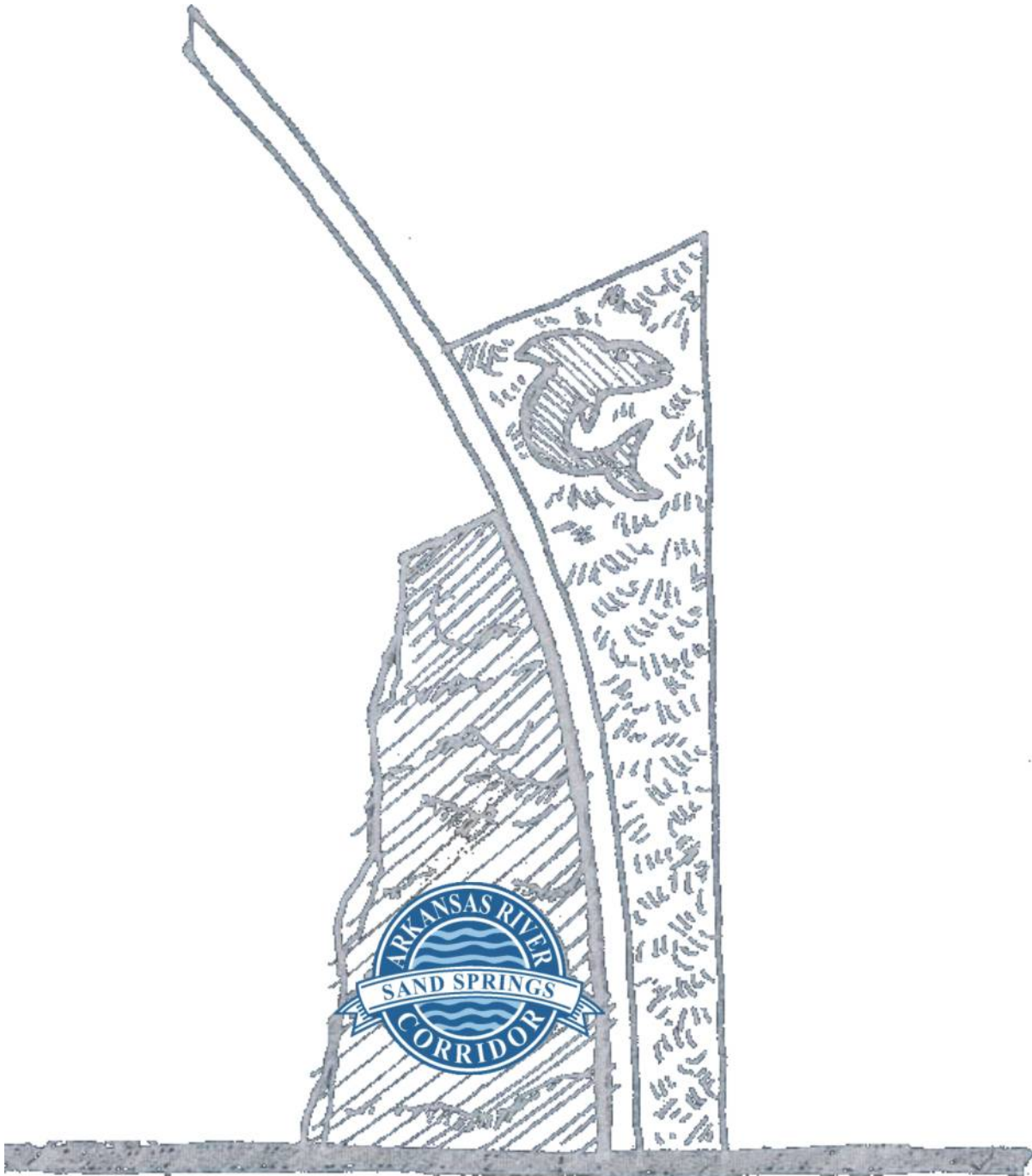


8.1 SAND SPRINGS MAIN STREET LOW WATER DAM CONCEPTUAL PLAN



8.1 SAND SPRINGS LOW WATER DAM

8.1.1 BACKGROUND AND REQUIREMENTS



Main Street Industrial Area

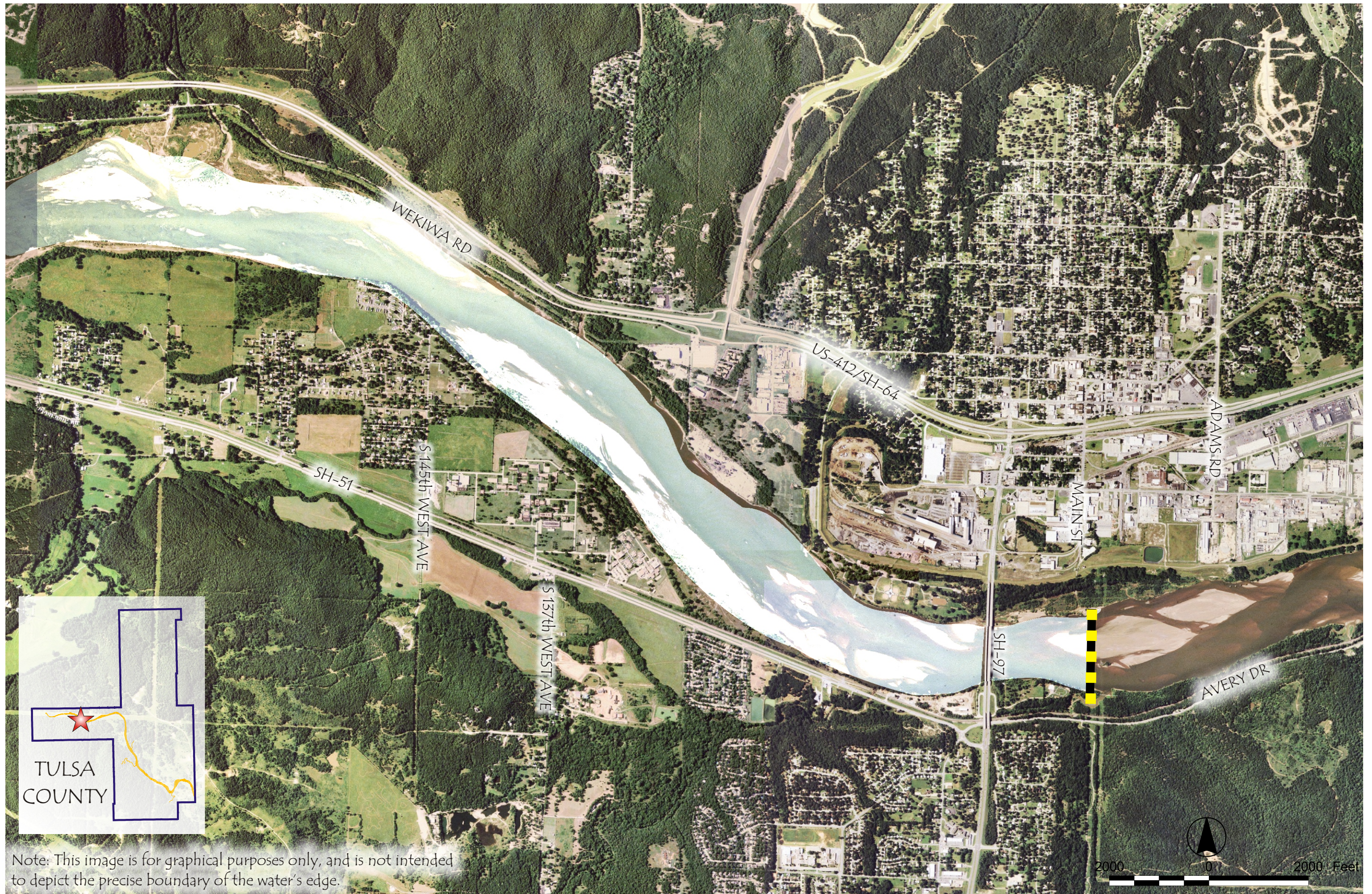
The central core in Sand Springs, designated as the Keystone Corridor, is the backdrop for a proposed low water dam and riverfront development. Existing land use in the area includes the southern portion of the Sand Springs Central Business District, a predominantly declining residential area with mixed commercial uses, churches, vacant lots, a kindergarten center, and an industrial area. The industrial area has large buildings, some of which are in use, and others which are vacant with little chance of re-use in their present state. Many of the residential areas are suffering from blight and neglect. Prior to the passage of the Vision 2025 initiative, the proposed urban redevelopment projects in the Sand Springs core were stalled due to a lack of necessary public support and financial resources. The Sand Springs riverfront is underutilized as a potential economic resource.



Keystone Corridor Redevelopment Area

Vision 2025 includes partial funding for two low water dams in the project corridor. Based upon Phase II Master Plan analyses, Sand Springs has been recommended as one of the two initial locations for a low water dam. A key element of the proposed economic revitalization in Sand Springs could be a low water dam and the associated economic, recreational, and natural amenities it provides.

The planning area, low water dam location, and river lake extents are depicted on the following page in Figure 8.1-1. A separate conceptual plan has been prepared for the Sand Springs riverfront. The Sand Springs Riverfront plan addresses a potential development scenario based upon the presence of a low water dam. Many of the components in this low water dam plan are incorporated into the Sand Springs Riverfront plan. This low water dam plan is intended to address the concept for the dam only. For conceptual graphics and renderings of the various amenities associated with the creation of the Sand Springs low water dam, please reference Section 8.3 of this document.



Note: This image is for graphical purposes only, and is not intended to depict the precise boundary of the water's edge.

SAND SPRINGS MAIN STREET LOW WATER DAM CONCEPTUAL PLAN

FIGURE 8.1-1



8.1.2 DESCRIPTION OF PLAN AREA

The proposed location for the Sand Springs low water dam is downstream of the State Highway 97 Bridge near the Main Street extension. This location would allow ready access and viewing from the Highway 97 Bridge, the River City Park area, and a proposed new development at the levee. The proposed dam would impound water beyond the reaches of River City Park, which is proposed to be enhanced and expanded to the east.

There is an existing Sand Springs Gravel/Mohawk Materials Sand and Gravel operation on the upstream side of the Highway 97 Bridge. This operation could benefit commercially from sand and gravel maintenance operations for the proposed low water dam, since the available volume of sand and gravel is diminishing in this reach of the Arkansas River. This area of the Arkansas River is also being strategically addressed for commercial and recreational developments.



*View south along Highway 97 Bridge in Sand Springs
(Photo courtesy of Tulsa World)*

8.1.3 DESIGN CRITERIA / LIMITATIONS



View toward Arkansas River from Proposed Main Street Terminus



River City Park Automobile Access



Wooded Area between Flood Control Levee and Arkansas River at the South end of Main Street

A primary development goal in Sand Springs is to provide a destination for retail and commercial services, and to improve the appearance of the City. The proposed low water dam and riverfront development will provide recreational opportunities and aesthetic improvements to the area, which would assist the City in achieving its goals.

There are several criteria and constraints that will need to be addressed in the design of the Sand Springs low water dam, as outlined below:

- Visual and automobile access to the Arkansas River is restricted from many areas in Sand Springs due to the location and height of the flood control levee.
- The low water dam and any associated riverfront planning areas must be developed in accordance with all flood control guidelines and must be consistent with regulations for the existing levee on the north side of the River.
- River City Park provides a great opportunity to bring recreational users to new lake activities that are created by the proposed low water dam.
- The wooded areas along both north and south banks of the River provide an opportunity for nature trails, bird watching areas, and riparian habitat restoration.
- A sand and gravel operation is located on the south side of the River, just west of the Highway 97 Bridge. The activity level of the operation has declined in the recent years, since the available volume of sand and gravel has diminished in this reach of the River. There may be opportunities for this operation to coordinate with long-term maintenance and sand removal associated with the low water dam and lake.
- Carefully planning for operation of the dam is a critical component to the success of fish populations in the area. It may be necessary to fully open the gates during fish spawning

seasons to allow upstream fish migration. The period of time for the gates to be opened for this purpose is yet to be determined.



View toward downtown Tulsa from Sand Springs levee

- Understanding the magnitude of velocities and flows will be critical in determining the size and species of fish that will be able to pass through the dam gate openings. This is also an important consideration in the proper design of the least tern habitat island that will be created in the pool.
- The low water dam should include a pedestrian bridge and fishing piers.
- A boat ramp should be included downstream of the dam for public use, fish harvesting, and emergency access.
- This project will be subject to local, state, and Federal laws. Prior to implementation, a detailed NEPA analysis will be conducted to address potential impacts to environmental resources.



*Looking east from Sand Springs along the Arkansas River with Avery Drive on the right bank
(Photo courtesy of Tulsa World)*

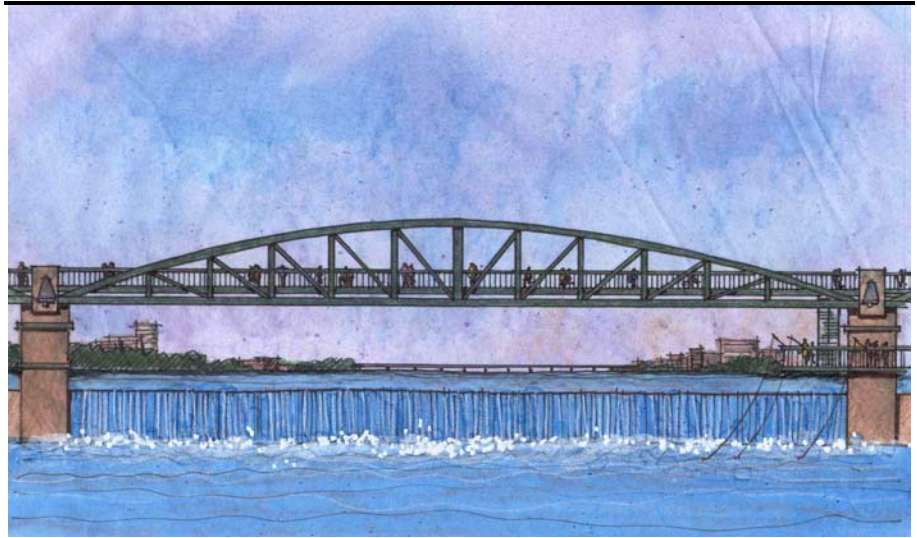
8.1.4 LOW WATER DAM CONCEPT

The general concept for the Sand Springs Main Street Low Water Dam is to provide multiple sets of bascule gates across the entire dam crest. The crest of the dam would alternate between gate sections and weir sections. With this concept, the possibility of storing significant sediments, sands, and gravels on the upstream side of the low water dam is reduced. Each gate, or set of gates, would require a hydraulic operator at each end. These hydraulic operators would be housed in "towers" adjacent to each gate or fixed weir along the crest of the dam. The "towers" would also provide structural support for the pedestrian/maintenance walkway proposed to be constructed above each of the low water dams. The pedestrian/maintenance bridge would connect the north and south banks of the Arkansas River in the Sand Springs area, and provide accessibility for maintenance of the gates and hydraulic equipment.

The following conceptual graphics represent two possible engineering concepts for the pedestrian bridge. Concepts for a cable-stayed option and a truss option are depicted. The sketches represent a typical section of the pedestrian bridge spanning the "towers" and repeating over the entire length of the dam. A grade-separated fishing pier is also depicted in the sketches; however, the optimal design and location of the fishing piers will need to be determined following a detailed analysis of downstream hydraulics and habitat.

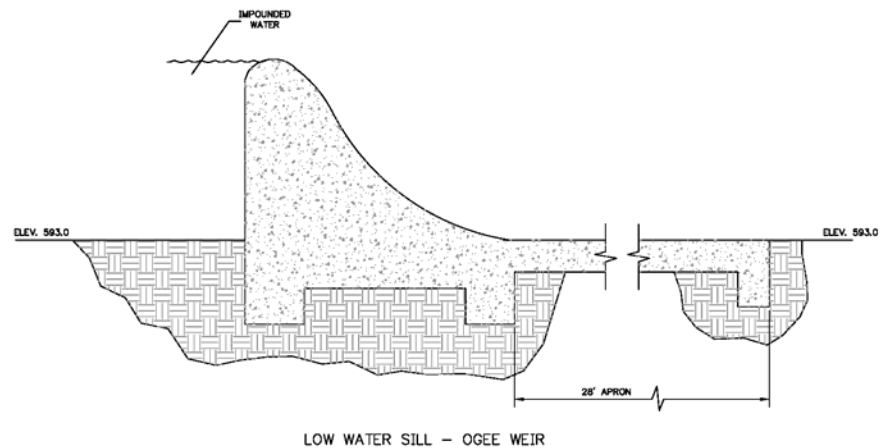


Concept for a cable-stayed pedestrian/maintenance bridge



Concept for a truss pedestrian/maintenance bridge

The main structure of the low water dam is proposed to be a series of reinforced concrete weir sections, each with a fixed crest elevation. Ogee weirs were used for modeling purposes; however, other types such as stepped cascade, labyrinth, and infuser weirs may be possible upon further analysis. The weir structures would provide the support for the gates and provide uncontrolled spillway capacity to pass Arkansas River flows. It is proposed to create a hydraulically efficient pier nose and tail at each "tower" location.



