

Arkansas River Corridor Projects Potential Water Quality Effects

TO: Tulsa County
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FROM: CH2M HILL
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Introduction

Tulsa County, as part of the Arkansas River Corridor Master Plan (Carter & Burgess, 2004; C. H. Guernsey and Company et al., 2005), is undertaking an improvement project on the Arkansas River. The primary goals of the overall project are to improve least tern habitat, improve fish habitat and fish passage, improve the function of the river system itself, enhance economic development, increase recreational opportunities, and increase connectivity between the river and surrounding communities. The conceptual project components are described in detail in the Technical Memorandum (TM) entitled Baseline Project Summary for the Arkansas River Corridor Project (CH2M HILL, 2009a). Key components include:

- Design of habitat improvements along the corridor
- Design of bank stabilization in select areas
- Design of a new Sand Springs low-head dam, pedestrian bridge, and amenities
- Design of modifications to Zink Dam and lake with whitewater features
- Design of a new South Tulsa/Jenks low-head dam, pedestrian bridge, and amenities

The purpose of this TM is to summarize the status of regulations and agency guidance relevant to water quality and the potential water quality impacts of the Project that will need to be considered as the project proceeds.

Existing Regulations

Beyond Oklahoma's antidegradation policy, which states that Oklahoma will protect the waters of the State from degradation, Oklahoma's surface water quality standards are specific to beneficial use designations. A beneficial use is defined as a "means of classification of the waters of the State, according to their best uses in the interest of the public" (Oklahoma Administrative Code [OAC], 2009). The Arkansas River and its major

tributaries within the project area have a combination of beneficial use designations, including: emergency water supply; fish and wildlife propagation, warm water aquatic community; agriculture – class I irrigation; primary or secondary body contact recreation; and aesthetics (OAC, 2009). These uses are protected in the Oklahoma Water Quality Standards through the restrictions imposed by narrative criteria and numerical standards.

Narrative criteria and numerical standards are organized by beneficial use. The general narrative criteria address minerals, solids, taste and odor, and nutrients. Oil and grease, as well as color, are also addressed via narrative criteria. The numerical standards address an extensive list of potential constituents. The more common water quality challenges addressed by the numerical standards include:

- Bacteria (coliform bacteria, Escherichia coli [E. coli], and enterococci)
- Dissolved Oxygen (DO)
- Temperature
- pH
- Toxicants
- Turbidity
- Salinity
- Metals
- Mineral constituents of water quality (e.g., sulfate, chloride, and total dissolved solids)

Each of these standards has been defined to provide a measure of diverse and healthy aquatic habitats, safe drinking water, and public safety and enjoyment, as well as a means to mandate action should these standards not be met. When an aquatic environment is modified (e.g., adding a discharge or modifying river hydraulics), DO is typically the parameter of most concern. DO standards are based on aquatic habitat needs. Table 1 presents the requirements associated with the fish and wildlife propagation beneficial use assigned to the project area, warm water aquatic community subcategory.

TABLE 1
Dissolved Oxygen Criteria to Protect Fish and Wildlife Propagation, Warm Water Aquatic Community Subcategory

Fishery Class	Dates Applicable	DO Criteria (Minimum, milligrams per liter [mg/L])	Seasonal Temperature^a
Early Life Stages	April 1 – June 15	6.0 ^b	25° C (77° F) ^c
Other Life Stages			
Summer Conditions	June 16 – October 15	5.0 ^b	32° C (89.6° F)
Winter Conditions	October 16 – March 31	5.0	18° C (64.4° F)

Source: Oklahoma Water Quality Standards, Appendix G, Table 1

1. ° C = degrees Celsius. ° F = degrees Fahrenheit.
2. Because of natural diurnal DO fluctuation, a 1.0-mg/L DO concentration deficit shall be allowed for not more than 8 hours during any 24 hour period.
3. Discharge limits necessary to meet summer conditions will apply from June 1 of each year. However, where discharge limits based on Early Life Stage (spring) conditions are more restrictive, those limits

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may be extended to July 1.

States are required to determine if these criteria are met by the monitoring requirements imposed in the Clean Water Act, Section 305(b), a rule requiring the states to develop a biennial water quality inventory. The monitoring provides a screening; if the data exceed the criteria, further studies and/or analyses are required to determine if the water body is or is not attaining its assigned beneficial use(s). These studies are identified in Oklahoma’s Use Support Assessment Protocols, developed by the Oklahoma Water Resources Board, and Continuing Planning Process, developed and updated by the Oklahoma Department of Environmental Quality (ODEQ).

If a water body is not supporting its designated use(s), the Clean Water Act, Section 303(d), requires that the water body be designated an impaired water, and a priority ranking for the development of mitigating actions is assigned. These mitigating actions are identified as part of the development of a total maximum daily load (TMDL) and subsequent efforts by affected point source dischargers.

When evaluating beneficial use attainment, it is not uncommon to find that many streams in Oklahoma do not support one or more of their beneficial uses. In many instances, the body contact recreational uses are not supported due to bacteria. It is for this reason that the Tulsa City-County Health Department has posted warning signs along the Arkansas River.

