Final Report

Arkansas River Corridor Projects

Preliminary Regulatory Review, Data Gaps Analysis, and Summary of Potential Project Effects

Prepared for

Tulsa County, Oklahoma

June 2009

CH2MHILL

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Acronyms and Abbreviations

ASTM	American Society for Testing and Materials
ABB	American Burying Beetle
BMP	Best Management Practice
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
EA	Environmental Assessment
EDR	Environmental Data Resource, Inc.
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Environmental Site Assessment
ESQD	Explosive Safety Quantity Distance
FEMA	Federal Emergency Management Agency
GIS	Geographic Information System
INCOG	Indian Nations Council of Governments
LOS	Level of Service
NEBA	Net Environmental Benefit Analysis
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration Plan
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
ODEQ	Oklahoma Department of Environmental Quality
ODWC	Oklahoma Department of Wildlife Conservation
OWRB	Oklahoma Water Resources Board
REC	Recognized environmental condition
ROI	Region of influence
RTE	Rare, threatened, and endangered
SHPO	State Historic Preservation Officer
SWPPP	Stormwater pollution prevention plan
TM	Technical Memorandum
TMDL	Total Maximum Daily Load

TSCA	Toxic Substances Control Act
USACE	United States Army Corps of Engineers
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

Executive Summary

Tulsa County, as part of a master plan for the Arkansas River Corridor (Carter Burgess, 2004; 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 the ecological function of the river system itself through restoration and bank stabilization, improve least tern habitat, and increase connectivity between the river and surrounding communities. Key components of the project include:

- 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
- Design of bank stabilization and habitat improvements in selected areas

Phase 1 of the Arkansas River Corridor Projects is designed to support refinement of project alternatives using an updated constraint analysis and conceptual engineering and to provide recommendations for studies required to proceed with the project under Phase 2. This report summarizes the results of analyses under Task 1-1 of Phase 1. These analyses included efforts to identify:

- Potential project effects on human and natural resources, whether beneficial or adverse
- Potential regulatory requirements for the conceptual project
- Data gaps which need to be addressed

The following list summarizes key results of the analyses.

- Although the project is not well enough defined to support characterization of effects in terms of the intensity and significance, the potential effects of the project were characterized by duration (short-term or long-term) and type (direct, indirect, or cumulative). Potential effects were associated with many of the resource categories reviewed: air quality; biological resources (terrestrial and aquatic); cultural resources; hazardous materials; health and safety; hydrology and hydrogeology; land use, land cover, and recreation; noise; socioeconomics; soils and topography; transportation; utilities and infrastructure; and visual and aesthetic resources.

- The regulatory review identified 45 executive orders and local, state and federal regulations which will likely apply to the project. Although each regulation is activity- and site-specific, the project's conceptual design suggests that the requirements under §404 of the Clean Water Act and regulations related to dam safety, floodplains and wildlife management, including the Endangered Species Act, will be major regulatory drivers for the project.

- A data gaps analysis of readily-available information prepared by a multi-disciplinary team indicates the following gaps need to be addressed to prevent schedule delays: sediment supply and transport studies, cultural resources surveys, American Society for Testing and Materials (ASTM)-Compliant Phase I Environmental Site Assessments (ESAs) of portions of alternatives that involve property purchase or could result in soil

disturbance, water quality modeling to assess effects of the project, and groundwater pollution analyses. If additional biological surveys were required by agencies, these studies would be a critical data gap.

- ASTM-Compliant Phase I ESAs: Avoidance of potentially contaminated sites is a key consideration during design. It is recommended that an ESA be conducted for each parcel upon which a portion of an alternative might be constructed prior to finalizing preliminary design.

The resulting review suggests that several issues require further refinement during the scoping process for Phase 2. Once project alternatives are better understood, more information will be available on the potential effects of the project and how best to characterize those effects, regulatory requirements and data gaps.

FIGURE ES-1
View of Bald Eagle Perched in Tree along South Shoreline of Arkansas River within Swift Park and Downstream of Keystone Dam

FIGURE ES-2
View of Severe Erosion in Lower Reach of Tributary along South Shoreline of Arkansas River near Proposed Site of Sand Springs Low-Head Dam

FIGURE ES-3
View of Southside Wastewater Treatment Plant Downstream of Interstate 44 Bridge with Turkey Mountain in Background

1.0 Introduction

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

- 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
- Design of bank stabilization and habitat improvements in selected areas

To support this effort, Tulsa County and its partners have engaged CH2M HILL to assess and further refine the project. The first phase of this effort (Phase 1) will: (1) identify data gaps affecting project analyses and design, (2) list possible direct, indirect, and cumulative effects of the project, (3) identify major federal and state statutes and executive orders (EOs) applicable to the project, (4) prepare a preliminary constraint analysis using existing data, (5) refine the schematic concept, and (6) provide detailed recommendations for work elements under Phase 2. Phase 1 will allow the County and its partners to identify strategic issues early and develop strategies to address those concerns.

This first report provides the results of the first three activities (project effects, regulatory review, data gap review) using the current project components as a basis for analysis. It is important to note that regulatory requirements and the process to refine the design are very site- and activity-specific, so recommendations may change as the project concept evolves. These reviews are focused to support later compliance with National Environmental Policy Act of 1969, 42 United States Code (USC) 4321 et seq. (NEPA), Council on Environmental Quality (CEQ) implementing regulations (40 Code of Federal Regulations [CFR] Part 1500, et seq.), associated EOs, and United States Army Corps of Engineers (USACE) NEPA guidelines, including the U.S. Army Environmental Command National Environmental Policy Act Desktop Reference 3.0.

2.0 Project Effects

2.1 Introduction

In order to assist the project team with maximizing benefits of the proposed project and avoiding adverse impacts, a list of possible project effects has been developed. The terms "effects" and "impacts" are used interchangeably under NEPA. Effects or impacts are the result of an action and can be both beneficial and adverse. These may include ecological effects (such as the effects on natural resources and on the components, structures and functioning of affected ecosystems), and aesthetic, historic, cultural, economic, social or health effects. Actions can have a combination of beneficial and adverse effects on a resource even if the net result is beneficial. The intensity of the effect and its significance can also vary due to its duration and the nature of the resource affected (e.g. the importance of the effect on resources and whether that function is temporarily or permanently affected).

2.1.1 Direct, Indirect, and Cumulative Effects

For planning purposes, an initial assessment of potential project effects focuses upon potential direct, indirect, and cumulative effects. §1508.8 of NEPA defines direct effects as those caused by the action (which might be an alternative) and occur at the same time and place. Indirect effects are caused by the action and "are later in time or farther removed in distance, but are still reasonably foreseeable" (CEQ, 1997a). "Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems" (NEPA, 1970 as amended). §1508.7 of NEPA defines a cumulative impact as an impact which results from the incremental impact of the action when combined with other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such actions.

2.1.2 Short-Term Versus Long-Term Effects

Effects are also expressed in terms of duration. The duration of short-term impacts typically is considered to be 1 year or less. However, specific site conditions may alter the duration of what is considered short-term. For example, the construction of a building on a generally level area would expose soil in the immediate area of construction. This effect would be considered short-term because vegetation would be expected to re-establish on the disturbed area, stabilizing the soil, within a year of the disturbance. Long-term impacts last beyond 1 year. Long-term impacts can potentially continue indefinitely, in which case they would also be described as permanent.

For this activity under Phase 1, the identification of potential effects is largely restricted to the characterization of the impact by these categories as well as its duration because of the conceptual nature of the current project. Later phases of the project would need to assess the effects of alternatives in terms of magnitude and significance, which will help to inform the decision about whether an EA (Environmental Assessment) or EIS (Environmental

Impact Statement) is appropriate. To support later discussions, the following sections describe how impacts would be further defined in later phases of the project.

2.1.3 Impact Characterization

Impacts are characterized by their relative magnitude. Adverse or beneficial impacts that are significant are the highest level of impacts. Conversely, negligible adverse or beneficial impacts are the lowest level of impacts. In this document, five descriptors are used to characterize the level of impacts. In order of degree of increasing impact, the descriptors are as follows:

- No Impact
- Negligible Impact
- Minor Impact
- Moderate Impact
- Significant Impact

Figure 2-1 graphically represents this hierarchy of impacts.

FIGURE 2-1
Hierarchy of Impacts

< Impact Scale >

Significant Adverse Impact	Moderate Adverse Impact	Minor Adverse Impact	Negligible Adverse Impact	No Impact	Negligible Beneficial Impact	Minor Beneficial Impact	Moderate Beneficial Impact	**Significant Beneficial Impact**

2.1.4 Significance

The term "significant," as defined in Section 1508.27 of the Regulations for Implementing NEPA (40 CFR 1500), requires consideration of both the context and intensity of the impact evaluated. Significance can vary in relation to the context of the proposed action. Thus, the significance of an action must be evaluated in several contexts that vary with the setting of the proposed action. For example, context may include consideration of effects on a national, regional, and/or local basis depending upon the action proposed. Both short–term and long–term effects may be relevant.

In accordance with the CEQ implementing guidance, impacts are also evaluated in terms of their intensity or severity. Factors contributing to the evaluation of the intensity of an impact include, but are not limited to, the following:

- Because an impact may be both beneficial and adverse, a significant impact may exist even if, on balance, the impact is considered beneficial.
- The degree to which the action affects public health or safety.
- Unique characteristics of the geographic area where the action is proposed such as proximity to parklands, historic or cultural resources, wetlands, prime farmlands, wild and scenic rivers or ecologically critical areas, and rare flora and fauna species.
- The degree to which the effects on the quality of the human environment are likely to be controversial.

- The degree to which the effects of the action on the quality of the human environment are likely to be highly uncertain or involve unique or unknown risks.
- The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
- Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action "temporary" or by breaking it down into small component parts.
- The degree to which the action may adversely affect districts, sites, buildings, structures or objects listed in or eligible for listing in the National Register of Historic Places (NRHP) or may cause loss or destruction of significant scientific, cultural or historical resources.
- The degree to which the action may adversely affect any endangered or threatened species or any habitat designated as critical under the Endangered Species Act.
- Whether the action threatens a violation of federal, state or local law or requirements imposed for the protection of the environment (Clean Water Act [CWA] and Endangered Species Act, etc.).

The determination of the significance of an effect has a direct bearing on the determination of what type of NEPA document is appropriate.

2.2 Methodology and Results

CH2M HILL assembled a multi-disciplinary team of cultural resources specialists, biologists, ecologists, environmental specialists, geologists, hydrogeologists, planners and engineers to use their previous project experience to identify potential effects of the project for major resource categories and to determine whether those effects would be direct or indirect and the duration of those effects. The methodology utilized is based upon the guidance of the U.S. Army Environmental Command's National Environmental Policy Act Desktop Reference (version 3.0), which specifies several resource categories and types of effects that should be considered during the planning phases of projects. The purpose of this exercise is to identify possible beneficial and adverse effects regardless of significance. As the impact analyses continue, using specific alternatives, the type of effects and their intensity, significance, duration and type can be better defined.

For this exercise, these effects characterizations were based upon the general types of construction activities and operations that could be expected as the project is currently envisioned. The team also identified other projects which may need to be considered from a cumulative effects perspective, which are described in greater detail in Section 2.3. Table 2-1 summarizes the results of this analysis.

TABLE 2-1
Potential Project Effects[a] of the Arkansas River Corridor Projects

Environmental Resources/Attribute	Potential Issue	Yes	No	Project Definition Related Activity	Short-Term[b]		Long-Term[c]	
					Direct[d]	Indirect[e]	Direct	Indirect
Airspace USE								
Airports/Airfields	Change in Approach or Departure Patterns		X	Impacts related to airspace use are not anticipated.	N/A	N/A	N/A	N/A
Air Quality								
Criteria	Pollution Emission Change	X		Increase in emissions would occur from construction equipment, construction related highway traffic, and proposed stationary sources. There is the potential for increased emission levels from recreational vehicles (boats, jet skis) and increased number of vehicles on the road once the project is completed. In later phases of the design process, the sponsor would need to review current attainment status for the project area and estimate air emissions generated by the project.	X		X	X
	Photochemical Smog Formation	X		An increase in ozone formation would be expected due to increased emission levels from construction equipment, increased highway and water traffic, and increased industrial emissions from proposed stationary sources.	X		X	X
Odor	Malodorous Emissions		X	Impacts related to malodorous emissions are not anticipated; impacts to existing wastewater treatment plants and effects on water quality and dissolved oxygen would be evaluated and the project design modified to avoid adverse impacts.	N/A	N/A	N/A	N/A
Biological Resources (Terrestrial)								
Flora	Flora Destruction	X		Short- and long-term losses due to construction of hike/bike trails. Added human and domestic animal activity would likely have minor negative impacts indirectly over time. Long-term impacts to flora due to inundation caused by stream structures. Increased recreation will result in direct loss of flora as humans and animals trample plants in the restored habitats, particularly near the banks. Long-term improvements to riparian habitat, including upland vegetation and bottomland restoration, are expected	X		X	X
	Exotic Species Introduction	X		Potential for introduction of exotic, invasive plant species as a result of land clearing and disturbance associated with project construction; indirect potential for introducing exotic species as a result of upland disturbance accompanying river corridor development.	X	X	X	X
Protected Species: Flora	Species Loss		X	It appears that no plant species of concern are present in the project area; Oklahoma statutes do not protect plant species and no federal species are listed within the project area.	N/A	N/A	N/A	N/A
Fauna	Species Disturbance	X		Potential displacement of wildlife from riparian zones and adjacent uplands altered by project construction or inundation by new or expanded pools; temporary effects of land clearing and disturbance from project construction (e.g., habitat alteration, erosion, noise, exhaust fumes); indirect effects to wildlife from increased human activity accompanying river corridor development.	X	X	X	X
	Population Dynamics Interference	X		Potential changes in local wildlife species composition and population structure (e.g., reptiles, amphibians, and birds) due to loss and fragmentation of riparian habitat; indirect long-term effects due to increased human activity accompanying river corridor development.	X	X	X	X
	Reduction in Biodiversity	X		Potential reductions in local wildlife biodiversity due to loss and fragmentation of least-disturbed or unique riparian habitat types; indirect long-term effects reducing biodiversity as a result of increased human activity accompanying river corridor development.	X	X	X	X
	Exotic Species Introduction	X		Potential for introduction of exotic, invasive wildlife species as a result of land clearing and disturbance associated with project construction; indirect potential for introducing exotic species as a result of upland disturbance accompanying river corridor development.		X	X	X
	Biotic Interaction Interference	X		Potential changes in local wildlife species composition and dispersal, and accessibility to the riparian corridor, as a result of permanent habitat alteration from project construction; indirect effects on wildlife movement and interactions as a result of river corridor development (e.g., bike trails as dispersal corridors).	X	X	X	X

[a] Project effects may include beneficial and adverse effects ranging from negligible to significant.
[b] Short-term is defined as transitory effects that are of limited duration, and are generally caused by construction activities or operation start-up.
[c] Long-term is defined as effects that occur or continue to occur over an extended period of time, whether they start during the construction phase or operation start-up, or start or during the operations phase.
[d] Direct impacts are caused by the action and occur at the same time and place. Cumulative effects will be addressed separately.
[e] Indirect impacts are caused by the action and are later in time and farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducement. Cumulative effects will be addressed separately.

TABLE 2-1

Potential Project Effects of the Arkansas River Corridor Projects

Environmental Resource/Attribute	Potential Issue	Yes	No	Project Definition Related Activity	Short-Term[a]		Long-Term[b]	
					Direct[c]	Indirect[d]	Direct	Indirect
Habitat	Habitat Destruction/Creation	X		Potential loss and alteration of riparian and adjacent upland habitats by project construction or inundation by new or expanded pools; temporary effects of land clearing and disturbance from project construction; indirect effects to terrestrial habitats from increased human activity accompanying river corridor development; mitigation of certain habitat effects as a result of proposed habitat restoration.	X	X	X	X
	Habitat Degradation/Improvement	X		Potential alteration and degradation of riparian and adjacent upland habitats by project construction or inundation by new or expanded pools; indirect long-term effects due to increased human activity accompanying river corridor development; potential habitat improvements through proposed mitigation/habitat restoration.	X	X	X	X
	Habitat Fragmentation	X		Potential fragmentation of least-disturbed or unique riparian habitat types as a result of project construction or inundation by new or expanded pools; temporary effects from construction; indirect long-term potential for habitat fragmentation resulting from increased river corridor development.	X	X	X	X
	Nutrient Cycling Alteration	X		Potential changes in terrestrial nutrient cycling associated with the loss, alteration, or conversion of riparian and adjacent upland habitats as a result of project construction or inundation by new or expanded pools; indirect long-term as a result of increased river corridor development.		X	X	X
	Disturbance Regime Change	X		Potential changes in terrestrial habitat disturbance regimes as a result of project construction, inundation of riparian zones, and associated changes in land use patterns; indirect long-term effects associated with increased river corridor development and accompanying land use changes.			X	X
Sensitive Habitats	Riparian Zone Alteration/Creation	X		Potential loss and alteration of sensitive forested riparian habitats supporting nest trees for bald eagle, which remains protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, and other migratory and resident wildlife species of conservation concern; temporary disturbance of sensitive habitats during project construction; indirect long-term alteration of sensitive habitats from increased river corridor development and associated land use changes; potential habitat creation/improvements through proposed mitigation/habitat restoration.	X	X	X	X
	Special or Unique Community Loss	X		Potential loss or degradation of unique terrestrial wildlife communities associated with remaining sensitive habitats directly affected by project construction or inundation; temporary effects from construction; indirect long-term effects from increased river corridor development activities.	X	X	X	X
Protected Species: Fauna	Species Disturbance	X		Potential loss or alteration of habitat for rare, threatened, and endangered (RTE) species of wildlife, including the federally endangered species interior least tern and American burying beetle (ABB), as a result of project construction, inundation by new or expanded pools, and project operation; existing interior least tern nesting sites are known to occur near the proposed site of Sand Springs dam, on Zink Island, in 3 areas between Zink Dam and the Creek Turnpike, near the proposed site of Jenks dam, and in 10 areas extending downstream from Jenks to beyond Bixby (Region of influence [ROI] extends from Keystone Dam downstream beyond Jenks); temporary impacts to RTE species habitat as a result of land clearing and disturbance from project construction (e.g., habitat alteration, erosion, noise); indirect effects to RTE species habitat resulting from increased human activity accompanying river corridor development.	X	X	X	X
	Critical Habitat Loss		X	As of 2009, critical habitat has not been designated for either interior least tern or ABB (U.S. Fish and Wildlife Service [USFWS], 2009a).				
Biological Resources (Aquatic)								
Flora	Flora Disturbance	X		Potential changes in the species composition and distribution of aquatic plant communities as a result of project construction and operation; indirect effects to aquatic plant communities as a result of habitat alteration and water quality effects accompanying increased river corridor development.	X	X	X	X
	Exotic Species Introduction	X		Potential for introduction of exotic, invasive aquatic plant species as a result of habitat alteration associated with project construction; indirect introduction of exotic aquatic plant species as a result of habitat modification and increased boating activities accompanying river corridor development.		X		X

