WATERSHED BASED PLAN

FOR THE

CENTRAL NORTH CANADIAN WATERSHED

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PREFACE

The North Canadian River extends across much of the state of Oklahoma, starting in the northwest and continuing into the east-central region. The **Central North Canadian Watershed Based Plan** is focused on the portion of the North Canadian Watershed located primarily in Blaine and Canadian Counties in central Oklahoma, from just below the Canton Lake dam to the Lake Overholser dam. A small part of the watershed is also in the eastern part of Dewey County. Designated beneficial uses for this segment of the river (Oklahoma Water Quality Management Segment 520530) include primary body contact recreation, fish and wildlife propagation--warm water aquatic community, public and private water supply, aesthetics, industrial and municipal process and cooling water, and agriculture. Landuse in the watershed is primarily agricultural in the west, including crop cultivation (especially wheat) as well as livestock production (range and pasture grazing, feedlots). Urban activities, which are expected to increase in the future, are most prevalent in the eastern half of Canadian County. El Reno and Yukon, the largest towns in the watershed, have grown by 10 percent in the last decade and continue to expand.

Water samples at various locations along the North Canadian River have repeatedly exceeded Oklahoma water quality standards for *Enterococcus* as well as turbidity. As a result, this segment of the North Canadian River is on the 2004 303(d) list as impaired for pathogens and turbidity. Other 303(d) list waterbodies within the watershed include Lake Overholser and El Reno Lake, which are impaired by turbidity, and Shell Creek, which is impaired for pathogens and low dissolved oxygen. In addition, the Lake Overholser watershed up to the Canton Dam was designated a nutrient-limited watershed in 2006 due to TSI values exceeding 62 in the lake.

Initial research indicates a large nonpoint source component in the impairment problems of the North Canadian watershed. Recent efforts to address water quality issues in this watershed include NRCS EQIP programs through the Blaine County Conservation District in Blaine County, through the East Canadian County and Central North Canadian River Conservation Districts in Canadian County, and through the Dewey County Conservation District in Dewey County. A portion of this watershed lies in the “Cheyenne & Arapaho Indian Lands Special Emphasis Area,” which covers 75,560 acres in Blaine, Canadian, Custer, Dewey, Kingfisher, Roger Mills and Washita counties. These programs are focused primarily on reduction of soil erosion. Both the USGS and the OWRB have permanent monitoring stations at several points in the watershed.

The Oklahoma Department of Environmental Quality (ODEQ) has released drafts of two TMDLs for bacteria loading to the North Canadian River. The 2005 TMDL recommended an 88% reduction in *Enterococcus*, the most stringent of the three bacteria criteria examined, based on data collected from 1997-2003 (ODEQ 2005). The Association of Central Oklahoma Governments (ACOG), in partnership with ODEQ, drafted a TMDL in March 2006, which overlaps slightly with the previous document and includes the watershed downstream. This TMDL, based on watershed data collected

between May 2003 and September 2003, recommended a 73% fecal coliform load reduction and a 96% *Enterococcus* load reduction to restore beneficial use support to the North Canadian River in Canadian County (ODEQ 2006).

In addition, modeling of the watershed has been performed by Oklahoma State University (OSU) in order to target areas for implementation of best management practices. SWAT models focused on the loading of phosphorus to waterbodies in the basin. Modeling results have been incorporated into the watershed plan, and management measures have been targeted to address the identified sources based on the models.

The Central North Canadian Watershed Based Plan (WBP) focuses on implementing practices to expand the EQIP programs ongoing in the watershed to reach the load reduction goals established by the bacteria TMDL and the SWAT model for phosphorus. Ultimately, the goal is to restore Primary Body Contact Recreation to this central segment of the North Canadian River, as well as other waterbodies in the watershed. Implementation of best management practices (BMPs) should improve both the bacteria and turbidity problems.

INTRODUCTION

In 1997, a nationwide strategy to protect water quality was initiated which led to the development of the *Clean Water Action Plan* (CWAP). The CWAP established goals and implementation schedules for numerous strategies dealing with point and nonpoint sources. Oklahoma's Office of Secretary of Environment (OSE) was designated as the lead agency to implement CWAP provisions in Oklahoma, and, under OSE's leadership, Oklahoma has successfully met the CWAP requirement to establish a *Unified Watershed Assessment* (UWA) strategy. Oklahoma's UWA is a written document whose development and implementation relied upon input from the state's UWA Work Group. Through the UWA process, the Work Group identified "Category I" watersheds in Oklahoma that were recognized as significantly impaired and in need of immediate federal and state funding to target restoration activities. The North Canadian Watershed in Canadian County (Figure 1) was one of these high priority watersheds, while the upper, Blaine County portion was given a Category II designation, "needing preventive action to sustain water quality."

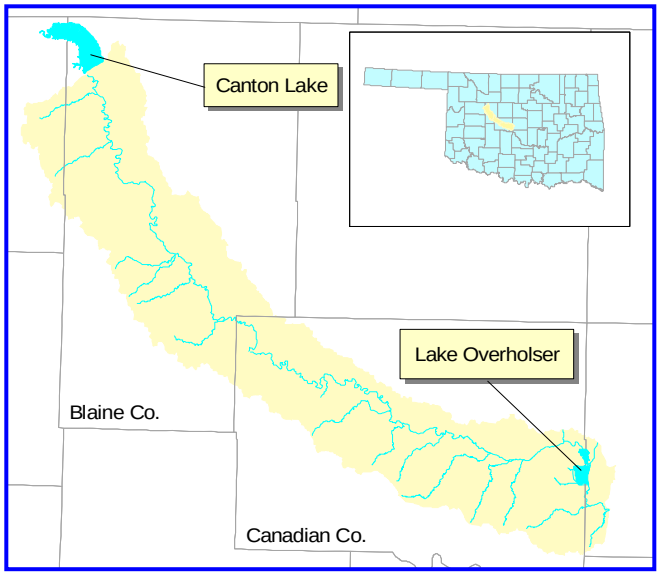

Figure 1. Central North Canadian River Watershed.

In addition to having high priority designation, the central North Canadian watershed has been chosen for implementation of a best management practice (BMP) demonstration program because of interest from the conservation districts in Blaine, Canadian, and Dewey Counties. It is rare for conservation districts to collaborate and approach the Oklahoma Conservation Commission about bringing a water quality program to their area, but these districts did exactly that. As a result, it is likely that landowner participation in the program will be high, and success in the watershed, in terms of BMP implementation and improvement in water quality, is expected.

The *Nonpoint Source Program and Grants Guidelines for States and Territories for FY 2004 and Beyond* requires a Watershed Based Plan (WBP) to be completed prior to any implementation using incremental funds. The guidance defines nine key components to be addressed in a watershed based plan: 1) identification of causes and sources that will need to be controlled to achieve load reductions, 2) estimate of load reductions expected from the management measures described, 3) a description of the management measures that will need to be implemented to achieve load reductions, 4) an estimate of the amounts of technical and financial assistance needed, associated costs, and/or the sources or authorities who will bear responsibility, 5) an

information/education component that will be used to enhance public understanding of the project and encourage early participation in the overall program, 6) a schedule for implementing the NPS management measures identified in this plan that is reasonably expeditious, 7) a description of interim, measurable milestones for determining whether control actions are being implemented, 8) a set of criteria that can be used to determine whether loading reductions are being achieved over time and substantial progress is being made or whether the Watershed Plan or Total Maximum Daily Load (TMDL) needs to be revised, and 9) a monitoring component to evaluate the effectiveness of the implementation efforts over time.

In order for the WBP to become an integral part of the entire watershed restoration program, it must be amenable to revision and update; the WBP for the North Canadian River Watershed has been developed as a dynamic document that will be revised to incorporate the latest information, address new strategies, and define new partnerships between watershed shareholders. It is anticipated that at least annual revisions may be necessary and that the responsibility for such revisions will rest primarily with the Oklahoma Conservation Commission (OCC), with support from the Office of the Secretary of the Environment (OSE) and the NPS Working Group. It is understood that the water quality goals set forth in this WBP, as well as the technical approach to address the goals, may not be comprehensive, so they may be expanded in the future. Federal and state funding allocations for future water quality projects designed to address the Central North Canadian Watershed problems should not be based solely upon their inclusion in this WBP; rather, the WBP should be considered a focal point for initial planning and strategy development.

CAUSES AND SOURCES

Watershed Characterization

The Central North Canadian Watershed is located in the Central Great Plains and Cross Timbers ecoregions in central Oklahoma. The specific target area of this WBP is a reach of the North Canadian River from just below the Canton dam in Blaine County to the Lake Overholser dam in Canadian County (see Figure 1), which is approximately 760 square miles in area (486,400 acres). The HUC 11 watersheds included in this study are 11100301060, 11100301070, and 11100301080, and the Oklahoma watershed ID of this segment of the river is 520530. Streams which feed into the North Canadian in this part of the watershed, along with any known impairment, are listed in Table 2. Designated uses for all waterbodies in this watershed include primary body contact recreation, fish and wildlife propagation--warm water aquatic community, public and private water supply, aesthetics, industrial and municipal process and cooling water, and agriculture.

Most soils in the watershed are highly erodible sandy, silty, or clay loams. The elevation in the watershed ranges from 1200-1500 feet. Landuse in the watershed is primarily agricultural (Table 1). Wheat is the principal crop, although hay, rye, grain sorghum, cotton, soybeans, and peanuts are also produced. Row crop production in

the watershed has decreased from about 13% of the landuse to less than 3% over the past decade. Livestock production is predominately cattle, with horses, swine, and sheep present as well. Urban activities, which are expected to increase in the future, are most prevalent in the eastern half of Canadian County.

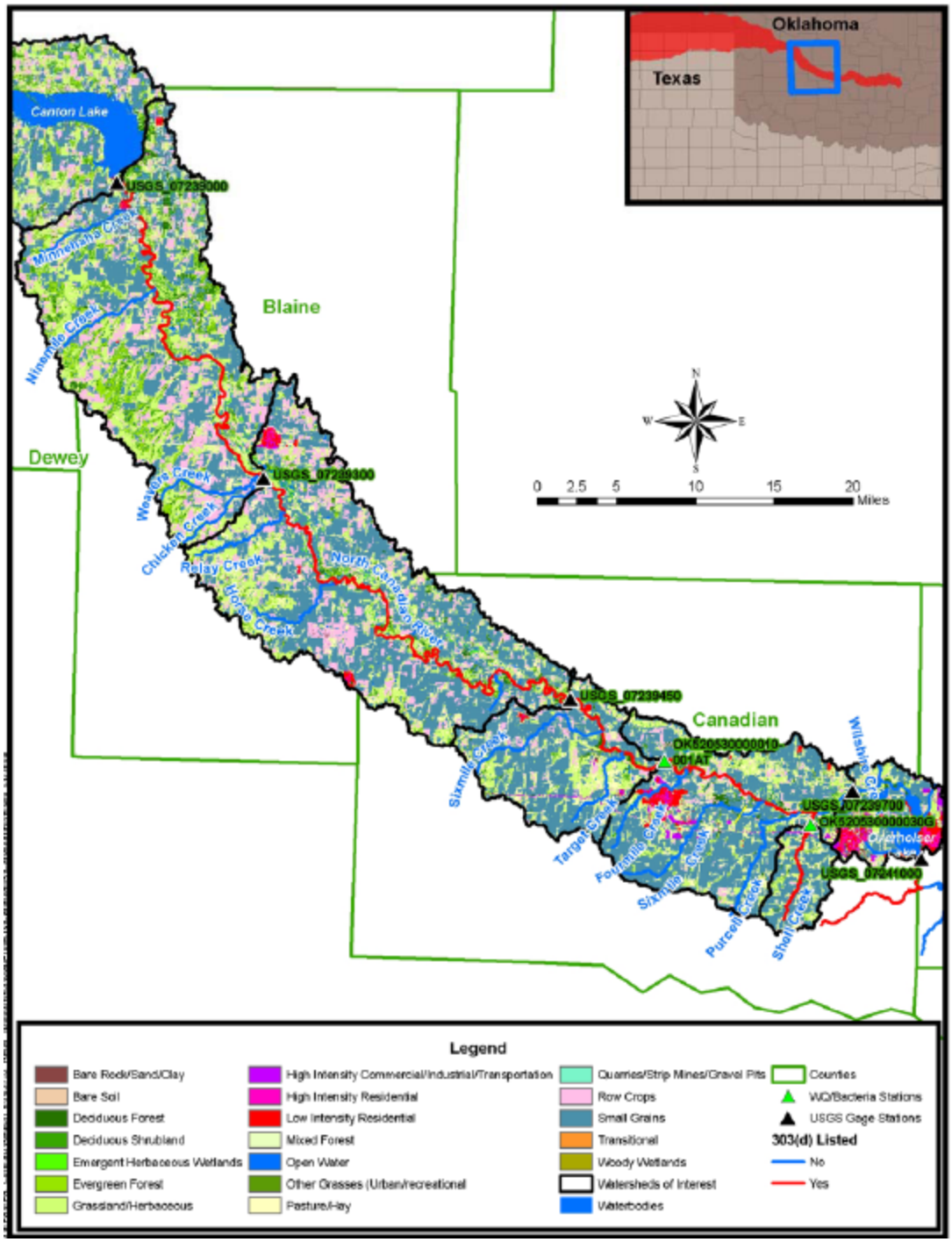

Figure 2. Landuse in the central North Canadian watershed (from ODEQ 2005). Waterbodies denoted in red are impaired.

