDLOW	OK		34094-E7	1	1
McALESTER NE	LYNN MOUNTAIN	OK		34094-E5	1	1
McALESTER NE	MOUNTAIN FORK	AR	OK	34094-F4	1	1
McALESTER NE	MUSE	OK		34094-F7	1	1
McALESTER NE	OCTAVIA	OK		34094-E6	1	1
McALESTER NE	PAGE	OK		34094-F5	1	1
McALESTER NE	SUMMERFIELD	OK		34094-H7	1	1
McALESTER NE	WHITESBORO	OK		34094-F8	1	1
McALESTER NE	WISTER	OK		34094-H6	1	1
McALESTER NE	ZAFRA	AR	OK	34094-E4	1	1
McALESTER NW	ADAMSON	OK		34095-H5	1	1
McALESTER NW	ADEL	OK		34095-E5	1	1
McALESTER NW	ALBION	OK		34095-F1	1	1
McALESTER NW	ALBION SE	OK		34095-E1	1	1
McALESTER NW	ALBION SW	OK		34095-E2	1	1
McALESTER NW	BAKER MOUNTAIN	OK		34095-G2	1	1
McALESTER NW	CLAYTON	OK		34095-E3	1	1
McALESTER NW	COUNTS	OK		34095-F5	1	1
McALESTER NW	DAISY	OK		34095-E6	1	1
McALESTER NW	DAMON	OK		34095-G3	1	1
McALESTER NW	GOWEN	OK		34095-H4	1	1
McALESTER NW	HARTSHORNE	OK		34095-G5	1	1
McALESTER NW	HARTSHORNE SW	OK		34095-G6	1	1
McALESTER NW	HAYWOOD	OK		34095-H8	1	1
McALESTER NW	HIGGINS	OK		34095-G4	1	1
McALESTER NW	KIAMICHI	OK		34095-F2	1	1
McALESTER NW	KIOWA	OK		34095-F8	1	1
McALESTER NW	KREBS	OK		34095-H6	1	1
McALESTER NW	LIMESTONE GAP	OK		34095-E8	1	1
McALESTER NW	MCALESTER	OK		34095-H7	1	1
McALESTER NW	MCALESTER SW	ОК		34095-G8	1	1
McALESTER NW	PANOLA	ОК		34095-H2	1	1
McALESTER NW	PITTSBURG	ОК		34095-F7	1	1
McALESTER NW	RED OAK	OK		34095-H1	1	1

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McALESTER NW	REDDEN	OK		34095-E7	1	1
McALESTER NW	SARDIS	OK		34095-F4	1	1
McALESTER NW	SAVANNA	OK		34095-G7	1	1
McALESTER NW	STANLEY	OK		34095-E4	1	1
McALESTER NW	TALIHINA	OK		34095-G1	1	1
McALESTER NW	ті	OK		34095-F6	1	1
McALESTER NW	WILBURTON	OK		34095-H3	1	1
McALESTER NW	YANUSH	OK		34095-F3	1	1
McALESTER SE	BATTIEST	OK		34094-D8	1	1
McALESTER SE	BEAR MOUNTAIN	ОК		34094-B8	1	1
McALESTER SE	BETHEL	ОК		34094-C7	1	1
McALESTER SE	<b>BIG HUDSON CREEK</b>	ОК		34094-C5	1	1
McALESTER SE	BOG SPRINGS	AR	OK	34094-C4	1	1
McALESTER SE	BROKEN BOW	OK		34094-A6	1	1
McALESTER SE	CHAPEL HILL	AR	OK	34094-A4	1	1
McALESTER SE	COVE	AR	OK	34094-D4	1	1
McALESTER SE	DE QUEEN NW	AR	OK	34094-B4	1	1
McALESTER SE	EAGLETOWN	ОК		34094-A5	1	1
McALESTER SE	GOLDEN	OK		34094-A8	1	1
McALESTER SE	HEE CREEK	OK		34094-C6	1	1
McALESTER SE	OLD GLORY MOUNTAIN	OK		34094-B7	1	1
McALESTER SE	ROCKEY CREEK	OK		34094-C8	1	1
McALESTER SE	SMITHVILLE	OK		34094-D6	1	1
McALESTER SE	STEEL JUNCTION	OK		34094-A7	1	1
McALESTER SE	STEPHENS GAP	OK		34094-B6	1	1
McALESTER SE	TOBLERVILLE	OK		34094-B5	1	1
McALESTER SE	WATSON	OK		34094-D5	1	1
McALESTER SE	WHITE ROCK MOUNTAIN	OK		34094-D7	1	1
McALESTER SW	ALIKCHI	OK		34095-B1	1	1
McALESTER SW	ANTLERS EAST	OK		34095-B5	1	1
McALESTER SW	ANTLERS WEST	OK		34095-B6	1	1
McALESTER SW	BOSWELL	OK		34095-A7	1	1
McALESTER SW	BOSWELL NW	OK		34095-B8	1	1
McALESTER SW	BOSWELL SW	OK		34095-A8	1	1
McALESTER SW	CANEY MOUNTAIN	OK		34095-C2	1	1
McALESTER SW	CLEBIT	OK		34095-D1	1	1
McALESTER SW	CLOUDY	OK		34095-C3	1	1
McALESTER SW	DARWIN	OK		34095-B7	1	1
McALESTER SW	DUNBAR	OK		34095-D5	1	1
McALESTER SW	FARRIS	OK		34095-C7	1	1
McALESTER SW	FINLEY	OK		34095-C4	1	1
McALESTER SW	FORT TOWSON	OK		34095-A3	1	1
McALESTER SW	HUGO	OK		34095-A5	1	1
McALESTER SW	HUGO DAM	OK		34095-A4	1	1
McALESTER SW	JUMBO	OK		34095-D6	1	1
McALESTER SW	KOSOMA	OK		34095-C5	1	1
McALESTER SW	LANE	OK		34095-C8	1	1
McALESTER SW	LANE NE	OK		34095-D7	1	1