TABLE 2-1

Potential Project Effects of the Arkansas River Corridor Projects

Environmental Resource/Attribute	Potential Issue	Yes	No	Project Definition Related Activity	Short-Term[a]		Long-Term[b]	
					Direct[c]	Indirect[d]	Direct	Indirect
Fauna	Species Disturbance	X		Potential changes in the species composition and distribution of fish and macroinvertebrates as a result of habitat loss, modification, and fragmentation from project construction and operation; indirect disturbance to species composition and distribution associated with increased river corridor development.	X	X	X	X
	Population Dynamics Interference/Increase	X		Potential changes in native species abundance and population structure due to loss, modification, and fragmentation of riverine (free-flowing) habitat; indirect effects on population dynamics due to habitat alteration and water quality effects accompanying increased river corridor development.	X	X	X	X
	Fish Passage	X		Potential loss or disruption of spawning and rearing habitats for migratory riverine fishes, including striped bass, paddlefish, sauger, and shovelnose sturgeon, resulting from the construction and operation of low-head dams as potential barriers to upstream and downstream fish passage; temporary effects on fish passage during construction; indirect long-term effects on fish passage accompanying river corridor development.	X	X	X	X
	Reduction in Biodiversity	X		Potential reductions in native fish and macroinvertebrate biodiversity due to loss, modification, and fragmentation of riverine habitat; indirect long-term effects reducing biodiversity as a result of habitat alteration and water quality effects accompanying river corridor development.	X	X	X	X
	Exotic Species Introduction	X		Potential for introduction or proliferation of exotic, invasive aquatic species as a result of habitat modification associated with project construction and operation; indirect introduction of exotic species as a result of habitat modification and increased boating activities accompanying river corridor development.		X		X
	Biotic Interaction Interference	X		Potential changes in fish and macroinvertebrate species seasonal habitat use and dispersal as a result of permanent habitat alteration from project construction; indirect effects on fish movement and interactions as a result of habitat alteration associated with increased river corridor development.	X	X	X	X
Protected Species	Species Disturbance	X		Potential loss or alteration of habitat for RTE species of fish and aquatic invertebrates as a result of project construction and operation; no federally or state threatened and endangered aquatic species are presently known to occur in the Arkansas River in the project area but state species of concern, such as Shovelnose Sturgeon, may seasonally occur there; indirect effects to habitats of species of concern accompanying increased river corridor development.	X	X	X	X
	Critical Habitat Loss		X	No critical habitat for federally listed fish and aquatic invertebrates has been designated in the Arkansas River in the project area.				
Wetlands	Wetlands Loss/Creation	X		Potential loss or conversion of wetlands as a result of project construction, inundation by new or expanded pools, or project operations; temporary effects to riparian wetlands due to construction; indirect loss or conversion of wetlands associated with increased river corridor development; potential wetland habitat improvement/creation through proposed mitigation/habitat restoration.	X	X	X	X
	Sedimentation	X		Potential changes in sediment transport and shoreline erosion and sedimentation as a result of project construction, inundation of shorelines by new or expanded pools, and project operation; temporary effects of erosion and sedimentation during construction; indirect long-term effects associated with increased river corridor development; potential wetland habitat improvement/creation through proposed restoration.	X	X	X	X
	Pollution/Contamination	X		Potential alteration of wetlands as a result of water quality degradation occurring due to project construction and operation; temporary pollution/contamination of wetlands during construction; indirect long-term water quality effects to wetlands accompanying increased river corridor development; potential wetland habitat improvement/creation through proposed mitigation/habitat restoration.	X	X	X	X
	Hydrologic Regime Alteration	X		Potential loss or conversion of wetlands due to changes in the existing hydrologic regime resulting from project construction, inundation by new and expanded pools, and project operation; temporary localized changes in wetland hydrology during construction; long-term effects to the hydrologic regime due to increased river corridor development; potential wetland habitat improvement/creation through proposed mitigation/habitat restoration.	X	X	X	X

TABLE 2-1

Potential Project Effects of the Arkansas River Corridor Projects

Environmental Resource/Attribute	Potential Issue	Yes	No	Project Definition Related Activity	Short-Term[a]		Long-Term[b]	
					Direct[c]	Indirect[d]	Direct	Indirect
Cultural Resources								
Archaeological (Prehistoric & Historic)	Destruction, Removal, or Alteration	X		Any ground-disturbing activities (construction of the dams, recreation facilities, roads, scenic overlooks and other associated structures) have the potential to disrupt archaeological features. There are at least 84 known historic and prehistoric archaeological sites in the project area. Further research and survey would be necessary to identify sites in the proposed construction areas. The Phase III report does indicate extensive surveys have occurred in the Sand Springs/Tulsa USGS Topographic Quadrangles which may be adequate to assess impacts in these areas. Other portions of the corridor have been evaluated less.			X	X
	Alteration Setting	X		If archaeological artifacts are removed from the location where they were found the setting of the artifacts is permanently altered.			X	X
Historic Buildings & Structures	Destruction, Removal, or Alteration	X		There are several NRHP historic districts and individual properties in Tulsa and Sand Springs and throughout the project area, several relatively close to the river. There is the potential for direct and indirect impacts to NRHP -listed and –eligible properties, both temporary impacts from construction and long-term indirect impacts, including visual and traffic changes and impacts to the setting, association and feeling of a structure or district. Further research and survey would be necessary to identify historic structures in the proposed construction areas.		X	X	X
	Alteration Setting	X		Depending on the extent of the construction activities, the historic setting of the NRHP -listed and –eligible properties could be impacted.				
Paleontology	Destruction, Removal, or Alteration	X		No data was found on this topic from available resources so an effect could occur. In later phases of the project, areas within or adjacent to construction should be surveyed to determine if impacts may occur.			X	X
	Alteration Setting	X		No data was found on this topic from available resources so an effect could occur. In later phases, this is an area that will need to be investigated further.				
Traditional Cultural Properties	Destruction, Removal, or Alteration	X		No traditional cultural properties were located through available resources. Further research and consultation with tribes and other cultural groups in the area would be required to identify traditional cultural properties.				
	Alteration Setting	X		Further research and consultation with tribes and other cultural groups in the area would be required to identify traditional cultural properties.		X	X	X
Scenic Resources	Destruction, Removal, or Alteration	X		There is the potential for scenic resources to be impacted by the increased recreation uses, dam changes, and water level alterations. Further research would be required to locate all state and federal scenic resources.	X	X	X	X
	Alteration Setting	X		There is the potential for scenic resources (including the view from the opposite bank of the river) to be impacted by the increased recreation uses, dam changes, and water level alterations (inundation). Further research would be required to assess scenic effects.				
Native American Resources	Grave Disturbance	X		There is a known Native American cemetery in the western portion of the Wekiwa quad map and there are many prehistoric and historic Native American archaeological sites throughout the project area.	X	X	X	X
	Spiritual Place Desecration	X		During public meetings in October 2005, a member of the Osage Nation commented that the project area may have religious and/or cultural significance to the tribe. Further research and consultation with tribes in the area would be required to identify Native American cultural and spiritual properties.				
Hazardous Materials & Waste								
Hazardous Materials	Introduction and Use of New, or Additional Hazardous Materials	X		New or additional hazardous materials are anticipated to be present due to planned construction activities. The specific hazardous materials will depend upon the specific construction activities. Hazardous materials may include, but are not limited to: paints, solvents, adhesives, pesticides, herbicides, and petroleum products from equipment operation and maintenance.	X		X	
	Exceeding Hazardous Materials Handling Capacity	X		It is not anticipated that hazardous materials handling capacity will be exceeded. Best Management Practices (BMPs) should be considered to address the handling and management of hazardous materials during construction activities. BMPs should include storage, labeling, and spill clean-up& reporting requirements and procedures to comply with applicable U.S. Environmental Protection Agency (USEPA) and OK regulations for hazardous materials.	X		X	

TABLE 2-1

Potential Project Effects of the Arkansas River Corridor Projects

Environmental Resource/Attribute	Potential Issue	Yes	No	Project Definition Related Activity	Short-Term[a]		Long-Term[b]	
					Direct[c]	Indirect[d]	Direct	Indirect
Hazardous Wastes	Generation of New or Additional Wastes	X		New or additional hazardous wastes will be generated due to the use of hazardous materials during construction activities. Hazardous wastes may include but are not limited to: spills or leaks of hazardous materials, septic wastes, and unused hazardous materials not intended for future use.	X	X	X	X
	Exceeding Hazardous Wastes Handling Capacity	X		It is not anticipated that hazardous waste handling capacity will be exceeded. BMPs should be considered to address the management of hazardous waste during construction activities. BMPs should include storage, labeling, packaging, transportation, spill clean-up& reporting, and disposal procedures to comply with applicable USEPA and OK regulations for hazardous waste.	X		X	
Hazardous Substances or Petroleum Products	Environmental Site Assessment	X		Based upon the Standard Environmental Risk Management Report prepared by EDR (Environmental Data Resource, Inc.) for the Arkansas River Master Plan, there are a number of Federal and State regulated properties located within the search radius of 5 miles. Further assessment, through the performance of a Phase I ESA (ASTM 1527-05), will be required to identify, to the extent feasible, recognized environmental conditions (RECs) defined as "the presence or likely presence of any hazardous substances or petroleum or products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substance or petroleum product into structures on the property or into the ground, groundwater, or surface water of the property."	X	X	X	X
Health & Safety								
Occupational Health & Safety	Exposure to New or Additional H & S Hazards	X		Construction workers would follow OSHA regulations for all construction related activities. Employees working at new proposed buildings would follow the corporation's Health and Safety procedures. Impacts are expected to be negligible. Following construction, BMPs should be used to manage new sources of hazardous materials during maintenance activities.	X		X	
Public Health & Safety	Exposure to New or Additional H & S Hazards	X		Practices should be implemented to keep the public out of construction zone sites. Rules and regulations will need to be established near the dam area once construction is complete to warn boaters about hazards associated with the dam. FEMA will provide federal guidance to state and local emergency management authorities for dam safety issues. Following construction, BMPs should be used to manage new sources of hazardous materials during maintenance activities.	X	X	X	X
	Radiation (Non-Ionizing) Exposure		X	No impacts caused by radiation exposure are anticipated as a result of the project.	N/A	N/A	N/A	N/A
	New or Expanded Hazard Area(s) for Launches or Weapons Testing		X	Launches or weapons testing associated with the proposed project are not anticipated, therefore new or expanded hazard areas are not a public health and safety issue.	N/A	N/A	N/A	N/A
	New or Expanded Explosive Safety Quantity Distances (ESQDs) for Weapons Storage		X	No new or expanded ESQDs for weapons storage are anticipated.	N/A	N/A	N/A	N/A
	Effects on Children	X		There is the potential for increased respiratory problems in children due to increased air quality emissions from construction related activities. Respiratory problems would be minor and temporary and would decrease once construction is complete. Children may also be affected during operation of the project from use of the lakes or white water recreational facilities. Facilities will be designed to minimize potential effects.	X	X	X	X
Hydrology & Hydrogeology								
Surface Water: Streams and Rivers	Channel Alteration	X		The river and stream channels will respond to both construction and the proposed dam network; to what extent will depend on the construction methods and alternative design chosen. The project will minimize negative impacts to the extent practicable by incorporating construction BMPs, biostabilization treatments, optimizing dam operations, etc.	X		X	X
	Drainage Network Alteration	X		Drainage networks will be modified both directly and indirectly as a result of construction and the project itself, to include the permanent drainage easements necessary to allow channel improvements to be constructed and maintained. Direct alterations include necessary routing modifications to limit negative channel alterations; indirect alterations include those resulting from increased population in the area.	X		X	X
	Stream Flow Change	X		The purpose of the project is to alter stream flow to increase storage in selected areas, encouraging recreation and economic growth; additionally, construction will modify stream flow to allow for work to occur. Operation of the dams resulting in optimum stream flow as it relates to sedimentation, water quality, habitat, etc. will be developed in an iterative manner.	X	X	X	X

TABLE 2-1

Potential Project Effects of the Arkansas River Corridor Projects

Environmental Resource/Attribute	Potential Issue	Yes	No	Project Definition Related Activity	Short-Term[a]		Long-Term[b]	
					Direct[c]	Indirect[d]	Direct	Indirect
Surface Water: Lakes	Water Quality (including Eutrophication and Nutrient Loading)	X		Previous modeling efforts suggest dissolved oxygen levels will remain above those considered necessary for a healthy aquatic environment in the reservoirs. Anticipated growth in urban areas, however, will potentially increase pollutant loading, to include nutrients and bacteria (a continued challenge for the River), increasing the chances for eutrophication and limited recreational benefits. Phases 1 and 2 will include additional modeling efforts to assess any potential effects.		X		X
Groundwater	Groundwater Withdrawal (Aquifer Decline)	X		The project does not directly involve groundwater withdrawal; therefore no aquifer decline should result from project implementation. The project could increase local groundwater levels because of increased recharge from the surface impoundments. This could require increased groundwater pumping at existing facilities that dewater or have groundwater extraction associated with remediation to maintain pre-project groundwater elevations.				X
	Subsidence Due to Drawdown		X	No decrease in groundwater levels below pre-project conditions will occur because of project implementation.	N/A	N/A	N/A	N/A
	Changes in Groundwater Flow/Levels	X		Project implementation is expected to increase local groundwater recharge, which in turn could increase local groundwater levels and change groundwater flow patterns.	X		X	
	Saltwater Intrusion		X	Saltwater intrusion is not anticipated to occur.	N/A	N/A	N/A	N/A
Land Use, Land Cover & Recreation								
Land Use	Change in Land Use	X		Construction of the Sand Springs and South Tulsa / Jenks low head dams as well as improvements to Zink Dam would result in short-term, direct impacts to lands adjacent to these structures and along the future shoreline. Direct impacts include potential dredging of the river bed and disturbance of the floodplain / riparian buffers to construct the dams and stabilize shorelines. Limited grading and clearing (to remove potential hazards) may occur in preparation of the periodic upstream inundation of lands 5 miles and 3 miles upstream of the dams. These lands will change to become transitional in nature during construction. Long-term, direct impacts will result due to these lands becoming either water or wetlands. Major land use changes potentially associated with Sand Springs includes the creation of 3 acres of wetlands from Prattville Creek, conversion of riparian lands on the north shore to water for a Marina, and the creation of recreational park lands. Additionally, a mix of riparian bottomland hardwoods and impacted industrial lands would be periodically inundated to create a water body. Major land use changes associated with South Tulsa / Jenks include the conversion of existing pasture lands south of Creek Turnpike and north of Polecat Creek to mixed use, the expansion of the existing pond and creation of a new pond upstream of the existing one. Construction of the dam will require short-term impacts to the riparian lands associated with the existing sand and gravel operation along the west bank as these are reinforced to support the dam.	X		X	
		X		Long-term, indirect changes in land use are also likely as under-utilized adjacent lands transition from historically industrial and lower density uses to a more mixed use character as illustrated in the Master Plan Figures. This induced growth could increase as the river corridor is restored and becomes a recreation destination.				X
	Conflicts with Land Use Plans, Policies, and Controls	X		The proposed action is part of the Arkansas River Corridor Master Plan, a comprehensive, iterative planning effort for the Arkansas River Corridor Project being guided by the Indian Nations Council of Governments (INCOG) and its member entities, including Tulsa County, the Cities of Tulsa, Jenks and Sand Springs. These local governments have been stakeholders in the development of the Master Plan which should reduce the likelihood of significant conflicts with their Land Use Plans. For example, the proposed action is consistent with this Plan as well as the Sand Springs Strategic Plan goals to develop the river with recreation, entertainment, and tourism opportunities (CSS, Undated). However, stakeholders have noted their concern that the corridor will be subject to serious degradation if zoning and environmental regulatory restrictions are not applied (all development will need to be to the 100-year flood pool elevation) (USACE, 2009). A review of lands impacted by the proposed action will be performed and all appropriate rezoning and plan reviews obtained to ensure compliance with local government policies, ordinances and controls.	X	X		
	Land Use Incompatibility	X		Encouraging public / recreational use of the corridor could be incompatible with conservation of the tern and bald eagle habitats since the introduction of boating could subject these species to disturbances. Short- and long-term measures would be needed to avoid direct and indirect human disturbance (USACE, 2009).		X		X