The largest towns in the watershed are El Reno, with a population of over 16,000, and Yukon, with approximately 21,000 residents. The population in and around these towns has grown by 10 percent in the last decade and continues to expand, due in part to close proximity to Oklahoma City.

Table 1. Landuse in the central North Canadian Watershed (based on 2006 Landsat TM Imagery).

Land Cover Type	Fraction of Basin (%)
Bare soil	0.03
Forest	15.3
Pasture	34.6
Urban low density	1.4
Urban high density	3.0
Water	1.0
Agricultural row crop	2.6
Rangeland-Brush	3.8
CAFO (pasture)	0.5
Winter wheat	37.8

Lake Overholser is located in eastern Canadian County and western Oklahoma County. The lake was built in 1919 by the City of Oklahoma City as a 1500-acre (13,913 ac-ft) off-channel impoundment of the North Canadian River for water supply and recreational purposes. It has a yield of 5,000 af/yr (4.5 mgd), supplemented by releases from Canton Reservoir. Water in the lake is of fair quality and, during periods of low flow, the river is diverted around Overholser to avoid worsening the lake's quality (OWRB 2002a).

Lake El Reno, located in Canadian County, was constructed in 1966 and is 170 acres (709 ac-ft). It is owned by the city of El Reno and serves as a flood control and recreation reservoir (OWRB 2005).

Causes

This 105 mile segment of the North Canadian River was listed as "not supporting" for the Primary Body Contact Recreation (PBCR) and Fish and Wildlife Propagation (FWP) designated uses in 2004 due to impairment by pathogens (*Enterococcus*) and turbidity. In addition, Shell Creek was on the 2004 303(d) list as impaired for pathogens (*E. coli*, *Enterococcus*, and fecal coliform) and low DO (ODEQ 2004). Lake Overholser and El Reno Lake, also located within this watershed, are both impaired by turbidity (Table 2). The Lake Overholser watershed, which includes all direct and indirect tributaries up to, but not including, the Canton Reservoir, has been designated a nutrient-limited watershed (NLW) due to TSI values above 62 in Overholser.

Table 2. Waterbodies in the North Canadian watershed (segment 520530) (ODEQ 2004).

OKWBID	Name	Size (Lake acres or Stream miles)	Impairment	Cause
OK520520000260_00	Overholser Lake	1,500	WWAC	Turbidity
OK520530000010_00	North Canadian River	10	*	
OK520530000010_10	North Canadian River	101	PBCR, WWAC	Pathogens, Turbidity
OK520530000020_00	Wilshire Creek	1	*	
OK520530000030_00	Shell Creek	9	PBCR, WWAC	Pathogens, low DO
OK520530000040_00	Purcell Creek	12	*	
OK520530000050_00	Sixmile Creek	16	*	
OK520530000060_00	Fourmile Creek	5	*	
OK520530000070_00	Fourmile Creek	4	*	
OK520530000080_00	El Reno Lake	170	WWAC	Turbidity
OK520530000090_00	Target Creek	8	*	
OK520530000100_00	Rolla Lake	80	*	
OK520530000110_00	Sixmile Creek	12	*	
OK520530000120_00	Laughlin Lake Creek	3	*	
OK520530000130_00	Laughlin Lake	45	*	
OK520530000140_00	Horse Creek	8	*	
OK520530000150_00	Relay Creek	8	*	
OK520530000160_00	Chicken Creek	8	*	
OK520530000170_00	Weavers Creek	8	*	
OK520530000180_00	Ninemile Creek	8	*	
OK520530000190_00	Minnehaha Creek	8	*	

WWAC=Warm Water Aquatic Community, PBCR=Primary Body Contact Recreation, *insufficient information or not assessed

Sources

Based on previous research performed as part of two TMDLs for the North Canadian River, nonpoint sources seem to be the major contributors to the pathogen exceedance in this watershed; however, in low flow periods, point sources are likely to be significant contributors as well (ODEQ 2005, 2006). Modeling conducted by Dr. Dan Storm from Oklahoma State University (OSU) confirms that both nonpoint sources (NPS) and urban sources are major contributors to the phosphorus exceedances in this watershed (Storm et al. 2007).

The Soil and Water Assessment Tool (SWAT) model subdivided this portion of the North Canadian River basin into 64 subbasins and considered the following factors: topography, soils, land cover, weather, slope, and ponds. The SWAT model was used to estimate the total phosphorus and total nitrogen loads to Lake Overholser and to predict the load reductions necessary for attainment of water quality standards.

Point Sources

Point sources are defined as “discernable, confined, and discrete conveyances…from which pollutants are or may be discharged to surface waters” (EPA website 2006). Point source discharges which are permitted through the national pollutant discharge

elimination system (NPDES) can be grouped into three subcategories: municipal and industrial wastewater treatment dischargers (WWTPs), municipal and industrial stormwater dischargers (MS4s), and confined/concentrated animal feeding operations (CAFOs). In addition, municipal and industrial NPDES permits are either "major" or "minor" based upon their size and/or their potential to impact the receiving stream, with major dischargers having design flows of greater than one million gallons per day (EPA website 2006).

There are five municipal and industrial discharge permits in this segment of the North Canadian River, with the cities of Yukon and Watonga being the only major dischargers (Table 3; Figure 3). Due to the NLW designation of the Lake Overholser watershed, no new point sources may be permitted.

Table 3. NPDES permits in the North Canadian watershed.

Facility	Type of discharge
ASKEW FABRICATION INC.	minor
DOLESE BROS. CO.- YUKON BATCH	minor
DOLESE BROS. CO.-EL RENO BATCH	minor
EL RENO MUNICIPAL AUTHORITY	minor
City of WATONGA	Major
City of YUKON	Major

According to the 2005 TMDL (ODEQ), the Watonga WWTP had occasional exceedances of fecal bacteria (approximately 20 percent exceedance of daily and monthly average based on data in 2000). The TMDL also states that sanitary sewer overflows (SSOs) may contribute significantly to fecal bacteria loading to streams, but it is not possible to determine if this has occurred in the North Canadian watershed at this time.

There are five confined/concentrated animal feeding operations (CAFOs) in the North Canadian Watershed (Figure 3). All of the CAFOs in this watershed have cattle, while one also has a significant number of horses and sheep. All of these CAFOs are large (greater than 1000 animals, EPA 2006), and two of the CAFOs are very large, one with a one-time capacity of approximately 20,000 animals and the other with a yearly capacity of over 200,000 animals (Table 4). CAFOs can be a potential contributor of both pathogens and nutrients in the water since large quantities of animal waste are

concentrated in a small area and can be washed into the water during rainfalls, although only “25-year, 24-hour events” should cause overflow at these facilities.

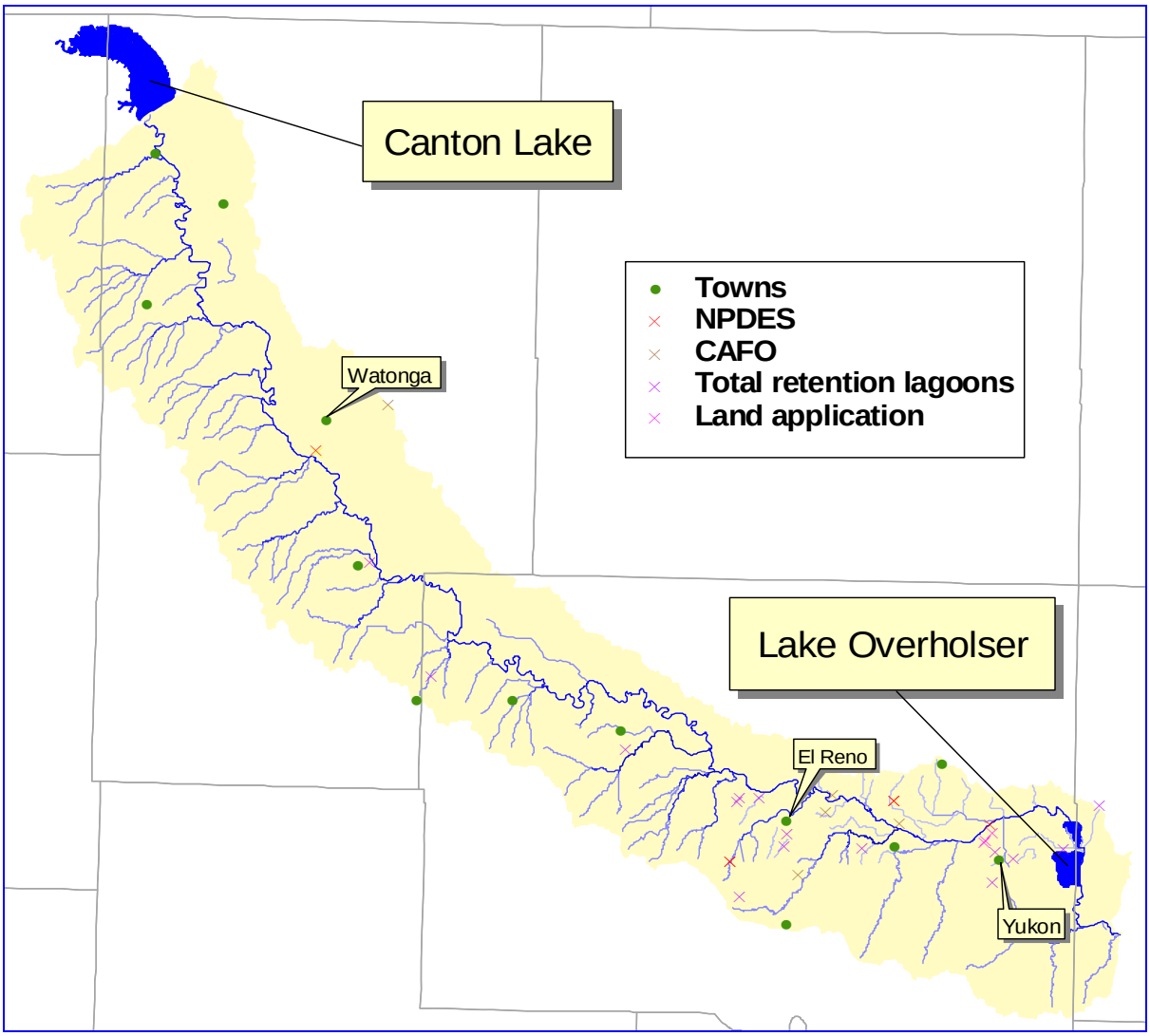

Figure 3. Permitted activities and potential pollution sources in the North Canadian watershed.

The Oklahoma Water Resources Board (OWRB) conducted a study from 1999-2000 on the effect of CAFOs on waters that supply Oklahoma City water which found that it was possible that at least some of the bacteria in the North Canadian River was traceable to a CAFO source, although not a specific source (OWRB 2002); however, the study concluded that there was “no direct connection between CAFO runoff and the North Canadian River.” In addition, according to ODAFF, there have been no reported performance problems from the CAFOs in this watershed (ODEQ 2005).

Table 4. Confined animal feeding operations in the watershed (ODAFF 2006). Values represent maximum capacity at a time, except for the facility denoted with * , which indicates the maximum one-year total.

NPDES ID	CAFO Name	City	County	Type of Facility	# Animals
OKG010006	Alfadale Stockfarm LLC	El Reno	Canadian	Cattle	6000
OKG010231	Robert A. Funk	Yukon	Canadian	Cattle	3000
OKG010289	Jensen Feedlot	El Reno	Canadian	Cattle	2950
OKG010067	OKC West Livestock Market	El Reno	Canadian	Cattle, Horse, Sheep	227,497*
OKG010081	Wheeler Bros. Grain Co.	Watonga	Blaine	Cattle	20,000

Nonpoint Sources

Nonpoint sources are those which supply pollutants to surface water diffusely, rather than as a definite, measurable quantity at a single location. These sources typically involve land activities that contribute bacteria, sediment, and/or nutrients to surface water as a result of runoff during and following rainfall. The initial TMDL (ODEQ 2005) found that small communities in this watershed, which do not have permitted discharges, have existing loads of fecal coliform bacteria at levels greater than the State's instantaneous standards. This indicates that nonpoint sources contribute significantly to the bacteria exceedance in the central portion of the North Canadian watershed.

Permitted Sources

Nonpoint source permitted activities within the watershed include two land application sites and 15 total retention lagoons (Figure 3). Land application of animal wastes is a common practice in Oklahoma which can be misused. That is, waste may be applied at incorrect concentrations or at inopportune times, both of which may negatively impact water quality. Total retention lagoons hold solid and liquid wastes prior to land application and may leak or overflow, thus affecting water quality.