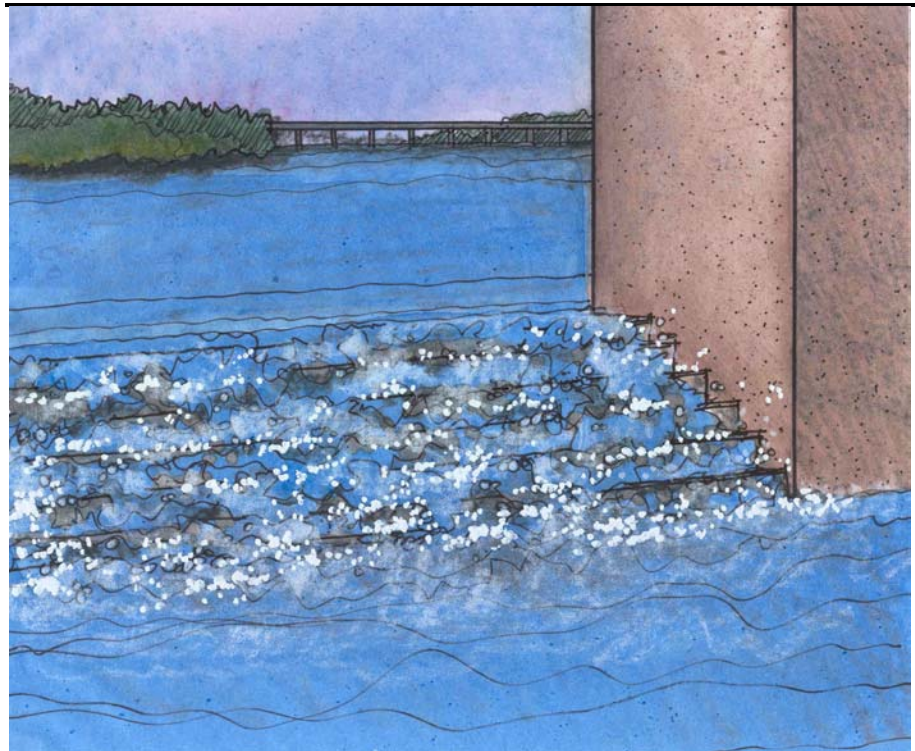
Conceptual section of a reinforced concrete ogee weir



Infuser weir at Chatuge Dam
Tennessee Valley Authority



Infuser weir at Chatuge Dam
Tennessee Valley Authority



Conceptual sketch of water riffling over a cascade weir section



Labyrinth weir at South Holston Dam
Tennessee Valley Authority



Close up of labyrinth weir at South
Holston Dam

One alternative for the design of the low water dam would be to construct the weir sections that lie between the gates as reinforced ogee weir sections. This would be the most hydraulically efficient alternative. Another alternative would be to also incorporate stepped-cascade, labyrinth, or infuser weir sections along the low water dam to improve aeration and aesthetics. The placement of these weir types could be varied; however, to remain consistent with the dam height and pool length described in this conceptual plan there would be limitations on the length of each alternative weir section and the total number of alternative weir sections used. Substituting weirs other than ogee in the low water dam would likely result in a shorter dam and smaller river lake.

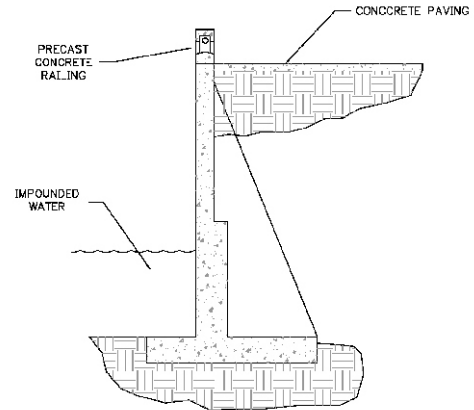
Cascade weir sections could be easily incorporated into the center of an ogee weir section, or used on either side of a gate section. Use of cascade weirs in the low water dam could help to re-oxygenate the water as it passes over the stair stepped structure and potentially improve the dissolved oxygen levels below the dam. These structures could also provide additional visual and auditory aesthetic appeal to the low water dam. The maximum length of each cascade weir section would likely be limited to approximately 50 feet, and the total number of these sections throughout the

dam should be limited to eight to avoid potential detrimental hydraulic impacts. It may not be hydraulically feasible to consider using only cascade, labyrinth, or infuser weir sections in the low water dam. Sedimentation, maintenance, and safety issues would also need to be evaluated for alternative weir types.

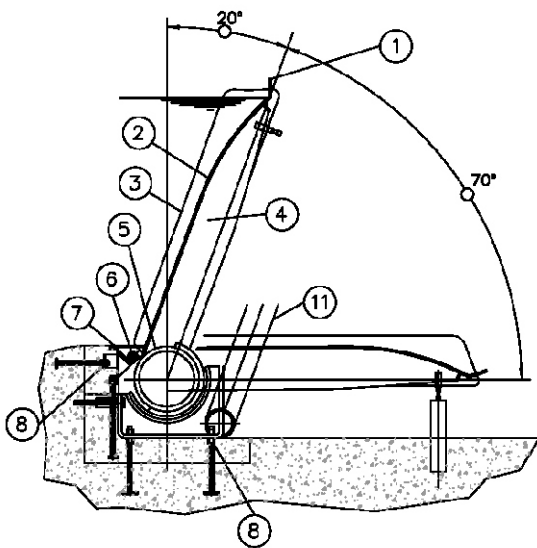


Example of a small stepped cascade weir on a drainage channel that flows into Mingo Creek in Tulsa,

The low water dam is proposed to have three sets of bascule gates across the crest of the dam. These could be either sets of four 45-foot long gates, or sets of two 100-foot long gates. The 100-foot long gates are proposed for this conceptual plan. The proposed bottom of each gate is at Elevation (Elev.) 626.0 based on the best available data from the INCOG aerial topography and the new USACE's HEC RAS backwater model. The fixed ogee/cascade crest is proposed to be at Elev. 633.0 thus creating a seven-foot deep pool at the upstream face of the low water dam. This is the maximum height of dam that can be created at this location, based on the information available, without causing a rise in the water surface elevation. The recreational river lake that is created will reach approximately 4.8 river miles upstream to a point near the Shell Creek confluence with the Arkansas River. Figure 8.1-2 depicts the conceptual elevation of the proposed Sand Springs Main Street Low Water Dam.



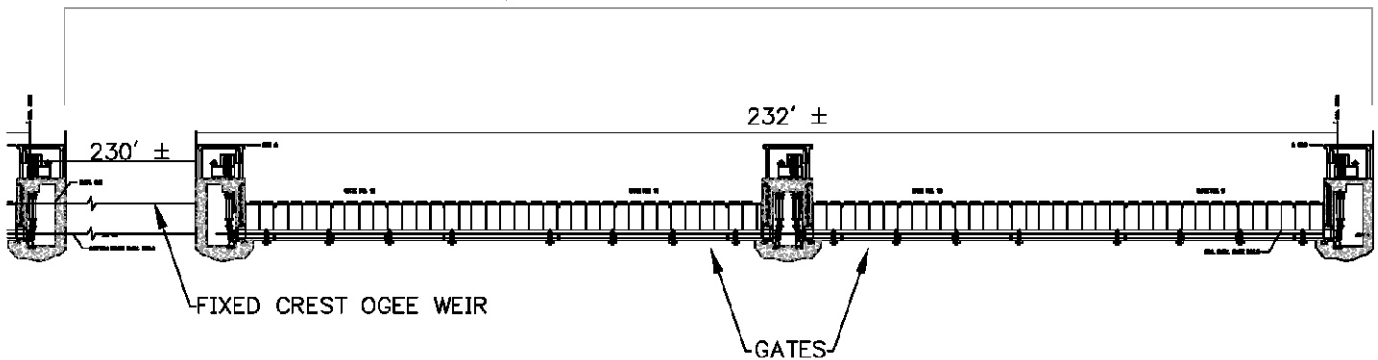
RETAINING WALL
RETAININGWALL CONCEPT



- | | |
|-----------------------------|--------------------------|
| 1. NAPP BREAKER | 9. ANCHOR BOLT |
| 2. UPSTREAM SKIN PLATE | 10. INTERMEDIATE BEARING |
| 3. END PLATE | 11. AIR ADMISSION PIPE |
| 4. GATE RIB | 12. PACKING BOX |
| 5. TORQUE TUBE | 13. FIELD JOINT RIB |
| 6. LONGITUDINAL RUBBER SEAL | 14. CYLINDER OPERATOR |
| 7. SEAL COVER PLATE | 15. LEVER |
| 8. SILL BEAM | 16. MAIN BEARING |

GATE CONCEPT

WEIR/GATE SECTIONS REPEATED 3 TIMES



SAND SPRINGS MAIN STREET LOW WATER DAM
CONCEPTUAL ELEVATION

FIGURE 8.1-2

Normal spring flows, high flows, and high SWPA hydropower generation releases would allow fish migration over the dam crest and/or through the fully-opened gates. The gates are proposed to be fully-opened during certain times of the year to allow for fish migration during spawning periods. The exact time and duration that would be required has yet to be determined.

Public safety is also a primary concern for the design and construction of a low water dam. Historical incidents with the former re-regulation dam on the Arkansas River and recent rescues below Zink Dam during high river flows have generated some public concerns. Subsurface currents created below the dams are often responsible for most accidents; however, engineering techniques can significantly improve public safety. Engineering solutions for low water dams have improved greatly over the years contributing to a greater degree of public safety associated with low water dams. Future designs for the Sand Springs Main Street Low Water Dam should include appropriate safety measures to create the safest possible structure.

The low water dam is required to be hydraulically designed to pass the Base Flood -100-Year or 1% Chance flood-without causing a rise in the upstream water surface elevation, in accordance with FEMA, City of Tulsa, USACE, and Tulsa County floodplain management criteria. The proposed low water dam meets these criteria within current standards of hydraulic design. The elevations and assumed dam heights to achieve these results are subject to change when further detailed studies are performed. It will be necessary to consider more detailed field survey data, geologic stratum, land ownership, and economic development opportunities on the banks of the Arkansas River.

8.1.5 CONCLUSIONS / RECOMMENDATIONS



River City Park

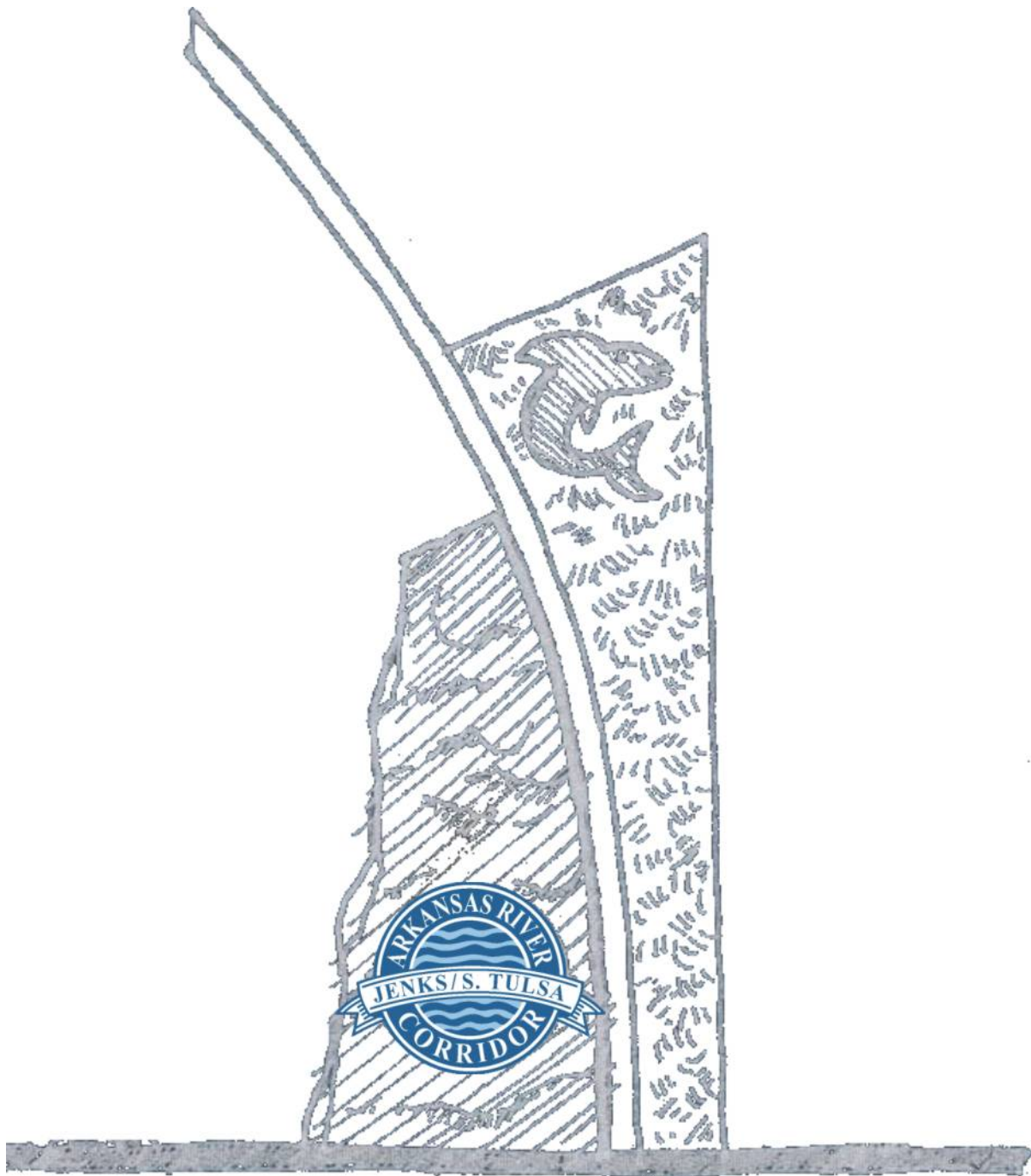
The Sand Springs area is embarking on a large-scale plan of commercial revitalization. The Sand Springs riverfront area has historically been underutilized and disconnected from the central core of the City. Creation of a low water dam would provide additional value to the aesthetics, natural resources, and revitalization efforts already underway in Sand Springs.

By providing recreational amenities, ecosystem restoration opportunities, and improved connectivity the proposed plan will provide Sand Springs with countless amenities to help complete the picture of a vibrant Sand Springs community. It is important to note that there will not be a year-round lake associated with this low water dam due to wildlife management constraints.

