



Oklahoma Comprehensive Water Plan Supplemental Report

Water Quality Issues & Recommendations

September 2011

This study was funded through an agreement with the Oklahoma Water Resources Board under its authority to update the Oklahoma Comprehensive Water Plan, the state's long-range water planning strategy. Results from this and other studies have been incorporated where appropriate in the OCWP's technical and policy considerations. The general goal of the 2012 OCWP Update is to ensure reliable water supplies for all Oklahomans through integrated and coordinated water resources planning and to provide information so that water providers, policy-makers, and water users can make informed decisions concerning the use and management of Oklahoma's water resources.

Oklahoma Comprehensive Water Plan



Water Quality Issues and Recommendations

The following report was developed for the 2012 Update of the Oklahoma Comprehensive Water Plan to address Oklahoma's water quality issues. This analysis was conducted by OCWP Water Quality Workgroup consisting of numerous representatives of local and tribal governments along with state and federal agencies that participate in water quality-related duties and programs in Oklahoma. These individuals were asked to provide program information related to their organizations and agencies as well as collective recommendations to address Oklahoma's most pressing water quality issues, including program requirements.

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1.0 INTRODUCTION

1.1 Water Plan Water Quality Goals

Freshwater is a vital environmental resource required by both humans and wildlife and provides many ecological services. Oklahoma Statutes set forth the policy of the State regarding water quality as follows:

Whereas the pollution of the waters of this state constitutes a menace to public health and welfare, creates public nuisances, is harmful to wildlife, fish and aquatic life, and impairs domestic, agricultural, industrial, recreational and other legitimate beneficial uses of water, it is hereby declared to be the public policy of this state to conserve and utilize the waters of the state and to protect, maintain and improve the quality thereof for public water supplies, for the propagation of wildlife, fish and aquatic life and for domestic, agricultural, industrial, recreational and other legitimate beneficial uses; and to cooperate with other agencies of this state, agencies of other states and the federal government in carrying out these objectives. (§82-1084.1. Waters of state - Public policy.)

As such, the management and protection of this resource is of utmost importance. For Oklahoma, the management and protection of this diverse resource focuses on its lakes, rivers, streams, wetlands, and groundwater. Oklahoma overlays 23 major groundwater basins, that have a combined storage of 320 million acre-feet of water. Oklahoma is also home to more than 78,578 miles of streams and rivers and 11,611 miles of shoreline. In addition, there are over 1,120 square miles of surface area in Oklahoma's lakes and ponds. This vast expanse of water stretches across the state and its 12, level 3 ecoregions.

2.0 Characterization of the Waters of Oklahoma

2.1 Surface Water

Oklahoma ranges from abundant high quality waters to limited quantities and marginal quality. Through construction of reservoirs and diversions, and in some locations substantial treatment to remove minerals, good water quality is available for most Oklahomans. Oklahoma must not only insure that a sufficient volume of water is available for the long term but also that it is of suitable quality for public use and to support Oklahoma's diverse aquatic community.

Southeast Oklahoma

In general, the waters of southeast Oklahoma are of excellent quality with low concentrations of dissolved minerals and very diverse aquatic life. The waters of SE Oklahoma are refuge for several federal endangered species including the Ouachita mucket and the leopard darter. The only known healthy population of Ouachita rock pocketbooks exists in the clean waters of the Kiamichi River, home to another 28 mussel species, including seven imperiled or vulnerable ones and more than half the mussels known to live in Oklahoma waters. The species rich Kiamichi River also harbors more than 100 native fish species.

The waters in this part of the state flow through the Ouachita Mountains, coastal plains Red River and the Red River Valley. The Mountain Fork, one of the States six scenic rivers flows into the scenic Broken Bow

reservoir and supplies water for a premier tailwater trout fishery. The reservoirs of SE Oklahoma are a critical water supply because of their excellent water quality.

Northeast Oklahoma

The streams of northeast Oklahoma are also of excellent quality containing five of the six Oklahoma scenic rivers. Waterbodies in this region of the state are prized for their recreational qualities. Those waters are threatened by pollutants from many different sources. Reservoirs in this area provide plentiful high quality water supporting many uses including a highly diverse community of fish and invertebrates. They are refuge for the endangered Neosho madtom, and several fresh water mussels.

Grand, Hudson, Fort Gibson, Tenkiller, Eucha/ Spavinaw and Oologah are important water supply lakes that must be protected.

Central Oklahoma

Waters of the central portion of the state are highly variable in their naturally occurring water quality. Although generally lower in minerals, both streams and reservoirs can have high turbidity. Streams are generally low gradient with sandy substrates. Water quality issues in this region tend to be bacteria, nutrients, dissolved oxygen, and turbidity. The waters of the Canadian River provide critical habitat for the endangered Arkansas River shiner.

Western Oklahoma

Much of the Arkansas River basin in northwest Oklahoma is underlain by shale, limestone and fine-to-course-grained sandstone. Water flowing through these rocks may dissolve large quantities of minerals, primarily sodium and sulfate. The Salt Fork of the Arkansas and Cimarron Rivers, two primary tributaries of the Arkansas, add highly mineralized water to the river. The Salt Fork of the Arkansas River and Cimarron River basins, underlain by massive gypsum deposits, are the location of numerous natural brine seeps and springs. Agriculture is the principal land use in the region which includes grassland and grazing land. The Salt Fork just downstream of Great Salt Plains Lake suffers somewhat from excessive concentrations of chloride, dissolved solids, nutrients, pesticides, toxic chemicals and suspended sediment. Great Salt Plains Lake itself has been partially filled with sediment and, in most areas water is only about four feet deep.

In the western portions of the state the waters can be highly mineralized where many of the stream names, such as Bitter Creek, Salt Creek, Stinking Creek and Dry Creek, lend evidence to the native water quality. With few exceptions, surface water in western Oklahoma is unsuitable for public supply due to undependable flows and large concentrations of dissolved minerals. There are however, other streams of excellent quality that provide valuable water supplies in this area. Medicine Creek, Cache Creek, Otter Creek and Beaver Creek are all exceptions that now provide valuable water supplies.

These waters can be what some call an extreme environment and therefore, support some uniquely adapted types of fish.

To enhance the utility of water in Lake Texoma, a controversial chloride control project in Texas and Oklahoma seeks to divert and retain the salt loads from the numerous salt springs in the Red River

watershed. On the other hand, waters in Fort Supply Lake, Canton Lake and Altus Lake, for example, provide critical water supplies with good water quality.

2.2 Groundwater

Groundwater is water that has percolated downward from the surface, filling voids or open spaces in the rock formations. An aquifer is a subsurface unit that can yield useful quantities of water. Oklahoma's aquifers may be divided into two general groups: bedrock and alluvial. The bedrock aquifers include sandstone aquifers; interbedded sandstone, limestone, and shale aquifers; soluble carbonate and evaporite (limestone, dolomite, and gypsum) aquifers; and the semi-consolidated sand and gravel that comprise the Ogallala aquifer. The alluvial aquifers consist of unconsolidated deposits of sand and gravel along rivers and streams.

The chemical composition of natural water is controlled by many interrelated processes and is derived from many different sources of solutes, including gases and aerosols from the atmosphere, weathering and erosion of rocks and soil, solution or precipitation reactions occurring below the land surface, and cultural effects resulting from human activities.

The *total dissolved solids* (TDS) content in a water sample is often used as a general indicator of water quality. Although OWRB considers groundwater with dissolved solid concentrations less than 5,000 mg/L (milligrams per liter) to be *fresh*, water is not considered desirable for drinking if the quantity of dissolved minerals exceeds 500 mg/L.

In Oklahoma, high concentrations of dissolved solids generally result from high concentrations of chloride and sulfate. Many aquifers in western Oklahoma have high concentrations of naturally occurring chloride and sulfate from groundwater that is in direct contact with halite (NaCl) or gypsum (CaSO₄*2H₂O) deposits that occur in Permian rock formations. Saline waters from adjoining Permian bedrock aquifers can migrate into portions of alluvial aquifers. Salinity also increases with depth in most bedrock aquifers from brines that are present in underlying geologic units. The depth to saline waters varies across the state, from less than 500 feet to more than 1,000 feet.

Although not used for drinking water, groundwater with high sulfate concentrations is used for irrigation of some crops. For example, the Blaine aquifer in southwest Oklahoma has a median TDS concentration of approximately 3,500 mg/L and median sulfate concentration of approximately 2,000 mg/L. Local farmers rely on the aquifer for irrigation of cotton and other crops.