Rural Land Use

Cropland and range/pasture land are prevalent in the Central North Canadian watershed. Livestock grazing in pastures deposit manure containing fecal bacteria onto land surfaces, making it possible for the bacteria to enter surface water with runoff. In addition, livestock often have direct access to waterbodies and may provide a concentrated source of fecal loading directly into streams. Table 5 presents the estimated number of animals in the North Canadian watershed, most of which have direct stream access. Research indicates that livestock are a significant source of pathogens in this watershed (ODEQ 2005). In addition, animals loafing in a stream, particularly cattle, can contribute to turbidity problems by stirring up sediment and eroding banks as they enter and leave.

Table 5. Estimates of livestock (not including CAFOs) in the Central North Canadian watershed (ODEQ 2005).

Livestock	Number of animals	Livestock	Number of animals
Cattle	71,152	Hogs, pigs	1,858
Dairy Cows	505	Bison	70
Cattle feedlots	10	Llamas	24
Horses	999	Rabbits	41
Mules, burros, donkeys	20	Chickens	457
Goats	247	Ducks, Geese	41
Sheep	679	Poultry	1,282

The NRCS implemented the Environmental Quality Incentives Program (EQIP) in sections of this watershed starting in 2003. Erosion is seen as a major problem in the North Canadian watershed which contributes to turbidity, so practices that are being promoted through EQIP include the establishment of permanent vegetation and buffers. In addition, terraces, waterways, residue management, pasture and range planting, grade stabilization structures, and prescribed grazing are encouraged. These practices should help to lower turbidity, as well as improve the pathogen problem.

Urban Land Use

As urbanization progresses, particularly in the El Reno and Yukon areas, runoff from impermeable surfaces and from construction areas (both housing developments and road construction) may contribute to turbidity exceedances in the watershed. Water quality may be impacted by increasing runoff volume and velocities, which could cause increased erosion of streambanks, destruction of instream and riparian habitat, and siltation.

Bacteria associated with urban runoff can emanate from humans, domestic pets, wildlife, and livestock. Given the low population density (based on 1990 US Census) in most of the North Canadian watershed, the 2005 TMDL suggests that urban runoff is unlikely to be a major contributor to the bacteria problem (ODEQ 2005). However, since the population has increased significantly in the eastern part of Canadian county and is projected to continue to grow, urban runoff should be considered as a potential nonpoint source of pollution for the future.

Septic Systems

Failing septic systems can contribute to pathogen problems in both groundwater and surface waters if leakage or illicit discharge occurs. Any loading of bacteria into the groundwater can enter surface water through seeps or springs. The 2005 TMDL (ODEQ 2005) found that failing septic systems were not likely to be a significant factor in the bacteria exceedance due to the low density of septic systems in the watershed.

Wildlife

Wild animals which produce fecal bacteria and have direct access to streams include deer, feral hogs, raccoons, other small mammals, and avian species. Based on estimates of deer populations in this watershed, wildlife is considered to be a minor contributor of pathogens in the North Canadian River (ODEQ 2005).

Relative contributions of sources

Storm et al. (2007) determined the relative phosphorus load allocations in the North Canadian River watershed due to each landuse occurring in the basin. Table 6 indicates the percentages and estimated values of both total and soluble phosphorus loading to the watershed attributed to each source.

Table 6. SWAT simulated total phosphorus by land cover for the North Canadian Basin for the period 1/2001-12/2005 (Storm et al. 2007).

Land Cover Type	Fraction of Basin (%)	Area hectares	Total Phosphorus (Kg/ha/yr)	Total Phosphorus (Kg/yr)	Percent Contribution
Agricultural Row Crop	2.6	4743	0.31	1462	3%
Bare Soil	0.0	56	1.68	95	0%
CAFO (Pasture)	0.5	972	0.19	186	0%
Forest (Mixed)	15.3	28037	0.05	1367	3%
Pasture	34.6	63510	0.19	12073	24%
Point Source (Yukon waste water)	0.0	NA	NA	362	1%
Rangeland Brushy	3.8	7046	0.19	1363	3%
Urban - High Density	3.0	5524	2.38	13132	26%
Urban - Low Density	1.4	2557	0.75	1909	4%
Water	1.0	1879	0.00	0	0%
Winter Wheat	37.8	69373	0.28	19111	36%

Three land use categories contributed over 85% of the total phosphorus load in the basin: winter wheat (36%), high density urban (26%), and pasture (24%). The high density urban had the highest total phosphorus loss per area. It accounted for only 3% of the basin area, but it generated over a quarter of the total phosphorus load, with the average total phosphorus loss for high density urban of 2.38 kg/ha/yr. Nitrogen loads were difficult to estimate since most of the data was below the detection limit of 0.05 mg/L for both nitrates and nitrites; as a result, "the loads predicted by SWAT were much larger than the observed data at both locations." Further detail about the estimation of causes and sources in the watershed can be found in the SWAT model report (Storm et al. 2007).

LOAD REDUCTIONS

The 2005 TMDL (ODEQ) used load duration curves to model load reductions for all three bacteria types. Then, the most conservative value of the three (i.e., the largest reduction value) was recommended as the load reduction goal. Based on data collected from 1997-2003, the TMDL estimated that an 89% load reduction for *Enterococcus* (88% reduction for *E. coli* and 66% for fecal coliform) would be necessary to restore the PBCR use to the North Canadian River. This sets a goal of reducing *Enterococcus* loading to 97.2 cfu/100 ml, which is 10% lower than the criterion value (108 cfu/100 ml) since it includes a "margin of safety."

The ACOG TMDL (ODEQ 2006) found similar estimates: a 73% fecal coliform load reduction and a 96% *Enterococcus* load reduction would be necessary to restore beneficial use support to the North Canadian near El Reno (values based on the

average of data from two sites upstream of El Reno using load-duration curves). However, this TMDL was based on only one season of data (May 2003-October 2003). Further explanation of the methodology for arriving at the load reduction goal can be found in the TMDL reports (ODEQ 2005; 2006).

The TMDLs did not differentiate between sources of loading within the watershed but instead recommended equivalent percentage reductions from both point and nonpoint sources. Urban areas in the watershed will have increased pressure to improve their phase II stormwater permits to address bacterial loading and to ensure that their point sources are fully compliant with permits. At the same time that urban sources are addressed, agricultural sources will need to reduce bacteria, sediment, and nutrient loading.

According to the SWAT modeling completed by Storm et al. (2007), about 30,000 kg of phosphorus per year are entering waters in the portion of the North Canadian River watershed between Lake Canton and Lake Overholser (Tables 6 and 7). Modeling showed that a 50% reduction in total phosphorus load into the lake corresponded to a 37% reduction in the lake total phosphorus concentration and a 20% change in the chlorophyll *a* concentration of the lake. When the total phosphorus load entering the lake was reduced by 75%, the concentration of chlorophyll *a* dropped dramatically (approximately 50%). This level of phosphorus reduction would achieve a chlorophyll *a* concentration of 10 ppb in Lake Overholser, the standard required for Sensitive Water Supply (SWS) lakes in Oklahoma; however, a 75% reduction in phosphorus loading can not be achieved solely by agricultural BMPs.

The reductions in the total phosphorus from point sources could have an impact on the lake, but the influences of point sources are not currently known. None of the point source dischargers in the basin are required to monitor phosphorus, and water quality data in the North Canadian River below the waste water treatment plant in Yukon, OK were poor or non-existent.

Storm et al. examined the effectiveness of six agricultural BMPs in reducing nutrient loading in the watershed (Table 7). Simulated agricultural BMP implementation had little effect on the lake, with only two BMPs having a significant effect on the lake's chlorophyll *a* concentration. The largest total phosphorus load reduction resulted from the addition of a 10 meter buffer strip on all agricultural land uses. Contour plowing and land conversion from agriculture to pastureland resulted in the next highest total phosphorus load reductions. Further explanation of the methodology for arriving at the load reduction goal can be found in the SWAT report (Storm et al. 2007).

Table 7. SWAT simulated total phosphorus loads and load reductions for best management practices in the North Canadian River watershed. The total phosphorus loads were calculated at El Reno, OK (USGS gage) upstream of most of the urban areas in the basin (Storm et al. 2007).

Best Management Practice	Total Phosphorus Load (Kg/yr)	Load Reduction
Default - No BMP	30,200	
Conservation Tillage	26,700	12%
No Tillage	28,900	4%
Contour Plowing	24,600	19%
Land Conversion AGRR/WWHT--->PAST	24,000	21%
Buffer Strip (10 meters)	21,700	28%
Pasture Conversion from Grazing to Hay	25,300	16%

Fortunately, BMPs recommended by the bacteria TMDLs and the nutrient SWAT model should address the other sources of impairment in watershed streams including turbidity and low dissolved oxygen. Several studies have found correlations between sediment and bacteria (e.g., Whitman and Nevers 2003). Significant correlations between bacteria and both turbidity and phosphorus have been observed in OCC projects as well. These correlations indicate that reducing the loading of nutrients and sediment should concomitantly reduce bacteria levels in the watershed. For example, BMPs which have been implemented as part of the OCC's Beaty Creek Project targeted at reducing nutrient loading have already been successful at reducing bacteria loads in that watershed; analysis of data before implementation compared to post-implementation showed significantly lower levels of both *E. coli* and *Enterococcus*.

Descriptions of the BMPs that will be promoted in this project are given in the "NPS Management Measures" section of this WBP. Continuation and expansion of BMPs implemented through EQIP should result in reduction of nutrients, sediment, and bacteria, with the ultimate goal of full attainment of all designated uses for all waterbodies in the watershed.

CRITERIA

The North Canadian River's designated beneficial uses include primary body contact recreation (PBCR), fish and wildlife propagation--warm water aquatic community (FWP—WWAC), public and private water supply (PPWS), aesthetics, industrial and municipal process and cooling water (I&M), and agriculture. Shell Creek and Lake Overholser have these same designated uses, and Lake Overholser is also one of the three primary drinking water sources for the Oklahoma City area. Waterbodies in this watershed exceed criteria for PBCR due to pathogens and for FWP due to turbidity and low dissolved oxygen; therefore, only these criteria are presented below, along with the criteria for the nutrient-limited watershed (NLW) designation. The goal of the TMDL is to reduce the *Enterococcus* loading to the river, from approximately 883.6 cfu/100 ml to 97.2 cfu/100 ml. Sediment and nutrient loads should also be reduced by the amounts

calculated by the SWAT model (ongoing). These load reductions are based on the following criteria, according to Oklahoma's Water Quality Standards (OWRB 2004):

To attain **Primary Body Contact Recreation** use (for streams):
Samples must be collected during the recreation season, from May 1-September 30, and at least 10 samples are required to make an attainment assessment.

- Fecal coliform bacteria
  a) No more than 25% of total samples will exceed 400 colonies/100 ml
  b) Geometric mean of less than 400 colonies/100 ml
- *Enterococcus* bacteria
  a) No sample shall exceed 406 colonies/100 ml
  b) Monthly geometric mean of less than 33 colonies/100 ml
- *Escherichia coli* (*E. coli*)
  a) No sample shall exceed 406 colonies/100 ml
  b) Monthly geometric mean of less than 126 colonies/100 ml

To attain **Warm Water Aquatic Community** use:

- Turbidity (only applicable during baseflow)
  a) No more than 10% of samples will exceed 25 NTU for lakes
  b) No more than 10% of samples will exceed 50 NTU for streams
- Dissolved oxygen (DO) for streams
  a) No more than 10% of samples will be below 5 mg/L, or 4 mg/L from June 16-October 15, based on at least 10 samples

Nutrient-Limited Watershed designation:
"Nutrient-limited watershed" means a watershed of a waterbody with a designated beneficial use which is adversely affected by excess nutrients as determined by Carlson's Trophic State Index of 62 or greater.

"The nutrient limited watershed area for Lake Overholser is the entire watershed and drainage area of Lake Overholser up to but not including Canton Reservoir, and includes direct and indirect tributaries in HUCs 11100301080 (excluding downstream from Lake Overholser), 11100301070, and 11100301060."

These criteria stem from Oklahoma's Water Quality Standards (OAC 785:45, OWRB 2004). The procedures by which the data must be collected and analyzed to verify whether or not these criteria have been met are identified in Oklahoma's Use Support Assessment Protocols (OAC 785:46, OWRB 2004). Both of these documents fall under the jurisdiction of the Oklahoma Water Resources Board.

NPS MANAGEMENT MEASURES

The BMPs that will be implemented in the demonstration area will focus on reduction of nutrient, sediment, and bacteria loading. Implementation of these practices is expected to achieve an initial NPS bacteria load reduction goal of 30 percent. SWAT modeling

was used to estimate phosphorus load reductions expected from certain management measures. These practices should also improve the turbidity and dissolved oxygen levels in the lakes and streams. It is recognized that not any one activity could realistically result in the required substantial bacteria reduction; instead, numerous strategies will have to work together to achieve the desired result.