Several additional studies are recommended prior to, or in conjunction with, the design phase including:

- A study to determine the frequency and duration the gates should be fully opened for fish migration.
- A comparison of paddlefish and striped bass swim velocities to the velocities of water coming through the gates
- A detailed analysis of survey data, the geologic stratum, land ownership.
- An analysis to determine the ideal placement of fishing piers and boat ramps based upon downstream hydraulics of the low water dam

8.2 CREEK TURNPIKE LOW WATER DAM CONCEPTUAL PLAN



8.2 CREEK TURNPIKE LOW WATER DAM

8.2.1 BACKGROUND AND REQUIREMENTS



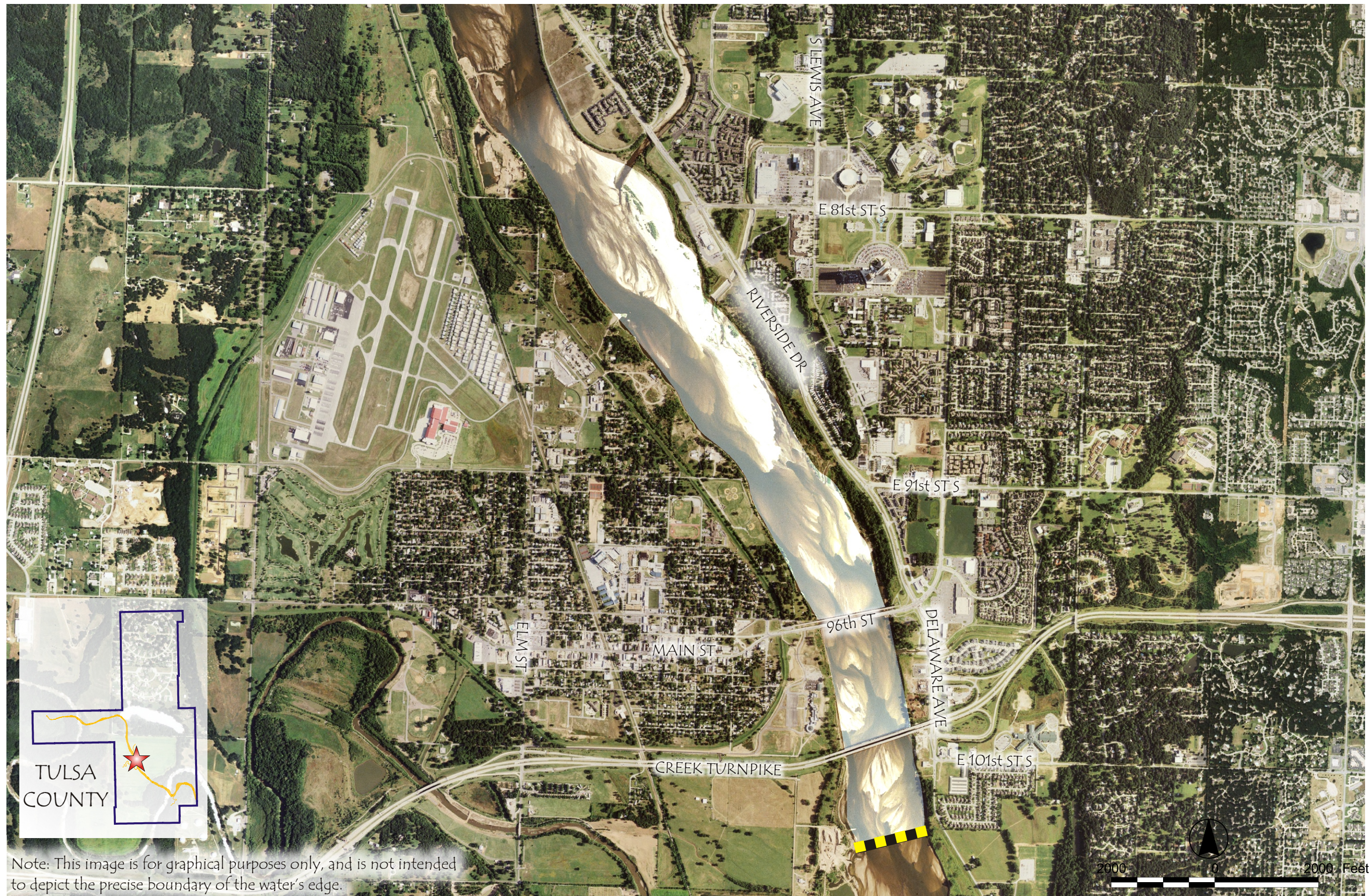
West Bank of Arkansas River adjacent to RiverWalk Crossing

The Jenks riverfront creates unique opportunities, due in large part to significant river-oriented developments that have been recently constructed or are underway. An area downstream of the Creek Turnpike has been identified as a preferred location for a low-water dam that will create a river lake and a great asset to new developments in the area. The planning area, low water dam location, and extent of the river lake are illustrated in Figure 8.2-1.

Vision 2025 includes partial funding for two low water dams in the project corridor. Based upon Phase II Master Plan analyses, the Creek Turnpike low water dam is recommended as one of the two initial locations for a low water dam. A key catalyst in the continued success of riverfront developments in the Jenks and South Tulsa areas could be a low water dam and river lake.

Exciting new developments have created a strong beginning of a retail and entertainment district that can connect to the proposed Muscogee Creek Nation Casino and restaurant/retail nodes on the east bank via water taxis.

A separate conceptual plan has been prepared for the planning area including the Creek Turnpike low water dam and riverfront. The Jenks/South Tulsa Riverfront plan addresses a potential development scenario based upon the presence of a low water dam. Many of the components in this plan are incorporated into the Jenks/South Tulsa Riverfront plan. This low water dam plan is intended to address the concept for the dam only. For conceptual graphics and renderings of the various amenities associated with the creation of the Creek Turnpike low water dam, please reference Section 8.7 of this report.



Note: This image is for graphical purposes only, and is not intended to depict the precise boundary of the water's edge.

CREEK TURNPIKE LOW WATER DAM CONCEPTUAL PLAN

FIGURE 8.2-1



8.2.2 DESCRIPTION OF PLAN AREA



Jenks Pedestrian Bridge

The proposed location for the low water dam is downstream of the 96th Street and Creek Turnpike Bridges and upstream of the Polecat Creek Confluence. These bridges would provide visual and vehicular access to the low water dam and lake area from both the east-bound and west-bound traffic on both bridges. A low water dam and river lake would enhance the new Oklahoma Aquarium, the RiverWalk Crossing Area, and the proposed Creek Nation Development. Other recent commercial developments include a Neighborhood Market, Kohl's, and a number of restaurants and shops on the Tulsa side of the River. New riverfront developments are also planned or under construction on the east bank between 96th Street and the Creek Turnpike. These developments include a recently opened Johnny Carino's restaurant and the proposed King's Landing. Tulsa's 96th Street Park is another nearby amenity.

There is also an existing sand and gravel operation downstream of this location on the west bank that could be incorporated into the operation and maintenance of the new lake.

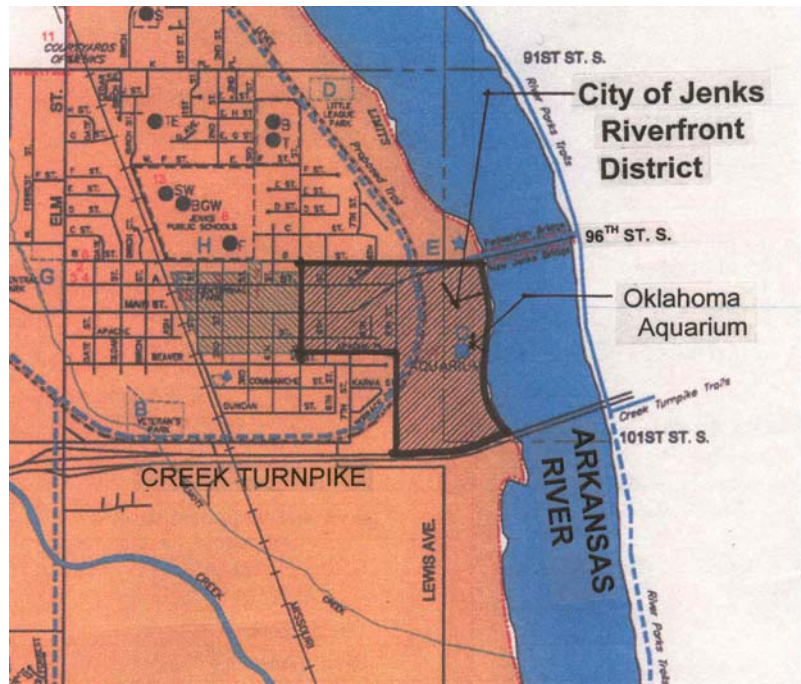


*RiverWalk Crossing under construction
(Photo courtesy of Tulsa World)*

8.2.3 DESIGN CRITERIA / LIMITATIONS

As defined in the Phase I Vision Plan, the primary focus for future development of the Jenks Riverfront is the creation of a retail/entertainment district. The Jenks/South Tulsa riverfront can benefit tremendously by the planned addition of a low water dam, to be located downstream of the Creek Turnpike Bridge and upstream of the Polecats Creek confluence with the Arkansas River.

The City of Jenks has established an appearance review district that provides guidance for future riverfront development. As shown below, the Riverfront District extends along the Jenks riverfront between 96th Street and the Creek Turnpike and encompasses the Oklahoma Aquarium campus and adjoining property to the west.



Jenks Riverfront District
(map source: INCOG)

The Riverfront District Guidelines provide design criteria for appearance/design, building materials, landscaping, fencing, signage, lighting, and outside storage/outbuildings, and may apply to dam appurtenances.

There are several other criteria and constraints that will need to be addressed in the design of the Jenks/South Tulsa riverfront planning area. These include:



Overhead Electrical Lines

- There are a number of major utility lines, pipelines, and easements that exist throughout the planning area. These include a large overhead electrical transmission line generally aligned with Lewis Avenue, that bisects the planning area with a north-south orientation. South of the Creek Turnpike, there are also several pipeline easements that cross the planning area.
- The low water dam and any riverfront planning must not impact flood damage reduction measures. The Polecat Creek confluence with the Arkansas River is also an important factor in the location of the proposed low water dam.
- A large sand and gravel mining operation is located south of the Jenks riverfront planning area. There may be opportunities for this operation to coordinate with long-term maintenance and sand removal associated with the low water dam and lake.
- Carefully planning for operation of the dam is a critical component to the success of fish populations in the area. It may be necessary to fully open the gates during fish spawning seasons to allow upstream fish migration. The frequency and duration for the gates to be opened is yet to be determined.
- Understanding the magnitude of velocities and flows will be critical in determining the size and species of fish that will be able to pass through the dam gate openings. This is also an important consideration in the proper design of two least tern habitat islands that will be created in the pool.
- The low water dam should include a pedestrian bridge and fishing piers.
- A boat ramp should be included downstream of the dam for public use and fish harvesting.
- This project will be subject to local, state, and Federal laws. Prior to implementation, a detailed NEPA analysis will be conducted to address potential impacts to environmental resources.

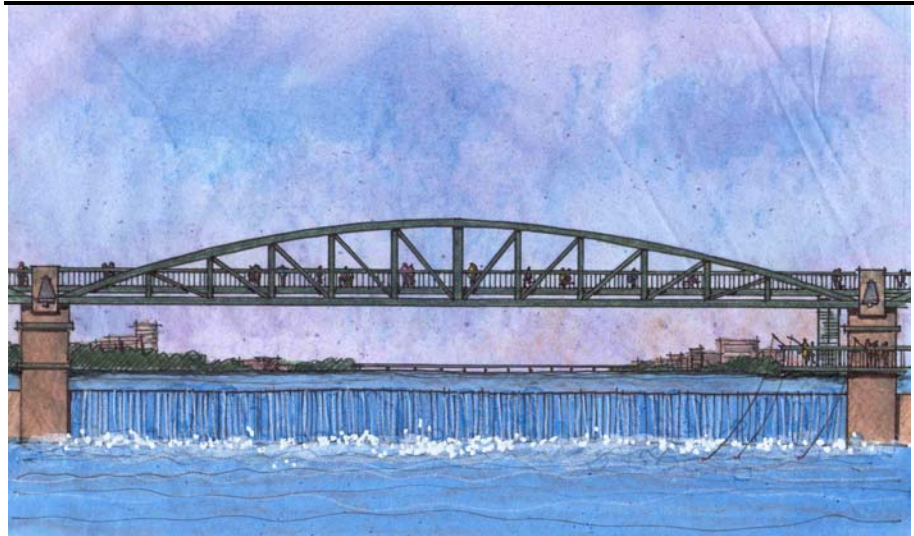
8.2.4 LOW WATER DAM CONCEPT

The general concept for the Creek Turnpike Low Water Dam is to provide multiple sets of bascule gates across the entire crest of the dam. The crest of the dam would alternate between gate sections and weir sections. With this concept, the possibility of storing significant sediments, sands, and gravels on the upstream side of the low water dam is reduced. Each gate, or set of gates, would require a hydraulic operator at each end. These hydraulic operators would be housed in "towers" adjacent to each gate or fixed weir along the crest of the dam. The "towers" would also provide structural support for the pedestrian/maintenance walkway proposed to be constructed above each of the low water dams. The pedestrian/maintenance walkway would connect the west and east banks of the Arkansas River in the Jenks/South Tulsa area, and provide accessibility for maintenance of the gates and hydraulic equipment.

The following conceptual graphics represent two possible engineering concepts for the pedestrian bridge. Concepts for a cable-stayed option and a truss option are depicted. The sketches represent a typical section of the pedestrian bridge spanning the "towers" and repeating over the entire length of the dam. A grade-separated fishing pier is also depicted in the sketches; however, the optimal design and location of the fishing piers will need to be determined following a detailed analysis of downstream hydraulics and habitat.

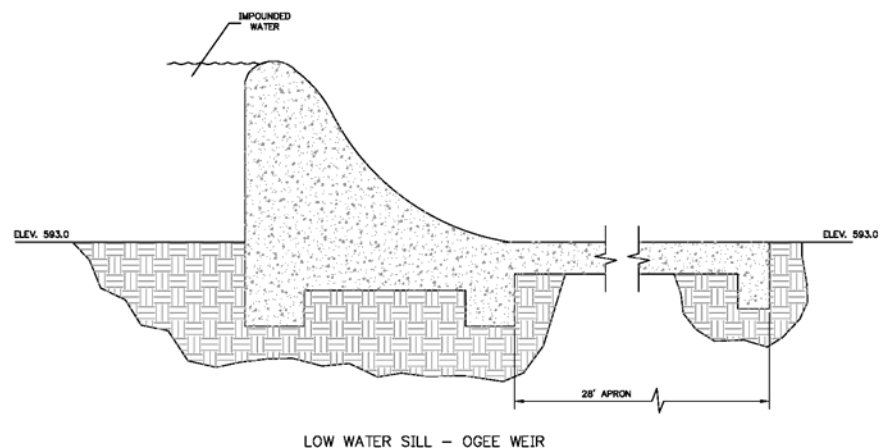


Concept for a cable-stayed pedestrian/maintenance bridge



Concept for a truss pedestrian/maintenance bridge

The main structure of the low water dam is proposed to be a series of reinforced concrete weir sections, each with a fixed crest elevation. Ogee weirs were used for modeling purposes; however, other types such as stepped cascade, labyrinth, and infuser weirs may be possible upon further analysis. The weir structures would provide the support for the gates and provide uncontrolled spillway capacity to pass Arkansas River flows. It is proposed to create a hydraulically efficient pier nose and tail at each "tower" location.



Conceptual section of a reinforced concrete ogee weir



Infuser weir at Chatuge Dam
Tennessee Valley Authority



Infuser weir at Chatuge Dam
Tennessee Valley Authority



Conceptual sketch of water riffling over a cascade weir section



Labyrinth weir at South Holston Dam
Tennessee Valley Authority



Close up of labyrinth weir at South
Holston Dam

One alternative for the design of the low water dam would be to construct the weir sections that lie between the gates as reinforced ogee weir sections. This would be the most hydraulically efficient alternative. Another alternative would be to also incorporate stepped-cascade, labyrinth, or infuser weir sections along the low water dam to improve aeration and aesthetics. The placement of these weir types could be varied; however, to remain consistent with the dam height and pool length described in this conceptual plan there would be limitations on the length of each alternative weir section and the total number of alternative weir sections used. Substituting weirs other than ogee in the low water dam would likely result in a shorter dam and smaller river lake.

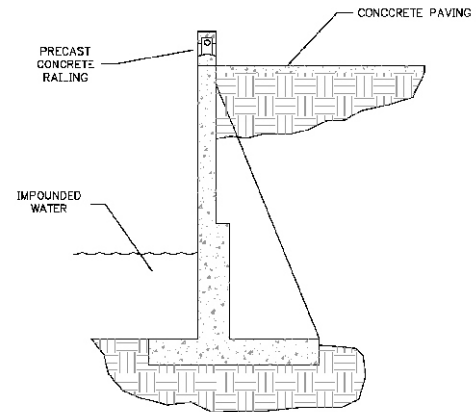
Cascade weir sections could be easily incorporated into the center of an ogee weir section, or used on either side of a gate section. Use of cascade weirs in the low water dam could help to re-oxygenate the water as it passes over the stair stepped structure and potentially improve the dissolved oxygen levels below the dam. These structures could also provide additional visual and auditory aesthetic appeal to the low water dam. The maximum length of each cascade weir section would likely be limited to approximately 50 feet, and the total number of these sections throughout the

dam should be limited to eight to avoid potential detrimental hydraulic impacts. It may not be hydraulically feasible to consider using only cascade, labyrinth, or infuser weir sections in the low water dam. Sedimentation, maintenance, and safety issues would also need to be evaluated for alternative weir types.