Except for the Blaine aquifer, the state's major aquifers provide water supplies that generally meet federal and state standards for drinking water. However, not all areas or depths within these aquifers produce water suitable for public supply. Other naturally occurring constituents, such as arsenic, selenium, uranium, fluoride, and gross alpha activity, limit use of groundwater for public drinking water supplies in some areas. For example, in deep parts of the Garber-Wellington aquifer concentrations of naturally occurring arsenic, selenium, and uranium exceed drinking water standards. Large concentrations of gross-alpha radioactivity and radium-226 occur near the eastern edge of the Rubidoux aquifer, and concentrations of fluoride exceed the drinking water standard in the southern portion of the Arbuckle-Timbered Hills aquifer.

3.0 Current Water Quality Trends

A comprehensive assessment of statewide trends in water quality is beneficial to the development of Oklahoma's Comprehensive Water Plan. Understanding trends related to various water quality constituents directly affects decisions related to the future allocation of surface waters. Eutrophication of waters creates serious problems such as taste and odor issues in drinking water supplies, treatment byproducts, and may cause serious human health concerns (e.g. toxins from harmful algal blooms). Increased ground and surface water depletion concentrates minerals impairing the beneficial use of those waters for agriculture, municipalities, and industry. Furthermore, increased sedimentation of Oklahoma's rivers and reservoirs decreases the amount of storage and increases the costs of pretreatment. These are merely a few examples of how decreased water quality has severe implications for future water planning.

4.0 Threats to Water Quality

4.1 Threats to Surface Waters

There are many potential pollution sources threatening surface waters. Some sources, with treatment, now enhance many of the states waters with additional flow and provide waters that are suitable for many beneficial uses. Many of the long recognized potential pollution sources now have long standing regulatory programs dictating their treatment and well developed technology to insure the discharge of those waste waters are of the most acceptable quality. Municipal sewerage and industrial point source treatment, after many years of evolution, now provide waters suitable for reuse that support aquatic communities downstream of their discharge. Remaining pollutants of concern from these sources are plant nutrients that cause excessive algae growth, personal care products and pharmaceuticals that pass through treatment works relatively unaltered.

The enactment of the Clean Water Act (CWA) in 1972 resulted in dramatic improvements in the:

- Number of wastewater treatment plants
- Percentage of the population served by wastewater treatment plants
- Quality of effluent treatment from wastewater treatment facilities

In 2008, 70% of Oklahoma residents received centralized wastewater treatment services at the secondary, advanced, or no discharge treatment level, compared to 39% in 1972. In Oklahoma, small community wastewater facilities serve 20% of the population and comprise 12% of total wastewater treatment and collection needs. <http://www.epa.gov/cwns/ok08.pdf>

Urban runoff is now the focus of a major Clean Water Act (CWA) effort with larger cities monitoring stormwater quality and implementing best management practices to reduce pollutants. Agricultural runoff is the largest unregulated source of pollutants to the states waters. The Natural Resource Conservation Service, Conservation Commission and Department of Agriculture implement substantial programs to reduce and/or prevent nonpoint source (NPS) pollutants such as sediment, nutrients, animal waste, pesticides and bacteria from entering the state's waters.

The oil and gas industry has historically caused significant impacts to Oklahoma water quality. Pollutants from that industry are now regulated and significant programs such as those managed by the Corporation Commission and the Oklahoma Energy Resources Board are slowly being remedied in many areas.

4.2 Threats to Groundwater

Human activities can impact groundwater quality by contributing nitrate, chloride, and other substances to underground supplies. Nitrate contamination from point and nonpoint sources, such as animal wastes, sewage, and fertilizers, is widespread throughout the state. Where nitrate concentrations exceed the U.S. EPA drinking water standard of 10 mg/L, water is declared impaired for public drinking supplies.

Other instances of human-induced groundwater pollution appear to be isolated. Examples of anthropogenic pollution include chloride from discontinued oil field activities and injection wells, metals from past mining operations, pesticides from residential applications, and hydrocarbons from various sources. Contaminated water from the abandoned zinc and lead mines in Ottawa County has the potential to degrade the quality of Roubidoux water in the vicinity of Miami and Pitcher. Water in the abandoned mines has a low pH and contains high concentrations of sulfate, fluoride, cadmium, copper, iron, lead, manganese, nickel, and zinc.

All groundwater is vulnerable to contamination from surface sources of pollution; however, some areas are more vulnerable than others. The OWRB determined the relative vulnerability of the surficial aquifers or hydrogeologic basins in Oklahoma, using the DRASTIC index method (Osborn and Hardy, 1999). Basins were classified in five groups of relative vulnerability: very low, low, moderate, high, and very high. The alluvium and terrace deposits are most susceptible to pollution of groundwater; the igneous and low yielding bedrock basins are the least susceptible. Basins with a high or very high vulnerability classification have been designated as “nutrient-vulnerable” and receive greater protection through the state’s water quality standards.

5.0 Programs Evolved to Protect Water Quality

Because the right to ownership and use of water does not include the right to pollute or degrade fresh water resources, numerous agencies and organizations have responsibilities related to the enforcement of state and federal pollution laws. The quality of surface and groundwater is of enormous importance to public health and prosperity in Oklahoma and, as a result, potentially harmful pollutants from both point and nonpoint sources are closely monitored to ensure that Oklahoma rivers, streams and lakes receive adequate protection. While the state originally passed laws to curb water pollution in the 1920s, it was through passage of the 1955 Pollution Remedies Act that Oklahoma made monumental strides toward public health and environmental protection. That law -- which was more fully enacted with passage of the federal Clean Water Act in 1972 and amended in 77 and other years, -- required regulation of discharges to state waters, provided for the protection of certain beneficial uses of stream water, and spawned adoption of Oklahoma’s first standards for water quality in 1968. These laws dealing with end of pipe discharge were termed “point source”. Other more diffuse sources were termed as “non-point sources”. The current manner in which state and federal agencies approach water quality regulation in Oklahoma has been greatly affected by passage of House Bill 2227, a measure passed in 1993 to mend the State’s fragmented environmental regulatory structure and better utilize limited financial and workforce

resources. The goal of HB 2227 was to eliminate the jurisdictional overlap and duplication of effort of state environmental agencies, provide for consistency of regulation between agencies and improve the way in which citizen pollution complaints are addressed through realignment of the responsibilities of eight agencies into one primary agency, the Oklahoma Department of Environmental Quality (ODEQ). Specifically, HB 2227 consolidated air quality, solid and hazardous waste, and certain water quality functions into the ODEQ and established jurisdictional powers among state environmental support agencies. The measure also directed each environmental agency to develop a complaints investigation and resolution process to be coordinated by the Secretary of the Environment and contained in a database managed by the Oklahoma Conservation Commission (OCC) through local conservation districts by creating an all-citizen rulemaking and appellate board for complaint, permit or penalty matters.

A major ongoing State effort to address pollution reduction is development and implementation of the whole basin planning approach (i.e., watershed based plans). This comprehensive or holistic strategy takes into account all threats to human health and ecological integrity within a specific watershed and seeks the input and participation of all interested stakeholders in development of NPS management objectives for the watershed. Greater emphasis is placed on all aspects of water quality including chemical quality (toxic and conventional pollutants), physical quality (temperature, flow), habitat quality (channel morphology, composition and health of biotic communities) and biodiversity (species number and range). Using this information, flexible mitigation strategies for a specific watershed can be developed to address problem areas in a prioritized, cost-effective manner.

5.1 Animal Waste Water Quality Protection Task Force

The Oklahoma Registered Poultry Feeding Operations Act adopted in 1998 brought important new controls for the use and handling of poultry litter. The Act limited poultry litter applications in general and further restricted litter applications based upon maximum soil phosphorus levels in watersheds identified as nutrient limited and nutrient vulnerable groundwaters, as identified in the Oklahoma Water Quality Standards. Revisions to the 1998 Oklahoma Concentrated Animal Feeding Operations (CAFO) Act brought similar controls for manure management from CAFOs. These important legislative initiatives were a result of the “Animal Waste and Water Quality Protection Task Force” in response to concerns raised over those rapidly expanding industries. An additional benefit from the Task Force was the recommendation to establish the OWRB Water Quality Beneficial Use Monitoring Program (BUMP).

5.2 Oklahoma Water Quality Standards and Implementation

In 1999, Senate Bill 549 (now Subsection B, 27A O.S. Supp 1998, Section 1-1-202) required that “each state environmental agency shall have promulgated by July 1, 2001, a Water Quality Standards Implementation Plan (WQSIP) for its jurisdictional areas of environmental responsibility in compliance with the Administrative Procedures Act and pursuant to the provisions of this section.” The statute also states “Each agency shall review its plan at least every three (3) years thereafter to determine whether revisions to the plan are necessary.”