A Watershed Advisory Group will be assembled to suggest practices and cost-share rates. Examples of practices that will be suggested to the WAG include (1) riparian establishment to include fencing, vegetative establishment, off-site watering, livestock shelters and incentive payments; (2) buffers zone establishment to include fencing and incentive payments; (3) streambank stabilization to include fencing and vegetative plantings; (4) animal waste storage facilities and/or composters; (5) no-till farming; (6) pasture management/pasture establishment; (7) heavy use areas; (8) nutrient management; and (9) on-site wastewater systems (septic systems).

Oversight of implementation will be the responsibility of the Project Coordinator with assistance from the three Conservation Districts and additional OCC staff. The OCC staff will draft the farm plans and agreements between the landowner and conservation district to implement approved practices. Distribution of funds will follow the pattern established with previous projects.

Demonstration will occur on cooperator farms, residences, or commercial properties. The landowners, selected through targeting based on SWAT modeling, will implement practices on a cost-share basis. Demonstration of the success of these practices should help spread the efforts to remaining parts of the watershed. The conservation districts, using the locally led State cost-share program, will glean information from the project on the BMPs that will reduce nutrient loading to the streams in the North Canadian River Watershed.

A detailed plan for the initial phase of implementation will be appended to the finalized WBP once the initial signup period is complete. This plan will detail the location of needs, the location of the initial cooperators, and the initial planned practices. This plan will also evaluate, on a subwatershed level, the load reduction likely to result from the planned practices. It is likely that not all producers in the critical areas will be willing or able to participate initially in the project. This implementation plan will allow project planners to evaluate the completeness of the initial effort and such that a follow-up effort can be developed as necessary to target producers who did not participate in the initial program but who could have a significant impact on water quality in the watershed. This plan will be presented to NRCS (at the state and local levels) in an attempt to facilitate cooperation between the 319 program and the use of EQIP funds.

Currently, the EQIP program is active in this watershed, with part of the funding stemming from the Cheyenne and Arapaho Indian Lands Priority Area, a local emphasis area spanning 75,560 acres in Blaine, Canadian, Custer, Dewey, Kingfisher, Roger Mills and Washita counties. Proposed activities to be supported by EQIP include terraces, waterways, residue management, pasture and range planting, grade

stabilization structures, brush management, prescribed grazing, and conversion of cropland to grassland. The goal of this program is to improve water quality in the North Canadian, as well as other rivers nearby, and to improve other resources in the area. Currently, the NRCS and local conservation districts (Blaine County, East Canadian County, Central North Canadian River, and Dewey County Conservation Districts) are continuing to promote and institute these BMPs.

A GIS data layer of farm plans will be created and maintained by the Project Coordinator. BMPs, planned and implemented, will be tracked for future watershed modeling and for reporting project performance. Project staff will make regular site visits to assess progress in implementing planned BMPs. Semiannual progress reviews will formally assess cooperator performance. Where implementation problems are identified, the Project Coordinator will follow through with plan revisions or cancellation of the cooperator's agreement and reallocation of the funds to demonstrate practices elsewhere within the project area. Details will be summarized in the project final report.

PUBLIC OUTREACH

The success of the water quality assessment and enhancement programs in the Central North Canadian watershed depends upon widespread public support and buy-in of stakeholders. This section identifies agencies, organizations, and services that are already active in the North Canadian watershed or that will be asked to participate in the project. These groups will help develop the WBP and assist in other planning efforts in the watershed to varying degrees.

The specific roles of the groups and programs which are likely to contribute to the public outreach efforts in the Central North Canadian Watershed are summarized in no particular order below:

1. Local Conservation District Offices

The Blaine County Conservation District (CD), East Canadian County CD, Central North Canadian River CD, and Dewey County CD, partnered with the OCC, NRCS, and Cooperative Extension, will be among the primary agencies responsible for public outreach in the watershed. The districts and NRCS work one-on-one with citizens of the watershed to reduce pollution and educate about the importance of protecting water resources, and, thus, will be crucial to the promotion of the 319 program. These groups also organize or participate in seminars, training sessions, and meetings to interact with local people and provide technical assistance and information.

2. North Canadian Watershed Advisory Group (WAG)

A North Canadian Watershed Advisory Group (WAG) will be established by the OCC to give guidance on the implementation program in the watershed. The WAG will be made up of local shareholders in the watershed (including private citizens, representatives of local industries, and local government) who will help

direct the program based on information supplied to them by technical agencies and their knowledge of the needs of the watershed residents. The WAG will discuss issues in the watershed, decide how to best promote BMP implementation, and recommend a series of practices and cost-share rates to be offered as part of the BMP demonstration effort. Those recommendations will form the basis of the ultimate plan for necessary BMPs to meet TMDL load reduction goals. The WAG will help insure that the program most effectively works towards reducing water quality impacts but, at the same time, meets the needs of and is acceptable to the local producers and other landowners. Producers on the WAG may contribute significantly towards local education through a "show and tell" approach.

3. NRCS Local Offices

The United States Department of Agriculture Natural Resource Conservation Service (USDA/NRCS) has been involved with the North Canadian watershed as part of the Environmental Quality Incentives Program (EQIP) since 1998, when the lower part of the watershed was designated as an EQIP Priority Area. In addition, the entire watershed is located in a NRCS special emphasis area, the Cheyenne-Arapaho Indian Lands. Any educational materials developed through the NRCS for this watershed will be utilized. Examples of materials produced for other projects include: 1) Animal Waste Management Handbooks; 2) Table Top Display to highlight water quality and conservation practices; and 3) Grassland/Wildlife Handbook for use in watershed protection.

4. Oklahoma State University (OSU) Cooperative Extension Service (OCES)

The Oklahoma Cooperative Extension Service promotes water quality education efforts in the State, working closely with the conservation districts and the NRCS to promote water quality awareness. The OCES provides one-on-one meetings and education with landowners along with group presentations and other forms of technical assistance to improve awareness in the watershed. The OCES also develops and utilizes test plots and demonstration sites to educate producers about the effectiveness of certain best management practices. For example, test plots have been used to demonstrate methods of integrated pest management and effectiveness of more managed fertilizer application in wheat production.

The OCES also holds public meetings and workshops to educate landowners on topics such as pesticide and fertilizer management, animal waste issues, and general Best Management Practices (BMPs). OSU has a website on Animal Waste Nutrient Management which provides all the background information needed for developing Nutrient Management Plans and Animal Waste Management Plans. OCES has organized Animal Waste Management Conferences and has developed overall producer-education programs for watersheds that focus on livestock production, grazing management, riparian protection, silviculture, and overall nutrient management.

5. OSU Publications and Fact Sheets

OSU has developed several fact sheets including: 1) “Soil Quality and Animal Manure" and 2) "Manure and Raising Soil pH". Other publications include a water quality driven soil handbook, "Oklahoma Soil Fertility Handbook". Relevant publications will be distributed at various events in the watershed to increase public knowledge.

6. Volunteer Monitoring Programs

The OCC and the Conservation Districts will work to implement the Blue Thumb volunteer monitoring education program in the watershed. The Blue Thumb program has developed a website to keep volunteers updated on Blue Thumb activities as well as inform the general public about the program. A portion of this webpage will focus on priority watershed projects, like the one in the North Canadian Watershed. In addition, the OWRB’s Oklahoma Water Watch Program will attempt to expand monitoring into this watershed.

7. OCC Education Programs

The education component of the Central North Canadian Watershed Implementation Project will be coordinated and implemented by a Project Education Coordinator employed by the OCC. Education plans developed for and used in other OCC implementation projects will be modified to produce an education plan for the North Canadian Watershed. The Education Plan will focus on specific educational goals which include:

(1) Work with Conservation Districts, NRCS, and OCES to coordinate education activities.
(2) Write monthly articles for area newsletters and/or newspapers about project activities in the North Canadian watershed.
(3) Develop and present a school educational component.
(4) Develop a display/exhibit for the project that can be used to educate the public on the 319 Program. Display should include basic information on the program, its cooperators, and contact people of ongoing programs in the watershed (including 2004 project contacts).
(5) Plan and conduct educational meetings to include: tours, earth days, fairs, etc. These education programs will be designed to explain the water quality problems and what can be done to reduce potential impacts, both agricultural and urban.
(6) Work with Conservation Districts on initiating a Blue Thumb program in the watershed.
(7) Form an Education Watershed Advisory Group (EdWAG) to set some area goals for education.
(8) Develop a recognition program for project cooperators.
(9) Track how participation in the education program has changed people’s behaviors. Project Education Coordinator will follow ten percent of people intercepted through different aspects of this and related project activities and will contact them on an annual basis throughout the project period to

determine whether they have made any changes that would affect NPS pollution.

Newspaper articles and other media can be used to inform citizens of the watershed about programs focused on water quality. The OCES, Conservation Districts, and NRCS often contribute articles that are released to local papers, covering a wide range of topics related to water quality, and more specifically, advertising education events and programs. Many articles serve as promotions for various upcoming trainings or other events. Other media related activities such as radio spots and logo contests can be used to further the efforts of the program. However, in using media and advertising in education programs, efforts must focus on measurable results. An information article about water quality is not enough; the article must be associated with some additional effort that is likely to change behaviors. Information alone doesn't often change people's behaviors; people must be persuaded to change their behavior. Persuasion is more likely to occur as part of a program of repeated contact and interaction than as the result of a well-written article in a newspaper.

Youth education is a significant effort pursued by OCES, NRCS, and the conservation districts. Most youth education activities focus on general water quality maintenance and improvement and include activities such as 4-H group water quality monitoring and education, "Earth-Day-Every-Day" activities fair where hundreds elementary school children and some of their parents are exposed to environmental education, and various other training sessions.

Under the Project Education Coordinator, current outreach programs in the watershed will need to expand and perhaps partially redirect their public outreach efforts to work towards more measurable results and to insure that the target audience is being reached. The target audience is the people whose change of behaviors could have the most substantial benefits to water quality. The target audience in the North Canadian Watershed should include cattle producers and urban residents, among others.

The success of water quality protection programs in the watershed depends on the approval and cooperation of the local landowners and various government agencies. In summary, public outreach to assure support of this and future evolutions the Watershed Based Plan will come from:

- Public meetings and listening sessions held throughout the watershed.
- Regular media coverage of activities/issues (both at local and State levels).
- Education programs that involve segments of the community ranging from school children to agricultural producers to homeowners.
- Programs that encourage local citizens to experience "ownership and understanding" of environmental issues such as volunteer monitoring, clean-up events, and other educational grassroots efforts to address the problem.

The ultimate goal of the public outreach portion of this project is to develop a program that will help the citizens of the North Canadian River Watershed reduce NPS pollution.

TECHNICAL AND FINANCIAL ASSISTANCE NEEDED

Funding needs are difficult to anticipate and will likely change over time, especially once the SWAT modeling is complete. The estimated costs associated with the various implementation strategies are highly conservative and may change as targeting of the watershed is finalized and further information becomes available.

All programs to implement NPS BMPs outlined in the above section require technical assistance in the form of a plan writer, certified by the NRCS. NRCS funds this technical support for their own programs (mainly EQIP in this watershed), but programs like a Conservation Reserve Enhancement Program or 319 must fund technical support through some other means. The North Canadian Project Coordinator, assisted by the Education Coordinator, will be responsible for plan writing and will work through the local conservation district and NRCS offices, as these are the places local landowners are most comfortable going to for technical support.

Initial estimates of the funds needed to carry out the North Canadian Watershed Implementation Project are shown below.

Table 8. Estimated funding needs for the North Canadian Watershed Project.

Task	Program	Federal	State	Cooperator	Total	Agency	Status
Project Management	319 Project				$172,492	OCC	Planned
BMP Implementation	319 Project	$183,583	$300,000	$75,000	$558,583	OCC	Planned
	EQIP	$150,000 - $200,000 annually	$37,500 - $50,000 annually		$125,000 - $250,000 annually	NRCS	Ongoing
Education and Outreach	319 Project				$132,366	OCC	Planned
Monitoring	319 Project				$41,940	OCC	Planned
	BUMP				???	OWRB	Ongoing
	USGS	$125,950 startup, $24,000 annually			$125,950 startup, $24,000 annually	USGS	Ongoing
Computer Modeling	SWAT Project to Target NPS Pollution				$166,667	OCC (via OSU)	Ongoing

IMPLEMENTATION SCHEDULE / INTERIM MILESTONES

Education, cost share, and demonstration of BMPs should reduce the overall load of nutrients, sediment, and bacteria entering the North Canadian watershed and ultimately reaching Lake Overholser. Implementation of best management practices will focus on riparian reestablishment and stream bank protection. Effects of implementation programs in the watershed on bacteria, nutrient, and sediment loading from the various sources (pasture, row crop, forest land, stream bank erosion, urban, point source, and any new sources) will be evaluated at the end of the project as well as every five years subsequently to determine the future strategy to be followed. This Watershed Based Plan will be revised approximately every two years to reflect new information and address short-comings identified with earlier plans.