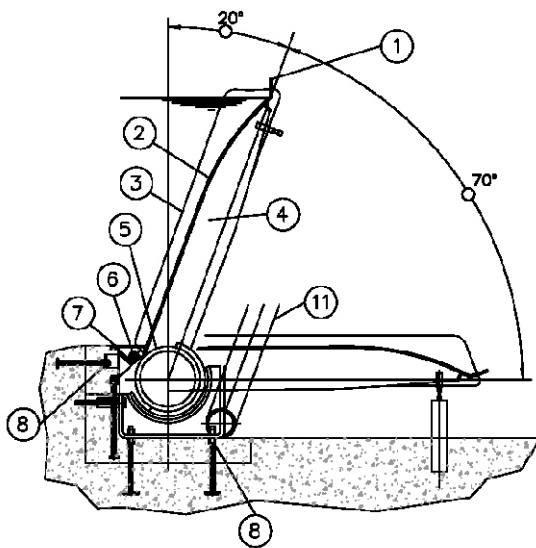


Example of a small stepped cascade weir on a drainage channel that flows into Mingo Creek in Tulsa

The low water dam is proposed to have three sets of bascule gates across the crest of the dam. These could be either sets of four 45-foot long gates, or sets of two 100-foot long gates. The 100-foot long gates are proposed for this conceptual plan. The proposed bottom of each gate is at Elev. 588.0 based on the best available data from the INCOG aerial topography and the new USACE's HEC RAS backwater model. The fixed ogee/cascade crest is proposed to be at Elev. 596.0 thus creating an eight-foot deep pool at the upstream face of the low water dam. This is the maximum height of dam that can be created at this location, based on the information available, without causing a rise in the water surface elevation. The recreational river that is created will reach approximately 2.9 river miles upstream to approximately 3,100 feet downstream of the 71st Street Bridge over the Arkansas River and downstream of the effluent discharge location from the City of Tulsa Southside Wastewater Treatment Plant. Figure 8.2-2 depicts the conceptual elevation of the Creek Turnpike Low Water Dam.



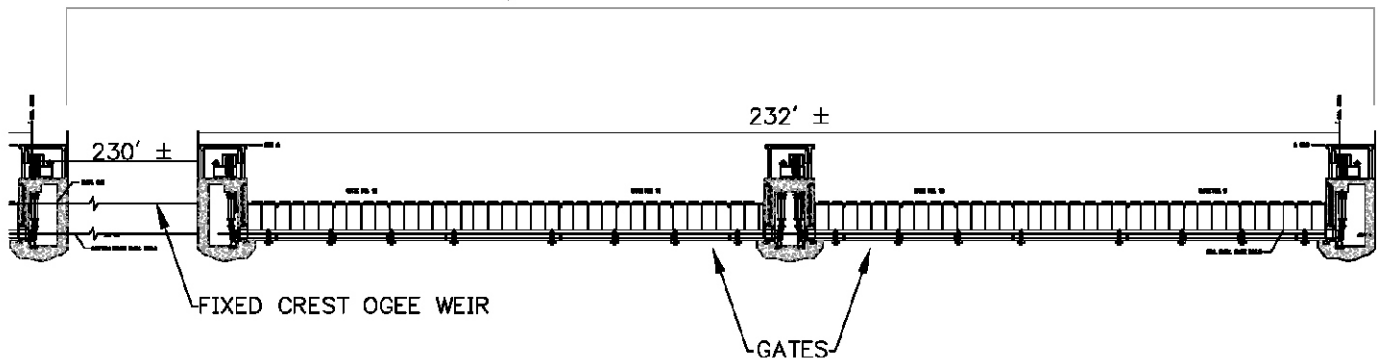
RETAINING WALL
RETAININGWALL CONCEPT



- | | |
|-----------------------------|--------------------------|
| 1. NAPP BREAKER | 9. ANCHOR BOLT |
| 2. UPSTREAM SKIN PLATE | 10. INTERMEDIATE BEARING |
| 3. END PLATE | 11. AIR ADMISSION PIPE |
| 4. GATE RIB | 12. PACKING BOX |
| 5. TORQUE TUBE | 13. FIELD JOINT RIB |
| 6. LONGITUDINAL RUBBER SEAL | 14. CYLINDER OPERATOR |
| 7. SEAL COVER PLATE | 15. LEVER |
| 8. SILL BEAM | 16. MAIN BEARING |

GATE CONCEPT

WEIR/GATE SECTIONS REPEATED 3 TIMES



CREEK TURNPIKE LOW WATER DAM
CONCEPTUAL ELEVATION

FIGURE 8.2-2

Normal spring flows, high flows, and high SWPA hydropower generation releases would allow fish migration over the dam crest and/or through the fully-opened gates. The gates are proposed to be fully-opened during certain times of the year to allow for fish migration during spawning periods. The exact frequency and duration that would be required has yet to be determined.

Public safety is also a primary concern for the design and construction of a low water dam. Historical incidents with the former re-regulation dam on the Arkansas River and recent rescues below Zink Dam during high river flows have generated some public concerns. Subsurface currents created below the dams are often responsible for most accidents; however, engineering techniques can significantly improve public safety. Engineering solutions for low water dams have improved greatly over the years contributing to a greater degree of public safety associated with low water dams. Future designs for the Creek Turnpike Low Water Dam should include appropriate safety measures to create the safest possible structure.

The low water dam is required to be hydraulically designed to pass the Base Flood-100-Year or 1% Chance flood-without causing a rise in the upstream water surface elevation, in accordance with FEMA, City of Tulsa, U.S. Army Corps of Engineers, and Tulsa County floodplain management criteria. The proposed low water dam meets these criteria within current standards of hydraulic design. The elevations and assumed dam heights to achieve these results are subject to change when further detailed studies are performed. It will be necessary to consider more detailed field survey data, geologic stratum, land ownership, and economic development opportunities on the banks of the Arkansas River.

8.2.5 CONCLUSIONS / RECOMMENDATIONS



RiverWalk Crossing (photo courtesy of the Tulsa World)

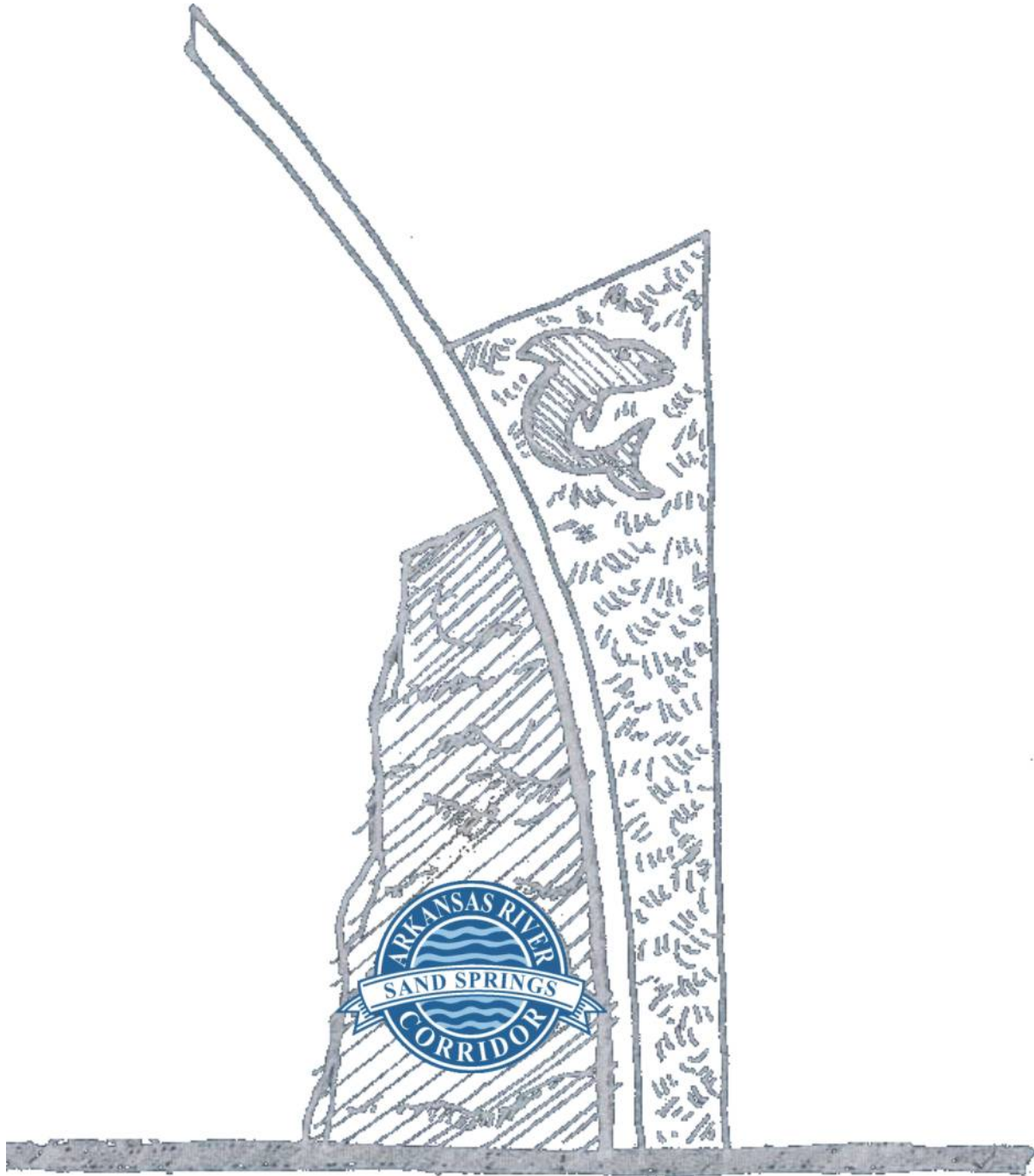
The Jenks/South Tulsa riverfront has nearly unlimited potential for development of a dynamic riverfront entertainment district. There is already a tremendous amount of momentum that has been generated by the Oklahoma Aquarium, RiverWalk Crossing, the proposed King's Landing, and other recent commercial development on the east bank. These attractions will anchor the riverfront and can stimulate new river-oriented development. The planned construction of a new low water dam will create a permanent lake, bringing aesthetic benefits and a greater connection to entertainment uses on the east bank.

There are also a number of issues that will require careful planning and coordination. Flood control will continue to be an important component for all new developments, as well as coordination with the Watkins Sand operation to maximize their operations adjacent to the planned low water dam. Site planning must also accommodate the large power lines and pipeline easements that cross many site areas.

Several additional studies are recommended prior to, or in conjunction with, the design phase including:

- A study to determine the frequency and duration the gates should be fully opened for fish migration.
- A comparison of paddlefish and striped bass swim velocities to the velocities of water coming through the gates
- A detailed analysis of survey data, the geologic stratum, land ownership.
- An analysis to determine the ideal placement of fishing piers and boat ramps based upon downstream hydraulics of the low water dam

8.3 SAND SPRINGS RIVERFRONT CONCEPTUAL PLAN



8.3 SAND SPRINGS RIVERFRONT CONCEPTUAL PLAN

8.3.1 BACKGROUND AND REQUIREMENTS



Main Street Industrial Area



Keystone Corridor Redevelopment Area

The central core in Sand Springs, designated as the Keystone Corridor, is the backdrop for proposed riverfront development. The Keystone Corridor area contains three sub-areas of approximately 94.2 total acres as shown in the graphic below. The existing uses include the southern portion of the Sand Springs Central Business District, a predominantly declining residential area with mixed commercial uses, churches, vacant lots, a kindergarten center, and an industrial area. The industrial area has large buildings, some of which are in use, and others which are vacant with little opportunity for re-use in their present state. Many of the residential areas are suffering from blight and neglect. Prior to the passage of the Vision 2025 initiative, the proposed urban redevelopment projects in the Sand Springs core were delayed due to a lack of necessary public support and financial resources.

According to the Sand Springs Keystone Corridor Redevelopment Plan: 2025, "In its present condition the Corridor Plan area gives



Sand Springs Keystone Corridor Planning Area (map prepared by INCOG)

the approximately 40,000 motorists a day on the Expressway a less than positive image of the City, while the unique and strategic location of the 94.2 acre Corridor area offers the city an opportunity for redevelopment to create a point of destination for retail and commercial services to the citizens of Sand Springs and the surrounding area.”

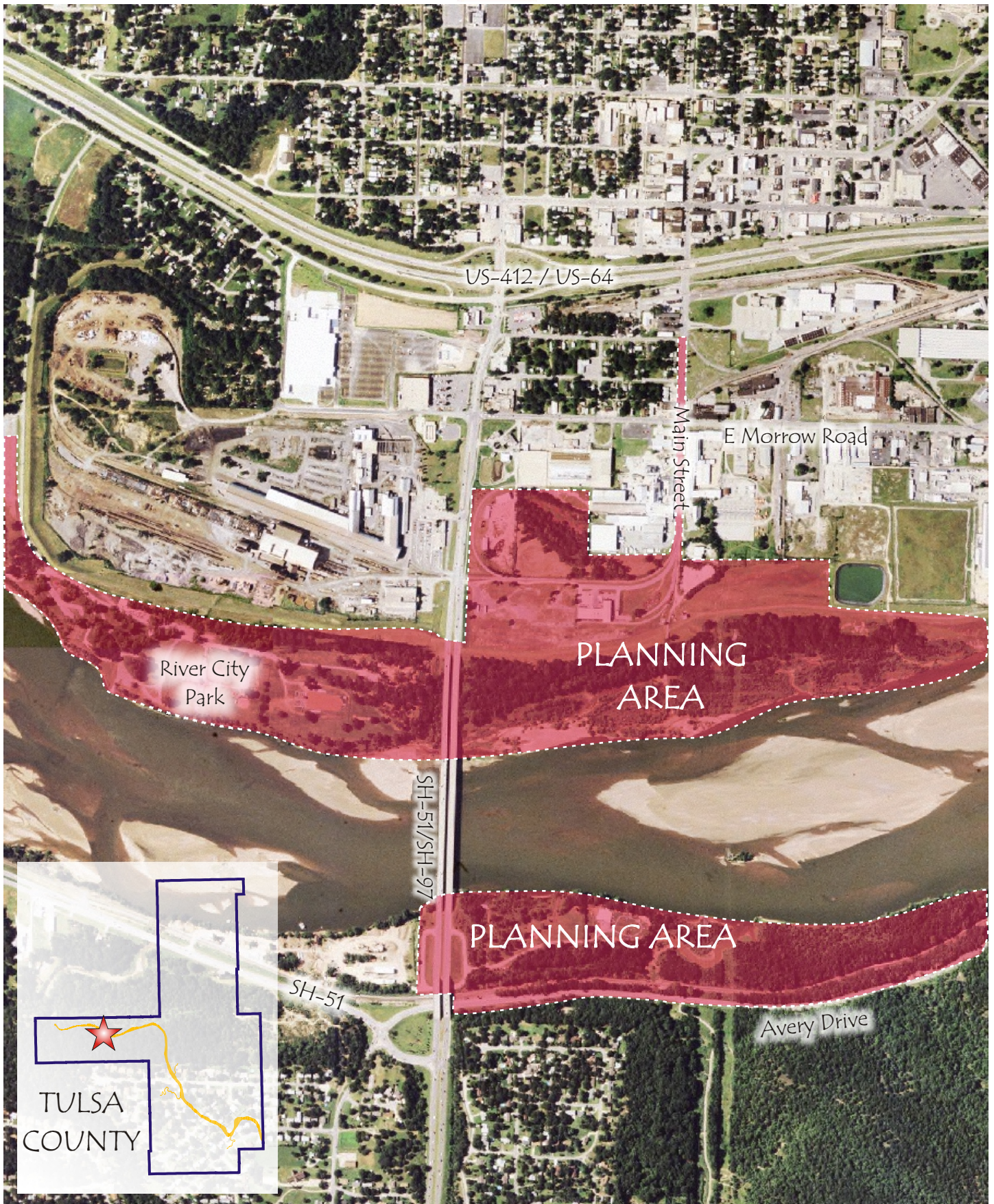


Keystone Corridor Redevelopment Area

In the Vision 2025 proposal development process, the citizens of Sand Springs chose the Keystone Corridor as their priority for redevelopment. The main goals of the redevelopment plan are to create a destination retail and commercial services district, improve the appearance of the City, and increase sales and property tax bases. The study for commercial and streetscape redevelopment is included in the Sand Springs Keystone Corridor Redevelopment Plan: 2025 currently being developed.