The *Water Quality in Oklahoma, 2008 Integrated Report*, prepared by ODEQ) in response to Clean Water Act Section 305(b) requirements, has been approved by the U.S. Environmental Protection Agency (EPA) (ODEQ, 2008a). Both the 2006 and 2008 reports listed significant portions of the Arkansas River as impaired; causes include enterococcus, fecal coliform, and E. coli (bacteria); lead; cadmium; oil and grease; and total dissolved solids. A TMDL study on bacteria impairments, *Bacteria Total Maximum Daily Loads for Arkansas River Segments OK120420010010_00, OK120410010080_00 and Haikey Creek Segment OK120410010210_00*, was conducted by the ODEQ and finalized in October 2008 (ODEQ, 2008b); it was approved by EPA in 2009 (ODEQ, 2009). Affected entities will be required to address the challenges presented in the study. For example, Phase II stormwater permittees must develop Bacteria Reduction Plans that include monitoring and best management practices (INCOG, 2009, personal communication). Should there be any overlap, the development and implementation of the Arkansas River Corridor Project will be consistent with any bacteria-related efforts performed due to the TMDL.

Also in the Clean Water Act, as outlined in Section 404, the U. S. Army Corps of Engineers (USACE) requires notification for any disturbance to waters of the United States, which includes most projects near water bodies, and, in most cases, a Section 404 permit must be obtained. The Arkansas River Corridor Project is no exception. Should an individual Section

404 permit be required, as opposed to coverage under a Nationwide permit, a Water Quality Certification, based on Section 401 of the Clean Water Act, would have to be obtained as well. The 401 certification addresses EPA regulations concerning discharges into the nation's public waters and is typically approved and enforced by the state environmental agencies; the 404 permit addresses the actual construction activities within those waterways and is typically approved and enforced by USACE.

Lastly, the National Environmental Policy Act (NEPA) [42 U.S.Code 4321 et seq.] establishes national environmental policy and goals for the protection, maintenance, and enhancement of the environment, and provides a process for implementing the policy and goals within the federal agencies (EPA, 2009). Section 102 requires federal agencies to incorporate environmental considerations in their planning and decision-making through a systematic interdisciplinary approach. Specifically, all federal agencies are to prepare detailed statements assessing the environmental impact of and alternatives to major federal projects significantly affecting the environment.

The NEPA process includes an evaluation of the environmental effects of a federal project, including its alternatives. Three levels of analysis are available, depending on whether or not the project could significantly affect the environment. The three levels are:

1. Categorical exclusion determination
2. Preparation of an environmental assessment/finding of no significant impact (EA/FONSI)
3. Preparation of an environmental impact statement (EIS)

A categorical exclusion determination waives the need for a detailed environmental analysis if a project meets certain criteria. Preparation of an EA/FONSI includes a written EA to determine whether or not a project would significantly affect the environment. If it would not, the federal agency issues a FONSI, which may address measures that an agency will take to mitigate potentially significant impacts. If it would, an EIS is prepared. An EIS is a more detailed evaluation of the proposed project and alternatives (EPA, 2009).

Previous Studies

Previous project studies have addressed water quality as a result of existing conditions and post-project implementation. The Phase I Vision Plan suggested that water quality studies could be used for educational purposes in the communities involved. It also stated that the Project must maintain continuity between the riparian corridor and aquatic environment as this would be critical to the sustainability of the river, including water quality conditions (Carter & Burgess, 2004).

Several years ago, INCOG developed DO water quality models (QUALTX and LAQUAL) to simulate existing conditions in the Arkansas River and potential water quality impacts of additions or modifications to certain point source discharges (e.g., wastewater treatment plant effluent discharges). The results of these simulations are then used by ODEQ in developing permits within the Oklahoma Pollutant Discharge Elimination System (OPDES). As part of the *Arkansas River Corridor Master Plan Phase II Master Plan and Pre-Reconnaissance Study* (C.H. Guernsey and Company et al., 2005), INCOG performed an update of the model and evaluated the potential impacts on DO in the Arkansas River if several proposed

new low-head dams were located in the project corridor. This modeling effort resulted in the removal of some dam locations from consideration due to potential water quality impacts. The modeling indicated that the remaining recommended low-head dam locations would not cause a reduction in DO concentrations below the water quality standards for all seasons (C.H. Guernsey and Company et al., 2005).

For Phase III of the Arkansas River Corridor Project studies, an assessment of existing water quality data was conducted. According to the report, "To adequately assess the [Arkansas River Corridor] (42-mile study area) one must first understand the basics of water quality measurements as well as the natural chemistry of surface water. It is also important to understand the basic characteristics of the Arkansas River as a whole" (Cherokee CRC Environmental Solutions, 2008). This assessment, conducted in 2006 and 2007, included the compilation, analysis, and synopsis of existing water quality data and a comparison of these data to relevant regulations. Water quality data were compiled from available published reports and scientific literature produced by municipal, county, state, and federal agencies and private industry. This analysis of existing water quality data produced a synopsis, or snapshot, of the current water quality conditions within the study area.