TABLE 2-1

Potential Project Effects of the Arkansas River Corridor Projects

Environmental Resource/Attribute	Potential Issue	Yes	No	Project Definition Related Activity	Short-Term[a]		Long-Term[b]	
					Direct[c]	Indirect[d]	Direct	Indirect
	Urban Sprawl		X	The proposed action is centrally located within the INCOG region with convenient access to downtown business district and public transportation; improving the attractiveness of the corridor will increase the potential for quality development close to existing job centers. As a result, these actions will not contribute to urban sprawl and will instead provide long-term direct and indirect positive impacts by encouraging the redevelopment of underutilized lands adjacent to the Arkansas River instead of green field (undeveloped) property and large parcels of prime farmland (minimizing agricultural land encroachment) on the edges of the region.				
	Special Land Uses	X		The proposed action along the western shoreline south of 71st street would be adjacent to the Turkey Mountain Wilderness Area, causing the potential for long-term indirect impacts. The Wilderness Area consists of over 300 acres with dirt trails for hiking, mountain biking, and is the only portion of River Parks where horseback riding is allowed.		X		X
Land Cover	Change in Land Cover	X		Short-term, direct impacts to land cover within the corridor will result from construction of the proposed action. Long-term indirect impacts to land cover could result as development and redevelopment activities increase in the corridor.	X			X
	Imperviousness Increase	X		The project components include the creation of additional parking opportunities in the corridor which will result short- and long-term impacts by creating impervious area within the floodplain. Additional long-term indirect impacts could result as development and redevelopment activities increase the amount of impervious surface within the corridor.	X			X
Prime Farmland	Increases/Decreases in Prime Farmland	X		INCOG has identified isolated pockets of prime farmland along both sides of the Arkansas River at its intersections with State Highway 97, location of the proposed Sand Springs Low Water Dam, and the Creek Turnpike, location of the proposed South Tulsa/Jenks Low Water Dam. Creation of these new low head dams and resulting periodic inundation of lands upstream could result in both short- and long-term, direct impacts by reducing the amount of prime farmland available for agricultural use (INCOG, 2005).	X		X	
Recreation	Access / Use Limitations during Construction	X		The River Parks system, administered by a Tulsa County and City appointed Authority, has over 800 acres of public land including park areas and recreation trails throughout the corridor, particularly south of the river's intersection with I-244. Access to some recreation facilities could be affected, limiting visitor use (fishing, boating during construction of or improvements to Zink Dam.	X			
		X		The Proposed Action includes placement of a public boat ramp on the south bank below the proposed Sand Springs dam. Short-term, direct impacts to the existing FFA/4H facilities would occur during construction as a result of constructing an access road approximately 700-feet beyond the existing road through the FFA/4H facilities (USACE, 2009).	X			
	Relocation & elimination of existing recreation facilities	X		The Proposed Action includes placement of a public boat ramp on the south bank below the proposed Sand Springs dam. The recommendation to relocate the FFA / 4H facilities offsite would result in long-term, direct impacts to those users of these facilities (USACE, 2009).			X	
Noise								
Continuous Noise: Humans	Annoyance, Hearing Loss, Speech and Sleep Interference (>55 dB)	X		Minor temporary impacts (annoyance and speech interference) will result from the construction of the proposed action. No impacts to hearing loss and sleep interference as a result of the proposed action are anticipated. More detail is needed on proposed building locations, noise levels, and distances to nearest sensitive receptors to determine long-term impacts. Need to review low-head dam noise levels.	X			X
	Health Impacts (>75 dB)		X	Construction workers would use hearing protection and follow OSHA regulations; therefore no health impacts related to the noise is anticipated.	N/A	N/A	N/A	N/A
	Compatibility with Surrounding Land Uses		X	The majority of the land uses surrounding the proposed action are either non-residential in nature or have a low density of workers to limit the effects of continuous construction noise.	N/A	N/A	N/A	N/A
Continuous Noise: Animals	Loss of Productivity for Domestic Animals		X	Due to the lack of dairy and poultry farms in the project area loss of productivity for domestic animals is not anticipated.	N/A	N/A	N/A	N/A
	Disturbance, Agitation, or Removal of Wildlife	X		Disturbance and agitation of wildlife due to construction related noise levels is anticipated, however, it is expected that animals will return to normal behavior once construction is complete. Potential for long-term impacts as development and urban sprawl increases in surrounding areas. Will need to review noise levels of proposed marina, parking lots, low-head dams and distance to habitats, specifically interior least tern colonies.	X			X

TABLE 2-1

Potential Project Effects of the Arkansas River Corridor Projects

Environmental Resource/Attribute	Potential Issue	Yes	No	Project Definition Related Activity	Short-Term[a]		Long-Term[b]	
					Direct[c]	Indirect[d]	Direct	Indirect
Impulse Noise: Humans	Annoyance	X		Impulse noises related to construction activities and increased recreational activities within the project area will result in short- and long-term impacts to human annoyance. Additional long-term indirect impacts could result as development and urban sprawl increases in surrounding areas. Distances to all sensitive receptors will need to be identified.	X	X	X	X
	Disturbance		X	Impacts to disturbance as a result of the proposed action are not anticipated.	N/A	N/A	N/A	N/A
	Vibration of Structures	X		Impacts to vibration of structures as a result of heavy construction equipment are likely. Distance to nearest structures will need to be identified before significance of impact can be determined.	X			X
Impulse Noise: Animals	Disturbance	X		Disturbance to wildlife is anticipated, but would be negligible. Need to coordinate very closely with USFWS to determine impacts to interior least tern.	X			X
	Startle Effect	X		Impulse noises associated with construction are anticipated and would potentially startle nearby wildlife. Distance to nearest wildlife receptors needs to be known before impacts are finalized. Potential long-term impacts from recreational impulse noises (boat whistles and horns) are anticipated.	X			X
Socioeconomics								
Employment	Direct, Indirect, and Induced Employment Generation	X		Increase in employment, business volume, expansion and new businesses from construction, operation and maintenance, and recreational activities within the Region of Influence (ROI) or area where an effect may occur . It is the non-local workers (and possibly their dependents who relocated temporarily to the ROI and who have the potential to affect demand for community services	X	X	X	X
Income	Direct, Indirect, and Induced Employment Generation	X		Increase in the income within the ROI due to an increase of jobs. Potential increase in tax revenues with increase in spending. Temporary residents will not spend as much (or on as wide a range of items) as workers who already reside in the ROI.	X	X	X	X
Population	Population Influx (In-migration)	X		Increase in population within the ROI due to beautification efforts, increase of jobs, and recreational activities, along the Arkansas River Corridor. It is the non-local workers (and possibly their dependents) who relocate temporarily to the ROI that have the potential to affect population levels. Population would increase only to the degree that additional long-term economic activity occurs.	X	X	X	X
	Demographic Changes	X		U.S. Census Bureau information for the area is available from previous assessments. Potential impact to demographics affected within the project area due to increase in population.		X		X
Housing	Increased Demand for Housing	X		Community and regional population growth could bring along changes in property values and tax revenues with increase in employment and income.	X	X	X	X
	Additional Housing Construction	X		Community and regional population growth could bring along changes in property values and tax revenues with increase in employment and income. Only to the degree that increased employment leads to additional residents and possibly family formation.	X	X	X	X
Community Services & Infrastructure	Increased Demand for Community Services and Infrastructure	X		Increase in community service and infrastructure from construction, operation and maintenance, and recreational activities within the ROI. Typically use level of service (LOS) ratios to estimate increased demand for personnel such as law enforcement officers, fire fighters, teachers, etc. Important to look at long-term as well as short-term spikes in demand. Impacts to public schools only to the degree that there is an increase in persons aged 18 or less.	X	X	X	X
	Additional Services/Infrastructure-Related Construction	X		Increase in additional service and infrastructure-related construction from proposed project construction, operation and maintenance, and recreational activities within the ROI. Additional services could include establishments that sell food products and fuel.	X	X	X	X
Environmental Justice	Disproportionate Impacts to Minority and Low Income Populations (Beneficial or Adverse)	X		U.S. Census Bureau information for the area is available from previous assessments to conduct analyses. The potential impact to minority and low-income populations within the project area would need to be assessed to determine if disproportional effects, whether beneficial or adverse, exist (CEQ,1997b).	X			
Protection of Children	Disproportionate Impacts to Children (Beneficial or Adverse)	X		Under EO 13045, Protection of Children from Environmental Health Risks and Safety Risks, a federally-funded project would be required to assess the project's effects on children in particular.		X		X

TABLE 2-1

Potential Project Effects of the Arkansas River Corridor Projects

Environmental Resource/Attribute	Potential Issue	Yes	No	Project Definition Related Activity	Short-Term[a]		Long-Term[b]	
					Direct[c]	Indirect[d]	Direct	Indirect
Soils & Topography								
Soils	Soil Erosion	X		Erosion of channel banks, runoff due to increased urbanization, and construction practices are three significant contributors to soil erosion. Minimizing each of these sources will be critical to a successful project; the manner in which to address them will differ based on the design alternative chosen.	X		X	X
	Soil Conservation	X		Soil conservation is dependent on protection from erosion and contamination. Minimizing erosion is a guiding principle in the design and construction of the project; soil contamination is not anticipated as a possibility.	X		X	X
	Soil Compaction	X		Construction activities may compact the soil beyond the point of desired and or natural infiltration abilities; alternatively, compaction may be required of construction. This issue must be managed to the extent possible during construction.	X			
	Development (Construction) in Hydric Soils	X		Construction in and development near hydric soils will occur. BMPs to minimize negative impacts to these soils will need to be implemented during construction and, potentially, incorporated into the design.	X			X
	Loss of Prime or Unique Farmland	X		INCOG has identified isolated pockets of prime farmland along both sides of the Arkansas River at its intersections with State Highway 97, location of the proposed Sand Springs Low-Head Dam, between Jenks and Bixby, and the Creek Turnpike, location of the proposed South Tulsa/Jenks Low-Head Dam. Creation of these new low-head dams and resulting periodic inundation of lands upstream could result in both short- and long-term, direct impacts by reducing the amount of prime farmland available for agricultural use (INCOG, 2005).	X		X	
Topography – Inland	Change in Slope (Conditional Stability)	X		Slopes will be modified as the drainage networks will be modified both directly and indirectly as a result of construction and the project itself. Direct alterations include necessary routing modifications to limit negative channel alterations; indirect alterations include those resulting from increased population in the area. The project will minimize negative impacts to the extent practicable by incorporating construction BMPs, biostabilization treatments, optimizing dam operations, etc.	X		X	X
	Deforestation/Vegetation Removal	X		Short- and long-term losses due to construction of hike/bike trails are anticipated. Added human and domestic animal activity would likely have negative impacts indirectly over time. Long-term impacts to vegetation due to inundation caused by stream structures. Increased recreation will result in direct loss of vegetation as humans and animals trample plants in the restored habitats, particularly near the banks. Long-term improvements to riparian habitat, including upland vegetation and bottomland restoration.	X		X	X
	Drainage Alteration	X		Drainage networks will be modified both directly and indirectly as a result of construction and the project itself. Direct alterations include necessary routing modifications to limit negative channel alterations; indirect alterations include those resulting from increased population in the area and changes in land use/impervious cover.	X		X	X
Transportation								
Roads & Highways (other modes as appropriate)	Increase Traffic, Congestion	X		Increase in traffic/congestion is anticipated due to increased vehicle trips from temporary construction workers. To assess this issue during future phases of work, the sponsor will need to know how many people will be brought in for construction and how many permanent jobs will be made as a result of the proposed project. There is the potential for increased traffic associated with greater numbers of the public visiting the proposed project area.	X	X	X	X
	Decrease in Level of Service	X		Short-term impacts to roadway level of service likely due to increase in construction traffic and heavy equipment. Long-term impacts could involve a decrease in level of service for existing road due to increased urbanization and human activity. Level of impacts will need further study to investigate the level of service ratings of local roads and highways using anticipated increase in traffic volume.	X	X	X	X
	Disruption of Traffic	X		Minor temporary impacts are anticipated at the start and end of the proposed project as a result of large construction equipment being brought onto the site. The sponsor will need to determine if there will be onsite storage for construction equipment.	X			X
	Infrastructure Improvements Needed	X		Improvements to infrastructure are anticipated depending on the number of jobs made available by the proposed project and the associated demand. The sponsor w ill need to know where employees will live, how far they will travel, etc.	X		X	X

TABLE 2-1

Potential Project Effects of the Arkansas River Corridor Projects

Environmental Resource/Attribute	Potential Issue	Yes	No	Project Definition Related Activity	Short-Term[a]		Long-Term[b]	
					Direct[c]	Indirect[d]	Direct	Indirect
	Increase in Traffic Accidents	X		There is the potential for an increase in traffic accidents during the construction phase of the proposed project due to greater numbers of people on the roads. Traffic accidents may also increase over the years depending on the economic and recreational success of the proposed project and how much the population increases.	X			X
Utilities and Infrastructure								
Electricity	Change in Demand	X		The project itself will increase the need for electricity during construction and upon operation of the dam network. Indirectly, the anticipated development/re-development caused by the project will increase the demand for electricity as well.	X		X	X
	Additional Infrastructure	X		As the project area is mostly developed, power appears to be available throughout. Additional meters, connections and lateral lines will likely be needed.	X		X	X
Natural Gas	Change in Demand	X		The project itself may increase the need for natural gas during construction and upon operation of the dam network (potentially in control buildings). Indirectly, the anticipated development/re-development caused by the project will increase the demand for natural gas as well.	X		X	X
	Additional Infrastructure Construction	X		As the project area is mostly developed, natural gas is anticipated to be available throughout. Additional meters, connections and lateral lines will likely be needed.	X		X	X
Potable Water	Change in Demand	X		The project itself will increase the need for potable water during construction and upon operation of the dam network (due to construction and operation employees, as well as other needs). Indirectly, the anticipated development/re-development caused by the project will increase the demand for potable water as well.	X		X	X
	Additional Infrastructure Construction	X		As the project area is mostly developed, potable water is anticipated to be available throughout via one of the municipalities. Additional meters, connections and lateral lines will likely be needed.	X		X	X
Wastewater	Change in Demand	X		The project itself will increase wastewater treatment needs during construction and upon operation of the dam network (due to construction and operation employees, as well as other needs). Indirectly, the anticipated development/re-development caused by the project will increase the needs for wastewater treatment as well.	X		X	X
	Additional Infrastructure Construction	X		As the project area is mostly developed, access to wastewater treatment is anticipated to be available throughout via one of the municipalities. Additional meters, connections and lateral lines will likely be needed. Any effects to the assimilative capacity of the river or the inundation of existing culverts would also need to be assessed and addressed.	X		X	X
Solid Waste	Change in Demand	X		The project itself will increase the need for solid waste services during construction and upon operation of the dam network. Indirectly, the anticipated development/re-development caused by the project will increase the demand for solid waste services as well.	X		X	X
	Additional Infrastructure Construction	X		As the project area is mostly developed, solid waste services are anticipated to be available throughout. Coordination to initiate additional collection routes may be necessary.	X		X	X
Visual and Aesthetic Resources								
Scenic Attractiveness and Integrity	Alteration and Degradation	X		The proposed action will alter the scenic attractiveness and integrity of the corridor in ways that can be construed as both positive and negative depending on a visitor's preferences. Short-term, direct impacts are anticipated during construction due to the need to work directly within the river and riparian corridor. While these actions are widely supported by stakeholders, visitors preferring the existing riverine view sheds will experience long-term, direct impacts. Additionally, stakeholders have expressed concern that increased public use will contribute to existing litter problem in the corridor (USACE, 2009).	X		X	
Visibility	Decrease in Visibility		X	Impacts related to a decrease in visibility are not anticipated as a result of the proposed action.	N/A	N/A	N/A	N/A
	Light Pollution		X	Impacts related to light pollution are not anticipated as a result of the proposed action.	N/A	N/A	N/A	N/A

TABLE 2-1

Potential Project Effects of the Arkansas River Corridor Projects

Environmental Resource/Attribute	Potential Issue	Yes	No	Project Definition Related Activity	Short-Term[a]		Long-Term[b]	
					Direct[c]	Indirect[d]	Direct	Indirect
Scenic Rivers	Waterways with Federal or State Designation		X	Impacts related to waterways designated as Wild and Scenic by either the Federal (US Department of the Interior) or State (Oklahoma Scenic Rivers Commission) are not anticipated as a result of the proposed action.	N/A	N/A	N/A	
Water Resources								
Water Quality: Surface	Pollutant Contamination	X		Anticipated growth in urban areas will 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 will not increase the chances for pollutant contamination.				X
	Sedimentation	X		Increased possibilities for sedimentation 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 flows; anticipated growth in urban areas will potentially increase sediment loading.	X			X
	Thermal Discharges	X		Under impounded conditions, particularly during the summer months, the water will tend to be warmer than under free flow conditions.			X	
	Assimilative Capacity	X		The anticipated conditions resulting from the addition of low-head weirs and the modifications to river flow will impact assimilative capacity. The impact could be an increase due to the expected increased low flows in the free flowing river; the impact could be a decrease in impounded areas, especially during low flow and high temperature conditions, and could impact dischargers to the river by forcing reduction of oxygen-demanding constituents.			X	
Water Quality: Groundwater	Pollutant Contamination	X		Groundwater contamination is present within areas that could be impacted by changes in local groundwater flow patterns. This could mobilize vadose zone contamination, affect existing groundwater extraction/containment systems, and alter the extent and migration of existing groundwater contaminants.	X	X	X	X
Water Supply	Reduction in Water Supply	X		The Arkansas River's natural water quality has caused it to be largely abandoned as a source of municipal, industrial, and public water supply (USACE, 2007); it does serve as an emergency supply for nearby municipalities. An increased water demand due to the growth in the area will equate to a reduced water supply, affecting the water body from which the municipalities are drawing raw water for potable use; the project will not directly affect water supply volumes.				X

2.3 Cumulative Effects

To assess cumulative effects, past, present, and reasonably foreseeable projects would need to be considered. Many of the models already established, including the floodplain and water quality model, consider past projects under existing conditions, such as changes in hydrologic regimes and wastewater treatment plants, and would consider those effects combined with the project. To identify present-day and reasonably foreseeable projects, a list of related projects has been prepared (Appendix A).

3.0 Regulatory Review

This section provides an evaluation of potential regulatory compliance issues in advance of the refined conceptual design of the project components and preparation of the required NEPA document. The purpose of this section is to summarize applicable regulations that are considered integral to the project, review requirements, and identify key issues for discussion with regulatory agencies. The regulations and findings are summarized in Table 3-1. The regulations reviewed include the CWA, Endangered Species Act, National Historic Preservation Act, and EOs for the protection of wetlands and floodplain management.

3.1 Major Permits and Coordination Efforts

Based on CH2M HILL's assessment, the most significant regulatory issues are associated with dredge and fill activities in waters of the U.S., dam construction, work in floodplain areas, and wildlife management concerns. Permitting and coordination requirements associated with those resources are discussed below.

3.1.1 Dredge and Fill in Waters of the U.S.

The proposed action will include dredging and placement of fill material in the Arkansas River and possibly in small areas of riverine wetlands that must be authorized under the CWA §404 and Rivers and Harbors Act §9 and §10 administered by the USACE. An Individual permit encompassing reviews under both acts will be required.

FIGURE 3-1
View of Mouth of Polecat Creek

Individual permits typically take 90 to 120 days for USACE to process, and the overall process can be much longer. The permit process includes a public notice after USACE deems the application complete, which allows the public and other governmental agencies to comment on the application. The Oklahoma §401 water quality certification process is initiated by USACE receipt of a §404 application. A §404 permit issued by USACE is not valid until it receives §401 water quality certification from the Oklahoma Department of Environmental Quality (ODEQ). No additional notification is required for the state certification process. The §401 review may require water quality modeling and water or sediment testing to ensure that water quality standards will be met and designated uses for the river will be maintained.

The Individual permit process includes coordination by USACE with the USFWS and Oklahoma State Historic Preservation Officer (SHPO) to allow for input on potential issues with threatened and endangered species and historic or archaeological resources. The applicant can frequently reduce the processing time by initiating coordination with these agencies in advance of filing the §404 application. Individual permits typically involve a separate EA prepared by USACE, although a NEPA evaluation prepared for a project that addresses §404 issues frequently can substitute for the USACE EA.