The planning area for the Sand Springs riverfront is shown on the following page in Figure 8.3-1. The riverfront development plan included in this study proposes an open space and recreational element which will complement the future commercial growth in the district, by providing previously undeveloped links to the Arkansas River, new riverfront uses in conjunction with a low water dam and lake, and additional trail links to the regional trail system. The Phase 1 Vision Plan proposed the extension of Main Street south to provide a connection to the Arkansas River, and also recommended the preservation of Avery Drive’s scenic character on the south side of the river.

One of the most important aspects of planning for the Sand Springs riverfront is the potential for a low water dam that creates a seasonal lake effect in the Arkansas River. The Phase I Vision Plan addressed the potential for a low water dam to be located downstream of the Highway 97 bridge. This dam has been prioritized as a Tier 1, location or near-term development.



SAND SPRINGS RIVERFRONT SITE LOCATION MAP

FIGURE 8.3-1



8.3.2 DESCRIPTION OF PLAN AREA



Industrial uses in the Sand Springs riverfront area

The planning area for the Sand Springs riverfront development primarily consists of land between Highway 97 and areas three quarters of a mile to the east, on both the north and south banks of the Arkansas River. The length of river frontage included in the study is approximately one mile. The northern boundary of the planning area is Morrow Road. The southern boundary is Avery Drive, which parallels the south bank of the River. Main Street is also a focus for the study as a critical connection between downtown Sand Springs and the River.

Highway 97 (S. Wilson Ave.), along the western edge of the study area, is a north-south highway connecting Sand Springs neighborhoods on both sides of the Arkansas River. This arterial also provides a connection to the City of Sapulpa and to I-44/Turner Turnpike approximately 10 miles south. The Sand Springs Expressway (US Highway 64 / 412 / SH51) serves as an east-west highway less than one-quarter mile to the north of Morrow Road. South Main Street bisects the study area as a north-south road that connects to downtown, which is immediately north of the underpass below the Sand Springs Expressway. South of the River, Avery Drive provides a scenic connection to the east that links with 21st Street into Tulsa.



Sand Springs historic downtown, located on the north side of the Sand Springs Expressway, currently has no significant connection with the Arkansas River.

The transportation network that serves the Sand Springs riverfront area will be further enhanced by the future completion of the Gilcrease Expressway, which will run north-south 3.5 miles to the east of Highway 97.



Industrial uses on S. Main Street.

The existing uses in the Sand Springs riverfront area are varied, with many vacant properties in decline. Industrial uses occupy the majority of the riverfront planning area, including viable business as well as older structures that are neglected or vacant. Rail spurs are also located throughout the area to serve the industries, including the expansive Sheffield Steel Mill to the west of Highway 97. The industrial character of South Main Street limits use of this street as a linkage from downtown to the River. Recent retail and commercial development northwest of the study area along Highway 97 has proven to be successful, as well as new commercial development to the east of the study area.



Intersection of Morrow Road / S. Main Street (view looking north)



Active rail spurs along portions of Main Street will create a challenge to transforming the street into an attractive, pedestrian-friendly boulevard.



River City Park

South of the industrial uses in the Sand Springs riverfront area, a levee is located approximately one eighth mile north of the Arkansas River. The area south of the levee consists of scenic woods that create a natural habitat for wildlife. River City Park, a large park along the River, west of the study site, is a large-scale regional park with diverse uses such as rodeo grounds, BMX bike courses, softball fields, and large picnic and play areas. The park hosts a large 4th of July celebration every year, as well as car shows and other seasonal outdoor events.

8.3.3 DESIGN CRITERIA / LIMITATIONS



View toward Arkansas River from Proposed Main Street Terminus

As defined in the Sand Springs Keystone Corridor Redevelopment Plan: 2025, the primary goals for the redevelopment of the Keystone Corridor are to provide a destination for retail and commercial services, and to improve the appearance of the City. As the commercial development proposed by the Keystone Corridor plan is established and begins to bring in more people to the area, the proposed riverfront development plan will help provide the needed recreational opportunities and aesthetic improvement to the area.

There are several other criteria and constraints that will need to be considered in the design of the Sand Springs riverfront area, as outlined below:



River City Park Auto Access

- Visual and automobile access to the Arkansas River is restricted from the Keystone Corridor redevelopment area due to the location and height of the flood control levee.
- Riverfront planning areas must be developed in accordance with all flood control guidelines and must be consistent with regulations for the existing levee on the north side of the River.
- River City Park provides a great opportunity to bring recreational users to new lake activities that are created by the proposed low water dam.
- The wooded areas along both the north and south banks of the River provide an opportunity for nature trails, bird watching areas, and riparian habitat restoration.
- A sand and gravel operation is located on the south side of the river, just west of the Highway 97 Bridge. The activity level of the operation has declined in the recent years, since the available volume of sand and gravel has diminished in this reach of the River. There may be opportunities for this operation to coordinate with long-term maintenance and sand removal associated with the low water dam and lake.



Wooded Area between Flood Control Levee and Arkansas River at the South end of Main Street

8.3.4 AREA / SITE PLAN



State Highway 97 Bridge /
Arkansas River



River City Park



Downtown Sand Springs

The proposed conceptual plan for the Sand Springs riverfront area is illustrated in Figures 8.3-2 and 8.3-3. The key to the new riverfront development is the proposed low water dam which is planned to be constructed approximately 1,700 feet (ft.) downstream of the Highway 97 Bridge. The proposed low water dam will create a pool with a seven-foot depth at the upstream face of the low water dam. The recreational lake that is created by the dam will reach approximately 4.8 river miles upstream to a point near the Shell Creek confluence with the Arkansas River. With a constant pool in the River at certain times of the year, water activities such as boating and fishing can take place in the area. One of the main features proposed in the concept plan is a new marina and boat launch proposed near the south end of Main Street. The proposed marina will serve as a focus for new water related recreational activities. Automobile and trailer parking are provided adjacent to the marina, with automobile traffic gaining access through an extension of Main Street across the levee and through River City Park under the Highway 97 Bridge. The addition of this marina and opportunities for water recreation will complement the diverse activities that are already available in River City Park.

As proposed in the Sand Springs Keystone Corridor Redevelopment Plan: 2025, Main Street will become an important link throughout the commercial district. The plan proposes a boulevard style Main Street with raised medians and wide sidewalks on both sides, as well as landscaping and sitting areas for pedestrians. As illustrated in Figure 8.3-2, the limited visibility and vehicular access between downtown Sand Springs and the River will be improved by extending Main Street as a boulevard to a traffic circle immediately north of the levee. Currently, the levee and native trees restrict views south toward the River from Main Street. The proposed traffic circle should be designed to help identify the access to the River; an architectural feature is proposed to create a highly visible gateway element. This new boulevard will also extend west to connect to State Highway 97, which improves access to the parcel between this street and the levee



SAND SPRINGS RIVERFRONT CONCEPT PLAN

FIGURE 8.3-2



SAND SPRINGS RIVERFRONT CONCEPT SKETCH

FIGURE 8.3-3



Industrial Area east of State Highway 97

With the major changes in land use proposed by the Keystone Corridor development plan, and the substantial investment in the low water dam, lake, and the associated recreational developments, the area south of Morrow Road and north of the flood control levee presents a potential zone for diverse market driven redevelopment. A major proposal for the Sand Springs riverfront plan is a large mixed-use redevelopment, located north of the levee as shown in Figures 8.3-2 and 8.3-3. This new development takes advantage of views to the new lake and nearby recreational opportunities. The proposed development integrates parking on the lowest level, with riverfront retail/restaurants on the next level—at the levee elevation or higher. The upper floors of this new development are planned to accommodate residential uses with scenic views overlooking the River and lake. An elevated boardwalk is proposed to allow for the existing levee to remain in its current location. Additional redevelopment opportunities include adaptive re-use of existing industrial buildings where appropriate, such as re-using industrial buildings for large indoor family entertainment centers, or completely rebuilding as a commercial or mixed use in areas where the industrial buildings cannot be re-used.

A proposed relocation of a segment of the Katy trail follows Main Street from the Keystone Expressway frontage area south to the new riverfront development. This shift in trail alignment will create a safer and more scenic route by jogging around the large-scale commercial developments that are planned between Morrow Road and the Sand Springs Expressway. The trail then heads west along the north bank of the Arkansas River through River City Park to eventually continue west along the expressway frontage. Heading east from the proposed riverfront development, the trail will link with another trail loop at Friendship Creek.

Additional proposed trail development includes a nature trail in the wooded area just east of the proposed low water dam on the north bank. This particular trail area provides an extension of recreational activities on the north bank area eastward from the proposed marina. On the south side of the river, a proposed nature trail, parking, and trailhead provide additional access to the existing wooded areas. Occasional river overlook areas are integrated to allow resting areas and locations for watching lake activities and wildlife. These nature trail areas are also potential sites for streamside habitat restoration and enhancement.

As illustrated in Figure 8.3-2, Avery Drive represents the south edge of the planning area for the Sand Springs riverfront. Avery Drive is an important roadway corridor along the south edge of the Arkansas River, connecting Tulsa with Sand Springs and providing access to Chandler Park. As recommended in the Phase I Vision Plan, Avery Drive should be designated as a scenic parkway, with an overlay district established to preserve the natural character of this roadway. To create a stronger visual connection to the River, it may also be possible to selectively “limb up” trees at key locations in the wooded areas north of Avery Drive. Another key proposal for Avery Drive is the creation of a protected bikeway along this corridor, either as a bike lane or separate trail that parallels the railroad tracks to the north.

An additional pedestrian/bike path is proposed on the Highway 97 Bridge, with river overlooks planned for both sides. The river overlooks can provide a place for fishing, viewing of river activities, and resting. The bridge overlooks also provide an opportunity for location of architectural identity features for Sand Springs. Downstream of the Highway 97 Bridge, the new low water dam is proposed to accommodate a pedestrian bridge that can further connect the riverfront areas on the north and south banks.



A new low water dam is proposed for construction east of the Highway 97 Bridge. The lake that will be created can be an excellent amenity in the new Sand Springs riverfront.

8.3.5 CONCLUSIONS / RECOMMENDATIONS



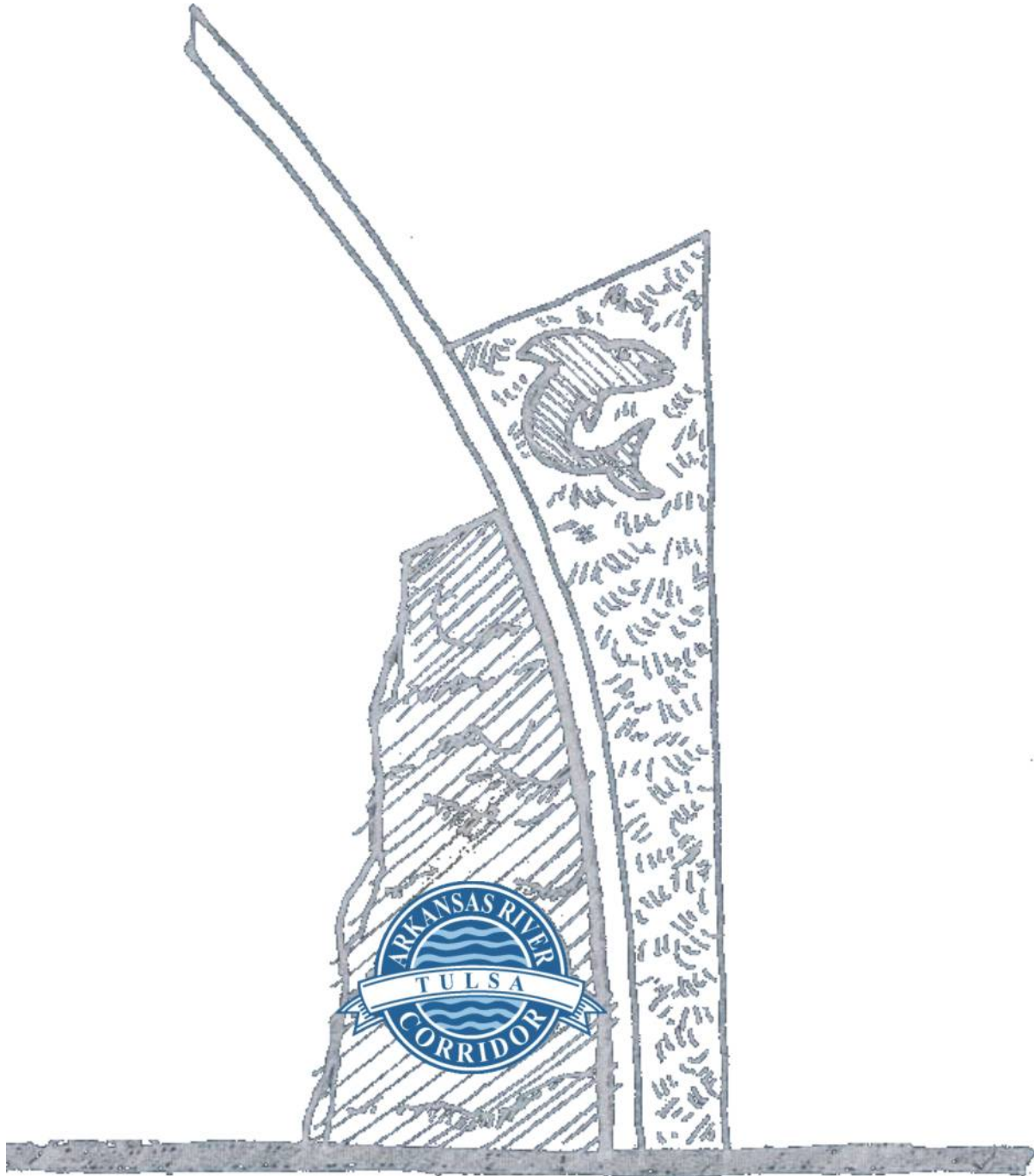
River City Park

The Sand Springs area is embarking on a large-scale plan of commercial revitalization. The Sand Springs riverfront area has historically been underutilized and disconnected from the central core of the City. Development efforts that bring large numbers of people into an area also bring with them the need for open space and recreational opportunity. The proposed riverfront development helps to provide the area with recreational and open space activities close to the redevelopment area, and provide a link between the new commercial area and the existing park space at River City Park. By allowing accessibility to the wooded riverside areas through development of nature trails, the proposed plan balances active recreational access to the River with preservation and enhancement of natural habitat. With a revitalized core, the proposed riverfront recreational activities will complete the picture of a vibrant Sand Springs community.



The proposed master plan will provide a strong connection between the Arkansas River and downtown Sand Springs.