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McALESTER SW	LANE NW	OK	34095-D8	1	1
McALESTER SW	MOYERS	OK	34095-C6	1	1
McALESTER SW	NASHOBA	OK	34095-D2	1	1
McALESTER SW	RATTAN	OK	34095-B4	1	1
McALESTER SW	SIGNAL MOUNTAIN	OK	34095-C1	1	1
McALESTER SW	SNOW	OK	34095-D4	1	1
McALESTER SW	SOBOL	OK	34095-B2	1	1
McALESTER SW	SOPER	OK	34095-A6	1	1
McALESTER SW	SPENCERVILLE	OK	34095-B3	1	1
McALESTER SW	SWINK	OK	34095-A2	1	1
McALESTER SW	WILDHORSE MOUNTAIN	OK	34095-D3	1	1
McALESTER SW	WRIGHT CITY	OK	34095-A1	1	1
OKLAHOMA CITY		014		4	
SE OKLAHOMA CITY	BROOKSVILLE	OK	35096-B8	1	1
SE OKLAHOMA CITY	CARSON	OK	35096-B1	1	1
SE OKLAHOMA CITY	EARLSBORO	OK	35096-C7	1	1
SE OKI AHOMA CITY	HOLDENVILLE	OK	35096-A4	1	1
SE OKLAHOMA CITY	LAKE HOLDENVILLE	OK	35096-A3	1	1
SE OKLAHOMA CITY	LAMAR	OK	35096-A2	1	1
SE	MAUD	ОК	35096-B7	1	1
SE	PEARSON	ОК	35096-A8	1	1
SE	PRAGUE SE	ОК	35096-C5	1	1
OKLAHOMA CITY SE	PRAGUE SW	ОК	35096-C6	1	1
OKLAHOMA CITY SE	SAINT LOUIS	ОК	35096-A7	1	1
OKLAHOMA CITY SE	SEMINOLE	ОК	35096-B6	1	1
OKLAHOMA CITY SE	SHAWNEE	ОК	35096-C8	1	1
OKLAHOMA CITY SE	TATE MOUNTAIN	ОК	35096-A5	1	1
OKLAHOMA CITY SE	WETUMKA	OK	35096-B2	1	1
OKLAHOMA CITY SE	WETUMKA SE	ОК	35096-A1	1	1
OKLAHOMA CITY		OK	35096-B4	1	1
OKLAHOMA CITY	WEWOKA WEST	OK	35096-B5	1	1
OKLAHOMA CITY	WOLF	OK	35006 46	1	1
OKLAHOMA CITY	WOLF	UK	55090-A0		1
SE	YEAGER	OK	35096-B3	1	1
OKLAHOMA CITY SW	FASON	OK	35097-42	1	1
OKLAHOMA CITY		01	05007 702	,	
SW OKLAHOMA CITY	LIIILE AXE	UK	35097-B2	1	1
SW OKLAHOMA CITY	MACOMB	OK	35097-B1	1	1
SW OKLAHOMA CITY	SHAWNEE RESERVOIR	OK	35097-C1	1	1
SW	STELLA	OK	35097-C2	1	1