The initial goal is that at least a 30% bacteria load reduction and at least a 30% phosphorus reduction will be measured at the end of the project period. If this load reduction cannot be demonstrated with water quality data, it will be demonstrated through documentation of reduction at the sources (for instance, upgrade of WWTPs). Table 9 details the schedule of the goals and actions of the WBP, as well as the interim milestones (within three years of implementation) and long-term load reductions.

There is ongoing long-term monitoring to assess water quality in the lakes and some of the streams in the watershed. The USGS, OWRB, OCC, and other agencies will continue to collect water quality data and source information throughout the watershed and will coordinate to insure that load reductions in the watershed can be measured throughout the project period. Trend analyses will be performed on the various data sets (bacteria, turbidity, lake chlorophyll-a concentrations, TSIs, and nutrient concentrations and loading) and will be evaluated at the end of the project period as well as at five year intervals to determine whether measurable changes have occurred in water quality.

Table 9. Schedule and Load Reduction Goals Associated with Activities Planned.

Goal	Action	Parameter to address	Load Reduction of Primary Parameters to Attain within 3 Years of Implementation	Ultimate Total Load Reduction to Attain	Year to Begin	Year to Evaluate and Make Necessary Adjustments	Year to Complete
Characterize NPS contributions and evaluate nutrient dynamics and impacts in watershed	Write / revise WBP	Pathogens, Sediment, Nutrients	NA	NA	2007	2008 and every 2 years subsequently	???
	Targeting					2012	Repeat at five year intervals
	TMDL development	Pathogens	NA	NA	2007??		???
Evaluate point source discharger contributions and implement strategy to reduce	TMDL	Pathogens, Nutrients, Sediment, Low DO	NA	NA	2007??		???
	Upgrade WWTPs		???	???	2007??		???
Develop education and outreach programs	319 Project	Pathogens, Nutrients, Sediment	30% NPS pathogen and phosphorus load	89% NPS pathogen load; 75% total phosphorus load	2007	Semiannually throughout project period	2007
Implement BMPs	Riparian establishment	Pathogens, Nutrients, Sediment, Low DO	30% NPS pathogen and phosphorus load	89% NPS pathogen load	2007	Annually	2010
	Streambank stabilization						
	Nutrient / Waste BMPs						
	Pasture Land BMPs						
	Urban BMPs						
Long term water quality monitoring programs	OWRB – Beneficial Use Monitoring Program, Oklahoma Water Watch Program	Pathogens, Nutrients, Sediment, Low DO	NA	NA	1998	Annually	Ongoing
	OCC –Priority Watersheds and Blue Thumb Program				2008 for N. Canadian project	Annually for priority watershed sites	Ongoing
	USGS				Ongoing	Ongoing	Ongoing
	ODEQ – toxics monitoring, NPDES permitting, TMDL monitoring				Ongoing	Ongoing	Ongoing

MONITORING PLAN

Every Watershed Based Plan requires a monitoring plan to gauge the overall success of restoration and remediation efforts. The goal of the monitoring plan for this WBP will be to develop a long-range monitoring program that will oversee the restoration of the beneficial use support in the watershed and preserve its natural resources for future generations.

The monitoring plan for this WBP provides for development of individual monitoring plans and associated quality assurance plans and Standard Operating Procedures for each underlying project or effort working toward the ultimate goal of restoration of beneficial use support. These monitoring efforts will need to be based on Oklahoma's Water Quality Standards and Use Support Assessment Protocols which define the process by which beneficial use support can be determined. Technical assistance in developing these plans can come from various sources, including the Oklahoma State Agency peer review process. In addition, the central North Canadian WAG will be allowed to review these individual plans to insure both that the plans address monitoring needs identified by stakeholders and that stakeholders remain informed about watershed monitoring activities.

Methodologies developed for use in this WBP will be selected to provide: 1) a quantifiable measure of changes in parameters of concern, 2) success measures that can be easily understood by cooperators and stakeholders with a variety of technical backgrounds, and 3) consistent, compatible information throughout the watershed.

Monitoring will focus on the primary causes of impairment, as listed in the 303(d) list, but will also consider related causes that may exacerbate the impacts of the primary causes or may ultimately reach impairment levels without improved management. As the WBP evolves and expands to be more inclusive all the parameters of concern, it is anticipated that this list will expand and contract. At this time, the following parameters will continue to be monitored in the North Canadian watershed:

- Water quality: nutrients, sediments, suspended solids, fecal bacteria, dissolved oxygen, temperature, pH, conductivity, alkalinity, hardness, turbidity, chlorophyll-a, BOD5
- Hydrologic budget: in-stream flows, infiltration rates, aquifer recovery, groundwater levels
- Landuse/land cover: acreage in different landuses, quality and type of land cover, timing and other variables of associated management practices
- Riparian condition: extent and quality of riparian zones in the watershed to include quality and type of vegetation, degree of impact or stability, condition of streambanks, and primary source of threat or impact
- Aquatic biological communities: assessment of the condition of fish and benthic macroinvertebrate communities related to reference streams and biocriteria

- BMP and other implementation efforts: type, extent, and specific location of practices to include an estimate of the potential load reduction due to implementation
- Behavioral change: participation in Watershed Based Plan-related activities and behavioral changes of affected communities

With each WBP-related program, as well as for the WBP as a whole, baseline conditions will be established and monitored prior to implementation. A monitoring schedule and Quality Assurance Project Plan (QAPP) will be developed based on the type of project and timing of its implementation. Monitoring results will be reported to the appropriate entities as defined in the QAPPs.

Baseline Data

Water Quality

The baseline data to evaluate progress in the North Canadian Watershed has been established by the 2005 TMDL. Watershed data from 1997-2003 was examined and used in the calibration. Until the TMDL is officially approved, water quality in this WBP will be guided by the following:

- ***Oklahoma Integrated Report*** -- CWA Section 303(d) List of Waters needing a TMDL, 2004. Lake Overholser and El Reno Lake are of concern because both are listed on the 2004 Category 5 (303(d)) list for turbidity, as is a segment of the North Canadian River. In addition, Shell Creek and portions of the North Canadian River are listed for pathogens, and Shell Creek is impaired for dissolved oxygen.
- ***OCC Special Project (Northwest Stream Assessment)*** – A site on Shell Creek was sampled monthly from 2000-2002 as part of a special OCC project.
- ***OWRB BUMP monitoring*** – The North Canadian River near El Reno has been monitored monthly since 1998; the North Canadian River near Watonga has been monitored monthly since 2003; Lake Overholser and El Reno Lake are monitored quarterly for one year every other year.
- ***USGS*** – The USGS has three permanent stations on the North Canadian River, one near Calumet (with data starting in 1974), another near El Reno (with data from 1938), and one near Yukon (with data from 1952). These sites are monitored for water quality parameters monthly in addition to providing “real-time” discharge and gauge height data.

Hydrologic Budget

- ***USGS*** gauging system – present at the three sites described above (near Calumet, El Reno, and Yukon), plus an additional site near Watonga, which only collects hydrologic data.

Landuse/Land Cover

- ***NRCS and OCC*** - Color digital orthophotos (2003)
- ***OSU Biosystems and Agricultural Engineering*** -
  - Modeling the North Canadian Watershed Using SWAT 2000 (ongoing)

Riparian Condition

- ***NRCS and OCC*** - Color digital orthophotos (2003)
- ***OSU Biosystems and Agricultural Engineering*** -
  - Modeling the North Canadian Watershed Using SWAT 2000 (ongoing)

Aquatic Biological Communities

- ***OCC*** – As part of the Northwest Stream Assessment project, the Shell Creek fish community was assessed in 2000, while the macroinvertebrate community was sampled three times during 2000-2002.
- ***OWRB – BUMP monitoring*** of the North Canadian River near El Reno and the North Canadian River near Watonga includes biannual sampling of macroinvertebrates and sampling of fish twice every five years.

Best Management Practices and Other Implementation Efforts (Coverages)

- ***NRCS/FSA*** - Records of locations, specific practices installed, and associated costs of programs such as EQIP, WRP, CRP, etc. (ongoing)
- ***OSU Biosystems and Agricultural Engineering and OCC*** - Estimates of load reductions related to installation of specific practices through computer modeling (ongoing)
- ***ODEQ*** - Permit upgrades for NPDES permitees in the watershed
- ***OWRB*** - Infrastructure upgrades supported through the State Revolving Fund Loan program

Data Collection Responsibilities

Responsibility for the collection of additional data of the types described above will reside with project managers of the individual projects as spelled out their individual work plans. These project managers will be responsible for ensuring that the data is submitted to the ODEQ for inclusion in the Oklahoma State Water Quality Database, which will ultimately be uploaded to the National STORET database. Data reporting under individual workplans will also be the responsibility of the project managers. Monitoring results for all projects will be available and accessible to the public through the posting of final reports on agency websites.

In addition to those monitors to be identified in the workplans of the individual projects under this WBP, the following groups will be involved in monitoring activities:

- Oklahoma Water Resources Board (OWRB): Beneficial Use Monitoring Program and Oklahoma Water Watch Monitoring Program
- Oklahoma Conservation Commission (OCC): Priority Watershed Project Monitoring and Blue Thumb Project Monitoring
- U.S. Geological Survey (USGS): surface and groundwater quality and quantity monitoring and special studies
- Oklahoma Department of Agriculture, Food, and Forestry: soil sampling associated with CAFO regulations

Monitoring Details

Stream Monitoring

Oklahoma Conservation Commission (OCC):

The OCC monitored the water quality of Shell Creek from 2000-2002 as part of the Northwest Streams Assessment Project. Starting in June 2008, three additional sites (see Table 12 for locations) will be monitored with autosamplers to collect continuous, flow-weighted samples. In addition, OCC will conduct routine physico-chemical monitoring at the autosampler sites, along with collection of bacteriological samples weekly during the recreation season. Biological and habitat monitoring will not be completed as part of this project because the presence of upstream and downstream reservoirs are likely to have a more significant impact on the fishery than the BMPs implemented, and the project size is unlikely to significantly impact habitat availability in the North Canadian River. Water quality monitoring will continue throughout the length of the project. Specific sites for the installation of the autosamplers will be determined after review of SWAT modeling results. Table 10, below, indicates the parameters that will be analyzed and the collection frequency. Data analysis will occur at the end of the project as well as at least biannually for inclusion in the State's Integrated Report to determine the status of water quality.

Table 10. OCC analytical parameters and sampling frequency.

Parameter	Collection Frequency
Dissolved Oxygen, Conductivity, pH, Temperature, Alkalinity, Turbidity, Nitrite-Nitrogen, Total Kjeldahl Nitrogen, Orthophosphorus	Monthly + 6 high flow events per year
Total Phosphorus, Instantaneous Discharge, Nitrate-Nitrogen, Ammonia-Nitrogen	Monthly grab samples + 6 high flow events per year; Weekly autosampler samples
Total Coliform, *E. coli*, and *Enterococcus*	Weekly from May 1 – September 30

USGS:

The USGS stations will continue collecting monthly water quality data and continuous hydrologic data at three sites in the watershed, as detailed in Table 11. An additional site (near Watonga) collects "real-time" hydrologic data only. Figure 2 illustrates the sample site locations.

Table 11. USGS parameters and sampling frequency.

Parameter	Sampling Frequency
Specific Conductance, Temperature, Dissolved Oxygen, Turbidity, pH, Nitrite, Ammonia-Nitrogen, Nitrite + Nitrate, Ortho-Phosphorus, Total Phosphorus, BOD5, TSS	Monthly
Discharge, Gauge height	Daily (real-time)

Instrumentation at these gauge stations includes a continuous stage recorder and some rainfall data. Data for these parameters from gauge stations are logged at 15-minute intervals to one-hour frequency (depending upon hydraulic characteristics of site), uploaded via satellite to USGS's Water Control Data System, and then downloaded via

satellite to become available to the public, real-time, via the USGS web site. These data will provide information about relative quantities of nutrients transported during both base flow and surface runoff conditions, as well as load contribution from each basin.