8.4 ZINK LAKE RIVERFRONT CONCEPTUAL PLAN



8.4 ZINK LAKE RIVERFRONT

8.4.1 BACKGROUND AND REQUIREMENTS



East bank of Arkansas River



Pedestrian area on east river bank



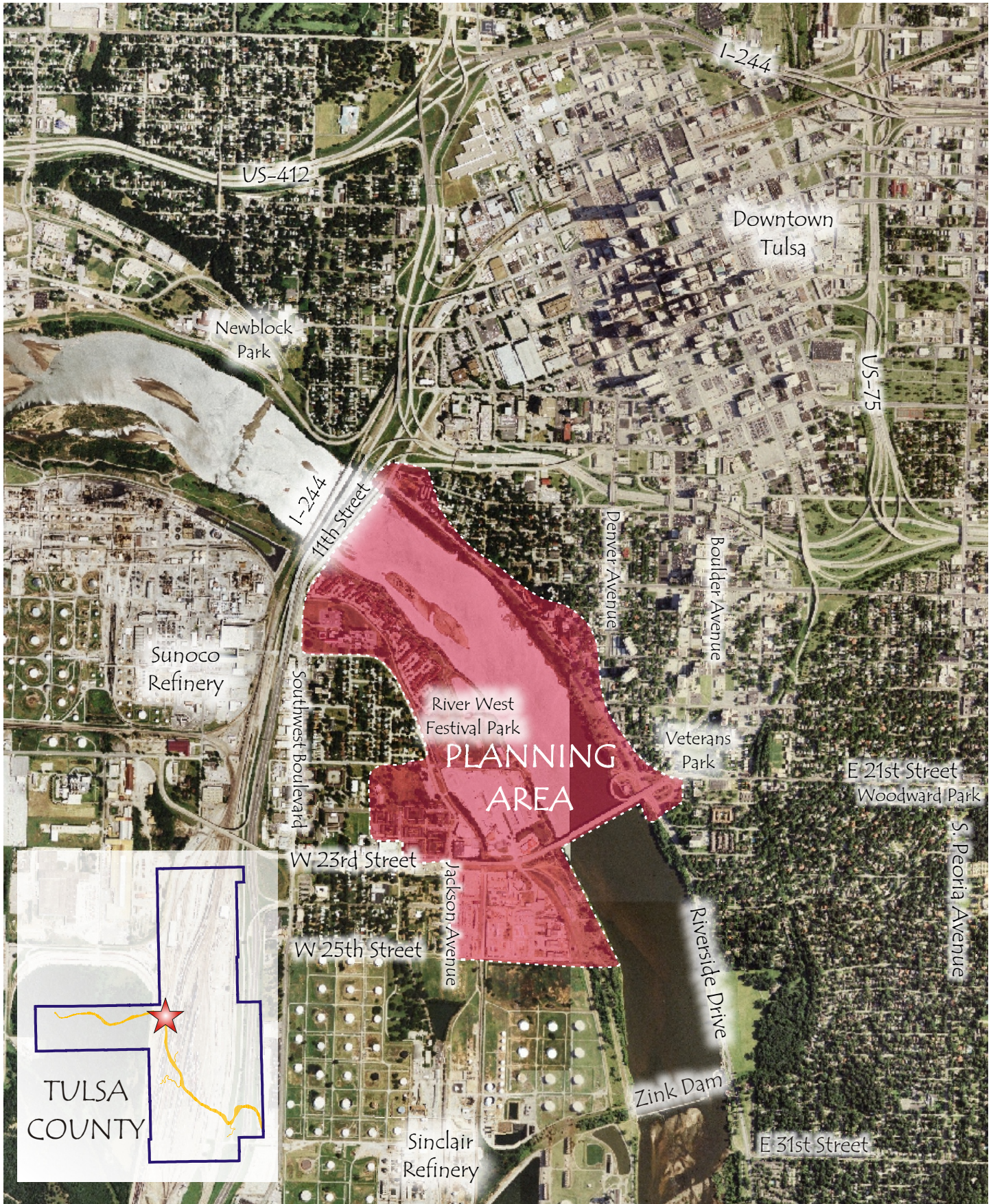
Riparian habitat on Arkansas River bank

In close proximity to downtown, Tulsa has a unique opportunity to create a dynamic riverfront district in the Zink Lake section of the Arkansas River. The Zink Dam, located near 31st Street, creates a continual river lake in the Arkansas River that extends upstream beyond the Route 66/11th Street Bridges. Zink Lake provides a scenic waterway that enhances the adjacent east and west riverbank areas.

As illustrated in Figure 8.4-1, the planning area for the Zink Lake riverfront addresses the northern end of the lake. On the east side of the Arkansas River, the planning area is between 21st Street and 11th Street, encompassing the open space between the River and Riverside Drive. Several redevelopment sites on the east side of Riverside Drive are also included in the master plan. On the west bank, the study area is generally bounded by 25th Street to the south; Jackson Avenue to the west; and 11th Street to the north. A major goal of the riverfront plan is to enhance physical and visual connections between the east and west banks. The Phase I Vision Plan for the Arkansas River identified the Zink Lake area as a key development zone. Specific improvements proposed for the east bank include mixed-use developments; an expanded café and entertainment area, new Riverside Drive gateways at Denver and Boulder Avenues; and enhancement of the 21st Street and Route 66 11th Street Bridges. For the west bank, proposed improvements include an expanded festival park; a potential minor league baseball stadium; and the creation of Riverside Drive West as a new boulevard.



The Zink Lake area of Tulsa's riverfront presents a great opportunity to connect the east and west riverbanks to create a cohesive, vibrant district.



ZINK LAKE RIVERFRONT SITE LOCATION MAP

FIGURE 8.4-1



8.4.2 DESCRIPTION OF PLAN AREA



*University Club Tower /
Arkansas River*

As shown on Figure 8.4-1, the planning area for the Zink Lake riverfront encompasses large areas of the west and east River banks in the heart of Tulsa. There is no area of the Arkansas River that is in closer proximity to downtown Tulsa. This proximity presents unparalleled opportunities for developing a riverfront district that enhances Tulsa's central business district. The Inner Dispersal Loop (IDL) highway network that defines the perimeter of downtown Tulsa creates a challenge to physical and visual connections to the Arkansas River.



*Southwest Blvd. / connection
to downtown Tulsa*



Opportunities to connect downtown with a dynamic riverfront district will become even more important with the planned construction of a downtown arena and major renovation to convention center facilities.



*Westport on the River
Apartment Homes*

The west side of the Arkansas River currently accommodates a wide variety of land uses. The Westport on the River Apartments, located between the River and Jackson Avenue, provide excellent views across the Arkansas River to downtown Tulsa. This housing is well maintained and benefits from excellent proximity to downtown and the River Parks trails. West of this complex and north of 17th Street, the Oklahoma State University (OSU) College of Osteopathic Medicine is located on approximately 14 acres. This large facility serves as a major institutional anchor for the north end of the Zink Lake area.



*OSU College of Osteopathic
Medicine (17th Street /
Southwest Boulevard)*

South of the Westport Apartments and east of Jackson Avenue, a 16-acre open space accommodates festivals and events. This well used area, under the jurisdiction of the Tulsa River Parks Authority, generally consists of a flexible open space with parking to the south and west perimeters. The River West Festival Park facilities include electrical hookups, drinking fountains, asphalt pathways, and restrooms that support events. The festival area also has hard surface courts, but they are in poor condition and are not well used.



Festival grounds at River West Festival Park



Reynolds Floating Stage at amphitheater



Existing amphitheater in River West Festival Park



Public boat ramp



Tulsa Rowing Club facility

The Reynolds Amphitheater and floating stage is the largest facility within the festival park, providing a venue for hosting numerous concerts throughout the year with seating that looks toward the downtown Tulsa skyline. Larger concerts are staged nearby on the open lawn areas of the festival park grounds. Interest has been expressed in the potential of developing a new/expanded amphitheater, primarily due to the difficulty in service access to the floating stage. The current facilities are obsolete and do not suit the current needs of the River Parks Authority. They would benefit greatly from a more functional and user-friendly facility.

A public boat ramp is available at the south edge of the festival park area, which is available for non-motorized boats. The Tulsa Rowing Club boathouse is located on the west bank of the river at 2100 South Jackson. Rowing activities occur on Zink Lake year-round and club members regularly compete in regattas around the country, as well as hosting such activities in Tulsa. The club also



Zink Lake Pedestrian Bridge



21st Street Bridge



Concrete plant (north of 23rd Street)



Rail traffic adjacent to Westport on the River



Railroad tracks (west of River West Festival Park)

assists training for local high school teams and is affiliated with the University of Tulsa Women's Varsity Rowing Crew. Rowing represents a very desirable activity at Zink Lake that is enjoyable to participate in and watch and adds to the ambiance of the riverfront.

Public events have been an integral part of River Parks since its inception in 1974. The River West Festival Park is the site for most major events, but runs and various smaller activities are held throughout the park. Tulsans enjoy events such as the River Shops Bike Ride, the Starlight Concert series, the Gatesway Balloon Festival, and one of the nation's outstanding festivals, Oktoberfest. This authentic celebration of German heritage attracts over 55,000 visitors annually. The park's holiday light display, "Christmas Lights the Park," illuminates the Zink Dam area each December. Celebrating the 4th of July in River Parks is also a Tulsa tradition. Oklahoma's largest free fireworks show, "Tulsa Salutes Freedom" includes musical entertainment and fireworks that are launched from the 21st Street Bridge. Consideration is being given to shooting fireworks from another location to maintain car and pedestrian access across the 21st Street Bridge during this event. A key objective for River Parks is to continue and expand its events that "embrace" the Arkansas River.

A large concrete plant is located south of the River West Festival Park. The concrete plant is bordered by 23rd Street to the south and Jackson Avenue/the existing railroad tracks to the west. This industrial site occupies approximately 1,000 feet of river frontage and, consequently, may present an opportunity for redevelopment that achieves "highest and best" use (provided that this is mutually agreeable to all parties).

West Tulsa Park is located west of the concrete plant on a 23-acre site. In addition to a large parking lot that can be used for River Park festivals, its facilities include playgrounds, sports fields, basketball courts, and a restroom. An existing railroad track runs through the west side of the Zink Lake riverfront area. On the north side of 23rd Street, the railroad right-of-way generally follows Jackson Avenue and the west perimeter of the Westport apartment complex. South of 23rd Street, the railroad tracks are parallel to Jackson Avenue, approximately 500 ft. to the east, as it extends into the Sinclair Refinery.



City of Tulsa West Yard facility



*View along levee on west bank
(south of 23rd Street)*



*Themed playground on west
river bank*



Entry to the River Skate Park

South of 23rd Street, the west bank area of the Arkansas River is primarily occupied by the City of Tulsa Public Works maintenance facility and engineering offices. This facility extends south of 23rd Street for one quarter mile, and spans the area between Jackson Avenue and the Arkansas River. This large facility includes storage yards and a number of buildings, including two brick structures that front onto Jackson Avenue. This maintenance facility occupies approximately 40 acres of riverfront property and should be evaluated for a more appropriate use that takes advantage of its prime location.

East of the city's maintenance facility, a flood control levee creates a 300-ft. wide linear park that is adjacent to the River. This area of River Parks accommodates a western themed playground, as well as trail connections to the south. The River Skate Park is also located in this area with an access drive that is shared with the city maintenance facility. This unique facility is owned by the City of Tulsa and programmed through the Tulsa Parks Department.



The popular River Skate Park features steel jumps and ramps and a spectator seating area.

Between 11th Street and 21st Street, the east river bank of Zink Lake is significantly different than the corresponding area on the west bank. The areas that are within the planning study limits for the east bank are generally residential in use and much more intimate in scale.

Riverside Drive parallels the east bank of the Arkansas River, from 11th Street to 21st Street, continuing south to 96th Street. Riverside Drive creates a linear park space of approximately 200-300 feet in width on the east riverbank between 11th Street and 21st Street. This urban open space is well used, integrating trails, playgrounds, and entertainment uses with scenic green space. As a major commuter route to downtown Tulsa, Riverside Drive provides four traffic lanes as far north as Denver Avenue. At its intersection with Riverside Drive, Denver Avenue becomes a major north-south traffic route into downtown.



As Riverside Drive continues north beyond Denver Avenue the street transitions to two lanes and a slower speed, residential character.



River Parks Trails

Riverside Drive has a grade-separated interchange with 21st Street. Due to its proximity to the Arkansas River, this intersection has an asymmetrical geometry with a ramp that extends over the river. This intersection also integrates a connection to Boulder Avenue, with large open spaces that can help identify this as another key connection to downtown Tulsa.

The park area between the Arkansas River and Riverside Drive accommodates riparian habitat, native tree groups, and a variety of active recreational uses. The River Parks trails are popular and heavily used by thousands of Tulsans, including residents of adjacent neighborhoods.



Scenic overlook next to Rivers Edge Bisto and Café



The River Parks trails on the east bank are heavily used. These trails currently stretch from 11th Street south to 10th Street, and are open for use by pedestrians, cyclists and for roller sports.

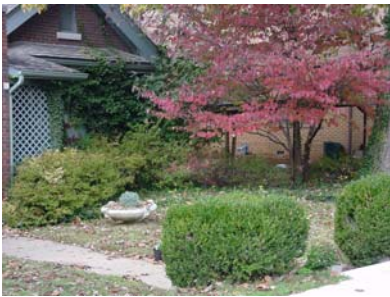
The riverfront area between Elwood Avenue and 21st Street has been developed with active uses that include a large playground; off-street parking lots; several river overlooks that create excellent access to the River; and a popular entertainment area, the Rivers Edge Bistro & Café.



Located at 19th and Riverside Drive, the Rivers Edge is open year-round, weather permitting, serving food, and local entertainment in a casual atmosphere.



Architectural character (Riverside Drive – south of 11th Street)



Neighborhood east of Riverside Drive



The Drunkard Theater (Riverside Dr. / Houston Ave.)



Multi-family housing on Riverside Drive

Veteran's Park, located at 21st Street and Boulder, is another important open space that should be connected to this riverfront. This 15-acre park, formerly known as Boulder Park, includes tributes to veterans of various American wars, as well as a Peace Tree. In the past few years, Veteran's Park has served as the ending point/festival area for the Tulsa Run.

The area east of Riverside Drive between 11th Street and 21st Street includes a wide range of housing types. In general, the existing neighborhoods and multi-family developments are well maintained and highly desirable due to their location and architectural style. Historic Riverview Neighborhood, established in 1905, accommodates many beautiful houses. The area east of Riverside Drive is also home to many landmark buildings, including the Drunkard Theater, the McBirney Mansion, and the Sophian Plaza apartments. The land to the east of Riverside rises in elevation, and many homes enjoy scenic river views from their hillside location.

The properties that immediately front onto Riverside Drive include a number of medium-density residential areas, primarily two to three story apartment complexes. These housing areas vary significantly in age, architectural style, and quality.



The McBirney Mansion, north of Riverside Drive on Galveston Avenue, provides a historic setting for overnight guests, conferences, and weddings.

Because of their excellent locations, complexes that are not achieving their highest and best use are strong candidates for market-driven residential or mixed-use redevelopment.

There are also several planned projects that can contribute to the diversity of this riverfront district. At the southeast corner of 21st Street and Boulder Avenue, a new development is under construction that will include upscale homes. At the northwest corner of Denver Avenue and Riverside Drive, another potential redevelopment is under consideration that would take advantage of Denver Avenue's prominence as a gateway to downtown. A planned unit development has been previously approved for this site that allows mixed-uses such as residential, office, and a restaurant.



A new residential development at 21st Street and Boulder Avenue has been designed to reflect the style of the neighboring Harweldon Mansion. Harweldon is a historic mansion, owned by the Oklahoma Arts and Humanities Council, which hosts public and private events throughout the year.

8.4.3 DESIGN CRITERIA / LIMITATIONS



Zink Lake



East bank vegetation on Arkansas River



Old Route 66 Bridge



Opportunity site at Riverside Drive / Southwest Blvd.

The Zink Lake area of the Arkansas River has tremendous potential for the creation of a vibrant and diverse riverfront district. By uniting the east and west banks with design elements and physical connections, a cohesive riverfront can be developed that will be enjoyed by Tulsans and visitors from other communities. The proximity to downtown and the urban core of Tulsa also creates opportunities for successful large-scale destinations and attractions. This area benefits from the community's foresight to construct Zink Dam under the leadership of then Mayor James Inhofe, creating the beautiful Zink Lake that enhances this district.

There are a number of objectives, opportunities, and constraints that will impact planning for the Zink Lake riverfront. These include:

- Zink Lake will benefit from Vision 2025 funding to help accomplish shoreline beautification and silt removal from the lake.
- The Phase I Vision Plan for the Arkansas River Corridor presented the concept to reuse the historic Route 66 Bridge as a periodic festival space. However, recent structural studies of this bridge indicate that it may be cost-prohibitive to repair the bridge to a condition that allows pedestrian use. Coordination should continue with the Route 66 Corridor planning study for further use of this historic bridge. Preliminary plans for the Route 66 master plan also identify the vacant site at Riverside Drive and Southwest Boulevard as an opportunity for a cultural attraction to celebrate Route 66's heritage and a possible partnership with River Parks for an office facility.
- As identified in the Phase I Vision Plan, the transportation corridors near the Zink Lake district provide opportunities to create large-scale gateways. On the west side of the Arkansas River, an improved gateway to downtown Tulsa and the River are needed at the Interstate 244 (I-244) / 11th Street Bridges. At the southwest corner of downtown, there is also an opportunity to replace the sloped concrete pavement on Southwest Boulevard (a.k.a. Lawton Avenue) with landscaped terraces.