If wetland impacts are identified, the requirements of EO 11990, Protection of Wetlands, must be met in addition to any USACE permitting requirements. This EO requires a demonstration that all practicable steps were taken to avoid and minimize impacts to wetlands. Compliance with EO 11990 supports the USACE application by providing support for the §404 (b)(1) analysis.

Key issues to be addressed in meeting regulatory requirements include:

- Analysis of alternatives to the project
- Demonstration of avoidance and minimization of negative impacts in the design
- Development of an acceptable mitigation plan

3.1.2 Dam Safety

The proposed new dams and dam modification will need to meet the requirements of the Oklahoma Dam Safety Act. An application will need to be prepared and submitted to the Oklahoma Water Resources Board (OWRB). The application requires information and plans containing design specifics, safety features, and hydrologic data. As part of the review, a hearing is held. A public notice must be published in local newspapers prior to the hearing.

The Federal Emergency Management Agency (FEMA) is responsible for providing federal guidance to state and local emergency management authorities for dam safety issues. Because the project includes a federal component, the project should be designed to be consistent with the Federal Guidelines for Dam Safety.

3.1.3 Floodplains

The proposed action would involve impacts to mapped and regulated floodplains. The requirements of EO 11988, Floodplain Management, must be met. This EO requires that the county:

- Demonstrate that alternatives were considered to avoid impacting the floodplain

- Design or modify the proposed action to minimize harm to the floodplain
- Prepare and circulate a notice explaining why the action is proposed to be located in the floodplain

Key floodplain issues include evaluation of alternatives, minimization of impacts, development of a public notice, and inclusion of flood-proofing in the project design.

Alternatives/Minimization Evaluation – The site constraints and required design features should be determined as a first step towards the alternatives/minimization demonstration requirement.

Public Notice – The County must prepare and circulate a public notice (Finding of No Practicable Alternative) if the project is to be located within a 100 year floodplain. The document needs to include a location map, an explanation of why the action must be located in a floodplain, a statement of whether the action conforms to applicable state or local floodplain standards, and a list of alternatives considered.

Design Requirements – Structures must be designed and constructed in accordance with standards and criteria consistent with those of the National Flood Insurance Program.

Floodplain Consultations and Permits

Approval is required from the USACE and local levee districts (e.g., Tulsa County Drainage District) prior to initiating any work that will affect existing levees, flood control structures, floodways, or rights-of-way.

The City of Tulsa, City of Jenks, and City of Sand Creek all require permits for work in floodplains. All three entities have similar programs for review and approval of project designs. Review of floodplain impacts is based on the most recent (2001) Flood Insurance Rate Map for Tulsa County and the flood management regulations of the National Flood Insurance Program (44 CFR 59 et seq).

Any changes to floodplain areas or significant variances from local requirements will require FEMA consultation to ensure that implementation of the project will not adversely affect mapped flood hazard areas.

3.1.4 Wildlife Management

The project is proposed for an area known to be used by a federally protected species, the interior least tern, and likely to be used by other sensitive species. Several of the regulations listed in Table 1-1 include mandatory USFWS consultation for potential impacts. These include the CWA §404 process, the Endangered Species Act, the Bald and Golden Eagle Protection Act, and the Fish and Wildlife Coordination Act. The Fish and Wildlife Coordination Act also includes provisions requiring Oklahoma Department of Wildlife Conservation (ODWC) consultation on potential impacts to wildlife resources. In addition, the ODEQ §401 water quality certification process and stormwater management permit will include evaluations of potential impacts to aquatic habitat in the river. Consultation with state and federal natural resources agencies should occur early in the project to ensure that required design features are included.

FIGURE 3-2
View of White Pelicans in Flight over Arkansas River near Fisher Bottom

TABLE 3-1
Summary of Regulatory Compliance Requirements

Regulation	Summary of Requirements	Summary of Potential Issues
Federal Statutes		
Endangered Species Act	Federal agencies must ensure that any action authorized, funded, or carried out is not likely to jeopardize the continued existence of an endangered or threatened species, or result in destruction or adverse modification of a critical habitat of such a species.	Threatened or endangered species have been identified in the county (i.e., the interior least tern, the piping plover, and the ABB). The USFWS will need to be contacted during the design process and as part of the agency coordination during the NEPA process.
Bald and Golden Eagle Protection Act	Taking, possession, and commerce of bald eagles and golden eagles are prohibited, except under certain specified conditions. Prohibited activities include those that cause disturbance to eagles.	The bald eagle is known to occur in the county and along the river. The USFWS will need to be contacted as part of the agency coordination during the design process and the NEPA process.
Fish and Wildlife Coordination Act	Consultation with the USFWS and the appropriate state wildlife agency is required whenever the waters or channel of a body of water are modified. Prior to modification, provision must be made for the conservation, maintenance, and management of wildlife resources and habitat.	Installation of two new low-head dams and modification to an existing dam will alter the waters and channel of the Arkansas River. The USFWS and ODWC will need to be contacted as part of the agency coordination during development of the project design and the NEPA process.
Migratory Bird Treaty Act	The Act implements various treaties and conventions for the protection of migratory birds are implemented. Taking, killing, or possessing migratory birds is prohibited.	The project will disturb riparian corridors used by migratory birds. Coordination with USFWS as part of the design and NEPA processes should address any migratory bird issues.

TABLE 3-1
Summary of Regulatory Compliance Requirements

Regulation	Summary of Requirements	Summary of Potential Issues
Clean Water Act	National Pollutant Discharge Elimination System (NPDES) permits are required for discharges to waters of the U.S. A §404 permit is required from USACE for dredge and fill activities. Water quality certification (§401) is also required from the ODEQ for those activities. A stormwater NPDES permit from the ODEQ must be obtained and stormwater must be treated during construction and post-construction for impacts greater than 1 acre. A stormwater pollution prevention plan (SWPPP) must be developed prior to construction.	Preparation of a USACE permit application will be required for dredge and fill activities associated with implementation of the proposed action. Mitigation will be required for any river and wetland impacts. Mitigation could include the planned bank stabilization, wetland creation, and habitat improvements. The USACE §404 permit application process will include ODEQ review under §401. If a §404 permit and §401 certification are granted, they will require design, construction, and operation requirements to protect water quality and maintain the designated uses of the Arkansas River. The Arkansas River is on the 303(d) list for impairment due to fecal coliform bacteria and a draft Total Maximum Daily Load (TMDL) has been prepared. An evaluation of potential effects on the fecal TMDL implementation will be needed. Additional water quality measures will be required if contaminated sediments are present. An evaluation of sediments may be required under §401(b)(1). A SWPPP must be prepared and implemented prior to construction as part of the requirements under ODEQ's Stormwater General Permit. Tulsa, Sand Springs, and Jenks are Municipal Separate Storm Sewer System locations. If drainage patterns will be altered in any way, coordination with local authorities will need to occur.

TABLE 3-1
Summary of Regulatory Compliance Requirements

Regulation	Summary of Requirements	Summary of Potential Issues
Rivers and Harbors Act	§9 of the Act prohibits the construction of any bridge or dam in navigable waterways of the U.S. without USACE or U.S. Coast Guard approval, depending on the location of the construction. Structures authorized by state legislatures may be built if the affected navigable waters are totally within one state, provided that the plan is approved by the Chief of Engineers and the Secretary of Army. Under §10 of the Act, the construction of any structure in or over any navigable water or any other work that affects the course, location, condition, or capacity of a navigable water must be approved by the USACE.	The project will require coordination and an application with the USACE to ensure compliance under §9. A §10 permit will be required from USACE. Review of impacts under §10 is typically conducted in conjunction with the USACE CWA §404 process.
Water Project Recreation Act	This Act requires that recreation and fish and wildlife enhancement be given full consideration as purposes of federal water development projects. This Act also authorizes the use of federal water project funds for land acquisition in order to establish refuges for migratory waterfowl and to provide facilities for outdoor recreation and fish and wildlife.	Fish and wildlife enhancement will need to be demonstrated. The project already includes components to enhance recreation and fish and wildlife. Once details are developed, those may be sufficient.
Land Water Conservation Act	Establishes a fund to subsidize state and federal acquisition of lands and waters for recreational and conservation purposes. The fund provides financial assistance to states for outdoor recreation planning, acquisition of land or waters, and facilities development. States must submit a comprehensive statewide outdoor recreation plan. The plan must address wetlands within the state as a recreation resource.	The project will need to be checked to confirm that it is consistent with the state outdoor recreation plan.

TABLE 3-1
Summary of Regulatory Compliance Requirements

Regulation	Summary of Requirements	Summary of Potential Issues
Watershed Protection and Flood Prevention Act	Provides for Natural Resources Conservation Service (NRCS) assistance with planning and construction funding for projects constructed by local sponsors, often in the form of flood control districts and flood protection measures. The Secretary of the Interior provides consultation regarding plans that affect reclamation, irrigation, or public lands and prepares fish and wildlife reports to be incorporated in project plans. This Act stipulates project cost-sharing for lands, easements, and rights-of-way in instances for which localities agree to operate and maintain a reservoir or other area for fish and wildlife, recreational development, and water quality improvement projects.	The USFWS will need to be consulted to confirm that components of applicable fish and wildlife plans are incorporated.
Wild and Scenic Rivers Act	This Act establishes a National Wild and Scenic Rivers System and prescribes the methods and standards through which additional rivers may be identified and added to the system. This Act establishes procedures and limitations for control of lands in federally administered components of the system and for dealing with disposition of lands and minerals under federal ownership.	No potential issues are expected. The Arkansas River is not listed as a wild or a scenic river.
Coastal Zone Management Act	This Act requires that any federal activity within or outside of the coastal zone that affects any land or water use or natural resource of the coastal zone be consistent with a state's coastal zone management plan.	No potential issues are expected. The project area is not within and would not affect a coastal zone.
Farmland Protection Act of 1981 (7 USC 4201 et seq., as amended) and CEQ Policy on Prime and Unique Farmland	Federal agencies must minimize the unnecessary and irreversible conversion of farmland (prime farmland, unique farmland, and land of statewide or local importance) to nonagricultural uses. Impacts to prime farmland must be assessed as part of the environmental assessment process.	Soil surveys will need to be checked to confirm that no prime farmland would be impacted by the project. If prime farmland is present, the NRCS will need to be contacted. It may be necessary to complete a Farmland Conversion Impact Rating Form.

TABLE 3-1
Summary of Regulatory Compliance Requirements

Regulation	Summary of Requirements	Summary of Potential Issues
Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act	This Act authorizes removal and remedial actions to clean up sites contaminated by hazardous substances. This Act addresses the National Contingency Plan, which provides the guidelines and procedures needed to respond to releases and threatened releases of hazardous substances.	The regulations will apply if the locations of the proposed action contain hazardous waste sites or are used for storage of hazardous materials. A Phase 1 ASTM-compliant ESA is recommended for project locations to provide information on the potential presence of hazardous substances.
Resource Conservation and Recovery Act	This Act provides for cradle-to-grave regulation of hazardous waste and addresses used oil management and recycling, storage of hazardous materials, underground storage tanks, handling of medical wastes, and disposal of hazardous waste. This Act requires that federal agencies establish programs for the procurement of recovered or recycled material.	The regulations will apply if the locations of the proposed action contain hazardous wastes or are used for storage of hazardous materials. A Phase 1 ASTM-compliant ESA is recommended for project locations to identify the potential presence of hazardous substances. Waste will be generated during construction. However, the volume of regulated wastes generated, stored, or shipped as a result of construction/operation of the dams is anticipated to be low.
Toxic Substances Control Act (TSCA)	The TSCA limits or prohibits the manufacture, processing, distribution, use, and disposal of certain toxic substances. The TSCA contains requirements specific to asbestos, indoor radon abatement, and lead exposure reduction.	The regulations will apply if the locations of the proposed action contain regulated substances or are involved with the use of hazardous materials. Construction and operation of the dams are not expected to result in activities regulated by TSCA.
National Historic Preservation Act	Before an action involving any historic district, site, building, structure, or object is undertaken, the designated Advisory Council on Historic Preservation established under the Act must have a reasonable opportunity to comment.	A Phase 1 cultural resources survey will likely be required for the project sites unless previous pedestrian surveys have been completed recently. Portions of the project within the Sand Springs/Tulsa USGS Topographic Quadrangles are the most likely to have previous studies that may be adequate (USACE and TVA. 2009). The

TABLE 3-1
Summary of Regulatory Compliance Requirements

Regulation	Summary of Requirements	Summary of Potential Issues
		SHPO will need to be contacted as part of the agency coordination for CWA §404 permitting and the NEPA process.
Archaeological Resources Protection Act	A permit is required to excavate or remove any archaeological resource located on public lands and to carry out activities associated with such excavation or removal. If the removal may result in harm to, or destruction of, a religious or cultural site, Native American tribes that may consider the site important must be notified.	A Phase 1 cultural resources survey will likely be required for the project sites to determine the potential presence of archaeological resources. The SHPO will need to be contacted as part of the agency coordination for the NEPA process.
Clean Air Act	Preconstruction and operating permits are required for stationary sources of air pollutants and related activities. For areas in non-attainment for criteria pollutant, compliance with the State Implementation Plan must be demonstrated.	No potential issues are expected. No new permanent sources of air emissions will be constructed. Tulsa County is currently in attainment for ambient air quality standards.
Noise Control Act	Each federal agency is required to limit noise emissions to within compliance levels in federal regulations and state and local laws.	No potential issues are expected. Significant noise levels are not expected to be generated during operation of the proposed dams.
Federal Regulations		
CEQ Regulations for Implementing NEPA (Title 40 CFR, Parts 1500-1508 [40 CFR 1500-1508])	Activities involving a federal action must integrate the NEPA process with other planning to evaluate potential environmental impacts prior to implementation.	The requirements of these regulations will be addressed by the preparation of the NEPA documentation.
Protection of Historic Properties (36 CFR Part 800)	Before an action involving any district, site, building, structure, or object is undertaken, the Oklahoma SHPO must have a reasonable opportunity to comment. Indian tribes that attach religious and cultural significance to historic properties that may be affected by an undertaking must be consulted.	A Phase 1 cultural resources survey will likely be required for the project sites. The SHPO will need to be contacted as part of the agency coordination for the NEPA process. The lead agency must consult with the tribes.

TABLE 3-1
Summary of Regulatory Compliance Requirements

Regulation	Summary of Requirements	Summary of Potential Issues
Flood Protection Works and Maintenance (33 CFR 208.10)	Flood control structures and facilities constructed by the United States must be maintained and operated to obtain the maximum benefits. Improvements, modifications, or construction of flood control structures or work within floodways or rights-of-way require prior determination by the USACE that the work will not adversely affect the functioning of the protective facilities.	Coordination with the USACE and local levee districts will be required to meet the regulatory requirements.
Executive Orders		
EO 11514, Protection and Enhancement of Environmental Quality (amended by EO 11991)	Agencies must develop procedures to ensure the provision of timely public information and understanding of plans and programs with environmental impacts. Information regarding existing or potential environmental problems or control methods must be made available to other governmental entities or institutions.	No potential issues are expected. The requirements of this EO will be addressed by the NEPA process and through agency coordination included as part of the project effort.
EO 11593 Protection and Enhancement of the Cultural Environment	Agencies must administer the cultural properties under their control, initiate measures to preserve federally owned sites, structures, and objects of historical, architectural, or archaeological significance, and institute procedures to assure that federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures, and objects of historical, architectural, or archaeological significance.	No potential issues are expected. There are no identified cultural resources in the areas proposed for the dams, bank stabilization, or habitat improvement areas.
EO 11988, Floodplain Management	For actions occurring on floodplains, alternatives must be considered, proper floodplain management implemented, and flood protection measures used.	The project will affect water flow in the Arkansas River. Coordination will need to occur with FEMA, USACE, and local floodplain and water management authorities. FEMA floodplain and floodway requirements will need to be met. The project will also need to comply with local criteria and ordinances.

TABLE 3-1
Summary of Regulatory Compliance Requirements

Regulation	Summary of Requirements	Summary of Potential Issues
EO 11990, Protection of Wetlands	Federal agencies must avoid new construction in wetlands, unless there is no practicable alternative. An evaluation of alternatives should consider the loss or degradation of wetlands as it relates to public health, maintenance of natural systems, and other uses of wetlands in the public interest. The proposed action must include all practicable measures to minimize impacts. Plans or proposals for construction activities in wetlands must be open to public review.	Construction could impact floodplain or riparian wetlands. The locations proposed for the dams, pools, stream bank stabilization, and habitat improvements will need to be surveyed. If wetlands are located, they will need to be included as part of the USACE CWA §404 permit application process.
EO 12088, Federal Compliance with Pollution Control Standards	Sufficient funds must be allocated for compliance with applicable pollution control standards. Violations must be addressed through consultation with regulating agency and development and implementation of a compliance plan.	Construction and operation of the proposed action will need to include sufficient funds to comply with any applicable standards.
EO 12372, Intergovernmental Review of Federal Programs	Agencies must cooperate and communicate with state and local governments to review and coordinate proposed federal development.	Communication and coordination with state and local entities is required. The communication planned for the project should be reviewed. Currently, the project includes public outreach and stakeholder involvement. In addition, the NEPA document prepared for the project will be distributed to appropriate governmental entities and be made publicly available for comment.
EO 12580, Superfund Implementation	This EO established the National Contingency Plan, National Response Team, and Regional Response Teams for protection and response to any release or threatened release. It includes cleanup schedules and enforcement.	This EO would only be applicable if the location of the proposed action contains hazardous waste sites or is used for storage of hazardous materials.
EO 12699, Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction	New buildings must be designed and constructed with appropriate seismic design and construction standards.	Design, construction, and modification of the dams will need to factor in seismic risk.