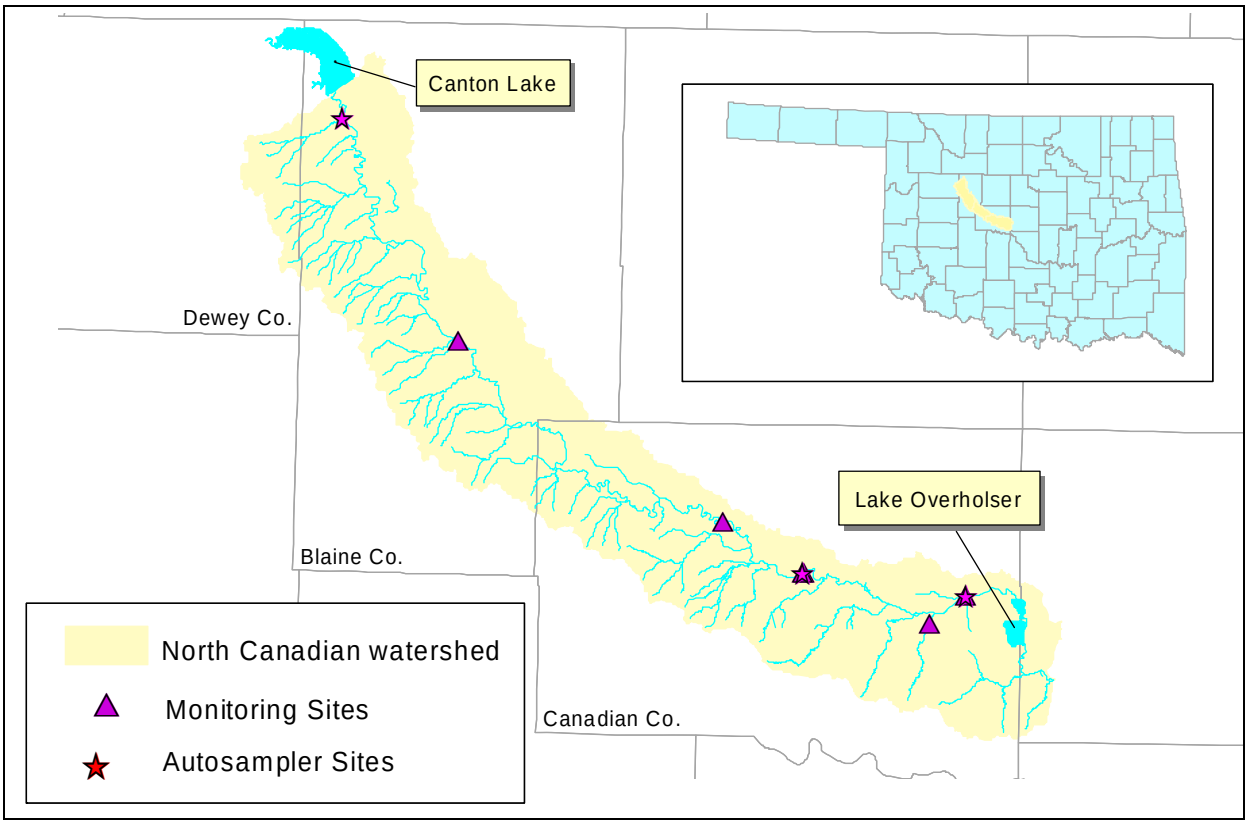

Figure 4. Locations of monitoring sites.

Table 12. Stream monitoring sites for water quality data.

Agency	Site Name	Latitude	Longitude	Type of Site
USGS	North Canadian River near Calumet, OK	35.61694	-98.06500	Ambient
USGS	North Canadian River near El Reno, OK	35.56306	-97.95722	Ambient
USGS	North Canadian River near Yukon, OK	35.53944	-97.74222	Ambient
OWRB	North Canadian River, US 81, El Reno	35.56261	-97.95885	Ambient
OWRB	North Canadian River, US 270, near Watonga	35.81217	-98.42080	Ambient
OCC	North Canadian near Canton, OK	36.05522	-98.58324	Autosampler
OCC	North Canadian near El Reno, OK	35.56145	-97.95932	Autosampler
OCC	North Canadian near Yukon, OK	35.53877	-97.74229	Autosampler

Oklahoma Water Resources Board (OWRB):

As part of the BUMP, OWRB will continue monitoring the two stream sites described above. Table 13, below, indicates the parameters collected in this program.

Table 13. OWRB stream parameters and sampling frequency.

Parameter	Collection Frequency
Dissolved Oxygen, Conductivity, pH, Temperature, Alkalinity, Oxidation/Reduction Potential, Salinity, Hardness, Chloride, Sulfate, Turbidity, Total Dissolved Solids, Nitrite-Nitrogen, Nitrate-Nitrogen, Ammonia-Nitrogen, TKN, Total Phosphorus, Orthophosphorus, Chlorophyll-a	10 times a year
Benthic Macroinvertebrates	2 summer/2 winter, 2 out of every 5 years
Fish	Once every year 4-5 years
Habitat	With macroinvertebrate and fish collections
Total Coliform, *E. coli*, and *Enterococcus*	5-10 times a year, from May 1 – September 30

Lake Monitoring

OWRB will continue to monitor both Lake Overholser (5 sites) and Lake El Reno (4 sites) as part of the BUMP. This involves quarterly sampling every other year in which the following parameters are monitored: temperature, pH, dissolved oxygen, salinity, dissolved oxygen % saturation, oxidation-reduction potential (redox), specific conductance, total dissolved solids (TDS), turbidity, Secchi disk depths, nitrate nitrogen, nitrite nitrogen, ammonia nitrogen, kjeldahl nitrogen, orthophosphorus, total phosphorus, true color, chloride, sulfate, total alkalinity, chlorophyll-a, and pheophytin. Vertical water quality profiles are recorded at one meter intervals from the lake surface to the lake bottom for at least three sites per reservoir: in the central pool area near the dam (lacustrine zone), in the upper portion of the lake and in the major arms of the water body (riverine zone), and in the area between the lacustrine zone and the riverine zone (transitional zone).

Point Source Monitoring

Information on discharges from waste water treatment plants (WWTPs) will be obtained through Discharge Monitoring Reports (DMR) in order to monitor maximum bacteria concentrations and exceedance violations during the project period.

Benefits of the Monitoring Plan

Implementation of this monitoring plan will enable North Canadian watershed partners to meet the goals of the WBP, which is ultimately to restore beneficial use support to waters of the watershed. Implementation of the monitoring plan will help further define areas of the watershed where restoration activities should be focused to realize the optimum benefit for the investment as well as evaluate the impacts (realized and potential) of implementation efforts. Collection of the data described under this monitoring plan will help define the relative contributions from various sources in the watershed and the processes contributing to water quality degradation in the watershed. Finally, continued collection of this data and evolution of the monitoring plan for the watershed will allow the program to adapt to meet the changing needs of watershed protection in the Central North Canadian Watershed.

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Appendix A

Pre-Implementation Plan

FINAL TARGETING REPORT: NORTH CANADIAN RIVER WATERSHED PRE-IMPLEMENTATION WITH SECONDARY STAGE TARGETING MECHANISM

FY 2007 319(h), #C9-996100-14
Project 6, Output 6.1.3

North Canadian River Watershed Implementation Project

Beginning November 1, 2007
Ending August 31, 2010

Developed by:

Oklahoma Conservation Commission

In Cooperation with:

Blaine County Conservation District
East Canadian County Conservation District
Central North Canadian Conservation District
Dewey County Conservation District
North Canadian River Watershed Advisory Group
Natural Resource Conservation Service

Oklahoma Conservation Commission

Guidelines
for the
North Canadian River Watershed
319 Non Point Source Cost-Share Project

Program Years 1-3 and Approved Practices

I. General

The Oklahoma Conservation Commission hereby declares that the following problems are having a detrimental affect on the state's water resources in the North Canadian River Watershed. Water samples at various locations along the North Canadian River have repeatedly exceeded Oklahoma water quality standards for *Enterococcus* and turbidity. As a result, this segment of the North Canadian River is on the 2004 303(d) list as impaired for pathogens and turbidity. Other 303(d) listed waterbodies within the watershed include Lake Overholser and El Reno Lake, which are impaired by turbidity, and Shell Creek, which is impaired for pathogens and low dissolved oxygen. In addition, the Lake Overholser watershed up to the Canton Dam was designated a nutrient-limited watershed in 2006 due to TSI values exceeding 62 in the lake.

Oklahoma's water resource is an important foundation of the state's economic infrastructure. Natural climatic events as well as human activity are impacting the state's water resources. Protecting and conserving this vital natural resource is paramount in preserving the state's economic future. In order to accomplish this goal, the Commission hereby establishes the following objective based on the Total Maximum Daily Load (TMDL) completed by the Oklahoma Department of Environmental Quality (ODEQ):

> Make incentive funds and equipment available to producers via Conservation Districts so they can implement Best Management Practices in crop fields, pastures, and in riparian areas to protect our water resource in the watershed.

The Conservation Commission herein establishes the list and description of the Implementation Project and practices. These policies and practices were reviewed and approved by the North Canadian River Watershed Advisory Group, Dewey County Conservation District, Central North Canadian Conservation District, Blaine County Conservation District, and East Canadian Conservation District representatives for use during this three (3) year program.

Cost-share rates (unit cost) will be based on the Oklahoma Natural Resources Conservation Service (NRCS) state average unit cost. These unit costs will be updated annually. Any variances in the best management practices must be recommended by the Watershed Advisory Group and approved by the respective conservation districts and the Oklahoma Conservation Commission Water Quality Director. These variances must be approved prior to performance agreements being signed.

The four districts and their cooperators will each have an equal opportunity to participate in the project within the bounds of the North Canadian watershed boundaries, subject to fund availability and targeting results. All agriculture producers and individual rural residents in the North Canadian Watershed are eligible to participate in the project. There will be no minimum cost-share payment to any applicant. In order to fairly distribute incentive and cost-share funds, a maximum assistance amount per participant has been set. The cap for the project is $50,000 per participant. For the purposes of this project, family members who are living together and operating a farm count as one participant.

Funds allocated for the project:

State Funds	$510,999.00
Federal Funds	$633,436.00
Total Funds	$1,144,436.00

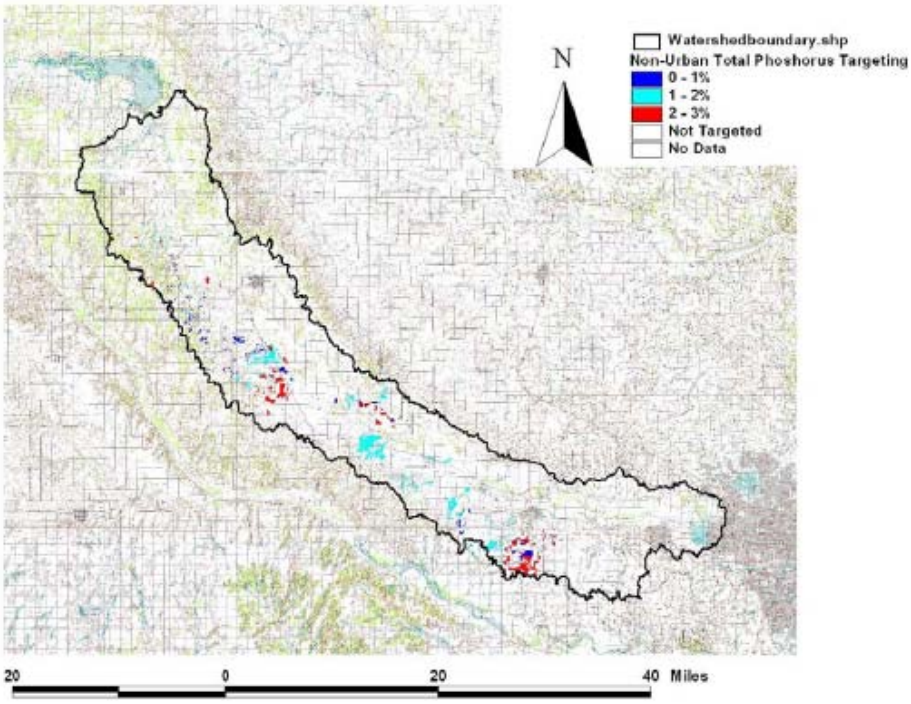
Landowner contributions are not included in this total.

Targeting:

The Conservation Commission Water Quality Staff, with the concurrence of the Environmental Protection Agency, has designated the following means to be used for targeting methodology:

(1) utilization of remotely-sensed and electronically mapped data. A GIS-based targeting exercise has already been completed for the North Canadian Watershed. Targeting efforts will be coordinated with the local NRCS offices that are actively assisting with the program. The purpose of this coordination includes leveraging of funds for mutual benefit. If it is determined that an individual does not meet the particular needs for the OCC program, he or she may still be suited to enroll in one of the many USDA programs;
(2) on-site assessments with the aid of aerial photographs, soil surveys, and the use of a priority ranking system similar to the one used by NRCS for the EQIP program;
(3) the use of a priority ranking system similar to the one used by NRCS for the EQIP program.

Those individuals desiring to participate in the program will receive a preliminary site visit from a conservation plan writer. The Plan Writer will do a preliminary investigation to determine the extent to which the particular landowner contributes to the water quality problems in the watershed and assign a ranking index based on the practices that would need to be implemented, the cost for implementation, and the expected impact on water quality improvement. A concerted effort will be made to identify the areas that are contributing the larger amounts of sediment and nutrients such that the remediation cost per unit mass of pollutant is minimized. A priority ranking system is being developed incorporating all of these factors and the targeting results.