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OKLAHOMA CITY						
SW	TRIBBEY	OK		35097-A1	1	1
PERRYTON NE	BALKO	ок		36100-F6	1	1
PERRYTON NE	BALKO NE	OK		36100-F5	1	1
PERRYTON NE	BALKO SW	ОК		36100-E6	1	1
PERRYTON NE	BEAVER	ОК		36100-G5	1	1
PERRYTON NE	BEAVER NW	OK	KS	36100-H6	1	1
PERRYTON NE	BOYD	OK		36100-F7	1	1
PERRYTON NE	BRYANS CORNER	OK		36100-E7	1	1
PERRYTON NE	BRYANS CORNER SW	OK		36100-E8	1	1
PERRYTON NE	ELMWOOD	OK		36100-E5	1	1
PERRYTON NE	FLORIS	ОК		36100-G6	1	1
PERRYTON NE	FORGAN	OK		36100-H5	1	1
PERRYTON NE	LITTLE PONDEROSA	OK	KS	36100-H8	1	1
PERRYTON NE	RED HORSE CREEK	OK		36100-F8	1	1
PERRYTON NE		OK		36100-G7	1	1
PERRYTON NE		OK	KS	36100-H7	1	1
PERRYTON NE		OK	no	36100-G8	1	1
		ÖN				
PERRYTON NW	ADAMS	ОК		36101-G1	1	1
PERRYTON NW	HARDESTY	OK		36101-E2	1	1
PERRYTON NW	HARDESTY NE	OK		36101-F1	1	1
PERRYTON NW	HARDESTY SE	OK		36101-E1	1	1
PERRYTON NW	HOOKER	OK		36101-G2	1	1
PERRYTON NW	HOOKER NW	ОК	KS	36101-H2	1	1
PERRYTON NW	OPTIMA DAM	ОК		36101-F2	1	1
PERRYTON NW	TYRONE	OK	KS	36101-H1	1	1
SHERMAN NE	ACHILLE AMBROSE (Whitewright	ОК	тх	33096-G4	1	1
SHERMAN NE	NW)	ТΧ	OK	33096-F4	1	1
SHERMAN NE	BENNINGTON SOUTH	OK		33096-H1	1	1
SHERMAN NE	BLUE	OK		33096-H2	1	1
SHERMAN NE	DENISON DAM	ТΧ	OK	33096-G5	1	1
SHERMAN NE	DEXTER	ТΧ	OK	33096-G8	1	1
SHERMAN NE	DURANT SOUTH	OK		33096-H4	1	1
SHERMAN NE	KEMP	OK	ΤX	33096-G3	1	1
SHERMAN NE	KINGSTON SOUTH	OK	TX	33096-H6	1	1
SHERMAN NE	LEBANON MULBERRY (Whitewright	OK	ТХ	33096-H8	1	1
SHERMAN NE	NE)	ТХ	OK	33096-F3	1	1
SHERMAN NE	ROBERTA	OK		33096-H3	1	1
SHERMAN NE	SHAY	OK		33096-H7	1	1
SHERMAN NE	TELEPHONE	ТΧ	OK	33096-G1	1	1
SHERMAN NE	YUBA	OK	ΤX	33096-G2	1	1
SHERMAN NW	CALLISBURG	тх	OK	33097-F1	1	1
SHERMAN NW	GAINESVILLE NORTH	ТΧ	OK	33097-F2	1	1
SHERMAN NW	HORSESHOE BEND	ТХ	OK	33097-G1	1	1
SHERMAN NW	MARIETTA EAST	OK		33097-H1	1	1
SHERMAN NW	MARIETTA WEST	ОК	ТХ	33097-H2	1	1

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SHERMAN NW	THACKERVILLE	OK	ТΧ	33097-G2	1	1	
TEXARKANA NE	ACWORTH	ТΧ	OK	33094-G8	1	1	
TEXARKANA NE	CERROGORDO	AR	OK	33094-H4	1	1	
TEXARKANA NE	ENGLISH	ТΧ	OK	33094-F7	1	1	
TEXARKANA NE	GARVIN	OK		33094-H8	1	1	
TEXARKANA NE	IDABEL	OK		33094-H7	1	1	
TEXARKANA NE	SHULTS	OK		33094-H6	1	1	
TEXARKANA NW	BLUFF	ОК	ТΧ	33095-H6	1	1	
TEXARKANA NW	DIRECT	ТΧ	OK	33095-G7	1	1	
TEXARKANA NW	FROGVILLE	OK	TX	33095-H3	1	1	
TEXARKANA NW	GRANT	OK	TX	33095-H5	1	1	
TEXARKANA NW	KIOMATIA	ТΧ	OK	33095-H2	1	1	
TEXARKANA NW	LAKE WEST	OK	TX	33095-H8	1	1	
TEXARKANA NW	MILLERTON	OK	TX	33095-H1	1	1	
TEXARKANA NW	MONKSTOWN	ТΧ	OK	33095-G8	1	1	
TEXARKANA NW	NEGLEY	ТΧ	OK	33095-G1	1	1	
TEXARKANA NW	NEW OBERLIN	OK	TX	33095-H7	1	1	
TEXARKANA NW	SHOALS	OK	TX	33095-H4	1	1	
TEXARKANA NW	SLATE SHOALS	ТΧ	OK	33095-G4	1	1	
TEXARKANA NW	WOODLAND	ТΧ	OK	33095-G3	1	1	
WOODWARD NW	CHARLEY CREEK EAST	ОК		36096-F8	1	1	
WOODWARD NW	CHARLEY CREEK WEST	OK		36096-F7	1	1	
WOODWARD NW	FORT SUPPLY	OK		36099-E5	1	1	
WOODWARD NW	FORT SUPPLY NE SLEEPING BEAR CREEK	OK		36099-F5	1	1	
WOODWARD NW	NW SLEEPING BEAR CREEK	OK		36099-F4	1	1	
WOODWARD NW	SW	OK		36099-E4	1	1.	TOTAL

**340** 340 **680**