The City of Tulsa and the surrounding communities have each developed stormwater management plans (SWMPs). The City of Tulsa's stormwater management program initially focused on controlling flooding challenges, and several suburban cities developed their own flood control programs. In 1990, the City of Tulsa met its Phase I stormwater permit requirements by developing a comprehensive SWMP to control pollution in stormwater runoff. By 2006, all Tulsa suburban cities and counties had developed their own pollution control SWMPs under the EPA's Phase II stormwater regulations.

For the current study, one of the first steps included developing a TM summarizing, among other things, possible direct, indirect, and cumulative effects of the Project. Specific to water quality, the following potential effects were noted in the TM report entitled *Arkansas River Corridor Projects: Preliminary Regulatory Review, Data Gaps Analysis, and Summary of Potential Project Effects* (CH2M HILL, 2009b):

- Anticipated growth in urban areas would potentially increase pollutant loading, to include nutrients and bacteria (a continued challenge for the river), increasing the chances for eutrophication and limited recreational effects. The Project itself would not increase pollutant loadings.
- Increased possibilities for sedimentation would exist during construction; a sedimentation and erosion protection plan must be followed. The Project itself should decrease sedimentation within the river, due to the regulation of flows by the low-head dams, resulting in lower average velocities. Anticipated growth in urban areas would potentially increase sediment loading from upland non-point sources.
- Under impounded conditions, particularly during the summer months, the water may tend to be warmer than under free flowing conditions, depending on dam operation.
- The anticipated conditions resulting from the addition of low-head weirs and the modifications to river flow may impact assimilative capacity, the river's ability to assimilate discharges. The impact could be an increase in assimilative capacity due to the expected increased low flows in the free flowing river. However, the impact could be

a decrease in assimilative capacity in impounded areas, especially during low flow and high temperature conditions; this could affect dischargers to the river by forcing reductions of oxygen-demanding constituents.

Current Status and Next Steps

Previous DO modeling of this portion of the Arkansas River, performed by INCOG, has been approved by ODEQ and EPA Region VI when used to set wasteload allocations for oxygen-demanding substances for wastewater dischargers within the corridor, where appropriate. According to INCOG, ODEQ has stated that INCOG's models are the most accurate and up-to-date water quality models for the project area and should be sufficient if a Section 401 water quality certification is required (INCOG, 2009, personal communication). For this reason, these models are periodically updated when new information affecting baseline conditions and/or potential water quality impacts from the proposed dams becomes available.

INCOG staff conducted preliminary modeling of the river water quality conditions with the proposed low-head dams in place and determined that DO would not be below levels necessary for a healthy aquatic environment and/or compliance with water quality standards (Cherokee CRC Environmental Solutions, 2008). Supporting this finding, the project team is unaware of monitoring results suggesting that DO has been below the water quality standard as a result of the construction of the low-head dam that created Zink Lake, constructed on the Arkansas River near Tulsa approximately 30 years ago.

The current CH2M HILL study has also included discussions with interested state and federal agencies. These discussions were intended to obtain feedback from the agencies to ensure that relevant perspectives are considered during implementation of the Arkansas River Corridor Project, and to ensure that agency concerns are addressed adequately such that any approvals necessary for obtaining permits for the Project will be obtained. Regarding water quality, two agencies in particular have voiced concerns: U.S. Fish and Wildlife Service (USFWS) and Oklahoma Department of Wildlife Conservation (ODWC). According to staff from both USFWS and ODWC, their concerns are specific to water quality under low flow, high temperature conditions once the Project is implemented. They allege that DO levels would fall below the criteria stipulated in the water quality standards in the backwater areas (pools) created by the new dams (CH2M HILL, 2009c).

INCOG's models are currently constructed using seasonal 7Q2 flow conditions, the lowest mean discharge for 7 consecutive days within a 2-year recurrence interval in a particular season. These flow volumes are required by ODEQ in approving OPDES permits and, for the project area, are 896 cubic feet per second (cfs) for summer conditions, 938 cfs for winter conditions, and 2,850 cfs for spring conditions. USFWS has indicated that flows often drop below the seasonal 7Q2 flows and, occasionally, below 100 cfs during the summer and that existing models may not accurately reflect future water quality impacts at these lower flows. USFWS representatives indicated that they expect DO levels in the proposed reservoir pools to drop below the DO criteria in the water quality standards during these low flow and high temperature conditions (CH2M HILL, 2009c). Note that the Arkansas River Project would provide flow attenuation via dam operation during non-flood and drought conditions.

To address the USFWS concerns, INCOG planned to perform water quality sampling activities during the summer of 2009 for model validation purposes, if the flow fell below the defined 7Q2 flows. Ideally, for worst case conditions, this sampling would take place during relatively hot temperatures as well. However, conditions were not suitable for such sampling during the summer of 2009. Therefore, INCOG intends to perform the sampling in the summer of 2010. Once available, the sampling results would be compared to the model output to validate the modeling results.

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