The WQSIP legislation also created a State Water Quality Standards Implementation Advisory Committee (WQSIAC), chaired by the OWRB and consisting of representatives from each of the state environmental agencies and the Secretary of Environment. Environmental agencies must submit their draft WQSIPs and subsequent revisions to the committee for review. The committee evaluates the extent to which the draft

WQSIP or revision meets the requirements and provides detailed recommendations that should be incorporated. A copy of these recommendations shall be submitted to the Speaker of the House of Representatives and the President Pro Tempore of the Senate.

Today, municipalities and industries must acquire waste discharge permits and adequately treat their wastewaters prior to release to ensure that the quality of receiving waters is not impaired. Oklahoma Water Quality Standards (OWQS), maintained by the OWRB and revised at least every three years, are the cornerstone of this regulation. Standards serve to enhance water quality, protect beneficial uses and aid in the prevention, control and abatement of water pollution. In particular, standards are critical to the development of water quality-based discharge permits which specify treatment levels required of industrial and municipal wastewaters. Identification and protection of beneficial uses -- similar in concept, though separate from the strategy utilized in state water management and use programs -- is vital to water quality standards implementation (WQSI). Currently recognized beneficial uses include water supply, fish and wildlife propagation, agriculture, industrial and municipal cooling water, recreation, aesthetics, navigation and hydropower. Physical, chemical and biological data on Oklahoma's rivers, streams and lakes are used to ascertain the condition of individual waters, determine appropriate present and future beneficial uses and thus set realistic water quality standards to protect them. Through assignment of as many beneficial uses as are attainable, standards provide a foundation for water quality management programs to assure that existing water quality is not unduly impacted. Narrative and numerical criteria imposed in the OWQS ensure attainment of beneficial uses, as well as limit waste and pollution of state waters. All uses receive equal protection, for each has its unique environmental and economic importance to Oklahoma.

Beneficial uses have also been assigned to the State's major groundwater basins. Through the efforts of numerous agencies and organizations, Oklahoma has made great strides in limiting pollution from point sources, including municipal and industrial stormwater.

5.3 Nonpoint Source Management

The majority of water quality impacts catalogued on the State's most recent 303(d) lists are due to nonpoint source (NPS) pollution related to agriculture, silviculture, urban development, and various other anthropogenic effects. Therefore, in order to address water quality concerns, the state must devote balanced efforts to address NPS, as well as point source pollution. The state benefits from numerous state and federal programs that encourage landowners and operators to adopt best management practices (BMPs) which reduce the impacts of NPS pollution. With over 90% of Oklahoma land in private ownership and between 75-80% of land in agricultural production, voluntary implementation of conservation practices is critical toward reducing NPS impacts and protecting water quality.

While these voluntary efforts have met with increasing success, available programs are not sufficient to address all NPS problems and therefore, NPS pollution continues to impact waters statewide. Efforts to address NPS pollution could be improved with the adoption of water quality standards that are specific to NPS pollutants such as sediment and nutrients. Most current criteria address the impacts of NPS pollution instead of the causes. Specific NPS criteria would allow better targeting of programs toward real sources and measurement of progress toward impact reduction.

5.4 Agency Programs

Several programs have been established over the years to address water pollution. The most extensive program protecting water quality is the Clean Water Act (CWA). The CWA is implemented through seven agencies in Oklahoma including; the Oklahoma Secretary of Environment (OSE), Oklahoma Dept. of Environmental Quality (ODEQ), Corporation Commission (OKCC), Oklahoma Department of Agriculture, Food and Forestry (ODAFF), Department of Mines, Conservation Commission (OCC) and the OWRB. Several programs and plans required of the State by the CWA, drive water quality management. The Water Quality Management Plan (WQMP), established pursuant to Section 208 of the CWA, is maintained by the ODEQ. Likewise, the ODEQ maintains the Continuing Planning Process (CPP) that documents most of the specific programs to control water pollution and details the methodology used in assessing and reporting on the status of surface waters in compliance with sections 305(b) and 303(d) of the CWA. The Total Maximum Daily Load (TMDL) program, which addresses impaired waters or 303(d) listings, is a major program to restore impaired waters of Oklahoma. The OCC is the state's technical lead for NPS management and is responsible for preparing the Nonpoint Source Management Plan and the OWRB maintains the OWQS. The Safe Drinking Water Act drives drinking water programs managed by the ODEQ and the federal Insecticide and Rodenticide Act and plan dictate many pollution control programs by ODAFF.

6.0 Local, State, Tribal and Federal Water Agencies Protecting Water Quality

Oklahoma works to protect and manage its water resources through a number of programs and initiatives. Jurisdictional areas of environmental responsibility are assigned to specific state agencies by statute (O.S. §27A) and serve to effectively direct water quality management programs to ensure comprehensive and efficient delivery. Representatives from local and tribal governments, along with state and federal agencies, participate in water quality related duties and programs that are summarized below. A more detailed description of State water quality programs and can be found in Appendix A.

6.1 Local

The **Indian Nations Council of Governments (INCOG)** and the **Association of Central Oklahoma Governments (ACOG)** are the lead area-wide planning agencies for water quality protection through the **208 Water Quality Management Plan (208 Plan)**; **INCOG** in northeast Oklahoma, serving Creek, Osage, Tulsa and Wagoner counties and **ACOG** in central Oklahoma, serving Oklahoma, Cleveland, Canadian, and Logan counties. Each agency performs **Wasteload Allocation (WLA) studies** and **TMDL modeling** for area dischargers; monitors area streams for assessing beneficial use attainment under **303(d) of the Clean Water Act**; and addresses nonpoint sources of pollution through public education. **INCOG** also addresses green infrastructure and non-permit pollutant reduction strategies through its **Stormwater Quality Program**, stream restoration organizations and promotes **Low Impact Development (LID)**. Under the **ACOG** umbrella is the **Garber-Wellington Association** where **GWA** staff provide continuing coordination and assistance to local governments for their groundwater systems and research efforts.

The water policy for the **Oklahoma Municipal League (OML)** is to develop, ensure and protect a reliable water supply for cities and towns throughout the State for the next 50 years. The **mission** of the **OML** is to provide services and programs required by municipal officials to assist them in better serving their citizens, and to act as the representative of Oklahoma municipalities in interactions requiring a united voice.

6.2 Tribes

There are 37 federally recognized tribes in Oklahoma. Many of the tribal governments have surface and/or groundwater programs. A few examples of some of the many tribal programs are as follows:

The **Absentee Shawnee Tribe of Oklahoma (AST)** performs water monitoring on surface waters in central Oklahoma. Currently monitoring has occurred on two drinking water lakes and one impoundment on AST lands. The **Water Monitoring Program** is advancing and will be adding a river and two more drinking water lakes in the near future. In addition, to these surface water monitoring points, groundwater is monitored for tribal members, tribal businesses and other tribal entities. The AST provides technical services to tribal members for water and wastewater issues. Surface water monitoring data is sent to the US EPA.

The **Kaw Nation** has both **Surface and Groundwater Monitoring Programs**. Under surface water monitoring, the Kaw Nation conducts water sampling and analysis on three river sites (Arkansas River), three creeks and five lake sites (Kaw Lake and Ponca Lake), and stream gauging (flow measurement) in the Kaw Lake Watershed. The Tribe has conducted water sampling every month since 2004. The Tribe also has two groundwater monitoring wells on its Tribal land. **Kaw Nation** is also conducting a **Wetland Restoration Program** and has completed a preliminary biological, hydrological and soil assessment. The purpose of the sampling is to determine water quality trends for regulatory purposes. The Tribe submits all its water quality data (WQX) to U.S. EPA through Central Data Exchange (CDX) to be shared by state and federal agencies.

The **Kickapoo Tribe of Oklahoma (KTO)** has both surface and groundwater monitoring programs. The **KTO** samples six sites along the North Canadian River 10 times per year. The purpose of the **Surface Monitoring Program** is to provide environmental data to the **Kickapoo Tribe Business Committee**, the Tribe's governing body. The **KTO** also owns and operates three public water supply systems. All three systems provide groundwater to users. Licensed operators are trained to monitor water quality. Typically the **KTO** does not sample any tribal members privately owned wells but can provide technical assistance in retrieving water and interpreting the water quality results.

The **Osage Nation (ON)** has both **Surface and Groundwater Monitoring Programs**. The **ON** samples ten sites at least ten times per year on Sand Creek, Bird Creek, Middle Bird Creek, South Bird Creek, Dry Creek, Hickory Creek, Pawhuska Creek, and Buck Creek. The **ON** also protects the groundwater as set forth by regulation for the **Osage Mineral Reserve, Underground Injection Control Program** by authority of the Safe Drinking Water Act. The regulations apply to owners and operators of Class II injection wells located on the Reserve. Approximately 2400 existing Class II injection wells and any newly constructed or converted injection wells are inspected by the **ON** at least once every two years. Also, approximately 350 mechanical integrity tests (MITs) are performed each year.