TABLE 3-1
Summary of Regulatory Compliance Requirements

Regulation	Summary of Requirements	Summary of Potential Issues
EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations	Programs, policies, and activities must be conducted in a manner that ensures they do not exclude, deny benefits to, or adversely impact people/populations because of their race, color, economic status, or national origin.	Installation and modification of the dams, bank stabilization, and habitat improvements are part of a larger plan for improvements along the Arkansas River. Positive impacts to populations located adjacent to the river would be expected.
EO 13045, Protection of Children from Environmental Health Risks and Safety Risk	Health and safety risks that affect children must be identified and assessed. Policies, programs, activities, and standards must be implemented in such a manner to address those risks.	The dams and pools could create an attraction for children. Potential impacts and dam safety steps will need to be addressed as part of the design and NEPA processes.
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds	Actions having measurable negative impacts on migratory bird populations must develop and implement (within a 2-year period) a Memorandum of Understanding designed to protect against the taking of migratory birds and their critical habitat.	Coordination with USFWS as part of the design process and NEPA process will need to occur to address any migratory bird issues.
EO 13327, Federal Real Property Asset Management (amended by EO 13423)	Federal real property resources must be managed to ensure efficient and economical use of real property assets.	No potential issues are expected. The overall project for the Arkansas River, including the three dams, would represent an enhancement of any federal real property.
EO 13423, Strengthening Federal Environmental, Energy, and Transportation Management	Environmental, transportation, and energy-related activities must be conducted in an environmentally responsible and economically efficient manner. These include reducing greenhouse gas emissions, consumption of water and petroleum products and electricity, and the quantity of hazardous materials. Construction activities should comply with high performance and sustainable buildings guidelines.	The design process and NEPA process should include information on any efforts and features planned for the project that address this EO.
EO 13175, Consultation and Coordination with Indian Tribal Governments	Input must be obtained from tribal officers in the development of regulatory policies that have tribal implications.	Communication and coordination with tribal governments by the lead agency is required. The communication planned for the project should be reviewed The project currently includes stakeholder involvement. Coordination with the SHPO as part of the NEPA process could identify additional needs for tribal input.

TABLE 3-1
Summary of Regulatory Compliance Requirements

Regulation	Summary of Requirements	Summary of Potential Issues
State and Local Regulations		
City of Jenks Planning and Zoning Requirements	The City of Jenks regulates activities that have the potential to affect stormwater runoff or impact a floodplain or floodway.	An earth change permit and floodplain development permit will be required.
City of Sand Springs Planning and Zoning Requirements	The public works department regulates activities that impact flood zones.	A development permit from the public works department will be required for the project.
City of Tulsa Stormwater Management and Hazard Mitigation Program	The Director of Public Works and the Stormwater Drainage and Hazard Mitigation Advisory Board regulate activities that have the potential to affect stormwater runoff or impact a floodplain or floodway.	Floodway, floodplain, and earth change watershed development permits will be required for the project.
Local Drainage District/Levee District Requirements	Local levee districts could have authority for maintaining flood protection structures as described under “Flood Protection Works and Maintenance (33 CFR 208.10)” above.	Local districts will need to be identified and consulted. Any local requirements that differ from 33 CFR 208.10 will need to be identified and included.
Tulsa County Planning and Zoning Requirements	The County Inspections Division regulates construction, alteration, and use of residential and commercial buildings and land. It issues building, electrical, zoning, mechanical, plumbing, house moving, earth change, and sign installation permits for Tulsa County. The division also administers and provides floodway and floodplain management rules.	A Tulsa County building permit will be required for activities within the county.
Oklahoma Dam Safety Act	This Act specifies design and construction requirements for dams, including required safety features. Dams above 25 feet in height impounding 15 acre-feet of water or above 6 feet in height impounding more than 50 acre-feet of water require approval from the OWRB.	Design, application, and notification procedures associated with the application process will have to be followed during the project’s development.
Oklahoma Water Use Requirements	Oklahoma water law and OWRB regulations require that a permit application be filed prior to the diversion of water. Obtaining a permit requires that the use of water not interfere with domestic or existing appropriations of water or existing or proposed uses within the stream system. The permit review includes publication of a public notice in newspapers.	A permit will be required from OWRB. If granted, the OWRB may condition the permit to protect existing rights and uses and current stream flows.

TABLE 3-1
Summary of Regulatory Compliance Requirements

Regulation	Summary of Requirements	Summary of Potential Issues
Oklahoma Department of Mines Permit	A permit is required prior to the commencement of sand and gravel mining operations. The required permit application must include legal and financial compliance information, safeguards for environmental resources, and an operation and reclamation plan. The minimum reclamation bond which must be posted with the department is $2,000.00.	This requirement could be triggered if mining is used to obtain sand to develop least tern habitat.

4.0 Data Gap Review

4.1 Introduction and Methodology

Existing reports were reviewed by engineering, environmental science, cultural resources, and planning professionals. These materials were supplemented by Geographic Information System (GIS) data (Appendix C) for human and natural environmental features, including infrastructure, land uses, topography, floodplains, and potentially jurisdictional waters of the U.S. Using best professional judgment and the current project understanding (Arkansas River Corridor Project Baseline Summary), the team identified data gaps hindering the characterization of existing conditions (or affected environment) for resource categories. Where possible, the absence of or needed refinements to analytical tools necessary to conduct impact analyses were also identified. These gaps are summarized in Table 4-1. It is important to note that data needs for these activities are activity- and site-specific, so data needs may change as the project is refined or new information becomes available. This analysis does not address all data necessary to address regulatory requirements because these needs may change as the project evolves and as resource agencies and stakeholders become more engaged in the permitting and NEPA review processes.

Based upon professional experience with similar projects, the team assessed the relevance of data needs in terms of the conceptual project's critical path or the necessary path or sequence from start to finish which estimates the time needed for completion. Data needs which are a part of the project critical path and could have a direct effect on schedule if delayed are noted as critical needs while data needs that have a lesser effect on schedule (could be obtained concurrent with other activities) are considered moderate needs. Data needs with a less of an effect on the schedule are generally described and are not considered major technical or schedule issues.

TABLE 4-1
Summary of Potential Data Gaps

Resource Category	Data Gap/Analytical Tools Description	Possible Effects of Data Gap
Aesthetics	Tools to assess the effects of the inundation and restoration on viewsheds.	Based upon the existing landscape and land use settings, it is unlikely that the viewshed impacts will be a major technical issue in development of the EIS. Simple models could be developed during later stages of the project to conduct an impact analysis during design.
Cultural Resources	Cultural Resources surveys have not been completed for the entirety of the project area. Information is available from previous surveys and reports, but it is limited and possibly outdated. There are various levels of cultural resource investigations and the type and scope of investigations required for this project will be determined in consultation with the Oklahoma SHPO and the lead federal agency. In addition, there are possible Osage Nation Cultural and Spiritual properties within the project area that will need to be investigated.	Based upon the nature of the corridor, cultural resources assessments will be critical to reduce adverse impacts and plan mitigation. This is considered a ***critical data gap***. Through negotiations with the SHPO and interested parties, a strategy for the cultural resource survey will be developed. Some type of survey will probably be required for Section 106 and NEPA compliance and for the issuance of a Section 404 permit. The survey would be developed and carried out in accordance with the Archaeological Resources Protection Act and National Historic Preservation Act. Could delay final formulation of alternatives, impact analyses, and permitting. Efforts for these studies would be focused upon areas involving construction or other activities which might degrade cultural resources.

TABLE 4-1
Summary of Potential Data Gaps

Resource Category	Data Gap/Analytical Tools Description	Possible Effects of Data Gap
Paleontology	No data was found regarding paleontological potential in the previous surveys and reports on the project area or indicating a literature search has not yet been completed. The determination of a site's degree of paleontological potential is found through a review of geological and paleontological literature. A future preliminary review may suggest particular areas of known high potential. If an area of high potential cannot be delimited from the literature search and specimen records, a surface survey would have to be conducted to determine the fossiliferous potential and possible impacts.	An assessment of geological and paleontological literature is recommended to determine if additional data need to be collected to reduce adverse impacts prior to the impact analyses and preliminary engineering. This is considered a ***critical data gap.*** A literature search for paleontological potential will need to be completed. Based on the results of the literature search, a surface survey may need to be conducted.
Hazardous Materials	General information regarding known hazardous materials sites is available. However, a Phase I ESA has not been completed to identify potential, unidentified areas of concern with proposed construction areas which might need to be considered.	Based upon the heavy industrialization of many parts of the corridor and known locations of concern, the ESA is considered a ***critical data gap***. It is recommended that the sponsor pursue avoidance of known hazardous materials features during the conceptual design and that, prior to carrying forward alternatives, a Phase I ESA be completed for all construction locations.
Minerals	Within Oklahoma, mineral rights may not be owned by the property owner. Therefore, research at the county courthouse is needed to identify mineral rights for specific parcels.	Due to the possible effects of mineral rights on the preliminary design and the cost of alternatives, it is recommended that mineral right research be conducted for any alternatives considered for further study as the preliminary design is refined. This is a moderate data gap. It is recommended that the sponsor conduct mineral rights research on parcels contained in alternatives that are recommended for further analysis. This research may suggest the need to alter the design to reduce effects on mineral rights and possible mitigation.

TABLE 4-1
Summary of Potential Data Gaps

Resource Category	Data Gap/Analytical Tools Description	Possible Effects of Data Gap
Plants and Wildlife	Protected Species – American Burying Beetle (ABB): Critical habitat for the ABB has not been designated. A survey for ABB was conducted in 2007 in representative habitats near the proposed areas for development in the Arkansas River corridor. An occurrence of ABB was documented at one site east of the river near the city of Bixby.	The findings of the ABB survey and literature review should provide the basis for evaluating the potential effects of the project on this federally endangered species. Based upon further definition of potential impacts during scoping and informal consultation with USFWS, additional biological surveys of potential impact areas and possibly a Biological Opinion may be necessary to comply with the Endangered Species Act and Fish and Wildlife Coordination Act. Based upon this understanding, the data need at this time is considered not to be a data gap. However, if additional surveys are needed, timing will be a factor. ABB is most active at temperatures greater than 60 degrees Fahrenheit which influences the timing of biological surveys (Northern State University, 2009). The guidance regarding biological surveys including timing is currently under review by the USFWS (2009b).
	Protected Species-Piping Plovers: Critical habitat for the piping plover has been designated, but Oklahoma is not included in the critical habitat designation. No data were found documenting piping plover occurrence within the project area.	Because the piping plover occurs in Oklahoma as a migratory transient and is not known to breed in the state, literature review and field observations made during other site surveys (e.g., for interior least tern) will likely provide adequate information for analyzing the potential effects of the project on this species. Although possible, it seems unlikely that USFWS would require field surveys specifically for piping plover to comply with the Endangered Species Act and Fish and Wildlife Coordination Act. Based upon this understanding, the data gap is considered moderate.
	Protected Species-Interior least tern: The Tulsa District USACE and USFWS have been collecting data on nesting patterns of the interior least tern. CH2M HILL is currently evaluating the existing information to identify any further study needs. Once these data	The requirements of the Endangered Species Act could cause a schedule delay if existing data are not sufficient to conduct an impact analysis; however, a substantial amount of distribution and abundance

TABLE 4-1
Summary of Potential Data Gaps

Resource Category	Data Gap/Analytical Tools Description	Possible Effects of Data Gap
	are reviewed, there may be suggested changes in approach. This review should be complete by mid-May (Texas Wildlife and Parks Department, 2009).	information for the species has been compiled by USACE for the project area. Annual USACE monitoring is ongoing in the project area.. If as an outcome of scoping and informal consultation with USFWS additional studies are needed, it is recommended that these studies include each of the recommended alternatives as well as an impact analysis to determine if the project objectives for interior least tern habitat can be met. For this reason, this data gap is considered moderate. A Biological Assessment and a Biological Opinion are likely to be required to comply with the Endangered Species Act and Fish and Wildlife Coordination Act. Breeding season occurs from early April to early June. If a biological survey were needed, this would need to be completed prior to further impact analyses.
	Bald Eagle: Wintering and nesting bald eagles have been documented within the project area. In an effort to avoid or minimize disturbance to wintering and nesting habitat, Phase I involves an assessment of habitats suitable for the bald eagle and consideration of that constraint during the refinement of the conceptual design.	Although the bald eagle has recovered in the lower 48 states and USFWS removed it from the federally threatened species list, it remains protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. Compliance with these acts could cause a schedule delay if existing information is not adequate to address their requirements pertaining to potential take of bald eagles. Thus, early consultation with USFWS is recommended to determine if a biological survey will be required. With this understanding, the data gap is considered moderate. Wintering eagles are most common from November to March. Breeding and nesting occurs from early April to early July.
	Species of Concern: The Oklahoma Department of Wildlife Conservation tracks species of concern that although not listed as state or federally threatened or endangered, are of conservation	CH2M HILL is currently evaluating existing literature and readily available information pertaining to potential effects of the project on shovelnose

TABLE 4-1
Summary of Potential Data Gaps

Resource Category	Data Gap/Analytical Tools Description	Possible Effects of Data Gap
	interest. Known species of concern in the Arkansas River include the shovelnose sturgeon (*Scaphirhynchus platorynchus*), but recent occurrence information is lacking for the project area	sturgeon. The fish and wildlife agencies may request a biological survey during scoping to determine the seasonal occurrence of the species in the project area and whether it currently uses this reach of the river for spawning and rearing of its young. These are factors important to understanding fish passage interests. With this understanding, this data need is considered moderate.
	Wetlands: A detailed assessment of potentially jurisdictional waters of the U.S. will be needed to develop impact assessments and associated mitigation plans.	An initial assessment of potential impacts can be based in a GIS; however, a delineation of potential jurisdictional waters will be needed for later stages of the project. Based upon the amount of potential impacts, it is recommended that delineation be conducted early in the preliminary engineering phase and that the preliminary engineering not be completed until after a preliminary mitigation plan is complete for inclusion in the design. The analysis would also be needed to assess cost and benefits, particularly ecosystem impacts. Because this task could be conducted concurrently with other tasks with a minimal effect on schedule, this is considered a moderate need. It is recommended that the sponsor conduct delineations of potentially jurisdictional waters of the U.S. in accordance with USACE guidance for alternatives that are recommended for further analysis.
	Net Environmental Benefits Analysis (NEBA): To more fully assess the effects on habitat and support preparation of the National Ecosystem Restoration Plan (NER) and related analyses for a feasibility study, NEBA model will need to be developed and updated with information sufficient to compare the effects of the future with and without project from an environmental benefits perspective.	Tools to conduct the net environmental benefit will need to be developed prior to the detailed cost-benefit analysis and NEBA.

TABLE 4-1
Summary of Potential Data Gaps

Resource Category	Data Gap/Analytical Tools Description	Possible Effects of Data Gap
Soils	Limited historical assessments of sediment transport and sediment supply have been conducted. A detailed fluvial geomorphic assessment is necessary to improve sediment transport and also assess the adequacy of sand supplies to support natural deposition of nesting islands for the least terns.	An understanding of how sediment transport and sediment supply might affect the design is critical to the refinement of the design. A key issue is the establishment of flows and sediment transport to sustain the least tern islands through operations of the low-head dams. In order to proceed with an efficient preliminary design, this analysis is considered a ***critical data gap.*** An assessment is recommended prior to conducting an alternatives analysis or feasibility analysis for the refined, conceptual project designs.
Socioeconomic	The monetary and nonmonetary effects of the project on socioeconomic resources need to be assessed to ascertain possible benefits and adverse effect. Examples of research topics include the potential economic benefits of the project during construction and operation, the current and projected level of services for various community facilities, including recreation, with and without the project, and environmental justice.	The monetary and nonmonetary effects of the project can be assessed in the later stages of preliminary design. The identification of the appropriate tool and collection of necessary data is considered a moderate data gap. To assess the monetary effects of the project, it is suggested that current USACE economic models with applicable data be used to estimate the effects of the construction and later operation of the proposed facilities. Analytical tools to assess nonmonetary effects should also be developed.

TABLE 4-1
Summary of Potential Data Gaps

Resource Category	Data Gap/Analytical Tools Description	Possible Effects of Data Gap
Water Resources		
Groundwater	*Groundwater Conditions and Surface and Groundwater Interrelationships*: Groundwater elevation maps depicting current and historical groundwater conditions are not available for the entire project area. Changes in groundwater conditions associated with the river stages have also not been fully assessed.	The magnitude and extent of groundwater level changes due to changes in river stage are not well understood. Additional data collection to characterize existing conditions and interpret future conditions with and without the project is needed. Without this information, the effects of the project on groundwater conditions cannot be assessed to make an informed decision during the design. Consequently, this is considered a ***critical data gap***. CH2M HILL has prepared an initial TM summarizing available data and will continue to research and provide recommendations for further study under Phase 1.
	Groundwater/Surface Water Interface: Data defining the groundwater and surface water interface of the Arkansas River within the reviewed documents were limited. This prevents an assessment of the possible effect on water quality for both as a result of the project.	Additional information and analytical tools to understand the relationship between groundwater and surface water are needed to understand the possible effects of the project. Without this information, the effects of the project on groundwater conditions cannot be assessed to make an informed decision during the design. Consequently, this is considered a ***critical data gap***. CH2M HILL has prepared an initial TM summarizing available data and will continue to research and provide recommendations for further study under Phase 1.

TABLE 4-1
Summary of Potential Data Gaps

Resource Category	Data Gap/Analytical Tools Description	Possible Effects of Data Gap
	Remediation Sites: Understanding of the groundwater conditions at remediation sites within the project area: A more complete review of groundwater conditions and remediation ongoing at the Sun, Sinclair, and Sand Springs facilities is needed to inform design.	Without this information, the effects of the project on groundwater conditions cannot be assessed to make an informed decision during the design. Consequently, this is considered a ***critical data gap***. CH2M HILL has prepared an initial TM summarizing available data and will continue to research and provide recommendations for further study under Phase 1. Further review of reports outside of this study is recommended to understand the status of remediation efforts and groundwater conditions. The design team would strive to avoid any contaminated groundwater or soil.
	Subsurface Building Features: Data on building with subsurface features are limited.	Considering the opportunity to mitigate potential effects during preliminary design, this is considered a moderate schedule risk. This data could be collected during the early stages of design. The lack of information prevents an assessment of the potential impacts of river stage changes and resulting groundwater levels on subsurface building features. It is recommended that these data be collected to allow for consideration of this effect in the preliminary engineering.

TABLE 4-1
Summary of Potential Data Gaps

Resource Category	Data Gap/Analytical Tools Description	Possible Effects of Data Gap
Water Quality	Water quality data during low-flow conditions and especially data for high temperature conditions near Zink Dam is not available due to the rarity of conditions that allow for data collection. INCOG with approval of the Program Manager has suggested that they could collect additional data near Zink Lake for conditions this summer and incorporate that into the existing models. Also, the effects of urbanization, especially increased urbanization as a result of economic development that might follow the project should be assessed from a cumulative impact perspective. Land use trends for full build-out conditions would also need to be researched to assess future conditions.	Considering the potential regulatory issues with the project and critical need to maintain recreation contact standards, this is considered a ***critical data need.*** The limitation of this data prevents the full calibration of the water quality model for a variety of flow conditions; however, sensitivity and uncertainty analyses could be used to approximate conditions under low flow and identify the uncertainty associated with those results. These assessments will be needed prior to the alternatives analysis to evaluate water quality conditions and approaches to maintain water quality suitable for recreational contact in the recreational boating and fishing areas as well as general aquatic habitat throughout the project area.
Water Quantity	Future development and effect of urbanization on water quantity associated with economic development activities would need to be assessed.	Existing models should be adequate for these analyses; however, the effects of related projects would need to be modeled prior to the impact analyses. With this understanding, these data are not to be a more technical issue or schedule driver.
Utilities	Underground utilities would need to be confirmed prior to preliminary design.	This would need to be completed prior to preliminary design. With this understanding, this data gap is considered moderate in nature.