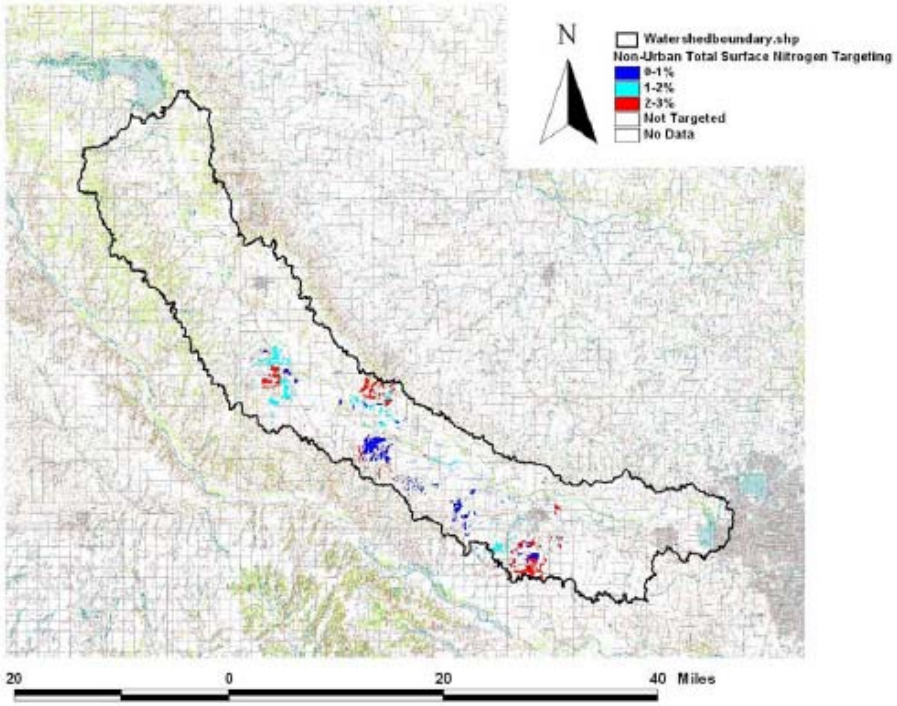


Figure 1. Targeted areas in the North Canadian River watershed.

Expected Load Reductions:

Dr. Dan Storm from OSU was contracted by the OCC to model the North Canadian watershed and the potential effects of implementation in the area. The SWAT model was used to simulate the changes in phosphorus loads due to implementation of various agricultural Best Management Practices (BMPs). The practices considered in the model included conservation tillage, no tillage, land conversion from agriculture to pasture, contour tillage, buffer strips on agricultural lands, and conversion of grazing pasture land to hay fields.

All Best Management Practices noted some reduction in total phosphorus load, as shown below, with the largest total phosphorus load reduction resulting from the addition of a 10 meter buffer strip on all agricultural land uses.

Best Management Practice	Total Phosphorus Load (Kg/yr)	Load Reduction
Default - No BMP	30,200	
Conservation Tillage	26,700	12%
No Tillage	28,900	4%
Contour Plowing	24,600	19%
Land Conversion AGRR/WWHT--->PAST	24,000	21%
Buffer Strip (10 meters)	21,700	28%
Pasture Conversion from Grazing to Hay	25,300	16%

II. Policies:

The Watershed Advisory Group (WAG) recommended the Best Management Practices (BMPs) that will be offered to residents in the North Canadian Watershed at a meeting on November 5, 2007. The BMPs

were then approved by the Conservation District Boards of the four participating districts and ultimately taken before the Oklahoma Conservation Commission Members for approval.

Cost-Share practices shall be implemented according to the standards and specifications of the Natural Resources Conservation Service. The Human Waste Portion will be implemented using the Department of Environmental Quality standards and specifications. Conservation Commissioners, Conservation Commission Staff, Conservation District Employees, or the spouses of any of these individuals shall not be eligible to participate in the Conservation Cost-Share Program. Conservation district directors and members of the Watershed Advisory Group are eligible and encouraged to participate in the North Canadian River Watershed Implementation Project. If district directors choose to participate, the following OCC policy will apply:

> In order to provide for an impartial legal majority no more than two district directors from each of the conservation districts shall participate in the cost share program for the North Canadian River Watershed Implementation Project. In addition, the directors who desire to apply for the cost share program shall refrain from discussing or voting on any items or issues pertaining to the cost share program. This includes: rates, practices, maximum payment, and applicants for the program.

The Oklahoma Conservation Commission Water Quality Staff, with the concurrence of the North Canadian River Watershed Advisory Group and approved by the aforementioned conservation districts and Oklahoma Conservation Commission, have developed standard forms which will be designated as NCW (North Canadian Watershed) for the following: (1) NCW Project Cost-Share Assistance Application Form; (2) NCW Project Priority Ranking System (3) NCW Cost-Share Evaluation Form.

A. Sign Up:

A two month sign up period, from January 15 to March 15, 2008, has been established for taking applications for the implementation project. Applications will be taken at each of the four conservation district offices using the NCW Project Application Form. The program will be well advertised in local print and airwave media and during the sign up period the project coordinator, education coordinator, and district staff will be making contact with individuals in the high priority areas as indicated by the map. After the prospective cooperator has applied, the project coordinator will determine eligibility and location in the watershed. Site visits will be conducted on these locations to ascertain contribution to the watershed using the NRCS soil loss equation and proximity to watercourses in the watershed. A conservation plan will be completed on each successful applicant to help determine needs. A performance agreement will be developed in accordance with the Oklahoma Conservation Commission Cost-Share Program (refer to OCC State Guidelines for Program Year 5). The completed performance agreement will be presented for approval to the appropriate conservation district. The final approval will be authorized by the designated OCC representative. The Watershed Advisory Group will be updated on plans and agreements. Additional sign ups will be taken on a continuous basis. Note: Absolutely no implementation practices can begin until all signatures are on the performance agreement.

B. Contract Compliance:

A performance agreement will be signed by the cooperator with the appropriate conservation district. A schedule of operations that outlines a year by year plan of the Best Management Practices will also be completed. An annual status review will be part of the contract process to ensure compliance with the policies and standards and specifications. At this time any concerns the producer has about BMPs will be discussed, and answers will be provided to any questions they might have. Deviation from the schedule of operations beyond the control of the cooperator will be discussed, and a revision schedule of operations can be completed and presented to the appropriate board for approval. In the event the cooperator is in non-compliance due to lack of interest the district board has the discretion to terminate the contract with 30 days notice. The initial contracts will be for two years with any remaining funds obligated on yearly contracts to facilitate the completion of BMP instillation.

C. List of Recommended Conservation Practices And Cost-Share Rates

The North Canadian River Watershed Advisory Group convened on November 5, 2007 and approved the following list of Priority and Best Management Practices for recommendation to the Commission Members. The list was approved by the representatives of the participating conservation districts at the meeting. The Oklahoma Conservation Commission approved the list at the monthly Commission meeting on December 3, 2007.

Practices			Cost-Share Rate
Priority #1	**Erosion**		**80%**
	Components:	(1) Vegetative Planting (2)Field Border (3)Residue Management (4)Structural Practices (5)Roadside Concerns	
Priority # 2	**Riparian Areas-Buffer Zones**		**90%**
	Components:	(1) Vegetative Planting (2) Stream Crossings (3) Fencing (4) Off Site Watering	
Priority #3	**Livestock Management**		**80%**
	Components:	(1) Vegetative Establishment (2)Cross Fencing (3) Watering Facilities (4) Heavy Use Areas (5) Nutrient Management	
Priority #4	**Septic Concerns & Special Projects**		**90%**
	Components:	(1) Septic Systems with Tank & Lateral Lines (2)Rock Reed Absorption Filters with Septic Tank (3)Residential Sewage Lagoons (4)Other	

For an applicant to qualify for cost share assistance, he must have a need for at least one of the Priority Best Management Practices and be willing to install the needed BMP(s).

III. Conservation Cost-Share Practice Standards Specifications:

Cost-Share practices shall be implemented according to the Natural Resources Conservation Service Standards and Specifications in Section V of the Field Office Tech Guide. For septic systems, see Bulletin 640-Special Qualification Guidelines for Septic Systems from the Department of Environmental Quality.

IV. Description of Approved Priority Practices:

Priority 1: Erosion

Definition
The detachment and movement of soil by wind and water.
Purpose
To reduce the sediment and erosion to improve water quality and the productiveness of the land.

Best Management Practices to Support Priority

Residue management, contour farming, contour buffer strips, cover crop, critical area planting, sediment basin, structural practices (GSS, waterway, etc.) nutrient management, mulching, field border, filter strip, grass planting, etc.

Establishment
All structures and practices are completed using the standards and specifications of NRCS.

Priority 2: Riparian Areas-Buffer Zones

Definition
Riparian areas are the lands adjacent to water bodies-from creeks, rivers to lakes, ponds, and wetlands. Riparian areas consist of trees, trees and shrubs, or trees, shrubs and vegetation. Buffer zones are strips or small areas of land in permanent vegetation adjacent to water sources or field edges.

Purpose
Reduce excess amounts of sediment, organic material, nutrients, pathogens, and/or pesticides in surface runoff and shallow water flow.

Best Management Practices to Support Priority
Exclusion fencing, vegetative establishment, off site watering facilities, stream crossings, etc.

Establishment
The riparian areas and buffer zones will be planned and designed according to NRCS specifications. The conservation water quality planner representing the local districts will complete the plan.

Management
The conservation planner will make recommendations to the applicant on management according to NRCS specifications. As a part of the management, exclusion incentives will be offered as follows:

1. Total Exclusion-$90.00/acre/yr for 3 years.
    a. These exclusion incentives are 100%.
2. Hay Production-$80.00/acre/yr for 3 years
    a. These exclusion incentives are 100%.
    b. Hay can only be accomplished in Zone 3 of the riparian area as determined by the conservation planner.

These exclusion incentives will be limited to no more than an average of 300' on each side of the stream bank.

Priority 3: Livestock Management

Definition
Management of livestock as it pertains to grazing practices, nutrient management, riparian access, waste disposal, and/or feeding sites.

Purpose
Aid in promoting improved grazing practices, nutrient needs, feeding practices, and/or watering facilities to maintain pastures in better condition and prevent movement of nutrients, sediment and bacteria to waterways.

Best Management Practices
Cross fencing, nutrient management, watering lanes, water well, pipeline, stream crossing, heavy use area, etc.

Priority 4: Septic Concerns and Special Projects

Purpose
To aid in the disposal of human waste for rural residents. The special projects component will be utilized for special needs in the watershed that do not fit specifically in one of the categories, yet still contribute significant sediment, nutrients, and or pathogens to the waters of the watershed.

Components-Human Waste
Excavation, septic tanks with lateral lines, rock reed absorption filters with septic tanks, and residential sewage lagoons are components necessary for the safe disposal of human waste.

Qualifications Criteria for Septic Systems
Cost-Share assistance for septic systems will be allowed only for non commercial single family dwelling that are used for permanent and primary residence. The cost-share funds can not be spent on new homes or new mobile homes. Recreational trailers are not eligible for cost-share assistance.

V. North Canadian River Watershed Components Parts List:

1. Residue Management, No till and Strip Till -329a

Definition
Managing the amount, orientation and distribution of crop and other plant residues on the soil surface year-round, while growing crops in narrow slots, or tilled or residue free strips in soil previously untilled by full-width inversion implements.

Purpose
This practice will be applied as part of a conservation management system to support the following: reduction of sheet & rill erosion and wind erosion, maintain or improve soil organic matter content and tilth, and conserve moisture.

Components
The use of harvesting equipment equipped with spreaders to distribute residue. No till or strip till methods of seedbed preparation, planting, and fertilizing while disturbing no more than one third of the row width.

2. Residue Management, Mulch Till-329b

Definition
Managing the amount, orientation, and distribution of crop and other plant residue on soil surfaces year-round, while growing crops where the entire field surface is tilled prior to planting.

Purpose
This practice will be applied as part of a conservation management system to support the following: reduction of sheet & rill erosion and wind erosion, maintain or improve soil organic matter content and tilth, and conserve moisture.

Components
The retention of loose residue on the field shall be evenly distributed. Tillage implements shall be equipped to operate through plant residue without clogging and maintain residue by undercutting or mixing.

3. Residue Management, Ridge Till 329c

Definition
Managing the amount, orientation, and distribution of crop and other plant residues on the soil surface year-round, while growing crops on preformed ridges alternated with furrows protected by crop residue.

Purpose
This practice will be applied as part of a conservation management system to support the following: reduction of sheet & rill erosion and wind erosion, maintain or improve soil organic matter content and tilth, and modify cool wet site conditions.

Components
The retention of loose residue on the field shall be evenly distributed. Ridge height shall be maintained throughout the harvest and winter seasons by controlling equipment and livestock. Planting and cultivation equipment designed to operate on ridges shall be used.

4. Contour Farming-330

Definition
A management tool used in tilling, planting, and other farming operations on or near the contour of the field slope.

Purposes
The function of contour farming is to reduce sheet & rill erosion and reduce transport of sediment and other water-borne contaminants.

Components
Contour farming is most effective on croplands with slopes between 2 and 10 percent.

5. Contour Buffer Strips-332

Definition
The narrow strips of permanent, herbaceous vegetative cover established across the slope and alternated down the slope with parallel, wider cropped strips.

Purpose
The function of contour buffer strips is to reduce sheet & rill erosion and reduce transport of sediment and other water-borne contaminants.

Components
This practice is most effective on uniform slopes in cropland where the slopes are between 4 and 8 percent.