City of Tulsa maintenance facility (south of 23rd Street.)



Zink Lake boat ramp

- Redevelopment of the west bank of the Arkansas River to create more appropriate uses must address significant obstacles. Although there is great potential for redevelopment with uses that maximize the value of riverfront land, there will also be considerable cost involved with the potential relocation of the City of Tulsa maintenance facility and the concrete plant. Air quality impacts from the existing refineries will also have an effect on future development in the near-term. Especially in consideration of the prevailing south winds in the summer, additional odor control for the refineries to comply with and/or exceed environmental regulations is critical. As illustrated previously in the Phase I Vision Plan, a large-scale revitalization of the west bank of the Arkansas River is also of great importance to the success of new riverfront improvements
- For the east bank area between 11th and 21st Street, the Phase I Vision Plan illustrates the potential for creating higher density residential or neighborhood-scale commercial redevelopment along Riverside Drive. Potential redevelopment would need to be sensitively integrated within the existing residential setting, and should focus on a market-driven approach for sites that are under-utilized or in marginal condition.

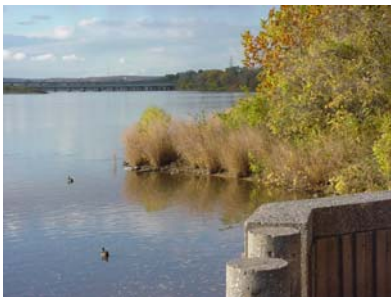


The residential areas to the east of Riverside Drive provide a scenic setting and a nice mixture of architectural style and density.

8.4.4 AREA / SITE PLAN



Arkansas River (view looking northwest)



Scenic overlook (west of Rivers Edge Bistro and Café)



East riverbank (looking south toward 21st Street bridge)

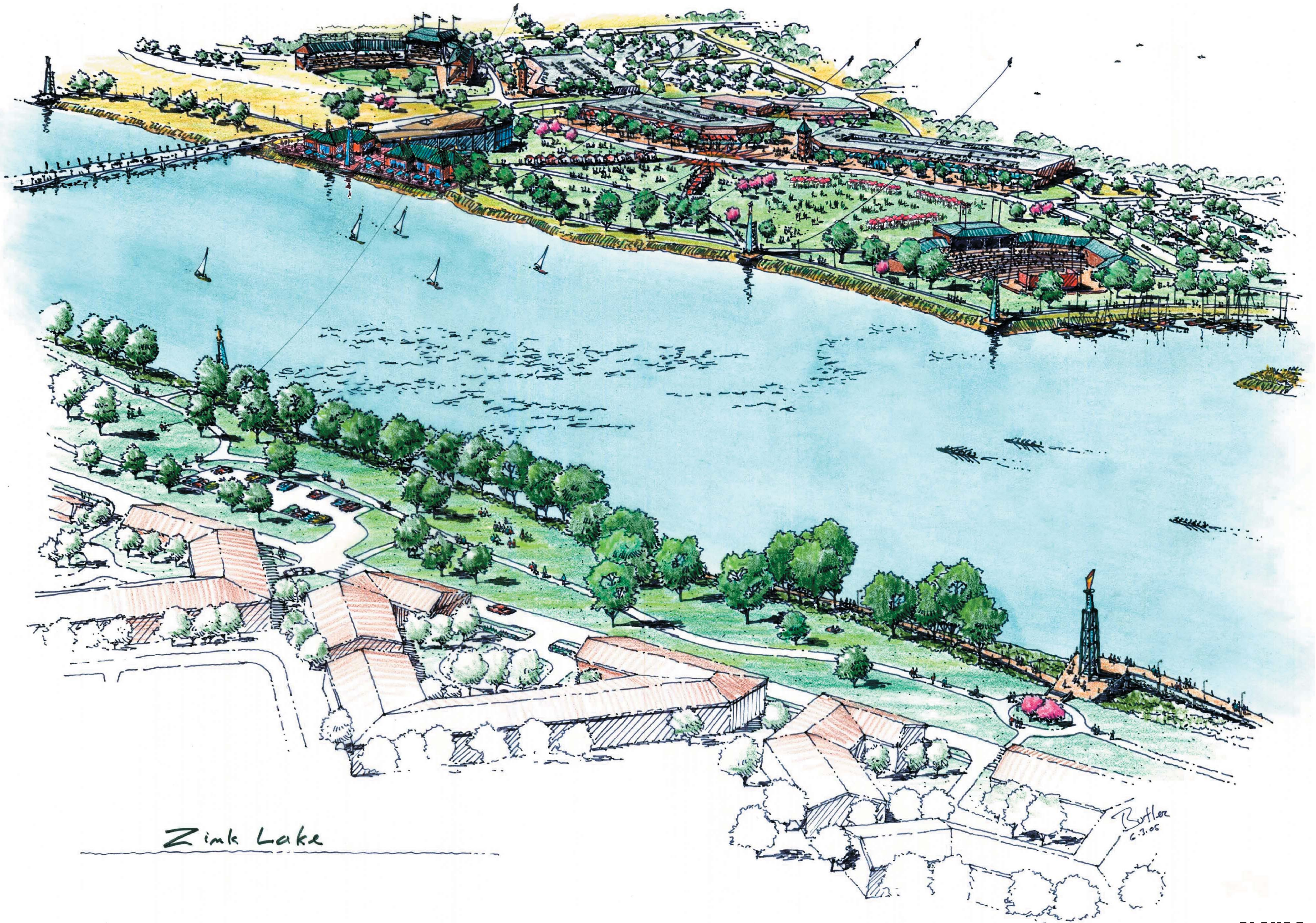
The proposed conceptual plan for the Zink Lake Riverfront is illustrated in Figures 8.4-2 and 8.4-3. The site plan addresses the area as a cohesive district, uniting the east and west river banks into a large civic space that accommodates many uses. The open and recreational space not only provides unique opportunities on its own, but also creates the underlying fabric onto which the other uses are woven. The proposed concept for the west side of the River expands upon the existing use as a site for festivals and musical events. On the west bank, a festival pavilion with an attached amphitheater is proposed on the existing open festival grounds. Additional uses proposed for the west side are a minor league baseball stadium, a museum or other cultural attraction, riverfront restaurants/shops, an expanded and renovated marina, expansion of the boathouse used by the rowing clubs, apartments, and a pedestrian promenade with river overlooks. To allow for the large-scale uses that are proposed on the west river bank, significant changes in land use would be required. The proposed baseball stadium would require the relocation of the existing City of Tulsa maintenance facility south of 23rd Street and east of Jackson Street. North of 23rd Street, the proposed expansion of the festival park would require the relocation of the existing concrete plant and adjacent businesses.

The proposed concept for the east side expands and complements the existing pedestrian and residential uses. Several existing multi-family sites were identified as possible residential redevelopment sites. A mixed-use development is also proposed at the intersection of Riverside Drive and Denver Avenue. The proposed location for the new Route 66 Center and Plaza is at the intersection of Riverside Drive and 11th Street. In the existing park area between Riverside Drive and the east riverbank, a pedestrian promenade with river overlooks is proposed, along with streambank habitat rehabilitation and landscaping. Gateways with architectural and landscape elements are proposed on Riverside Drive at the 21st Street ramp, and at the intersection of Denver Avenue and Riverside Drive. Additional improvements include a potential expansion of the restaurant and entertainment area near 19th Street. A more detailed description of proposed riverfront improvements follows.



ZINK LAKE RIVERFRONT CONCEPT PLAN

FIGURE 8.4-2



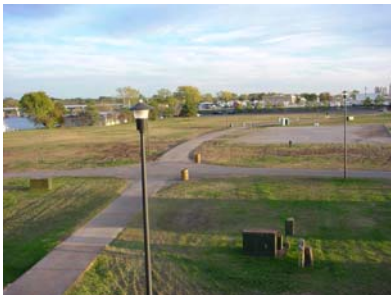
Zink Lake

ZINK LAKE RIVERFRONT CONCEPT SKETCH

FIGURE 8.4-3



Reynolds Amphitheater and floating stage



16-acre West Festival Park



West Tulsa Park

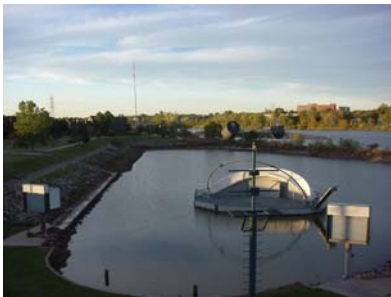
Festival Park: The indoor space that will be provided by the proposed festival pavilion/amphitheater has long been a goal of the River Parks Authority. The proposed facility provides the ability to have permanent amenities for indoor activities associated with the festivals, rental areas for groups, permanent locations for support activities, and an expanded area for staging musical events. The new facility, located on land south of the existing cove, will also better accommodate the festivals and musical events already being staged at the facility, and will allow for more and varied events to be added. It would also not be subject to the widely varying water levels affecting the floating stage. As shown in Figure 8.4-2, short term plans include the construction of surface parking lots for festivals. These areas can be developed as parking garages with retail frontage as needed with future growth of the festival area. In the proposed plan, the existing amphitheater is moved from the floating location in the cove to the proposed festival pavilion, with the spectator view to downtown preserved. The proposed amphitheater accommodates 3,500 to 5,000 people in the permanent seats and allows for additional seating in the lawn areas nearby. The improved stage and support facilities allow for an increased variety of events, and will improve efficiency and quality in the process of staging the performances. The new facilities would also provide the River Parks Authority with much needed storage space.

West Tulsa Park: With the proposed improvements at Festival Park, some of the hard surface courts presently located at the existing festival area will need to be relocated. Since basketball and tennis courts are usually more of a neighborhood use, the plan proposes building the needed basketball and tennis courts at the existing West Tulsa neighborhood park, and providing overall improvement to the park with refurbishment of the swimming pool and the addition of a splash pad and picnic areas. Additional parking is needed in this area for festival patrons.

Museum: A children's museum or other cultural facility is proposed just south of the expanded festival grounds, north of the 21st Street Bridge. A new building is proposed for the primary museum space, creating a new attraction that will bring visitors to the west bank on a daily basis. The museum will provide a destination on its own, as well as an additional activity for families or groups using the park space, visiting festivals or going to baseball

games. The central location in Tulsa can provide an easily accessible facility for schools field trips.

Minor League Baseball Stadium: With the long term need for a new stadium for the Tulsa Drillers, the proposed plan illustrates the potential for a new stadium south of 23rd Street on the west side of the Arkansas River. According to a March 2003 study prepared by CSL regarding Driller Stadium, "The existing facility is oversized and does not provide the same level of amenities often found in new ballparks." A new stadium in the area proposed for redevelopment would allow for a modern facility in a recreational setting, with redevelopment sites available nearby for associated entertainment, retail and restaurant uses. A proposed parking garage that integrates retail frontage provides nearby shopping and dining opportunities immediately west of the stadium. It may be possible to incorporate the two existing brick buildings that face Jackson Avenue into the redevelopment. With the proposed recreational and commercial improvements, the entire riverfront district will function as a destination to support a full day or evening of recreation, shopping, and dining for ballpark visitors.



Reynolds Amphitheater and floating stage

Marina and Boathouse: With the relocation of the floating amphitheater to the festival pavilion, the existing cove is proposed as a public facility for boating. The local rowing clubs have planned an expansion of their existing boathouse facilities within the festival park area. The proposed concept includes a new boathouse for rowing club use located at the north end of the marina. This would allow the rowers to enter the water in a protected area, then access the River from that point. The facility also includes several boat docks for use by private citizens or by boating rental concessions.

Riverfront Restaurants/Shops: Adjacent to the proposed museum north of 23rd Street, the master plan proposes several riverfront restaurants and shops. This location provides a strong relationship to the festival park, museum, and baseball stadium. With a boardwalk that creates excellent views of the River and downtown Tulsa. This new complex creates a scenic setting for restaurants and small shops. The addition of a small fitness facility and a bike rental shop would also complement the use of River Parks trails by runners, walkers, and cyclists.

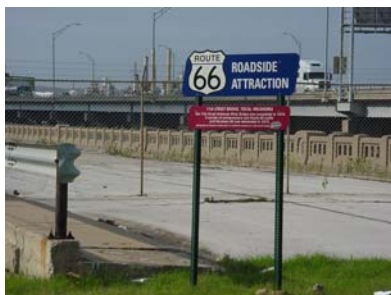
Bridge Enhancements: The 11th and 21st Street Bridges generally form the northern and southern boundaries of the proposed development area. Along with the existing pedestrian bridge to the south, the two bridges mentioned provide critical crossing areas for pedestrians, and are the only pedestrian river crossings for several miles in either direction. The proposed improvements for the bridges include lighting from the underneath, additional pedestrian paths and river overlooks, and locations for identity elements such as banners, artwork and architectural elements. The Route 66 Bridge at 11th Street was previously proposed as a festival style pedestrian bridge, but at the time of this study is believed to be structurally unsound for pedestrian use. An enhanced pedestrian path along the south side of the Southwest Boulevard/11th Street Bridge with a scenic overlook is proposed.



Example of pedestrian overlook on bridge – Wichita, Kansas



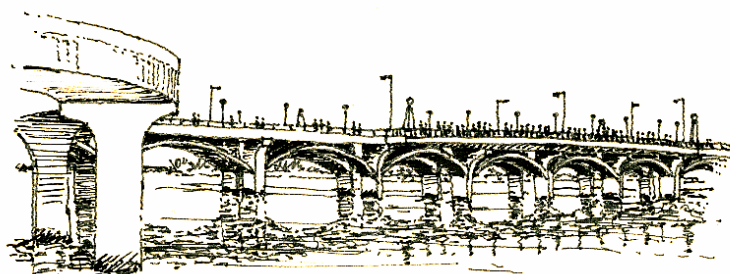
Cyrus Avery Route 66 Bridge



Cyrus Avery Route 66 Bridge

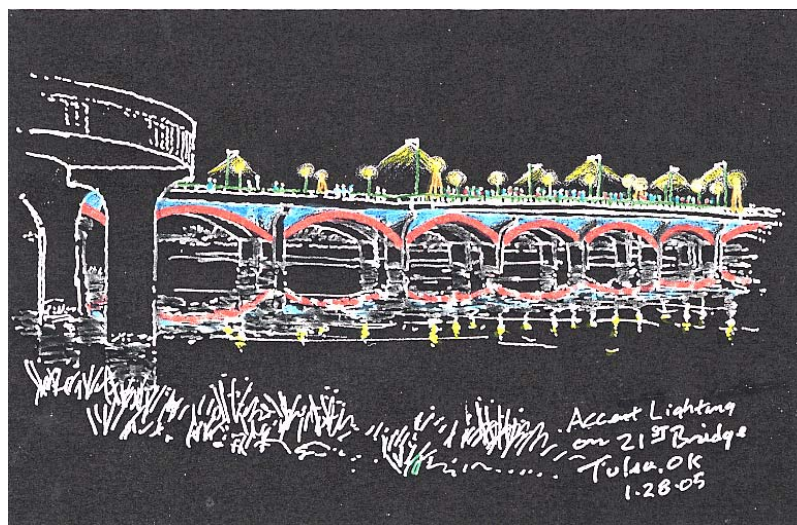


21st Street Bridge



Pedestrian Overlook on 21st Bridge
Tulsa, OK
1-28-05

Concept: 21st Street Bridge amenities



Accent Lighting on 21st Bridge
Tulsa, OK
1-28-05

Concept: 21st Street Bridge at night with new lighting

Pedestrian Promenade, River Overlooks and Riverbank Enhancement: Two major goals of the riverfront development plan are (1) enriching the pedestrian access to the River while providing a sense of space that weaves together the character of both sides of the River, and (2) addressing shoreline beautification and sedimentation of Zink Lake. Vision 2025 includes matching funds for shoreline beautification and silt removal in Zink Lake. Enhancement of the existing vegetation along the riverbanks is an integral feature of the plan.