Notes: These data gaps were identified based upon a limited review of previous studies and data provided by others. The availability of additional data would amend these needs; furthermore, the nature of the design and agency comments may result in new data gaps.

4.2 Prioritization of Data Gap Resolution

The Phase 1 effort will refine existing conceptual designs using readily-available data to identify both physical constraints, such as a historic property or existing habitat for a protected species, and operational constraints, such as minimum flows to maintain water quality or aquatic habitat. The Phase 1 effort does not include collection of new data, which are needed for many data sets either prior to or during preliminary design. Based upon the available information, the following are considered to be the highest priority for resolution due to the potential effect of the data gaps on the NEPA, alternatives formulation, and permitting processes.

- Biological Surveys: Due to their seasonal nature, additional biological surveys could have a significant effect on the overall schedule. Although existing information appears to be adequate for impact analyses, additional, early consultation to confirm this is recommended. The goal of such efforts is to obtain information on habitat that should be avoided prior to preliminary design.
- Sediment Supply and Transport: Understanding the availability of sediment and transport patterns is critical for design of the project, including bank stabilization efforts.
- Cultural Resources Surveys: Considering the need for unobstructed views of buildings and land, the cultural resource surveys should be conducted in clear weather conditions. Due to the regulatory costs of potential mitigation, the goal of this effort is to use that information to avoid NRHP-listed or –eligible historic properties or other cultural resources during preliminary design.
- ASTM-Compliant Phase I ESAs: Avoidance of potentially contaminated sites is considered a key design issue with a direct effect on project costs and regulatory burdens. It is recommended that a Phase I ESA be conducted for each of the alternatives proposed for further study.
- Water Quality Analyses: Maintaining recreation contact standards is critical to the long-term success of the project.
- Groundwater Analyses: Groundwater analyses are necessary to prevent adverse effects on groundwater levels in subsurface portions of buildings and also to address possible groundwater pollution concerns.

5.0 Conclusions

The Arkansas River Corridor Projects will have widespread effects on the river corridor and are likely to require multiple local, state, and federal permits. This report summarizes the results of research to identify potential project effects by resource category, potential regulatory requirements, and data gaps which might affect the planning phases of the project. The following paragraphs summarize the results of those analyses.

Although the project is not well enough defined to support characterization of effects in terms of the intensity and significance, the potential effects of the project were characterized by duration (short-term or long-term) and type (direct, indirect, or cumulative). Effects could be beneficial or adverse and the project team's analysis reflects the possibility of occurrence regardless of intensity. For example, a negligible beneficial effect would be included.

The review spanned many resource categories: aviation; air quality; biological resources (terrestrial and aquatic); cultural resources; hazardous materials; health and safety; hydrology and hydrogeology; land use, land cover, and recreation; noise; socioeconomics; soils and topography; transportation; utilities and infrastructure; and visual and aesthetic resources. The resulting review suggests potential impacts for all of these resource categories. It is recommended that the scoping plan for Phase 2 of the project address the impact analysis for each of these categories. Cumulative effects would need to be characterized for related projects as well as other reasonably foreseeable projects. It is recommended that the list of related projects be supplemented with a list of other major projects under development in the river corridor prior to the impact analyses.

The regulatory review identified 45 EOs and local, state, and federal regulations which will likely apply to the project. Although each regulation is activity- and site-specific, the project's conceptual design suggests that the requirements under §404 of the CWA and regulations related to dam safety, floodplains, and wildlife management, including the Endangered Species Act, will be major regulatory drivers for the project. It is recommended that the scoping for Phase 2 address studies to support future regulatory permit applications.

The data gap analysis involved an assessment of data sets provided by INCOG, the USACE, and others. Based upon the conceptual understanding of the project and professional experience in impact analyses, a multi-disciplinary team reviewed the data and available analytical tools. A data gap was identified as critical if it would have a direct, unavoidable effect on project schedule. For example, if a lack of a seasonal biological survey would prevent the completion of impact analyses or preliminary engineering, it would be considered critical. The analysis identified the following data gaps as critical:

- Sediment Supply and Transport: Understanding the availability of sediment and transport patterns is critical for design of the project, including bank stabilization efforts.

- Cultural Resources Surveys: Considering the need for unobstructed views of buildings and land, the cultural resource surveys should be conducted in clear weather conditions. Due to the regulatory costs of potential mitigation, the goal of this effort is to use that information to avoid NRHP-listed or –eligible historic properties or cultural resources during preliminary design.
- ASTM-Compliant Phase I ESAs: Avoidance of potentially contaminated sites is considered a key design issue with a direct effect on project costs and regulatory burdens. It is recommended that a Phase I ESA be conducted for each of the alternatives proposed for further study.
- Water Quality Analyses: Maintaining recreation contact standards is critical to the long-term success of the project.
- Groundwater Analysis: A groundwater analysis is necessary to prevent adverse effects on groundwater levels in subsurface portions of buildings and also to address possible groundwater pollution concerns.

Biological surveys are currently considered a moderate data gap; however, if agencies require additional surveys, these data gaps would be critical. Due to the required timing and potential need for multiple surveys, additional biological surveys could have a significant effect on the overall schedule.

The resulting review suggests that several issues require further refinement during the scoping process for Phase 2. Once project alternatives are better understood, more information will be available on the potential effects of the project and how best to characterize those effects.

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Appendix A
Technical Memorandum (TM): Baseline Project Summary for the Arkansas River Corridor Project

Arkansas River Corridor Projects Baseline Summary

PREPARED FOR: Tulsa County

PREPARED BY: CH2M HILL

DATE: May 5, 2009

Introduction

While the Arkansas River has long been a significant natural resource for the surrounding land and its inhabitants, historical alterations have degraded watershed conditions and masked the river's unique potential. The 1964 construction of Keystone Dam, to protect nearby communities from extreme flood events, significantly changed the natural hydrology of the Arkansas River. Additionally, growth and development associated with the Tulsa metropolitan area, and related intensive land use practices, have led to streambank erosion, destruction of riverine wetlands, increased stormwater runoff, and a high degree of sediment transport to the river. As a result, ecosystems native to the Arkansas River area have been compromised, and instream habitats continue to be depleted.

In recent years, however, citizens of Tulsa County have begun to recognize both the potential of the Arkansas River as a resource and the need to address declining water quality and aquatic ecosystems. Due to this increased awareness, a Dialog/Visioning 2025 Citizen's Summit was held in early 2002 to identify potential improvements to the Arkansas River and the Arkansas River Corridor. From this Citizen's Summit, the Arkansas River Corridor Project was initiated and has included a wealth of research, planning, and design initiatives for the beautification and improvement of 42 miles of the Arkansas River Corridor, between Keystone Dam and the Tulsa County/Wagoner County line. Multiple stakeholders are involved in the project, including Tulsa County, the Indian Nations Council of Governments (INCOG), the U.S. Army Corps of Engineers (USACE) and the Tennessee Valley Authority (TVA). The project involves enhancement and restoration at seven key development sites within the 42-mile project reach and includes modification of the existing Zink Dam and the addition of two low water dams, at Sand Springs and South Tulsa/Jenks.

This document details components of the Arkansas River Corridor Project that are proposed for funding by Tulsa County and the USACE, including improvements at Zink Dam, Sand Springs and South Tulsa/Jenks. Supplemental development at these sites, as well as proposed improvements at the four additional key development sites, are not included in the current phase of the project but may be funded and implemented during future phases. This document includes a summary of the current phase of the Arkansas River Corridor Project, including its purpose and need, goals, project elements, project benefits, estimated costs and potential funding sources.

Background

The Arkansas River Dialog/Visioning 2025 Citizen's Summit, which was held to identify a path forward for improvement of the Arkansas River Corridor, resulted in the addition of Proposition 4 to the Tulsa County 2025 sales tax initiative. Approval of Proposition 4 in 2003 authorized $9.5 million in sales tax revenues for: (1) construction of two low water dams downstream of Keystone Dam, (2) Zink Lake shoreline beautification and (3) Zink Lake silt removal improvements. Approval was also the impetus for multiple studies conducted on the Arkansas River Corridor. Since approval of Proposition 4, additional work has been authorized by INCOG and the USACE for the following studies:

- Arkansas River Corridor Master Plan, Phase I Vision Plan (Carter Burgess, 2004)
- Arkansas River Corridor Master Plan, Phase II Master Plan and Pre-Reconnaissance Study (Guernsey et al., 2005)
- Conceptual Planning, Tulsa Wave Whitewater Park (McLaughlin Whitewater Design Group, 2007)
- Vision for the Arkansas River Corridor at Tulsa (TVA, 2008)
- Vision 2025, Arkansas River Corridor, Ecosystem Restoration Plan (Cherokee CRC, 2009)

The Arkansas River Corridor Phase I Vision Plan, initiated by INCOG in 2003, is a preliminary plan to "enhance the river and the citizens' lives" (Carter Burgess, 2004, p. 2). The Phase I Vision Plan evaluated seven major features with the potential to maximize the beneficial use of the Arkansas River Corridor while integrating ideas supported by the community: bridges and crossings, natural features and resources, low water dams, multi-use trails and parks, traffic network and gateways, river-oriented activities and community development opportunities. The Phase I Vision Plan is primarily based on citizen input and is general and basic in conceptual design; however, it provided the necessary framework for the comprehensive Phase II Master Plan (Guernsey et al., 2005).

The Phase II Master Plan addresses economic, physical, environmental, ecological and legal issues related to the Arkansas River Corridor Project. Through the comprehensive Pre-Reconnaissance study, a number of opportunities associated with the Arkansas River and Arkansas River Corridor were identified, including low water dams, mixed-use areas, parks, fishing piers, boating access, new and expanded trails, and bridges. The Master Plan includes conceptual plans, estimated costs, and potential funding sources for seven selected key development sites, construction of two new low water dams and modifications to Zink Dam.

After completion of the Phase II Master Plan, TVA provided a technical review of the low water dam construction and dam modifications proposed in the Phase II Master Plan. The Vision for the Arkansas River at Tulsa (TVA, 2008) outlines the findings and recommendations of this study, which was aimed at identifying a hydraulic system that meets project goals while also ensuring safety and meeting floodplain regulations. The Tulsa Wave Whitewater Park conceptual planning document (McLaughlin Whitewater Design Group,

2007) details potential whitewater recreational opportunities that could be made possible by the modified and newly created low water dams.

Phase III of the Arkansas River Corridor Project includes a baseline environmental study (by Cherokee CRC, 2009) and an associated Ecosystem Restoration Plan (US Army Corps of Engineers, 2009). The Phase III study, which was limited to the Sand Springs and South Tulsa/Jenks low water dam and lake systems, presents ecosystem recommendations for consideration during the development of these project components. The Ecosystem Restoration Plan would be submitted as part of the USACE regulatory permit application process during the next phase of the project.

Project Purpose

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. Oklahoma's final 2006 and draft 2008 Water Quality Assessment Integrated Reports list significant portions of the Arkansas River as impaired due to elevated levels of fecal coliform, *Enterococcus,* and *Escherichia coli (E. coli)* bacteria; lead; cadmium; oil and grease; and total dissolved solids. Potential watershed pollutants include pathogens, pesticides and organic compounds from urban, municipal, commercial and agricultural runoff that affect water quality.

In addition to water quality impairment, the Arkansas River has been substantially impacted by anthropogenic alteration, development of surrounding land use, increased stormwater runoff, and streamflow fluctuations resulting from hydropower operations. The river has been inundated with sediment, and the channel is deeply incised with highly erosive streambanks. The changes to the natural hydrology of the river have resulted in streambank erosion and depletion of habitat for native fish populations. Impacts to habitat and fish populations have affected other Arkansas River ecosystems, including federally endangered and threatened bird species that utilize the river's food sources and corridor.

The Arkansas River will continue to undergo degradation if existing environmental issues are not addressed. The Arkansas River Corridor Project includes restoration components that are intended to mitigate the impacts of growth and development, improve physical habitat and aquatic ecosystems, improve and maintain water quality and enhance public enjoyment of the river. A more detailed description of the project purpose and need will be prepared to support the development of the future environmental impact statement and Section 404 permitting process with the USACE.

Goals

The primary goals driving the Arkansas River Corridor Project are to establish greater connectivity between the river and surrounding communities, address flood damage reduction, improve and protect habitat for interior least terns *(Sterna antillarum athalassos)*, improve recreational opportunities, and improve the riverine system's functionality, primarily through the addition of two new low water dams, at Sand Springs and South

Tulsa/Jenks, and modifications to the existing Zink Dam. Other goals, which have been developed from proposed project concepts, include:

- Providing riverine habitat for small, non-migratory fish, such as shiners, minnows, darter and silversides
- Allowing upstream migration of striped bass, sauger, shovelnose sturgeon and paddlefish and downstream transport of eggs and larvae during the spawning season
- Improving aquatic habitat in the Arkansas River
- Increasing the diversity and abundance of macroinvertebrate and fish assemblages
- Allowing sediment transport downstream of dams and reducing lake sedimentation
- Minimizing impacts to fish species that are a source of food for interior least terns and other bird species
- Developing a recreational whitewater park at Zink Dam, and potentially at Sand Springs and Jenks/South Tulsa Dams

Project Components

The Arkansas River Corridor Project involves restoration components at seven key development sites between Keystone Dam and the Tulsa County/Wagoner County line. Restoration along this 42-mile reach of the Arkansas River would positively affect portions of several communities, including Sand Springs, Tulsa, Jenks, Bixby, and Broken Arrow, and would provide a variety of benefits outlined in the Phase II Master Plan. The current phase of the project includes modification of Zink Dam and the addition of two low water dams, at Sand Springs and South Tulsa/Jenks. These elements have been identified for funding by Tulsa County and the USACE and are detailed in the following section.

Because Keystone Dam, at the upstream end of the project area, currently blocks sediment transport, sediment is supplied from only three sources in the project reach: the channel bed, the channel banks, and the tributary inputs. The project would aim to minimize the sediment contribution from these sources and would also focus on sediment transport throughout the dam system. The low water dams would be operated in an integrated manner to optimize flow control through each individual dam, as well as through the overall river/lake system along the 42-mile reach of the Arkansas River. Dams would be engineered to eliminate safety hazards and to consider potential impacts from anthropo-genic sources, sedimentation, debris, Zebra mussels and historic flow regimes (Cherokee CRC, 2009, p. 26). Dams would also be engineered with consideration of public safety, fish passage and habitat restoration.

In addition to dam construction and modification, other components of the overall Arkansas River Corridor Project include: boating amenities in dam impoundments, fishing piers, pedestrian bridges, hiking and nature trails, water taxi transportation, whitewater recreation areas, retail development centers and public parks. Public access to all new project components would require linking the existing trail system to new access roads and trails.

Trails, boardwalks and pedestrian bridge concepts would be developed to provide convenient access to river crossings and to improve connectivity between the Arkansas River and nearby communities.

Proposed project components for the three key development sites included in this phase of the project are outlined below.

Zink Dam Modification and Riverfront

Zink Lake is a popular outdoor area that provides recreational opportunities and a festival venue for the Tulsa area. However, due to a lack of initial capital funding, Zink Dam has limited functionality to transport sediment downstream, resulting in sedimentation within Zink Lake and scour near the edges of the dam. Additionally, the dam structure, an ogee weir, has the potential to create an unstable and potentially unsafe hydraulic "roller" effect. Proposed improvements to Zink Lake include the installation of weir gates to improve sediment transport, fish passage, flood reduction and flow attenuation and to correct the roller effect. Various gate types, including Obermeyer, bascule and fuse, would be evaluated during the design phase of the project to identify the optimal design for this dam. Depending on the extent of sediment removal that can be achieved from dam modification, Zink Lake may also be dredged by local sand and gravel operators to remove additional sediment.

Zink Dam would be operated at a fixed or variable pool elevation as needed, made possible by equalizing low flow releases from the Sand Springs Dam. The dam could also be raised by 2 to 3 feet to expand the area of Zink Lake and provide additional recreational opportunities, including boating amenities and, potentially, a whitewater wave park. This would be achieved by the addition of 2-3 ft. high gates installed on the top of the existing dam. Their operation would control water depth as needed for rowing events, whitewater releases, low flow storage and augmentation. The McLaughlin Whitewater Design Group conducted a preliminary engineering analysis on rehabilitating the "Tulsa Wave," a unique whitewater wave effect that forms downstream of Zink Dam, in conjunction with developing a whitewater wave park (2007). Additionally, potential features at Zink Dam could include integration of design concepts that would yield benefits in addition whitewater recreation, in conjunction with fish passage, flow management, and sediment control.

In addition to dam modification, a major goal for the Zink Lake area is to "enhance physical and visual connections between the east and west banks" (Guernsey et al., 2005). The Phase II Master Plan involves improvements to the Zink Lake Riverfront as well as the development of new recreational opportunities. Current proposed project components in the Zink Lake area include:

Improved riparian habitat and shoreline beautification

- Increase lake depth to enhance the boating and rowing opportunities
- Consideration of a whitewater recreation facility and /or improvements to the existing "Tulsa Wave"

- Hiking and nature trails, with overlooks and observation points, on the east bank including maintenance and access
- Gathering place for rowing, whitewater and boat launching activities or observation.

Sand Springs Low Water Dam and Riverfront

The site proposed for construction of Sand Springs Dam is located downstream of Oklahoma Highway 97, at least 150 feet upstream of the confluence of Prattville Creek to avoid erosion impacts (Cherokee CRC, 2009). The dam would be approximately 11 to 12 feet high and would create a lake extending 5 miles upstream of the dam, to the Shell Creek area. Maintaining of a minimum downstream flow would be achieved by alternating the storage and release from the top 2 to 3 feet of the lake of the flows from Keystone Dam, and during periods of non-generation at Keystone Dam.. Assuming a daily release from Keystone Dam, Sand Springs Dam would allow between 400 and 1,000 cubic feet per second of flow and provide sufficient water for daily activities in the Tulsa and Jenks area (Cherokee CRC, 2009, p. 11).