The **Quapaw Tribe of Oklahoma** has a **Surface Water Monitoring Program**. The **Quapaw Tribe** collects monthly grab samples at six sites on three waterways in northern Ottawa County: Spring River, Beaver Creek, and Tar Creek . Grab samples are analyzed for nutrients, metals, and bacteria. The **Quapaw Tribe** has also partnered with the University of Oklahoma in the operation of a gauging station on Beaver Creek near the Tribal Pow-Wow Grounds. The purpose of the **Surface Monitoring Program** is to provide environmental data to the **Quapaw Tribe Business Committee**, the Tribe’s governing body. Water quality data generated by the **Quapaw Tribe** is also submitted to EPA’s National Database (STORET) on a regular basis. The **Quapaw Tribe** owns and operates several public water supply systems. Licensed operators are trained to monitor water quality. Typically the **Quapaw Tribe** does not sample any tribal members privately owned wells, however technical staff, including an engineer, a geologist, and an environmental scientist, are more than capable of providing technical assistance in retrieving water samples and interpreting the water quality results.

The **Sac and Fox Nation** has both **Surface and Groundwater Monitoring Programs**. The **Sac and Fox Nation Surface Water Monitoring Program** currently includes five creeks, two rivers, and one lake with projections to broaden the scope of monitoring and to incorporate additional bodies of water(s) within the Sac and Fox Nation jurisdiction. Chemical, Biological, and physical monitoring is utilized in the understanding and defining the function and health of the waterbody and its ecosystem. Chemical water quality monitoring includes field and laboratory analysis. Biological and physical water quality monitoring includes macroinvertebrate collections, fish collections, mercury data collections, physical habitat assessments, and E. coli analysis. Monitored water results are used in to determine beneficial use and nutrient threatened conditions, if any exist. The **Sac and Fox Nation Ground Water Monitoring Program** includes rural and public water well monitoring. The Tribe owns and operates one Public Water Supply (PWS) that provides water to tribal members as well as other users in the tribal complex. The PWS is supplied by eight different groundwater wells that are monitored by licensed operators. Rural water wells are also being monitored for basic drinking water parameters at the request of tribal members within the Sac and Fox Nation jurisdiction.

6.3 State

The goal of the **Office of the Secretary of Environment (OSE)** is to protect and enhance Oklahoma's environment and natural resources through preservation, conservation, restoration, education and enforcement in order to maintain and improve the environmental quality and natural beauty of our state and better the standard of living for all Oklahomans. The **OSEs** major duties/responsibilities involve being recipient and administrator of **Federal Clean Water Act (CWA) funds**.

The **Oklahoma Conservation Commission (OCC)** is the agency that provides assistance and guidance to the State’s conservation districts and helps coordinate their activities. The agency mission is “to conserve, protect, and restore Oklahoma’s natural resources, working in collaboration with the conservation districts and other partners, on behalf of the citizens of Oklahoma.” The OCC has jurisdictional environmental responsibility over the following areas related to water quality; 1) soil conservation, erosion control and nonpoint source management; 2) monitoring, evaluation and assessment of nonpoint source impacts on streams and rivers; 3) **Wetlands Management Strategy**; 4) abandoned mine reclamation; 5) cost-share program for land-use activities; 6) assessment and conservation plan development and implementation in watersheds of clean lakes; 7) complaints

database management; 8) coordination and natural resources education; 9) Federal upstream flood control program; 10) groundwater protection for activities subject to the OCC's jurisdictional areas of environmental responsibility; 11) verification and certification of carbon sequestration pursuant to the Oklahoma Carbon Sequestration Enhancement Act and 12) utilization of Oklahoma Water Quality Standards and development of a Water Quality Standards Implementation Plan. In addition, the OCC is designated as the technical lead for NPS categories as defined in Section 319 of the CWA, except as otherwise provided by state law. In doing so, the OCC is responsible for development of the State's **Nonpoint Source Management Plan**, the document that defines the goals, strategies, and activities the state will apply in the use of CWA funds to address NPS pollution problems. The OCC is also responsible for the NPS Assessment Report, which details state waters impacted by NPS pollution. The **NPS Assessment Report** has been incorporated into the State's Integrated Report, beginning in 2002." The OCC implements the **Rotating Basin Monitoring Program** to evaluate waters for impacts of nonpoint source pollution and assess the success of pollution reduction strategies. The OCC also maintains the **Statewide Bluethumb Volunteer Monitoring Program** to educate citizens of the state about water quality and nonpoint source pollution. Finally, the OCC oversees **Priority Watershed Implementation Programs** to install BMPs to reduce NPS impacts in priority watersheds.

The **Oklahoma Corporation Commission (OKCC)** regulates oil and gas activities through its **Oil and Gas Field Operations, Technical, Pollution Abatement, Underground Injection Control (UIC), Groundwater Protection, Petroleum Storage Tank and Brownfields Programs** including exploration, production and field operations for oil, gas, and brines; reclaiming facilities; underground injection; storage tank farms and transmission pipelines, spills from these; and subsurface storage of oil & gas. The **OKCC** has jurisdiction over the construction, operation, maintenance, site remediation, closure and abandonment of these facilities and activities. The **OKCC** samples surface and groundwater around spills to determine the extent of any pollution. It also samples (and has had other state agencies sample) streams in old oilfield areas to determine where historic oilfield activities have caused adverse impacts to the waters of the State, and to determine background water quality in these watersheds.

The **Oklahoma Dept. of Agriculture, Food and Forestry (ODAFF)** enforces rules and regulations relating to the State's agricultural industry through three distinct divisions: the **Agricultural Environmental Management Services Division (AEMS)** focuses on regulating animal waste, especially on waste disposal and reuse, to protect waters, including both ground and surface water of the State. **AEMS** develops and updates the **Water Quality Standards Implementation Plan (WQSIP)** every three years of activities within its areas of jurisdiction with the goal of bringing the regulated facilities into compliance with water quality standards; the **Consumer Protection Services (CPS) Division** conducts the required **Fertilizer and Pesticide Programs**; the **Forestry Services Division (FSD)**, is responsible for the State's forestry **Best Management Practices (BMP)** and for establishing methods for controlling NPS pollution related to forestry. The **Oklahoma Department of Mines** is the environmental regulatory authority empowered to execute, enforce and implement provisions of state and federally mandated programs in the area of health, safety, mining and land reclamation practices associated with surface and subsurface mining.

The **Oklahoma Dept. of Environmental Quality (ODEQ)** supervises the majority of the State's environmental protection and management programs. The **ODEQ** permits all point source dischargers, including stormwater, except for dischargers from oil and gas activities and agricultural dischargers. Under the **Oklahoma Pollution Discharge Elimination System (OPDES)**, the **ODEQ** reviews daily monitoring reports of all permitted facilities, investigates complaints and conducts routine inspections, checking for violations, issues construction permits through **Wastewater Systems Construction Permitting** and **Public Water Supply Systems Construction Permitting Program**. The **ODEQ** permits and enforces the **Pre-treatment Program** by reviewing applications from municipalities to implement and manage their own pre-treatment program. The **ODEQ** issues **Water Quality Certifications** by reviewing federal permit applications to determine whether the activity to be permitted by the federal agency will meet applicable **Oklahoma Water Quality Standards**. The **ODEQ** also conducts the testing of operators, license those individuals who pass the test, oversees the continuing education of operators and undertakes enforcement against operators who violate the Environmental Quality Code through the **Public Water Supply & Municipal Wastewater Operators Licensing**. The **ODEQ** is responsible for **Safe Drinking Water Act Enforcement**, including the **Primary Drinking Water Standards** in the primacy agreement between the USEPA and the **Drinking Water State Revolving Fund** where it conducts technical and administrative management of the **DWSRF** program. The **ODEQ** manages the **Total Maximum Daily Load Program (TMDL)** for the State through the coordination of sampling and modeling to produce a **TMDL** for a specific stream segment. There are several statewide publications that the **ODEQ** is the lead technical agency for their production; the **Areawide Waste Treatment Management Plan (208 Plan)**, a comprehensive document aimed at systematically managing water quality in various watersheds within the State of Oklahoma and includes an inventory of dischargers within the State, the **Integrated Report** is a combination of the reports required by **Section 303(d)** and **305(b)** of the **Clean Water Act**, and the **Continuing Planning Process (CPP)** publication that describes the water quality programs implemented within the State. The **ODEQ** has two groundwater protection programs; **Underground Injection Control (UIC)** ensures that groundwater sources are protected and primary drinking water standards are maintained from the injection of wastes through regulated wells and the **Freshwater Wellhead Protection Program** that provides assistance to public water supplies using groundwater to protect wellhead and source water from contamination.