6. Cover Crop-340

Definition
The establishment of grasses, forbs, or other herbaceous plants for seasonal cover and conservation purposes.

Purpose
Maintaining a cover crop reduces erosion, increases organic matter, manages excess nutrients in the soil profile, and promotes weed suppression.

Components
Fertilizer/Lime, seedbed preparation are needed for the practice.

7. Critical Area Planting-342

Definition
The planting of vegetation, such as trees, shrubs, vines, grasses, or legumes on highly erodible or critically eroding area.

Purpose
This is used to stabilize the soil, reduce damage from sediment and runoff to downstream areas.

Components
Seedbed preparation, nutrient management, mulching, grass planting, tree and shrub planting, lime are needed for the practice.

8. Sediment Basin-350

Definition
A basin constructed to collect and store debris or sediment.

Purpose
A sediment basin is used to preserve the capacity of reservoirs, waterways, and streams by reducing or abating silt and other debris.

Components
Grade stabilization structures, ponds, grass planting, tree and shrub planting, and fencing are needed for the practice.

9. Diversion-362

Definition
A channel constructed across the slope generally with a supporting ridge on the lower side.

Purpose
This practice may be applied to support the following: diverting the water from actively eroding gullies or areas, intercepting surface flow on long slopes, and reducing erosion and runoff on agricultural sites.

Components
Critical area planting, fill section, and ridge and/or channel (parallel or broad base) are needed for this practice.

10. Pond-378

Definition
A water impoundment made by constructing a dam or an embankment or by excavating a pit or dugout.

Purpose
Ponds are used to provide water for livestock, fish, wildlife, recreation, fire control, crop and orchard spraying, and other related uses to maintain or improve water quality. Ponds can also intercept and store pollutants that would otherwise reach natural bodies of water.

Components
Excavation or embankment, barrel and/or riser, blanket material, trash guard, and clay liners are needed for a pond.

11. Fence-382

Definition
A constructed barrier to exclude livestock, wildlife, or people.

Purpose
Fencing is used as part of a conservation management system to aid in treatment of water and other resource concerns.

Components
The proper height, size, spacing, and type of posts should be used to provide the needed protection for the task. Labor, posts, wire, and other equipment are needed to construct this practice.

12. Field Border-386

Definition
A strip of permanent vegetation established at the edge or around the perimeter of a field.

Purpose
A field border assists in reducing erosion from wind and water. They also provide turn and travel areas for equipment at the edge of fields.
Components
Seed bed preparations, nutrient management, and grass planting are needed for this practice.

13. Riparian Forest Buffer-391

Definition
An area of predominantly trees and/or shrubs located adjacent to and up-gradient from watercourses or water bodies.

Purpose
These buffers reduce sediment and nutrient loading in watercourses. They also create shade to lower water temperatures to improve the habitat for aquatic organisms.

Components
Seed bed preparation, grass planting, tree and shrub planting, and nutrient management are necessary for establishment.

14. Filter Strip-393

Definition
A strip of vegetation established between cropland, grazing land, or disturbed areas and the streams and water sources.

Purpose
Filter strips reduce sediment, nutrients, and other pollutants from reaching our water sources.

Components
Seed bed preparation, nutrient management, grass and shrub planting are necessary for filter strips.

15. Grade Stabilization Structure-410

Definition
A structure used to control the grade and head cutting in natural or artificial channels.

Purpose
The structures are used to stabilize the grade and control erosion in channels to prevent the advance of gullies and enhance the water quality.

Components
Grade stabilization structures require excavation, concrete, drop pipes, vegetative establishment, and or embankment practices.

16. Grassed Waterway-412

Definition
A natural or constructed channel that is shaped or graded to required dimensions and established with suitable vegetation.

Purpose
This practice is applied as part of a conservation management system to support the following: to convey runoff from terraces without causing erosion, reduce gully erosion, and to protect/improve water quality.

Components
Construction/shaping, seed bed preparation, nutrient management, and grass planting are needed for a waterway.

17. Lined Waterway or Outlet-468

Definition
A waterway or outlet with an erosion resistant lining of concrete, stone, or other permanent material.
Purpose
These provide for safe disposal of runoff from other conservation structures or natural concentrations of flow without damage from erosion.

Components
Construction and/or shaping, concrete, forms, and grass planting are necessary for a lined waterway or outlet.

18. Use Exclusion-472

Definition
The management practice of excluding animals, people, or vehicles from and area.

Purpose
This practice aids in prevention of access to an area to maintain or improve the quality or quantity of natural resources.

Components
The practice requires fences or other natural barriers along with an alternate watering source or limited access watering site if the exclusion area is a watering site..

19. Mulching-484

Definition
The applying of plant residues or other suitable materials to the surface of the soil.
Purpose
The mulching accomplishes or aids in the following: reduction of runoff and erosion, aids in prevention of surface compaction, helps establish plant cover, conserves moisture, and controls weeds.

Components
The practice makes use of cotton burs, hay, and sawdust or chips to cover critical area vegetative planting.

20. Pasture and Hay Planting-512

Definition
The establishment of native or introduced forage species.

Purpose
This practice may be used as part of a conservation management system to accomplish one or more of the following: reduce soil erosion by wind and water, provide complimentary forage to improve or maintain livestock nutrition or health, and or provide emergency forage production.

Components
The practice needs one or more of the following parts: grass sprigging and/or planting, seed bed preparation, nutrient management, and/or seeding of other grass species.

21. Pipeline-516

Definition
The pipeline is a means of conveying water in a closed conduit to an alternate site. The pipeline must have an inside diameter of 8" or less.

Purpose
Pipelines are used to convey water from a source of supply to points of use for livestock, wildlife, or recreation.

Components
The practice requires pipe (steel or plastic) that meets the NRCS requirements, a trencher, and a water supply.

22. Prescribed Grazing-528a

Definition
The proper treatment and use of pastureland.

Purpose
This practice enhances the prolonged life of desirable species to aid in protection of the soil and production of livestock. This reduction in erosion improves water quality and lowers sediment deposits.
Components
This practice requires establishment of forages, management of grazing practices, nutrient management, and/or cross fencing.

23. Range Planting-550

Definition
The establishment of adapted plants by seeding on native grazing lands (does not include pasture and hay land planting).

Purpose
This practice serves to prevent excessive erosion and improve water quality. It also provides forage for livestock and wildlife habitat.

Components
This practice involves seedbed preparation, nutrient management, and forage selection

24. Heavy Use Area Protection-561

Definition
The stabilization of areas frequently and intensively used by animals. This is accomplished by establishing vegetation, surfacing with suitable materials, and/or installing needed structures.

Purpose
This practice is used as part of a conservation management system to support the following practices: Improve water and air quality, reduce erosion, improve livestock health.

Components
The components needed for this practice include: vegetative establishment, structural practices, and/or installation of materials such as geo-textile, geo-cell, concrete, or rock.

25. Stream bank and Shoreline Protection

Definition
The structural and managerial treatment used to protect banks of streams, constructed channels, and lakes.

Purpose
The practice is used in preventing the loss of land and improving water quality by reducing erosion and run off.

Components
The practice calls for vegetative planting (grasses, trees, and or shrubs), and/or structural practices.

26. Stream Crossing-583a

Definition
A trail or trail way constructed across a stream to allow livestock or equipment to cross without disturbing the bottom or causing erosion on the banks (does not include culvert crossings).

Purpose
Stream crossings improve water quality by controlling erosion at the entry and exit points on a stream.

Components
The practice entails excavation and/or embankment, structural practices, a liner for the stream (rock, cement, geo-textile, or geo-cell) and fencing.

27. Contour Stripcropping-585

Definition
The practice of growing crops in a systematic arrangement of equal width strips on or near the contour of a field.

Purpose
The benefits of contour strip cropping are expressed in the reduction of sheet & rill erosion and the reduction of sediment and other water borne contaminants.

Components
The practice requires following of the contours in the fields with tillage and planting equipment on slopes of 15% or less.

28. Structure for Water Control-587

Definition
A structure in a water management system that conveys water, controls the direction of flow, and maintains a desired water surface elevation.

Purpose
The practice may be applied as a management tool to control the stage, discharge, distribution, or direction of flow to improve water quality.

Components
The practice requires excavation or embankment, structural practices, vegetative establishment, and/or

trash guards.

29. Nutrient Management-590

Definition
The management of the amount, source, placement, form and timing of the application of nutrients and soil amendments.

Purpose
Nutrient management minimizes non point source pollution of surface and ground water by efficiently monitoring vegetative needs. It improves the physical, chemical, and biological condition of soil.

Components
The practice calls for soil sampling, maintaining records, fertilizer and/or lime applications, and management of crop removals.

30. Terrace-600

Definition
An earth embankment, a channel, or a combination ridge and channel constructed across a slope.

Purpose
A terrace reduces slope length, intercepts flow, and prevents gully formation to reduce sediment and improve water quality.

Components
The terraces need a fill section, ridge and/or channel, and possibly vegetative establishment.

31. Tree/Shrub Establishment-612

Definition
The establishment of woody plants by planting seedlings or cuttings, direct seeding, or natural regeneration.

Purpose
The establishment of the woody plants provides for long term erosion control, filter pollutants from run off, provide for wildlife habitat, and improve water quality.

Components
Tree/shrub establishment calls for correct planting dates for seeds or seedlings, exclusion of livestock to allow for growth, and site preparation.

32. Trough or Tank-614

Definition
A tank or trough (with needed devices for water control and waste) installed to provide drinking water for livestock.
Purpose
A tank is installed to provide watering facilities for livestock that will protect vegetative cover and eliminate the need for livestock to be in streams.

Components
These watering facilities need concrete, water tank, freeze proof hydrants or other water sources.

33. Water Well-642

Definition
A hole that is drilled, dug, driven, bored, or otherwise constructed to an aquifer.

Purpose
The wells provide water for livestock, wildlife, and humans to facilitate proper use of vegetation on pastures.
Components
Water wells require excavation, drilling, casing, and wellhead protection.

34. Septic Systems

Definition
An on-site system designed to treat and dispose of domestic sewage. A typical septic system consists of a tank that receives waste from a residence or business and a drain field or subsurface absorption system consisting of a series of percolation lines for the disposal of the liquid effluent. Solids (sludge) that remain after decomposition by bacteria in the tank must be pumped out periodically.

Purpose
To insure that the rural residents have adequate means of disposing of human waste.

Components
The necessities for septic systems are: Septic tank, lateral lines, rock/reed fields, and/or residential sewer lagoons.
The septic systems will be designed according to Department of Environmental Quality (DEQ) bulletin 640-Special Qualification Guidelines for Septic Systems.

Procedures for Implementation
North Canadian River Watershed Demonstration Cost-Share Program

1. Open Application Period.
2. Keep list of all applications received and submit the Summary of Applicants report to OCC Water Quality Representative at the end of each week, updating all information on each application weekly.
3. Planners will determine eligibility, complete farm visits, and make evaluations on all applicants. The Evaluation Form must be completed for each applicant.
4. Develop a case file on each applicant. (Refer to Case File Check List). **Note: If and when the applicant is approved for funding and the conservation plan is developed, all items in the case file should be placed in with the plan.**
5. After all evaluations have been completed, the water quality representative and district personnel will rank all applicants. The ranking will be based on the priority ranking criteria set in the North Canadian River Priority Watershed Project State Policies and Approved Practices.
6. Successful applicants will be notified and a Performance Agreement will be signed by applicant, district board, and OCC Water Quality Representative. **Note: Absolutely no work can begin or materials purchased by any applicant until all three signatures have been obtained**.
7. Conservation plans will be developed on all approved applicants. Four copies of the conservation plan will be made with the landowner receiving one copy, the district office the second, and the Water Quality Representative retaining two copies (one copy will be kept at the representative's office with the other going to the Oklahoma Conservation Commission WQ office).
8. Arrangements are then made for the designated NRCS and/or OCC Water Quality Representatives to design the approved conservation practices.
9. Certify work is complete and authorize payment through the Conservation Commission. The notarized cost-share payment claim must be accompanied by a copy of all invoices, Performance Agreement, Consent Form (if applicable), Certification of Completion and Acceptance, and Cost-Share Payment Calculation Sheet. These will be forwarded to OCC for payment.
10. Upon receipt of payment for OCC, the district will obtain the signature of the participant on the Release of Warrant Form and place in the conservation plan case file. The disbursement of the funds to the cooperator will be completed to finalize the procedure.
11. Annual Status Reviews will be performed on the anniversary of the completion date for the practice.

<u>Case File Checklist</u>

1. Application for allocated funds
2. Copy of Evaluation Form
3. Performance Agreement
4. Amendments to Performance Agreement
5. Maintenance Agreement
6. Amendments to Maintenance Agreement
7. Certifications of conservation practice quantities and cost
8. Vouchers, Bills, and or receipts
9. Copies of any approved cost-share payments claims
10. Consent Form if applicable
11. Release of Warrant Form
12. Any correspondence to and from the participant
13. Any note of relevant conservation with the participant
14. Annual Status Reviews

Note: These items can be placed in the conservation plan folder in the district office after preparation of the plan.