Based on TVA guidance, an adjustable dam would be designed to allow for seasonal changes in flow and the creation of either a lake or river system (TVA, 2008). Sand Springs Dam would be designed to allow for a river system during the typical spawning season of the local fishery (March to June) and to allow for a lake system, providing recreational opportunities, during other months. Changes in dam height would be made possible by weir gates, such as Obermeyer, bascule or fuse gates. The seasonal river system would allow upstream fish migration as well as downstream transport of eggs and larvae to sustain fish propagation. The river system would also prevent land bridging and allow downstream sediment transport to maintain nesting island habitats for interior least terns. Additionally, when the lake is impounded, the bald eagle (*Haliaeetus leucocephalus*) population would be able to use both the lake and the area downstream of the dam for feeding.

While Sand Springs Lake would reduce downstream erosion, additional streambank stabilization methods would be used to protect streambanks during the spring season, when the dam is lowered. Streambank stabilization would involve a mix of bank "armor" and bio-remediation measures, as appropriate. "High risk areas" that could compromise the functioning of the dam, such as Prattville Creek, would be prioritized for erosion control. Eroding streambanks would also be prioritized for stabilization based on field reconnaissance of physical parameters and results of modeling analyses. Additionally, 3 acres of the creek would be converted to a created wetland to provide habitat for aquatic ecosystems and water quality improvement through vegetative filtering. Native planting to replace vegetation removed during project implementation, including the planting of American sycamores (*Platanus occidentalis*), or other tall trees, would provide additional habitat for bald eagles.

The Phase II Master Plan primary development goal of the Sand Springs Riverfront is "to provide a riverfront destination for retail and commercial services, and to improve the appearance of the City...and to provide recreational opportunities and aesthetic improvements to the area" (Cherokee CRC, 2009, p. 8). Development proposed in the Sand Springs area for the current phase of the project includes:

- New Low Water Dam with pedestrian bridge and fishing piers along w/ potential whitewater recreation opportunity.
- Boat ramp on the south bank to access the river below the dam, for public use, fish harvesting, and emergency access
- Hiking and nature trails and overlooks on the north and south banks

South Tulsa/Jenks Low Water Dam and Riverfront

The proposed South Tulsa/Jenks Dam would be constructed approximately 3,500 feet downstream of the Creek Turnpike and upstream of the Polecat Creek confluence. The low water dam would be approximately 8 to 9 feet in height and would create an impoundment approximately 3 miles long to afford boat access to the Creek Nation. South Tulsa/Jenks Dam would be operated at a fixed pool elevation, made possible by flow from Sand Springs Dam. As with Sand Springs Dam, TVA recommends an adjustable dam design in the South Tulsa/Jenks area, to allow for a river or lake system and to support fish passage. The South Tulsa/Jenks Dam design would be similar to the Sand Springs Dam design.

Erosion control methods would be used on nearby river reaches to reduce sedimentation and protect stream banks. These would consist of bank "armor" as well as vegetation measures to assure protection while maintaining both view and access. Bank stabilization measures would be implemented to protect Vensel Creek, primarily when the dam is lowered, and to protect Arkansas River embankments upstream and downstream of Jenks RiverWalk. For ecosystem restoration, the USACE recommends the planting of native shrubs and trees near the commercial development upstream of the Creek Turnpike and continued preservation of the existing Habitat Restoration and Bald Eagle Preserve near the 96th Street Bridge (Cherokee CRC, 2009).

The Phase II Master Plan primary development goal of the South Tulsa/Jenks area is the "creation of a retail and entertainment district on both sides of the river" (Cherokee CRC, 2009, p. 16). Proposed development in the South Tulsa/Jenks area, for the current phase of the project, includes:

- Low Water Dam with pedestrian bridge and fishing piers along w/ potential whitewater recreation opportunity.
- Boat ramp for public use, fish harvesting, and emergency access
- Constructed habitat beyond the upper reach of the lake and/or downstream of the dam to provide nesting habitat for interior least terns
- Ecosystem restoration with integrated hiking and nature trails

Projected Benefits

Through the creation of an integrated system of dams that optimize the functionality of the Arkansas River, in conjunction with beautification of its shorelines, the Arkansas River Corridor Project has the potential to restore and enhance aquatic, riparian, and terrestrial habitats as well as to improve the quality of life in nearby communities. Table 1 summarizes

the anticipated benefits of the project to Tulsa County communities; aquatic and riparian ecosystems; and water quality. Selected key benefits are described below.

The Arkansas River supports a prominent fishery providing valuable recreational opportunities to area residents. The Arkansas River Corridor Project design phase would include an evaluation of the upstream and downstream fish passage needs of migratory riverine species of potential interest to the Oklahoma Department of Wildlife Conservation (ODWC), the U.S. Fish and Wildlife Service (USFWS) and other stakeholders. Based on a review of life cycles, seasonal habitat needs and the availability of potentially suitable habitat, low water dams would be engineered with consideration of fisheries management goals and objectives for striped bass, paddlefish, sauger, shovelnose sturgeon and other native riverine species in the project area. Adjustable dams would allow for increased flow and upstream migration during the spring spawning season to promote fish propagation and protect other riverine ecosystems.

The USFWS has identified one federally threatened bird species, the piping plover (*Charadrius melodus*), and one federally endangered species, the interior least tern, that utilize the Arkansas River Corridor in the project area. In addition, the bald eagle, which was removed from the federal list of threatened and endangered species in 2007, maintains a habitat in the project area. The project would improve the habitat conditions of the interior least tern by preventing land bridging and protecting nesting islands from riparian predators, and plantings and preservation in riparian areas would increase the available habitat for the piping plover and bald eagle. The increase in fish assemblages associated with the project would also contribute to food resources available to threatened and endangered bird species.

Other benefits of the Zink, Sand Springs, and South Tulsa/Jenks low water dams and corresponding lakes include waterfront beautification, recreational opportunities such as fishing, boating, and potential whitewater sports, flow attenuation, flood reduction, downstream sediment transport, improvement of downstream habitat, mitigation of flashy river flows due to hydropower releases and protection of smaller non-migratory fish species.

TABLE 1
Expected Benefits of First Phase of Arkansas River Corridor Project

Expected Benefit	Project Component Related to Benefit
Community Benefits	
Improve the aesthetics of riverfront areas	Creation of new lake systems; pedestrian bridges and riverfront access; erosion control measures
Increase recreational opportunities	Creation of river/lake systems for fishing and boating; whitewater sporting venue from dam releases; boat access and fishing piers for accessible fishing; expansion of hiking and nature trails
Provide connectivity between communities and the resources of the Arkansas River	New road, trail and bridge systems

TABLE 1
Expected Benefits of First Phase of Arkansas River Corridor Project

Expected Benefit	Project Component Related to Benefit
Reduce flood-related hazards	Creation of integrated dam system engineered in compliance with Federal Emergency Management Agency (FEMA) regulations, to allow downstream flow without impacting the 100-year flood elevations
Increase habitat for recreationally important species, such as trout, bass, sunfish and catfish	Creation of weir pools
Ecosystem Benefits	
Allow upstream migration of fish species, such as striped bass, sauger, shovelnose sturgeon and paddlefish during critical seasons	Adjustable dams, with weir gates, that allow for lake or river systems
Allow downstream transport of eggs and larvae from spawning habitat to nursery habitat	Adjustable dams that allow for river systems and maintained minimum flow during spawning season
Improve and maintain habitat for smaller non-migrating fish species (shiners, minnows, darters, silversides)	Minimum flows provided by dams; mitigation of flashy flow caused by hydropower operations
Protect least tern nesting areas	Minimum flows provided by dams to eliminate land bridging; downstream sediment transport provided by dams; protection of nesting islands through the creation of river/lake system
Increase the foraging areas for bird species, such as least tern, bald eagle and piping plover	Seasonal dams to allow continued spawning of minnow species; minimum flows provided by dams to increase the habitat for fish that contribute to least tern food resources
Increase aquatic habitat	Construction of created wetlands
Improve habitat for bald eagles	Riparian planting of American sycamores or other tall trees
Restore and maintain ecosystems	Preservation of riparian areas, native plantings, expansion of parks and nature areas
Provide stable habitat during low flow conditions	Minimum flows provided by dams; mitigation of flashy flow caused by hydropower operations; addition of weir pools
Aid fish production to benefit predators found along the Arkansas River Corridor, such as bald eagle, piping plover and interior least tern	Minimum flows provided by dams; mitigation of flashy flow caused by hydropower operations; addition of weir pools
Water Quality Benefits	
Improve water quality to restore the river to meet its designated use	Riparian preservation and plantings to reduce stormwater runoff; streambank stabilization
Reduce streambank erosion and instream sedimentation	Streambank stabilization methods
Improve the riverine system's functionality and restore the river to a more natural state	Integrated network of dams

TABLE 1
Expected Benefits of First Phase of Arkansas River Corridor Project

Expected Benefit	Project Component Related to Benefit
Increase dissolved oxygen concentrations necessary for small fish species	Minimum flows provided by dams
Decrease sedimentation in impoundments	Modified and new dams engineered with consideration of sandy nature of substrate and soil in floodplains

Estimated Project Cost and Potential Funding Sources

Approval of Proposition 4 of the Tulsa County 2025 sales tax initiative in 2003 authorized $9.5 million in sales tax revenues for partial funding of the Arkansas River Corridor Project. The Phase II Master Plan provides preliminary cost estimates for the project that can be used for initial planning purposes. Table 2 outlines the cost estimate for elements of the first phase of the project based on the Master Plan (2005) and updates provided in the TVA Report (2007). While Proposition 4 revenue would provide resources for a portion of the Arkansas River Corridor Project, other potential funding sources would need to be identified to develop multiple project phases.

"A variety of possible development tools and funding sources have been identified including cost-share scenarios with federal, state and local entities, funding from non-governmental organizations, and the establishment of tax increment financing districts. River oriented development could also generate its own revenue stream through enhanced property values and induced sales tax, thus adding value to the Greater Tulsa area, and attracting visitors from near and far" (Guernsey et al., 2005, p. ES-3). A variety of potential funding sources is outlined in the Phase II Master Plan (Guernsey et al., 2005, p. 219), including:

- Section 206, Water Resources Development Act of 1996
- Section 22, Water Resources Development Act of 1974
- Section 208, Flood Control Act of 1954
- Section 14, Flood Control Act of 1946
- Section 1135, Water Resources Development Act of 1986
- Section 205, Flood Control Act of 1948
- Section 206, Flood Control Act of 1960

These funding sources, as well as others, should be evaluated for portions of the Arkansas River Corridor Project that remain unfunded and for potential sponsorships during future project phases.

TABLE 2
Estimated Construction Costs for Components of the First Phase of Arkansas River Corridor Projects

Project Improvements	Source	
	Master Plan 2006	TVA Sept 2007
Sand Springs		
Low Water Dam (11 ft)	$ 17.459	$ 40,514
Pedestrian Bridge	$ 3.400	$ 7.870
Fish passage / Recreation		
Habitat Restoration / Bank Stabilization		
Right-of-Way		
Zink Lake		
Weir Modification & Gates	$ 2.100	$ 5.819
Tulsa Whitewater Park (4/07)	$ 1.500	$ 1.500
Shoreline Beatification		
Fish passage / Recreation		
Habitat Restoration / Bank Stabilization		
Right-of-Way		
Jenks / South Tulsa		
Low Water Dam (8 ft)	$ 17.459	$ 27.634
Pedestrian Bridge	$ 3.400	$ 7.870
Fish Passage / Recreation		
Habitat Restoration / Bank Stabilization		
Right-of-Way		
Total Project	$ 45.318	$ 91.207

Note- Shading indicates elements not included past project cost estimates.

References

Carter Burgess. 2004. Final Arkansas River Corridor Master Plan, Phase I Vision Plan. Prepared for Indian Nations Council of Governments (INCOG).

Cherokee CRC, Inc. 2009. Vision 2025 Arkansas River Corridor, Ecosystem Restoration Plan. Prepared for the U.S. Army Corps of Engineers (USACE), Tulsa County, and the Tennessee Valley Authority (TVA).

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McLaughlin Whitewater Design Group. 2007. Conceptual Planning, Tulsa Wave Whitewater Park.

Tennessee Valley Authority (TVA), River Systems Operation and Environment. 2008 Vision for the Arkansas River Corridor at Tulsa.

Appendix B
Related Projects to be Considered During the Cumulative Impacts Analyses

Arkansas River Corridor Projects
Summary of Potential Future Elements

PREPARED FOR: CH2M HILL

PREPARED BY: Lauren Murphy/ATL

DATE: April 14, 2009

Introduction

While the Arkansas River has long been a significant natural resource for the surrounding land and its inhabitants, historical alterations have degraded watershed conditions and masked the river's unique potential. The 1964 construction of Keystone Dam, to protect nearby communities from extreme flood events, significantly changed the natural hydrology of the Arkansas River. Additionally, growth and development associated with the Tulsa metropolitan area, and related intensive land use practices, have led to streambank erosion, destruction of riverine wetlands, increased stormwater runoff, and a high degree of sediment transport to the river. As a result, ecosystems native to the Arkansas River area have been compromised and instream habitats continue to be depleted.

In recent years, however, citizens of Tulsa County have begun to recognize both the potential of the Arkansas River as a resource and the need to address declining water quality and aquatic ecosystems. Due to this increased awareness, a Dialog/Visioning 2025 Citizen's Summit was held in early 2002 to identify potential improvements to the Arkansas River and the Arkansas River Corridor. From this Citizen's Summit, the Arkansas River Corridor Project was initiated and has included a wealth of research, planning, and design initiatives for the beautification and improvement of 42 miles of the Arkansas River Corridor, between Keystone Dam and the Tulsa County/Wagoner County line. Multiple stakeholders are involved in the project, including Tulsa County, the Indian Nations Council of Governments (INCOG), the U.S. Army Corps of Engineers (USACE), and the Tennessee Valley Authority (TVA). The project involves enhancement and restoration at seven key development sites within the 42-mile project reach and includes modification of the existing Zink Dam and the addition of two low-head dams, at Sand Springs and South Tulsa/Jenks.

The Baseline Project Summary for the Arkansas River Corridor Project document (April 2009) details components that CH2M HILL will be involved with during the first phase of the project. These elements include improvements at Zink Dam, Sand Springs, and South Tulsa/Jenks and are proposed for funding by Tulsa County and the USACE. The overall plan for the Arkansas River Corridor Project, including future phases, includes supplemental development at these sites, as well as proposed improvements at the four additional key development sites. While these elements would be proposed under alternative funding, they may need to be considered during the current phase of the project, for any secondary

cumulative impacts. Therefore, this document summarizes potential future project elements, including goals, components, expected benefits, estimated costs, and potential funding sources.

Background

The Arkansas River Dialog/Visioning 2025 Citizen's Summit, which was held to identify a path forward for improvement of the Arkansas River Corridor, resulted in the addition of Proposition 4 to the Tulsa County 2025 sales tax initiative. Approval of Proposition 4 in 2003 authorized $9.5 million in sales tax revenues for: (1) construction of two low-head dams downstream of Keystone Dam, (2) Zink Lake shoreline beautification, and (3) Zink Lake silt removal improvements. Approval was also the impetus for multiple studies conducted on the Arkansas River Corridor. Since approval of Proposition 4, additional work has been authorized by INCOG and the USACE for the following studies:

- Arkansas River Corridor Master Plan, Phase I Vision Plan (Carter Burgess, 2004)
- Arkansas River Corridor Master Plan, Phase II Master Plan and Pre-Reconnaissance Study (Guernsey et al., 2005)
- Conceptual Planning, Tulsa Wave Whitewater Park (McLaughlin Whitewater Design Group, 2007)
- Vision for the Arkansas River Corridor at Tulsa (TVA, 2008)
- Vision 2025, Arkansas River Corridor, Ecosystem Restoration Plan (Cherokee CRC, 2009)

The Arkansas River Corridor Phase I Vision Plan, initiated by INCOG in 2003, is a preliminary plan to "enhance the river and the citizens' lives" (Carter Burgess, 2004, p. 2). The Phase I Vision Plan evaluated seven major features with the potential to maximize the beneficial use of the Arkansas River Corridor while integrating ideas supported by the community: bridges and crossings, natural features and resources, low-head dams, multi-use trails and parks, traffic network and gateways, river-oriented activities, and community development opportunities. The Phase I Vision Plan is primarily based on citizen input and is general and basic in conceptual design; however, it provided the necessary framework for the comprehensive Phase II Master Plan (Guernsey et al., 2005).

The Phase II Master Plan addresses economic, physical, environmental, ecological, and legal issues related to the Arkansas River Corridor Project. Through the comprehensive Pre-Reconnaissance study, a number of opportunities associated with the Arkansas River and Arkansas River Corridor were identified, including low-head dams, mixed-use areas, parks, fishing piers, boating access, new and expanded trails, and bridges. The Master Plan includes conceptual plans, estimated costs, and potential funding sources for seven selected key development sites, construction of two new low-head dams, and modifications to Keystone Dam.

After completion of the Phase II Master Plan, TVA provided a technical review of the low-head dam construction and dam modifications proposed in the Phase II Master Plan. The Vision for the Arkansas River at Tulsa (TVA, 2008) outlines the findings and

recommendations of this study, which was aimed at identifying a hydraulic system that meets project goals while also ensuring safety and meeting floodplain regulations. The Tulsa Wave Whitewater Park conceptual planning document (McLaughlin Whitewater Design Group, 2007) details potential whitewater recreational opportunities that could be made possible by the modified and newly created low-head dams.

Phase III of the Arkansas River Corridor Project includes a baseline environmental study and an associated Ecosystem Restoration Plan (Cherokee CRC, 2009). The Phase III study, which was limited to the Sand Springs and South Tulsa/Jenks low-head dam and lake systems, presents ecosystem recommendations for consideration during development of these project components. The Ecosystem Restoration Plan would be submitted as part of the USACE regulatory permit application process during the first phase of the project.