The Oklahoma Dept. of Wildlife Conservation (ODWC) has jurisdiction over wildlife protection on all surface waters, as well as investigating wildlife kills and seeking damage for restitution of lost resources as a result of these claims. The **ODWC** also prepares and updates a **Water Quality Standards Implementation Plan (WQSIP)** every three years for areas within its area of jurisdiction.

The **Oklahoma Scenic Rivers Commission (OSRC)** is invested with the power to establish minimum standards for planning and other ordinances necessary to carry out the provisions of the **Scenic Rivers Act**. The primary emphasis of the Commission is to preserve and protect the aesthetic, scenic, historic, archaeological and scientific features of the Illinois River and its tributaries (Lee Creek, Little Lee Creek, Barren (Baron) Fork Creek, Flint Creek and (Upper) Mountain Fork). The **Illinois River Management Plan** was developed to manage the river corridor's natural, cultural, and historical values. **Oklahoma State Parks** are a part of the **Oklahoma Tourism and Recreation Department**, which is governed by the **Oklahoma Tourism and Recreation Commission**, operates and maintains state parks by engaging in

resource mgt planning and various conservation and preservation practices through the **Statewide Comprehensive Outdoor Recreation Plan (SCORP)**. The SCORP addresses public outdoor recreation and includes commentary on water quality and its impacts on recreation.

The **Oklahoma Water Resources Board (OWRB)** promulgates and adopts Oklahoma's **Water Quality Standards (WQS)** that classify waters of the state according to their best uses; prescribe narrative and numerical criteria, as well as general implementation and antidegradation policies. The **OWRB** prepares and updates a **Water Quality Standards Implementation Plan (WQSIP)** every three years within its areas of jurisdiction. The **Water Quality Standards Program** establishes rules generally affecting water quality standards implementation. These policies address the assessment of water quality data for beneficial use support determination. The **Oklahoma Beneficial Use Monitoring Program (BUMP)** institutes a state-wide monitoring program to document beneficial use impairments, identify impairment sources (if possible), detect water quality trends, provide needed information for the **OWQS** and facilitate the prioritization of pollution control activities. Working with state agencies that conduct water quality monitoring, the "**Status of Water Quality Monitoring in Oklahoma**" is submitted to the legislature every even-numbered year outlining the status of water quality monitoring in OK. Other water quality programs such as **Clean Lakes Restoration** assess, monitor, study and restore Oklahoma lakes. A portion of this program is to provide sedimentation surveys on surface water reservoirs. The **OWRB** provides coordination of the **Oklahoma/United States Geological Survey Cooperative Program** to ensure that needed data is available to both governmental and non-governmental parties. Data recorded and analyzed from this network of stream-flow gages provides the information needed to help define, use and manage the State's water resources. The **Stream Water Rights Program** includes the process of determining applications for stream water permits, the review of usage of existing stream water rights, the process of declaring reduction or cancellation of stream water rights due to nonuse and the administration of rights to use groundwater through **the Groundwater Quantity Program**, includes the process of determining applications for groundwater permits and amendments, the study of groundwater basins and the process of determining the maximum annual yield of groundwater basins. The **Well Drillers and Pump Installers Program** is for licensing and regulating persons engaged in the commercial drilling or plugging of wells, monitoring wells, observation wells, wells for heat exchange purposes, geotechnical borings, and the commercial installation of water well pumps. The **OWRB** also administers the **Financial Assistance Program** for water/wastewater projects; **Drinking Water and Clean Water State Revolving Fund Loan Programs, Rural Economic Action Plan (REAP) grants, Revenue Bond Loan and Emergency Grant Programs**. Other administrative responsibilities include; **Interstate Stream Compacts, Floodplain Management Program, Dam Safety Program, and Oklahoma Water Conservation Program Grant**.

6.4 Federal

The **U.S. Army Corps of Engineers (USACE)** environmental operating principles guide their **Civil Works Program**, giving it authority to provide water resources related assistance to Oklahoma. The Corp provides water related assistance in various forms; **General Investigation Watershed Studies**, planning initiatives for a watershed study to include water supply, natural resource preservation, ecosystem restoration, environmental infrastructure, recreation, navigation, flood risk management activities, and regional economic development and through **Statewide Comprehensive Water Planning for**

Oklahoma, providing technical assistance for the development of updates of the Oklahoma Comprehensive Water Plan, **Environmental Infrastructure** to provide assistance to non-Federal interests for carrying out water-related environmental infrastructure and of course, through the 1972 **Federal Water Pollution Control Act** which added **Sec. 404(b)** authorizing the Sec. Of the Army to issue permits for discharge of dredged or fill material into waters of the US at specified disposal sites.

The **U.S. Bureau of Reclamation (Reclamation)** currently operates seven multipurpose reservoirs in Oklahoma. The State of Oklahoma officially adopted similar management objectives as those of federal legislation for each reservoir as part of their Water Quality Standards. The goal of the present effort is to systematically develop a long-term monitoring program for **Bureau of Reclamation Reservoirs** in Oklahoma that will provide resource managers and the public with current, useful, water quality information for meeting operational objectives and detecting impairment.

The **United States Dept. of Agriculture's (USDA), Natural Resources Conservation Services (NRCS)** in Oklahoma is responsible for **Farmbill Programs** that provide cost share and technical assistance for the application of conservation practices that protect water quality. NRCS program efforts provide erosion and sediment control practices and **Watershed Based Protection** that combine land treatment with flood control measures to protect and improve water quality. **NRCS** programs include; the **Environmental Quality Incentive Program (EQIP)** which provides financial assistance for planning and application of conservation practices that help to manage, control, store and support proper application of animal waste. **NRCS** provides technical and financial assistance with the development of **Comprehensive Nutrient Mgt. Plans** as part of a producer's general Conservation Plan. **NRCS Conservation Practice Standards** address water well installation, well head protection & irrigation practices, which increase irrigation efficiency. The **Agricultural Research Service (ARS)** is **USDA's** in-house research arm. As part of **USDA's** national **Conservation Effects Assessment Project (CEAP)**, research focuses on interactive effects of climate, land use, and agricultural management on hydrologic processes and natural resource sustainability. Two additional programs, **Eastern Red Cedar Research** and **Soil and Water Assessment Tool (SWAT) and MODFLOW**, focus on groundwater recharge and surface-subsurface hydrologic process that affects water supply and water quality.

United States Environmental Protection Agency (USEPA), Region 6 Water Quality Protection Division, is responsible for regional management and oversight of water programs; Recommends to the Regional Administrator goals, priorities and objectives for the Regional water program including water quality planning, evaluation and management, public water supply, groundwater protection, state revolving funds/construction grants, and NPDES permit issuance. EPA's water programs are administered by the following five branches; **Assistance Programs, Ecosystems Protection, Planning and Analysis, NPDES Permits and TMDLs** and **SOURCE WATER PROTECTION Branch**.

The **U.S. Fish & Wildlife Service (USFWS)** has responsibilities and authority relating to the quality of groundwater and surface water that provides habitat to many threatened and endangered species and migratory birds in the State of Oklahoma. These Programs have been implemented by the Service to protect and ensure high quality aquatic habitat necessary for the survival of these species: **Endangered Species Program, Environmental Contaminants Program and the Partners for Fish and Wildlife Program (PFW)**. Through the **Federal Activities Program**, the **Oklahoma Ecological Services (OES)** staff

coordinates with other Federal and State agencies in planning federally-funded, permitted, or licensed water and land resources development projects under the authority of several laws. The **Fisheries Program** and the **Federal Aid in Sport Fish Restoration Act**, act to conserve fish and other aquatic resources and provides Federal aid to the States for management and restoration of fish having "material value in connection with sport or recreation in the marine and/or fresh waters of the United States."

The **United States Geological Survey (USGS)** has many water related programs for which it is responsible for in Oklahoma. The major objective of **the National Stream Quality Accounting Network (NASQAN)** program is to report on the concentrations and loads of selected constituents delivered by major rivers to the coastal waters of the United States and selected inland sub-basins in priority river basins to determine the sources and relative yields of constituents within these basins. The **Hydrologic Benchmark Network (HBN)** provides long-term measurements of streamflow and water quality in areas that are minimally affected by human activities. Status and trends of surface-water-quality are assessed within eight large geographical regions, referred to as "major river basins" covering the U.S. through the **National Water Quality Assessment Program (NAWQA)**. The **Toxic Substances Hydrology Program** provides objective scientific information on environmental contamination, the **U.S. Geological Survey (USGS)** monitors the quantity and quality of water in the Nation's rivers and aquifers, assesses the sources and fate of contaminants in aquatic systems, among other things, and cannot be accomplished effectively without the contributions of the **Cooperative Water Program**. The **National Atmospheric Deposition Program** carries out Bureau responsibilities related to wet-deposition monitoring, sensitive surface-water monitoring, and research on processes by which atmospheric deposition affects hydrologic systems and cultural materials.