Goals

The primary goals driving the overall Arkansas River Corridor Project are to enhance economic development, establish greater connectivity between the river and surrounding communities, address flood damage reduction, improve and protect habitat for interior least terns *(Sterna antillarum athalassos)*, improve recreational opportunities, and improve the riverine system's functionality, primarily through the addition of two new low-head dams, at Sand Springs and South Tulsa/Jenks, and modifications to the existing Zink Dam. Other goals, which have been developed from proposed project concepts, include:

- Providing riverine habitat for small, non-migratory fish, such as shiners, minnows, darter, and silversides
- Allowing upstream migration of striped bass, sauger, shovelnose sturgeon, and paddlefish and downstream transport of eggs and larvae during the spawning season
- Improving aquatic habitat in the Arkansas River
- Increasing the diversity and abundance of macroinvertebrate and fish assemblages
- Allowing sediment transport downstream of dams and reducing lake sedimentation
- Minimizing impacts to fish species that are a source of food for interior least terns and other bird species
- Developing a recreational whitewater park downstream of Zink Dam, and potentially upstream of Sand Springs and South Tulsa/Jenks Dams
- Providing hydropower

Proposed Project Components Under Future Phases

The Arkansas River Corridor Project involves restoration components at seven key development sites between Keystone Dam and the Tulsa County/Wagoner County line. Restoration along this 42-mile reach of the Arkansas River would positively affect portions of several communities, including Sand Springs, Tulsa, Jenks, Bixby, and Broken Arrow, and would provide a variety of benefits outlined in the Phase II Master Plan (Figure 1). The

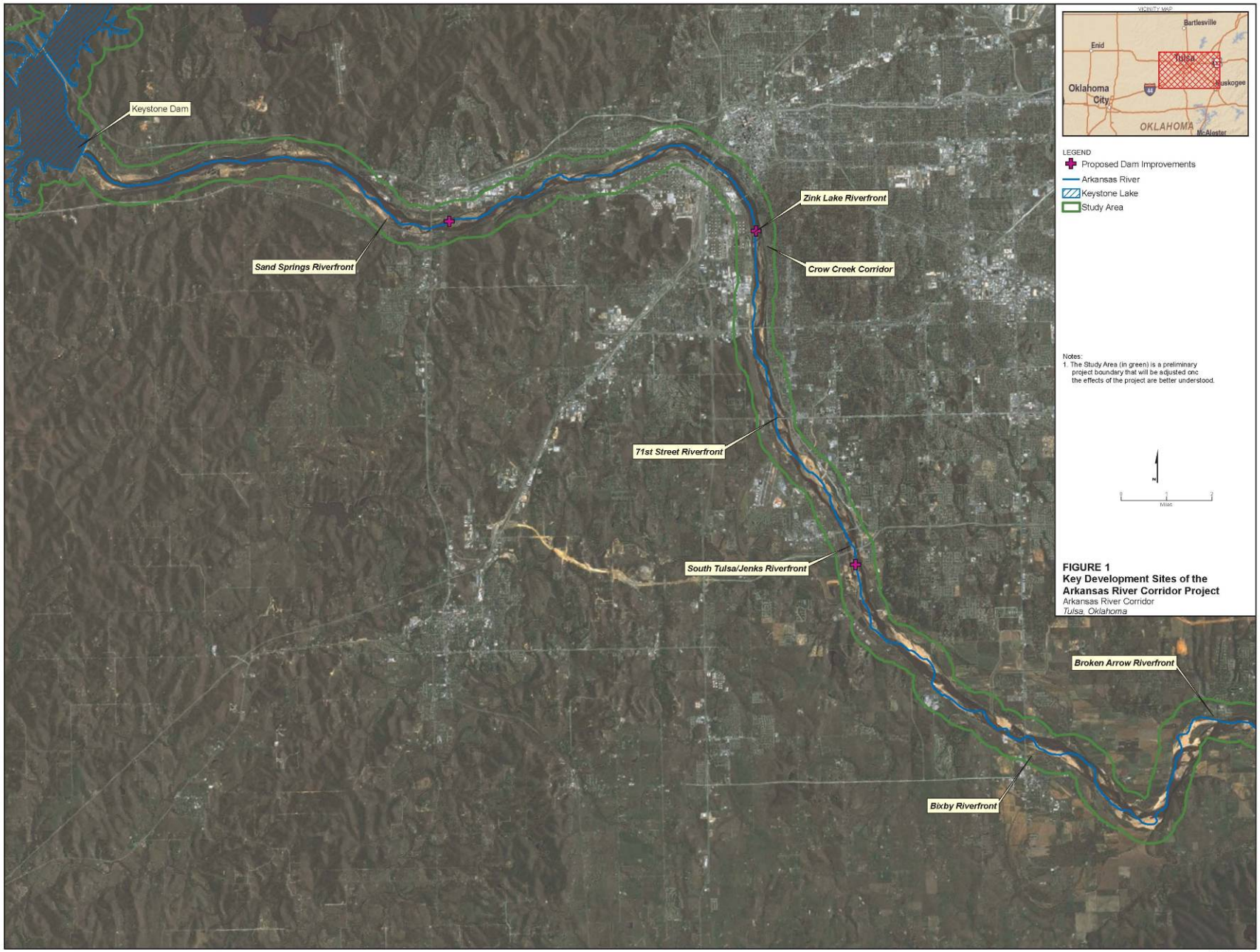

FIGURE 1
Key Development Sites of the Arkansas River Corridor Project
Arkansas River Corridor
Tulsa, Oklahoma

initial phase of the project would include modification of the existing Zink Dam and the addition of two low-head dams, at Sand Springs and South Tulsa/Jenks. These elements have been identified for funding by Tulsa County and the USACE and are summarized in the Baseline Project Summary document.

In addition to dam construction and modification, other Arkansas River Corridor Project components include: boating amenities in impoundments, fishing piers, pedestrian bridges, hiking and nature trails, water taxi transportation, whitewater recreation areas, retail development centers, and public parks. Public access to all new project components would require linking the existing trail system to new access roads and trails. Trails, boardwalks, and pedestrian bridge concepts would be developed to provide convenient access to river crossings and to improve connectivity between the Arkansas River and nearby communities.

Proposed project components for the seven key development sites that may be included in future phases of the project are outlined below.

Zink Lake Riverfront

Zink Lake is a popular outdoor area that provides recreational opportunities and a festival venue for the Tulsa area. The Phase II Master Plan involves improvements to the Zink Lake Riverfront as well as the development of new recreational opportunities, with the goal to "enhance physical and visual connections between the east and west banks" (Guernsey et al., 2005). Potential future project elements in the Zink Lake area include:

- Expansion of the River West Festival Park
- New outdoor amphitheater
- Conversion of industrial properties to recreational land use on the west bank
- Mixed-use and residential development on the east bank
- New public activity center
- Bridge lighting
- Expansion of marina and boat docks on the west bank
- Pedestrian promenade

Sand Springs Low-head Dam and Riverfront

The Phase II Master Plan primary development goal of the Sand Springs Riverfront is "to provide a riverfront destination for retail and commercial services, and to improve the appearance of the City...and to provide recreational opportunities and aesthetic improvements to the area" (Cherokee CRC, 2009, p. 8). Development proposed in the Sand Springs area for future phases of the project includes:

- Extension of Main Street to the Arkansas River between first set of piers (potential to extend Main Street into east end of park, and ultimately connect to west end)
- Marina, boat ramp, and parking lot on the north bank, for local boating and fishing access

South Tulsa/Jenks Low-head Dam and Riverfront

The Phase II Master Plan primary development goal of the South Tulsa/Jenks area is the "creation of a retail and entertainment district on both sides of the river" (Cherokee CRC, 2009, p. 16). Proposed development in the South Tulsa/Jenks area, for future phases of the project, includes:

- Expansion of the Oklahoma Aquarium campus
- Public park and overlook structure upstream of the east end of the dam
- Retail area between the upper end of the public park and the Creek Turnpike
- Commercial development upstream of the Creek Turnpike, to Vensel Creek
- Pedestrian bridge across Vensel Creek
- Jenks Riverfront and Retail Development on the west shoreline, overlooking the lake
- Riverfront Retail and Cultural Arts area on the west side of the river between the Creek Turnpike and the 96th Street Bridge
- Expansion of Jenks RiverWalk and construction of an associated parking lot
- Water taxi system to connect developments on both shorelines

71st Street Riverfront

The 71st Street Riverfront was selected as a key development area due to its "accessibility and high visibility [and] special prominence within the Arkansas River Corridor" (Guernsey et al., 2005). Potential future project components in this area include:

- Mixed-use development at the south end of Helmerich Park on the east bank
- Expansion of the Turkey Mountain Urban Wilderness Area and incorporation of the proposed Native American Cultural Center
- Additions to Helmerich Park, including a health and fitness center, meeting facility, classrooms, cafés, expanded playground, and landscaped parking facilities
- Development of new sports complex with soccer fields and a parking lot
- Creation of 7-acre lake with fishing piers, restaurant, overlooks, and trails, south of the health and fitness center

Bixby Riverfront

The 300-acre Bixby Riverfront area includes a combination of developed and undeveloped property with the potential to provide panoramic views of the Arkansas River and to accommodate new development. Proposed project components for the Bixby Riverfront include:

- New Bentley Park sports complex, with baseball and softball fields, hard surface courts, and other recreational facilities

- "Bixby Landing" development to include a pedestrian promenade, restaurants, and retail and entertainment areas
- Commercial redevelopment along Memorial Drive
- Boardwalk along the Arkansas River

Broken Arrow Riverfront

The Broken Arrow Riverfront development site is approximately 2 miles long and includes the 164-acre Indian Springs Sports Complex. Proposed development opportunities at Broken Arrow include:

- Improved access to the Arkansas River from Aspen Avenue
- Expansion of Aspen Avenue
- Enhancements to the Indian Springs Sports Complex
- Enhancement/restoration of riparian habitats
- Nature center and trails for recreation and environmental education
- New activity center near the riverfront

Crow Creek Corridor

Crow Creek was identified as a key development area because it is a "significant natural feature connecting the vibrant Brookside neighborhood to the river corridor" (Guernsey et al., 2005). Proposed conceptual plans in the Crow Creek Corridor include:

- Pedestrian walkway along Crow Creek
- Streambank restoration on Crow Creek
- Hiking/nature trail system

It should be noted that any development considered within the Crow Creek Corridor should be compatible with the findings of the USACE Section 206 Aquatic Ecosystem Restoration Feasibility Study conducted on Crow Creek (Guernsey et al., 2005, p. 134).

Projected Benefits

Table 1 summarizes the anticipated benefits of future phases of the project to Tulsa County communities. While the initial phase of the project is focused on community benefits, as well as benefits to aquatic ecosystems and water resources, future phases of the project are aimed more toward economic development and aesthetic improvements for nearby communities.

TABLE 1
Expected Benefits of Future Phases of Arkansas River Corridor Project

Expected Community Benefit	Project Component Related to Benefit
Improve the aesthetics of riverfront areas	Creation of new lake systems; new retail areas, pedestrian bridges, parks, and riverfront access; erosion control measures
Increase recreational opportunities	Public parks and activity centers, conversion to recreational land use, boat access and fishing piers for accessible fishing; expansion of hiking and nature trails
Stimulate economic development and improve the quality of life for nearby communities	New mixed-use, retail, and commercial developments
Provide connectivity between communities and the resources of the Arkansas River	New road, trail, and bridge systems

Estimated Project Cost and Potential Funding Sources

The Phase II Master Plan provides preliminary cost estimates for the Arkansas River Corridor Project that can be used for initial planning purposes. Table 2 outlines the cost estimate for potential future elements of the project, in 2005 dollars, as well as an escalation to present day (2009) dollars. Escalation from 2005 to 2009 dollars includes an estimated escalation factor of 1.3, based on cost escalations from the Dallas area between March 2005 and March 2009.

"A variety of possible development tools and funding sources have been identified including cost-share scenarios with federal, state, and local entities, funding from non-governmental organizations, and the establishment of tax increment financing districts. River oriented development could also generate its own revenue stream through enhanced property values and induced sales tax, thus adding value to the Greater Tulsa area, and attracting visitors from near and far" (Guernsey et al., 2005, p. ES-3). A variety of potential funding sources is outlined in the Phase II Master Plan (Guernsey et al., 2005, p. 219), including:

- Section 206, Water Resources Development Act of 1996
- Section 22, Water Resources Development Act of 1974
- Section 208, Flood Control Act of 1954
- Section 14, Flood Control Act of 1946
- Section 1135, Water Resources Development Act of 1986
- Section 205, Flood Control Act of 1948
- Section 206, Flood Control Act of 1960

These funding sources, as well as others, should be evaluated for portions of the Arkansas River Corridor Project that remain unfunded and for potential sponsorships during future project phases.

TABLE 2
Estimated Construction Cost for Potential Future Components of Arkansas River Corridor Project

Project Component	Estimated Cost (2005 $)		Estimated Cost (2009 $)[a]	
	High	Low	High	Low
Existing Bridge Improvements[b]				
Railings, per mile	$1,750,000	$337,000	$2,275,000	$438,100
Lighting with decorative poles, each	$2,500	$750	$3,250	$975
Underside lighting, per bridge	$1,500,000	$75,000	$1,950,000	$97,500
Pedestrian lane, per mile	$750,000	$350,000	$975,000	$455,000
Streetscaping/Landscaping Scenic Roadways[b]				
Native/rural landscape, per mile	$149,000	N/A	$193,700	N/A
Streetscaping, per mile	$579,000	N/A	$752,700	N/A
New paved 10-foot trails, per mile	$250,000	$115,000	$325,000	$149,500
Lighting, each	$2,500	$750	$3,250	$975
Decorative towers with laser lights, each	$1,500,000	$750,000	$1,950,000	$975,000
Park Amenities[b]				
Baseball field, each	$150,000	$90,000	$195,000	$117,000
Soccer field, each	$150,000	$90,000	$195,000	$117,000
Sports complex, each	$9,000,000	$6,000,000	$11,700,000	$7,800,000
Parking lot, per acre	$145,000	$95,000	$188,500	$123,500
Tennis court, each	$50,000	$25,000	$65,000	$32,500
Lighting field, each	$150,000	$90,000	$195,000	$117,000
Picnic areas (with 20 covered tables), each	$350,000	$200,000	$455,000	$260,000
Pavilion (120 feet x 60 feet), each	$350,000	$180,000	$455,000	$234,000
AA Baseball Stadium (10,000 capacity), each[b]	**$40,000,000**	**$25,000,000**	**$52,000,000**	**$32,500,000**
Bridge and Roadway Improvements, general[c]				
Vehicular bridge, per square foot	$100		$130	
Pedestrian bridge, per square foot	$200		$260	
Gateways (material and installation), per set	$350,000		$455,000	
Bridge and Roadway Improvements, specific[c]				
Lighting, 11th Street and 21st Street Bridges, total	$1,500,000	$75,000	$1,950,000	$97,500
177th West Avenue Bridge (4 lane vehicular with bike/pedestrian lane), total	$19,200,000		$24,960,000	
Gilcrease Expressway Bridge, total	$27,000,000		$35,100,000	
41st Street Bridge, (4 lane vehicular with bike/pedestrian lane), total	$13,100,000		$17,030,000	
Yale Avenue Bridge, total	$33,000,000		$42,900,000	
193rd East Avenue Bridge (4 lane vehicular with bike/pedestrian lane), total	$20,100,000		$26,130,000	

TABLE 2
Estimated Construction Cost for Potential Future Components of Arkansas River Corridor Project

Project Component	Estimated Cost (2005 $)		Estimated Cost (2009 $)[a]	
	High	**Low**	**High**	**Low**
Sand Springs Main Street Extension, total	$3,500,000		$4,550,000	
Broken Arrow-Aspen Ave Extension, total	$800,000		$1,040,000	
Total	**$125,000,000**	**$123,575,000**	**$162,500,000**	**$160,647,500**
Riverside Drive West, total[d]	**$29,300,000**		**$38,090,000**	
Riverside Drive Intersection Improvements[e]				
Intersection improvements at 21st, 31st, and 41st Streets, total	$1,529,100		$1,987,830	
Mid-crossing improvements at 26th, 36th, and 46th Streets, total	$1,245,600		$1,619,280	
Pedestrian bridge replacement over Riverside Drive, total	$418,000		$543,400	
Total	**$3,192,700**		**$4,150,510**	
Riverside Drive Improvements from 21st Street to I-44[f]				
4-lane boulevard, total	$8,370,000		$10,881,000	
3 major intersection improvements, total	$1,530,000		$1,989,000	
3 mid-crossing improvements, total	$1,250,000		$1,625,000	
Replace Pedestrian Bridge over Riverside	$420,000		$546,000	
Total	**$11,570,000**		**$15,041,000**	
Hydropower Production, per dam[g]	**$800,000**		**$1,040,000**	

Note: When only one cost is shown, it is the only cost estimate provided.
N/A – Not Available

[a] Planning level cost estimate, based on an escalation factor of 1.3, from 2005 dollars
[b] Guernsey et al., 2005 (p. 230)
[c] Guernsey et al., 2005 (p. 234)
[d] Guernsey et al., 2005 (p. 236)
[e] Guernsey et al., 2005 (p. 237)
[f] Guernsey et al., 2005 (p. 238)
[g] TVA, 2008 (pg. 9)

References

Carter Burgess. 2004. Final Arkansas River Corridor Master Plan, Phase I Vision Plan. Prepared for Indian Nations Council of Governments (INCOG).

Cherokee CRC, Inc. 2009. Vision 2025 Arkansas River Corridor, Ecosystem Restoration Plan. Prepared for the U.S. Army Corps of Engineers (USACE), Tulsa County, and the Tennessee Valley Authority (TVA).

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McLaughlin Whitewater Design Group. 2007. Conceptual Planning, Tulsa Wave Whitewater Park.

Tennessee Valley Authority (TVA), River Systems Operation and Environment. 2008 Vision for the Arkansas River Corridor at Tulsa.

Appendix C
Data Sets Consulted to Identify Data Gaps

ESRI Streetmap. April 1, 2008. *Arkansas River Stream Centerline*. ESRI Streetmap Data CD (March 24, 2009).

ESRI Streetmap. April 1, 2008. *Cemeteries*. ESRI Streetmap Data CD (March 24, 2009).

ESRI Streetmap. April 1, 2008. *Churches*. ESRI Streetmap Data CD (March 24, 2009).

ESRI Streetmap. April 1, 2008. *Federal Land Areas*. ESRI Streetmap Data CD (March 24, 2009).

ESRI Streetmap. April 1, 2008. *Golf Course Locations*. ESRI Streetmap Data CD (March 24, 2009).

ESRI Streetmap. April 1, 2008. Hospitals. ESRI Streetmap Data CD (March 24, 2009).

ESRI Streetmap. April 1, 2008. *Keystone Lake Area Boundary*. ESRI Streetmap Data CD (March 24, 2009).

ESRI Streetmap. April 1, 2008. *Landmark Areas*. ESRI Streetmap Data CD (March 24, 2009).

ESRI Streetmap. April 1, 2008. *Railroads*. ESRI Streetmap Data CD (March 24, 2009).

ESRI Streetmap. April 1, 2008. *Recreational Park Area*. ESRI Streetmap Data CD (March 24, 2009).

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