7.0 Water Quality Monitoring

Specifically, the OWQS are housed in OAC 785:45 and consist of three main components. These components are (1) beneficial uses, (2) criteria to protect beneficial uses, and (3) an antidegradation policy. A critical fourth component is a monitoring program to assure that beneficial uses are maintained and protected. If uses are not being met, the cause must be identified and restoration activities should be implemented. The OWRB has developed Oklahoma Use Support Assessment Protocols (USAP) which has been promulgated into Oklahoma Administrative Code (OAC) 785:46. The USAP protocols help meet monitoring program needs described in Oklahoma's Water Monitoring Strategy.

7.1 Surface Water

Oklahoma's Water Quality Standards (WQS) are set forth under statutory authority of the OWRB authorized under 82 O.S. § 1085.30. Under these statutes, OWRB "is required to set water quality standards which are practical and in the best public interest and to classify the state's waters with respect to their best present and future uses. These WQS are designed to enhance the quality of the waters, to protect their beneficial uses, and to aid in the prevention, control and abatement of water pollution in the State of Oklahoma". The WQS have established designated beneficial uses and standards for all of Oklahoma's waters.

Water quality monitoring programs in Oklahoma document beneficial use impairments, identify impairment sources, detect water quality trends, provide needed information for the Water Quality Standards and facilitate the prioritization of pollution control activities. The OCC and OWRB provide the majority of critical data to determine beneficial use attainment for Oklahoma waters. These monitoring programs are designed to monitor and assess ambient surface water quality as well as evaluate waters to determine impacts and sources of pollution. Without adequate funding, the scope of these programs is significantly limited such that numerous contaminants of concern and types of waterbodies are unable to be evaluated and the number of waterbodies that can be monitored is limited. This data is critical to making informed and prudent water quality management decisions. The goals of these programs are to obtain accurate, scientific data upon which to base water management decisions for the state of Oklahoma. It is essential that state and federal monies be spent where most needed. To achieve this, Oklahoma must continue to be effective at determining where our water quality problems are occurring and focus resources where most needed.

7.2 Groundwater

The goals of the Safe Drinking Water Act (SDWA) are that the nation's groundwater is free of harmful levels of contaminants and they set national standards for drinking water. Several state agencies are charged with the protection of Oklahoma's groundwater. These include the DEQ, ODAFF, Corporation Commission, OCC, and the OWRB. The DEQ is designated as the lead agency for the Wellhead Protection Program (WHPP). There are instances of man induced groundwater pollution in the state. Except in a few old oilfields, they appear to be isolated instances and not general contamination of groundwater drinking water supplies. Historical data indicates water is of good quality from most aquifers. Oklahoma has Groundwater Standards located in OAC 785:45-7.

Groundwater is critical to our economy and quality of life. Half of the state's water withdrawals are derived from its aquifers. Whereas the State of Oklahoma has mature and successful surface water quality monitoring programs, no comprehensive approach or plan to monitor the quality of the state's groundwater resources has been developed. Presently, groundwater monitoring is performed on a limited basis by several state agencies within their jurisdictional boundaries. These monitoring programs are generally specific to pollution control activities or required reporting by public water supply systems to the ODEQ. While existing monitoring programs are very important, they tend to focus more narrowly around a specific permitted activity or the source water of a public water supply system (wellhead protection area). To ensure the protection of water quality of our groundwater supplies in the future, it is essential that groundwater monitoring be broadened to encompass all of the fresh groundwater in the state.

8.0 Water Quality Related Agency Recommendations for the 2010 OCWP Update

The following policy recommendations are submitted by the OCWP Water Quality Workgroup to compliment those derived through the OCWP's formal public participation and policy development process. The Water Quality Workgroup consists of representatives from local and tribal governments along with state and federal agencies that participate in water quality-related duties and programs. These individuals were asked to provide program information related to their organizations and agencies as well as collective recommendations to address Oklahoma's most pressing water quality issues, including program requirements.

Enumerated below are a summary of recommendations identified by the OCWP Water Quality Workgroup as having priority in regards to immediacy for implementation. The complete list of Workgroup recommendations follows in Appendix A.

Priority Recommendations Identified by the OCWP Water Quality Workgroup

1. The current Surface Water Quality Monitoring Programs should be expanded and enhanced to allow for the collection and management of more comprehensive data, including identification of long-term trends and potential threats to the state's streams and reservoirs.
2. Additional resources are required to facilitate current water quality data management and reporting needs.
3. A state Stream Gaging Network should be supported, enhanced and maintained. This should include extension of partnerships cooperating under the existing Stream Gaging Program.
4. Nonpoint Source Programs should be maintained and continue to implement innovative NPS pollutant reduction and management practices while also stressing use of proven measures. These programs should encourage development of technical assistance programs that promote establishment of pollution prevention plans by landowners.
5. The OCWP Water Quality Workgroup strongly supports establishment of a comprehensive Groundwater Quantity and Quality Monitoring Program for Oklahoma to investigate long-term trends of this sensitive and valuable resource.
6. Many contributors, including those from the 2010 Oklahoma Academy Town Hall Meeting, recommended that the State peruse interagency watershed and regional planning for water programs. The Town Hall meeting recommended the formation of regional planning committees to work with regional stakeholder-based water resources management groups.

APPENDIX A: OCWP Water Quality Workgroup Recommendations

Water Quality Sampling and Monitoring

Groundwater Monitoring

The Office of the Secretary of Environment OSE/OWRB, should coordinate efforts of appropriate state and federal environmental and natural resource agencies, universities and organizations to establish a comprehensive state water quantity and quality data collection program to monitor the condition of Oklahoma's groundwater resources.

Groundwater Quantity

- Expand the existing groundwater Mass Measurement Program; establish standards and provide training to encourage private well data submission including well construction and sampling and analysis;
- Use existing grant funds (106), and apply for additional funds (104b, 104g, state BUMP funding, etc.) to set up a consistent groundwater sampling program across the state. A statistical sampling protocol could help identify trends even with fewer samples than desired;
- Encourage systemic natural groundwater reuse, recycling, especially in western 2/3rds of the State.

Groundwater Quality

- Establish a monitoring program (like BUMP or Rotating Basin Monitoring Program) for aquifer evaluation: Sample raw water from domestic and public wells across each aquifer at least once every 5 years for common impairments that affect drinking water quality and agricultural use including salinity, nitrate, metals, and bacteria and pesticides and herbicides in areas where they are used.
- Establish a groundwater quality baseline for each aquifer and, monitor for trends to predict and prevent future water quality problems – adverse health and economic impacts;
- Development of an ambient trend and probabilistic based monitoring program to evaluate our groundwater resources to better manage resources in the future.
- More extensive monitoring of water/brine groundwater plumes in old oilfield and evaporation pit areas;
- Groundwater monitoring program of tribal private water wells; and
- Cross-reference groundwater monitoring results from Federal/State/Tribal entities with epidemiological data on illness that may be related to water quality.

Lakes Monitoring

The OWRB should identify and recommend to the State Legislature a mechanism -- to restore the federal Clean Lakes Program -- to fund water quality assessment and restoration of Oklahoma lakes.

- Encourage continued and potential expansion of funding to implement the BUMP program in Oklahoma, especially currently unfunded components which include: “fixed station load monitoring, fixed station groundwater monitoring and intensive investigation sampling”;
- OWRB and /or OCC identify a funding mechanism for nutrient limited watershed impairment studies for streams and lakes. Use this data to develop protocol for classifying streams and lakes as nutrient impaired
- Expand tribal monitoring programs to include other major water resources within tribal jurisdiction;
- Develop a long-term water quality monitoring program to provide the public with current and useful water quality information for the purposes of meeting each reservoir’s beneficial uses and operational objectives;
- Holistic Monitoring; covering a wider range of conditions and targeting changes so that we are able to detect trends;
- Examine data objectives to include extreme environmental conditions; hydrologic conditions, high flow to drought, etc.

Streams Monitoring

- Continued statewide monitoring and assessment activities to determine the occurrence, nature, and extent of nonpoint source (NPS) impacts to State waters, as well as document healthy waters deserving protection;
- Increase In-stream flow (ISF) work; provide protection for the State’s designated Scenic Rivers, expanding to a state wide goal for supporting diverse, healthy aquatic communities and ecosystems;
- Support continued efforts of the In-stream Flow (ISF) workgroup
- A near field in-stream monitoring program should be conducted at upstream and downstream sites of near-by waterbodies related to locations of animal waste land application fields in evaluating the benefit rendered by effectively using CNMPs developed for the animal feeding operations;
- Increased multi-assemblage biological monitoring to characterize fish, macroinvertebrate, and algal communities as well as increased and more detailed characterization of in-stream/riparian area habitat characteristics and landuse/land cover;
- Stream Gaging Network; critical to Water Quality Management, permitting and monitoring and assessment, and should be supported, enhanced and maintained. Partnerships (with USGS and others) should be extended to improve efficiency and effectiveness of the state stream gaging program, and support associated costs;
- OWRB, OCC and/or ODEQ identify a funding mechanism for the development of an automated assessment process to assess biological and water quality data to determine if a waterbody is meeting the water quality standards and designated uses as set forth in the Oklahoma Water Quality Standards.

Water Quality Data Management

State and federal environmental and natural resource agencies, state universities and other involved organizations should continue to build capacity for collection and dissemination of water resource data.

- Maintain and enhance a centralized water quality data base to serve as a repository for the collection of biological and water quality data collected by all of the various Oklahoma state and federal environmental agencies, natural resource agencies, state universities, etc.
- Pursue grant funding through the Environmental Exchange Network to support more effective and efficient exchange of water quality data and water quality assessment results via the Water Quality Exchange (WQX-STORET) and the Clean Water Act Integrated Reporting, Water Quality Assessment, and the Impaired Waters Data Exchange (OWIR).
- Develop a mechanism to fund improvements to OWRB’s “Water Information Mapping System” (WIMS). Improvement of this portal would provide access to data from more than one site simultaneously through a query, as well as providing access to shape files for site locations of State sites other than the BUMP sites (ODEQ, etc.).
- With support from other agencies continue to expand on GIS water quality-related products and data including water related-products like diversion data, tribal data (from cooperative projects), drought sensitivity data, etc.
- Create a better groundwater database for data management to help fulfill the legislative mandate.
- Have all cities, towns, and rural water districts using groundwater, provide a copy of all of their sampling data, current and historical, to the State database. Combine this with groundwater sampling done by OWRB and Corporation Commission (>3000 samples) into a database to show where groundwater problems exist. This can then be combined with planned new sampling to map groundwater quality trends;
- Make groundwater data part of the annual BUMP report;
- Use Best Management Practice (BMP) Compliance Monitoring Data to refine the BMPs and improve effectiveness of BMP education programs by targeting high priority watersheds, specific forestry practices or key audiences.

Surface Water Management

The State Secretary of Environment (OSE) along with the Oklahoma Conservation Commission (OCC), should encourage and promote:

Nonpoint Source Pollution and Watershed Management

- Implementation of innovative Nonpoint Source (NPS) pollutant reduction and management practices while also stressing use of proven measures;
- Encourage development of technical assistance programs that promote establishment of pollution prevention plans by landowners;
- Assurance that State programs incorporate an adequate level of watershed planning, Best Management Practice (BMP) design, Water Quality Monitoring and assessment of progress;
- Provide additional resources, as required, to stay up-to-date on research and develop watershed BMP inventories to estimate load reductions;
- Forestry practices should be considered part of the solution in a watershed approach to water quality management, in partnership with others, including those outside commercial forest areas.
- Improve the effectiveness of forestry BMPs in reducing sediment loads;

- Continue support of both the unwanted pesticide disposal and pesticide container recycling programs;
- Water Quality Programs should incorporate Ecosystem Management and look at critical yield management vs. individual system wide management;

Water Quality Programs should follow the Unified Watershed Prioritization Scheme developed by the NPS working group based upon High Quality Waters, Endangered Species etc;

- Development and implementation of watershed planning and management strategies that encourage the use of Geographical Information System (GIS) technology at the local, state and federal levels, as well as encourage coordination of data sources.
- Encourage the development of Source Water Protection Plans as a mechanism to ensure that current source waters are protected from increased Confined Animal Feeding Operations (CAFOs) and permitted discharges; Also, encourage an integrated source water protection approach that is tied to pesticide applications whereby the applicator is responsible for monitoring the source water and/or the use of fecal source tracking markers to determine pollution sources.

Surface Water Quality Standards

- Increase efforts to implement Water Quality Standards (WQS), especially biological criteria on a watershed basis, including additional protection for Outstanding Resource Waters;
- Move toward development and implementation of additional numeric nutrient criteria, particularly for phosphorus and nitrogen, for all waterbodies;
- Develop numeric minerals criteria for protection of Oklahoma's fish and wildlife propagation use, or numeric translators to implement the current narrative criterion for minerals with respect to the fish and wildlife propagation;
- Increase efforts to implement Oklahoma's anti-degradation policy and implementation procedures in the State's Water Quality program;

Oklahoma's Congressional Delegation should encourage the federal government to:

- Consider Water Quality Standards Implementation procedures that look at not only criteria and permit development, but also field validation of discharge permits which protect human health and aquatic life.
- Review and update the current aquatic life and human health water quality criteria for Appendix G, Table 1 of Oklahoma's Water Quality Standards.
- Narrative Standards should be quantified into standards that can be measured and evaluated for surface water.

Groundwater Management

The Oklahoma Water Resources Board, through the Water Quality Standards process, should further develop and upgrade Oklahoma's groundwater quality standards as both a protection and cleanup tool. Consideration should be given to:

- Explain how the narrative and numerical standards work together; should be outlined (in the WQ section of the OCWP);

- Narrative Standards should be quantified into standards that can be measured and evaluated for groundwater;
- Consideration of the effects of parameters for one beneficial use on other uses.

Oklahoma Interagency Water Resources Management

Oklahoma has several agencies that have a role in Water Resources Management. These agencies are not located in close proximity to each other and information comes in different formats making it difficult for the public to interact with them. In addition, water resource management is fragmented and inconsistent because of insufficient interagency coordination, jurisdictional conflicts, and regulatory gaps.

Interagency, Regional and Watershed Coordination

Under the interagency coordination approach, a coordination committee should be established that includes representatives from all agencies having jurisdiction over water. Agency representatives should be either the department or division head from the section or area of the agencies that have authority over water, or appoint another representative that is familiar both with water issues and agency programs. Relevant federal agency personnel should also be included on the committee. The committee should work with regional stakeholder-based Water Resources Management groups to help meet its goals. To help the agencies facilitate cooperation and allow for ease of public access, agencies should be relocated in close proximity to each other.

The committee should meet regularly and report annually to the Governor and Legislature on the progress and implementation of the Comprehensive Water Plan, success of the coordination efforts between agencies and other accomplishments. This annual report should also suggest ideas for improving Water Resources Management and making legislative changes. All meetings held under the Open Meetings Act, and all reports should meet the guidelines of the Open Records Act.

Wetland Protection and Management

Oklahoma's Comprehensive Wetlands Conservation Plan (OCWCP) was developed through interagency cooperation in 1996 with the goal to "...conserve, enhance, and restore the quantity and biological diversity of all wetlands in the state." Currently, the State, under leadership by the OCC, is developing a Wetland Program Plan (WPP) which will take substantive steps in building program capacity for accomplishing four core elements: 1) monitoring and assessment, 2) regulatory activities, 3) voluntary restoration and protection, and 4) water quality standards for wetlands of the State of Oklahoma. Future wetland programs should include:

- Coordinated wetland projects between state agencies should continue to be implemented to identify, delineate and inventory in order to manage the State's wetlands;
- Define wetlands;
- Designate beneficial uses of wetlands;
- Identify measures to mitigate losses of wetlands, protect and manage them on a watershed or hydrologic unit basis;
- Develop standards for critical wetlands;
- Recommend measures to ensure the protection of landowner property rights while protecting legitimate public interests; and

- Define the roles of appropriate State agencies.

Endangered Species

Appropriate state and federal environmental and natural resource agencies should facilitate increased public involvement in the Endangered Species Act administration and decision-making process.

The Oklahoma Water Resources Board should ensure that future state water quality standards revisions consider the comments and policies of other state and federal environmental and natural resource agencies to achieve a reasonable and environmentally-sensitive balance between protection of endangered and threatened species, economic concerns, consumptive water uses and related considerations.

Municipal & Rural Water/Wastewater Systems

- Provide a sedimentation survey on a 10 year rotation for Ok water supply reservoirs;
- Apply preventative measures for Source Water Protection;
- Smaller municipalities need more resources to attract and maintain qualified employees to run more advanced Waste Water Treatment Plants (WWTP);
- Municipalities need additional resources for Well Head Protection;
- Municipalities experiencing increased total organic carbon (TOC) should be prioritized for diagnostic tools to determine the feasibility of improving raw water quality.

Financing

- State agencies need adequate funding for routine water quality monitoring;
- Obtain grant funding to extend the HEM (Helicopter borne Electro-Magnetic) project to determine groundwater impairments, surface water/groundwater interaction and impacted groundwater areas from old oilfields;
- Include in future budgets; either expansion of the BUMP/Conservation Commission programs to cover other agencies' monitoring needs or provide separate funding for monitoring to other agencies;
- Focus funding efforts on Prevention ~ Proactive use, addressing areas that don't presently have any problems;
- Offer State economic incentives (with the State bearing at least part of the cost of environmental protection) in exchange for societal benefits from private forestlands.
- Promote the concept of perpetual funding of natural resources and environmental programs through a penny sales tax increase.
- Provide Cost Benefit Analysis for comparing the cost of improving raw water quality (watershed and in-lake BMPs) vs. treatment plant upgrades when faced with degraded water quality.

APPENDIX B: Additional Programmatic Issues

Oklahoma's Reservoirs; A Critical Resource

A century of extensive water resources development in Oklahoma has resulted in the construction of 52 major lakes with at least 1,000 acres of surface area containing more than 14 million acre-feet of water. In addition, there are almost 3,000 lakes and ponds that are 10 acres or greater in size, containing a total of 1,049 square miles of water and 10,384 miles of shoreline. An estimated 387,000 smaller lakes and ponds also dot the state's landscape, providing valuable sources of drinking water, irrigation, flood control, recreation, and habitat for fish and wildlife. Surface water sources provide public water supply for millions of Oklahomans. Oklahoma lakes generate millions of dollars every year for the state's economy through tourism and recreation. Eleven lakes contain hydropower facilities, which provide more than five percent of Oklahoma's total electric power generation. Thousands of species of aquatic wildlife are sustained by the state's vast network of rivers, streams, and lakes. The importance of Oklahoma's lakes to its citizens cannot be overemphasized.

A lake's multiple purposes must be given consideration. This is a challenge as there are many and varied water managers that are faced with the task of balancing competing needs with competing authorities. In addition to requirements associated with authorized uses and state-issued water rights, reservoir operators must consider and evaluate many factors to determine appropriate management of water and storage. For example, during drought water supply needs are of particular concern while power generation, recreation, irrigation, fish and wildlife, and other commitments must also be considered. During flooding events, or when flooding is imminent, the challenge is to maintain or reduce lake levels. In manageable situations, when lake levels exceed the designed storage capacity, water is released slowly over the course of days or weeks to prevent flooding to downstream low-lying lands. Under more critical situations, operators must pay particular attention to lake levels, river stages, precipitation forecasts, and related hydrologic factors just to minimize impacts. While all of these scenarios are a part of, they but do not directly address the issues of water quality.

The physical, chemical, and biological characteristics of lakes, including light, temperature, currents, nutrient levels, contaminants, biomass, and the number and growth rates of fish and plant populations, to name a few, are extremely variable. While the size, function, and water source of a lake are major determinants of these variables, all lakes experience dramatic changes over time. Of the 160 most popular lakes in Oklahoma one quarter of these were built between the years of 1909 and 1997. Of these lakes, 81 are 50 to 100 years old and are thus reaching the end of their projected lifespan. That does not necessarily mean these lakes are unsuitable for their original purposes. However, the fact that so many of Oklahoma's major lakes are rapidly maturing should prompt planners to address changes not only in lake capacity but also water quality.

Over time, a lake will fill with sediment and dead plant material, a process referred to as “succession,” that is accelerated by human activity in the watershed. Materials that fill up a lake can be carried there by streams, runoff, through the air, or from materials produced in the lake itself. For individual lakes, phases of succession differ depending on the local environment, but all lakes will eventually experience an increase in total biomass. “Eutrophication” is a term used to describe an increase in the concentration of lake nutrients, primarily nitrogen and phosphorus, to an extent that growth of algae and other plankton is increased ultimately beyond the capacity of the lake’s ecosystem to incorporate them. The increase in growth and depleted oxygen levels will often result in taste and odor problems, as well as accelerated sedimentation. Under natural conditions, eutrophication generally occurs over a long period of time. However, most human-oriented land uses, including agricultural, residential, and commercial development, can greatly accelerate the process. This is called “cultural eutrophication” with the direct effect seen as elevated to excessive algae content in our reservoirs. Higher algae content leads to higher risk of harmful algae blooms (and production of cyanotoxins), decreased aesthetics and elevated risk of public health effects through recreational exposure, increased cost for treating raw water and increased risk for exposure to disinfection byproducts of treated drinking water. Sources leading to cultural eutrophication include municipal waste, fertilizers, farm and feeding operation waste, and other human derived by-products that are delivered to the lake through runoff. These pollutants are problematic across the state. While Oklahoma has one of the strongest non-point source programs in the nation very little work is ongoing to directly mitigate the impact of elevated algae content in Oklahoma’s reservoirs. To date no one entity has been tasked with addressing the comprehensive effects of reservoir aging to the state of Oklahoma. Each of the eight state environmental agencies and several of the federal agencies address their component within their narrow jurisdiction but no one group has taken a comprehensive view from the reservoirs perspective. This is because the reservoirs physical, chemical and biological composition does not follow jurisdictional boundaries.

The OWRB has tracked eutrophication in Oklahoma lakes for the past 12 years as part of the agency’s Beneficial Use Monitoring Program (BUMP). Lakes are rated on a scale from “oligotrophic” to “hypereutrophic.” Oligotrophic means the lake is very low in nutrients, has low levels of algal production, is rich in oxygen, and has clear water. Hypereutrophic lakes are nutrient rich with algae blooms and low transparency. These ratings and other water quality data can be found on the OWRB’s website. BUMP data provides critical information to assess water quality conditions, support Oklahoma’s Water Quality Standards, and prioritize pollution control activities. BUMP data has become indispensable to sound decision-making. Identification of problem areas enables the development of targeted pollution control and remediation programs. Ongoing state water quality monitoring through BUMP ensures that future generations of Oklahomans will be able to make sound and defensible decisions concerning both the quality and quantity of supplies critical to the continued growth and welfare of the state

In addition to monitoring, the OWRB has taken on several projects over the years to combat the effects of eutrophication and slow down the succession of our state’s lakes. These projects have focused on establishing aquatic plant communities and shoreline stabilization. Since shoreline erosion leads to an unanchored shore, eutrophication is hastened and the establishment of stable plant communities becomes even more difficult. In fact, once the process of shoreline erosion begins, it often takes human intervention to stabilize the shoreline long enough to get plants established. Bioengineering methods

have been developed that halt the erosive processes long enough to allow for establishment of a healthy aquatic plant community. This can result in low-cost, long-term erosion control. The OWRB has also employed a battery of diagnostic tools to determine the reason for elevated algae levels, assess the impact to water supply and recommend feasible solutions to decrease the risk of elevated organic content to the end user. These programs show promise to reduce long-term infrastructure upgrades for drinking water supply by increasing the quality of raw water supply. These tools should be afforded to all water supply reservoirs experiencing the effect of cultural eutrophication.

The OWRB's modern-day bathymetric mapping program, which utilizes the agency's GIS and related technology, began in the late 1990s. As of August 2010, the OWRB has completed bathymetric surveys on 37 reservoirs. The purpose of the program is to provide accurate determinations of the current storage capacities in the state's reservoirs. Obtaining accurate storage volumes is an integral tool used in the management of the state's water supply. For many reservoirs, the only available storage volumes are those that were estimated when the lake was first constructed. Because of sediment, the volume of the reservoir can be reduced over time. By conducting a lake bathymetric survey, the managing authority of a reservoir is better equipped to handle critical water management issues. The valuable information that a bathymetric survey produces can be used for many purposes. State and federal agencies use bathymetric maps for determining TMDLs, dam breach analysis, and watershed monitoring and management. Municipalities use the maps to help determine the amount of water a lake can yield in the driest of times (reliable yield) and aid in assessing future needs. Fisheries managers use the maps to help determine fish stocking quotas, provide an estimate of lake volume for chemical rehabilitation projects and vegetation control, and to calculate potential yield of fish. Anglers use the maps to find sunken points, drop-offs, mud flats, and other features within the lake, while hunters use them to find points and passes for waterfowl hunting. Water supply lakes with excessive turbidity may be more at risk for sediment accumulation than others. While all of Oklahoma's reservoirs should be slated for routine sedimentation surveys on a ten year rotation, those assessed as having excess turbidity or sediment accumulation should be prioritized for further investigation. These investigations would determine cause and effect for the problem as well as offer most feasible actions in the drainage basin and lake to restore or mitigate impaired beneficial uses.