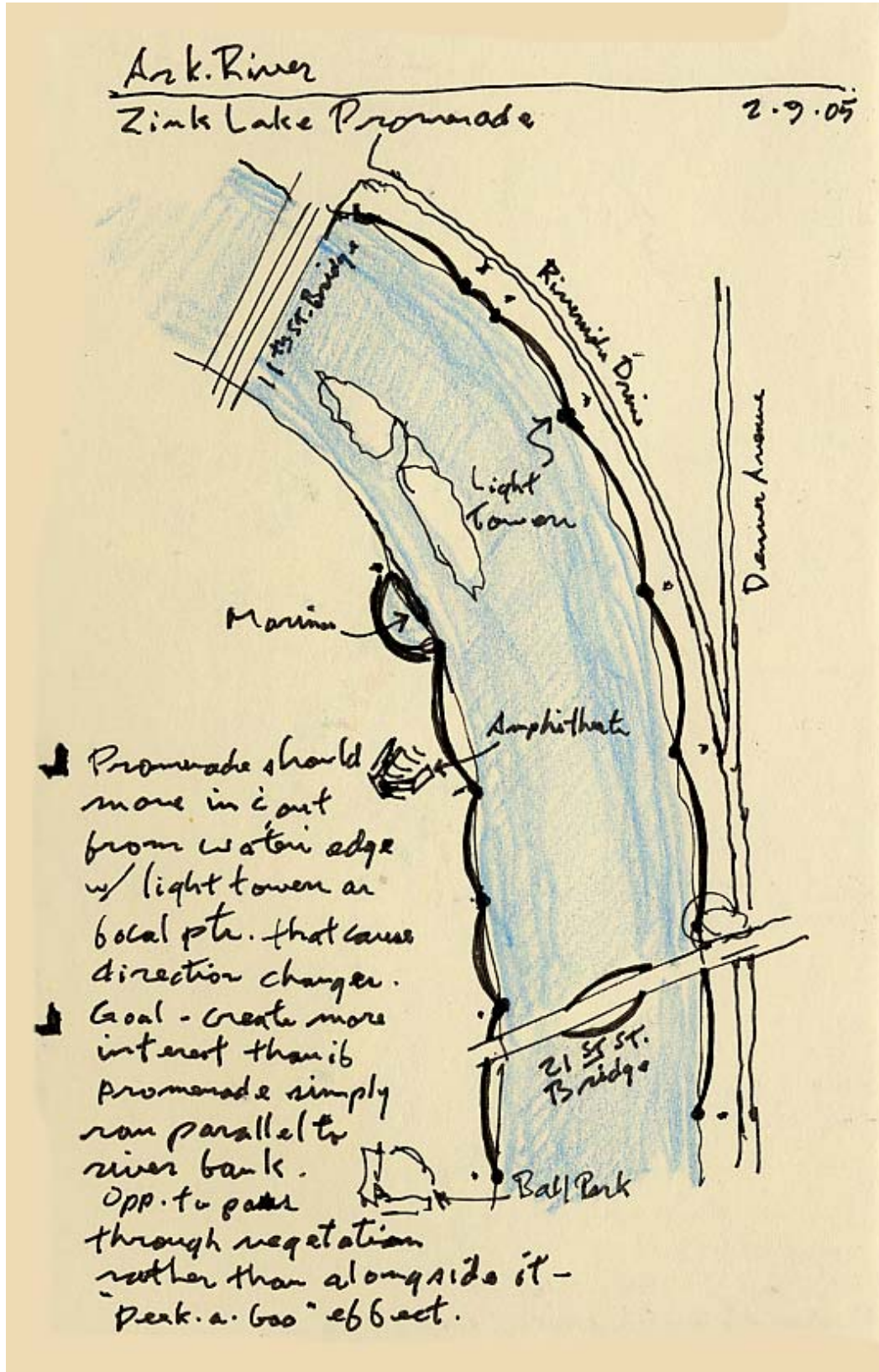
Arkansas River – east bank
vegetation



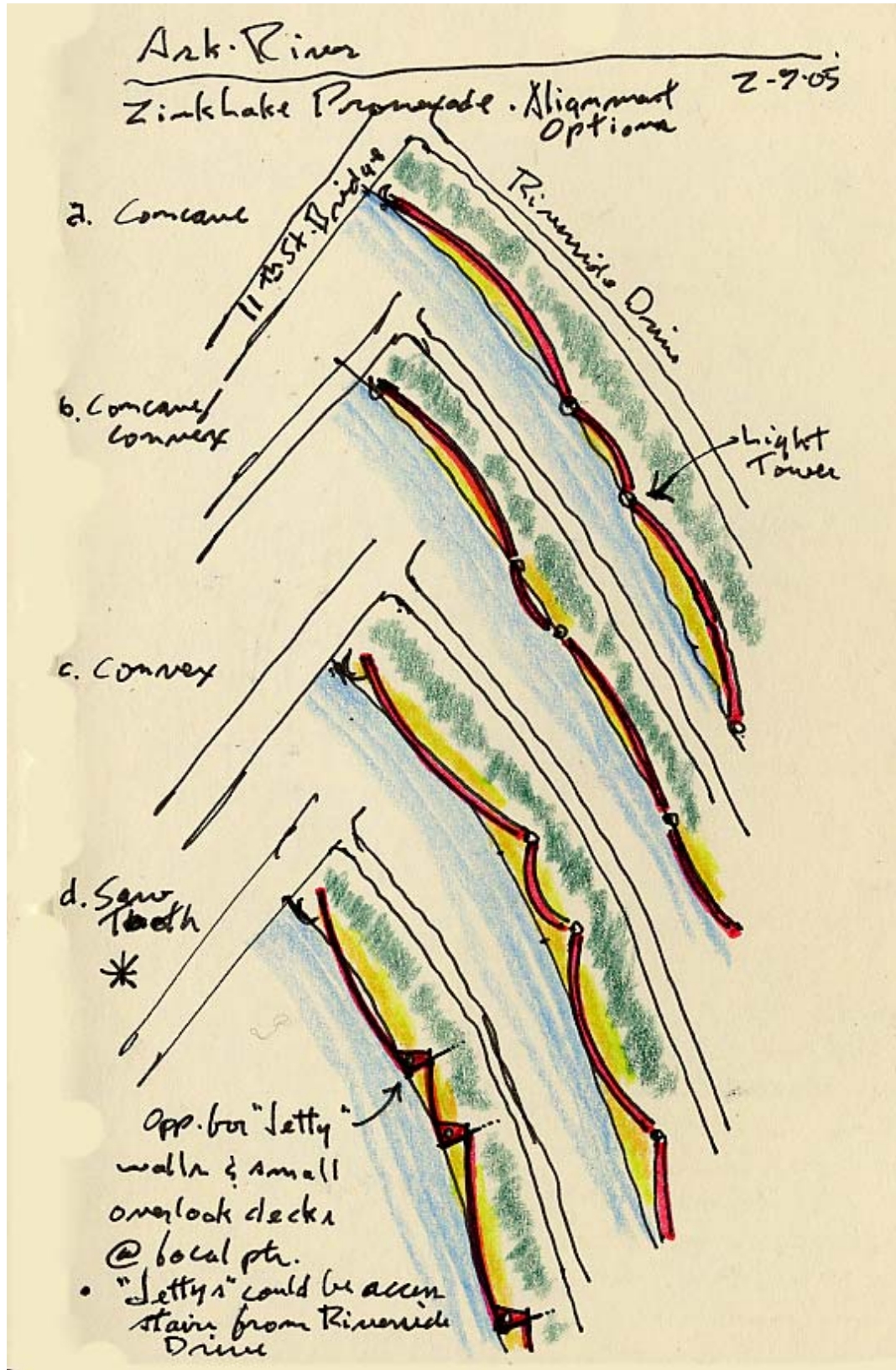
Pedestrian walkway adjacent to
amphitheater/cove on west side
of river

Pedestrian promenades proposed on both sides of the River move in and out from the waters edge, providing an opportunity for pedestrians to move through the riverside vegetation rather than alongside it. Proposed overlook decks at focal points allow spaces for resting, observing river activities, and gathering of small groups. Shade trellises and area lighting provide comfort during the day and security at night. Conceptual sketches of the promenade concept and alternate paths from the promenade are presented following this page.

Connections to Downtown: As discussed earlier in this study, the Zink Lake area has excellent proximity to downtown Tulsa. There are tremendous opportunities for natural benefits between the central business district and this key section of the riverfront. Boulder Avenue and Denver Avenue provide strong linkages between the Arkansas River and downtown Tulsa. There is also potential for a trolley that will link key downtown and riverfront attractions. Another important connection between the Zink Lake riverfront district and downtown is planned near the proposed Route 66 Center and Plaza. As illustrated in Figure 8.4-2, the planned Centennial Walk will provide a pedestrian linkage to the southwest corner of downtown Tulsa. To further enhance the appearance of downtown at its prominent southwest corner, the Master Plan proposes the replacement of the unattractive sloped concrete wall that is adjacent to the Tulsa Regional Medical Center. By creating terraced landscape planters in this highly visible area, a much more attractive gateway to downtown Tulsa and Zink Lake is achieved.

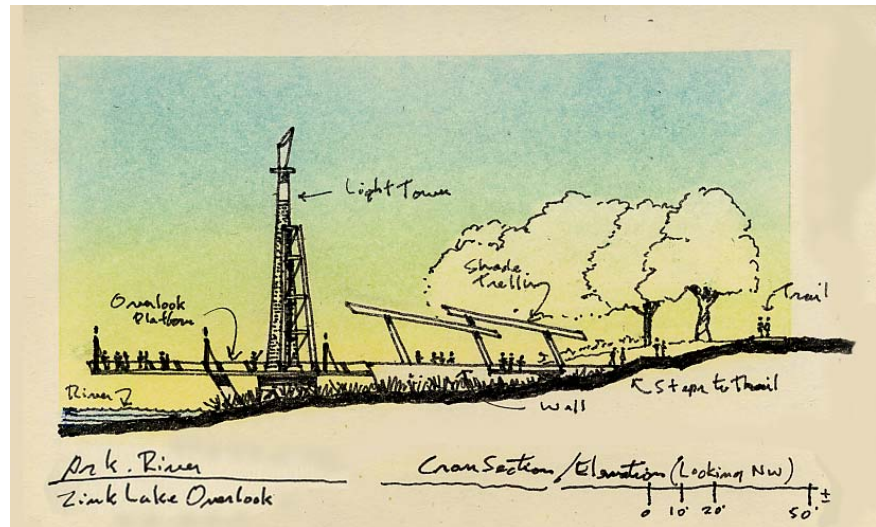


Pedestrian Promenade Concept



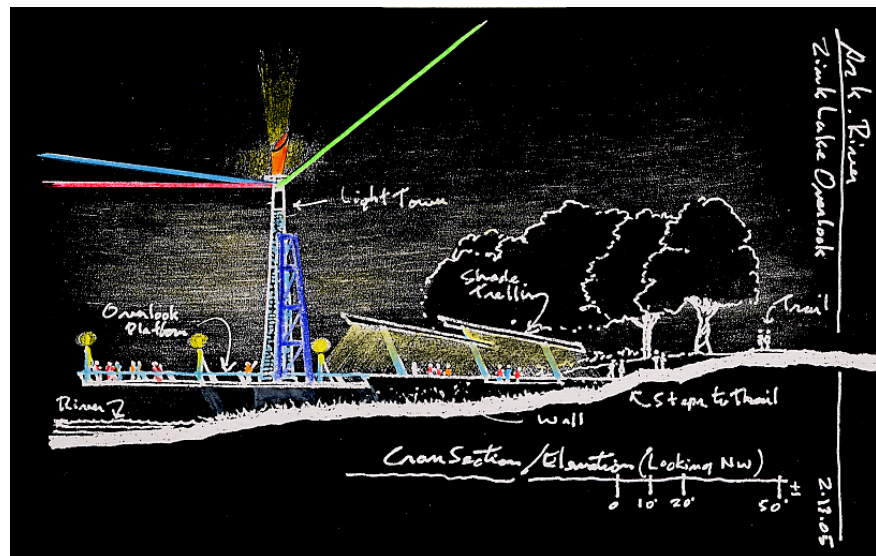
Conceptual sketch depicting alternate paths for the pedestrian promenades

Light towers are proposed as an architectural element to provide exciting visual interest and to create a unique identity for the riverfront district.



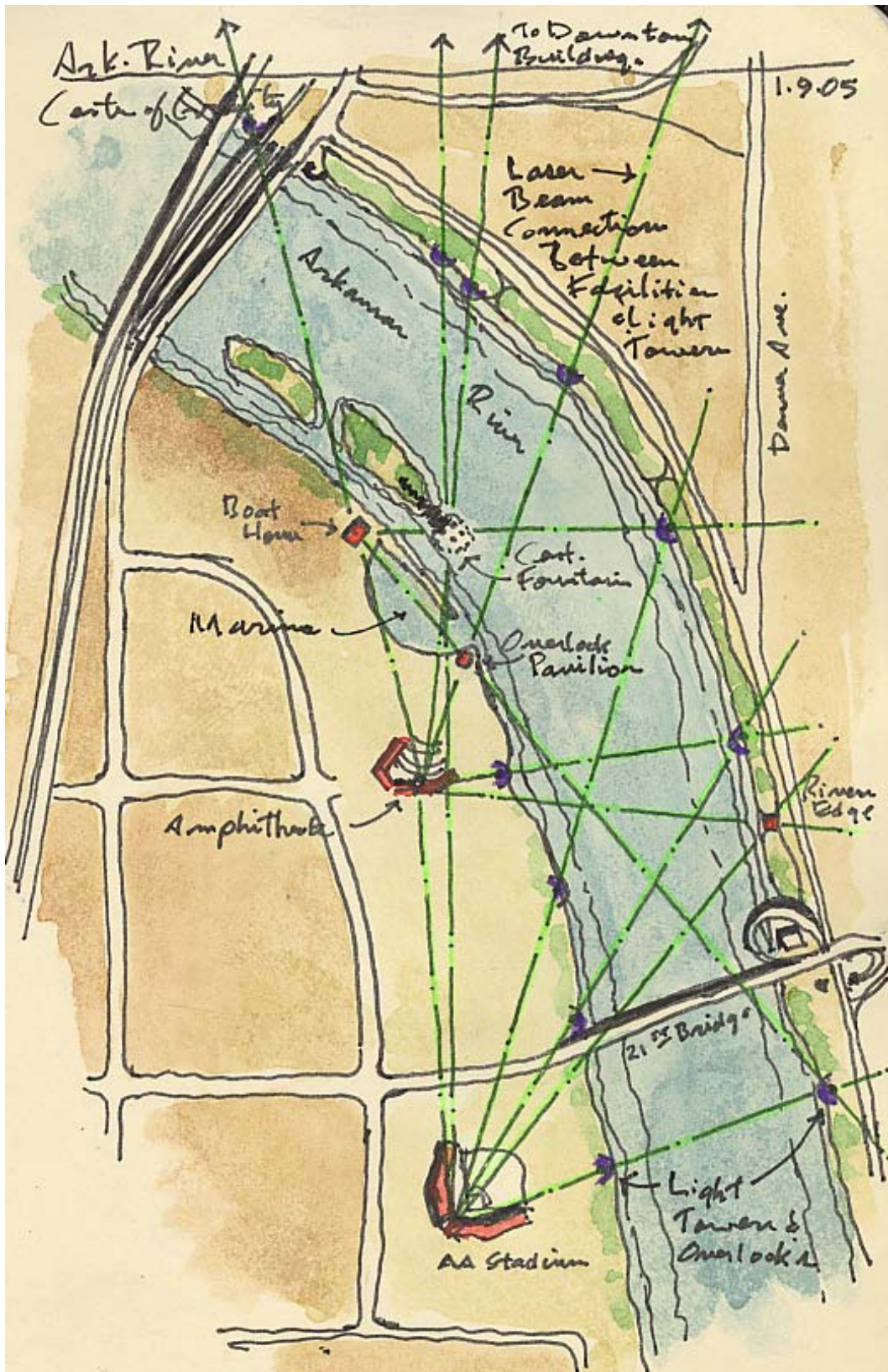
Concept: River Overlook

The proposed light towers and pedestrian promenades will require further analysis to investigate the potential for any environmental or engineering-related impacts.

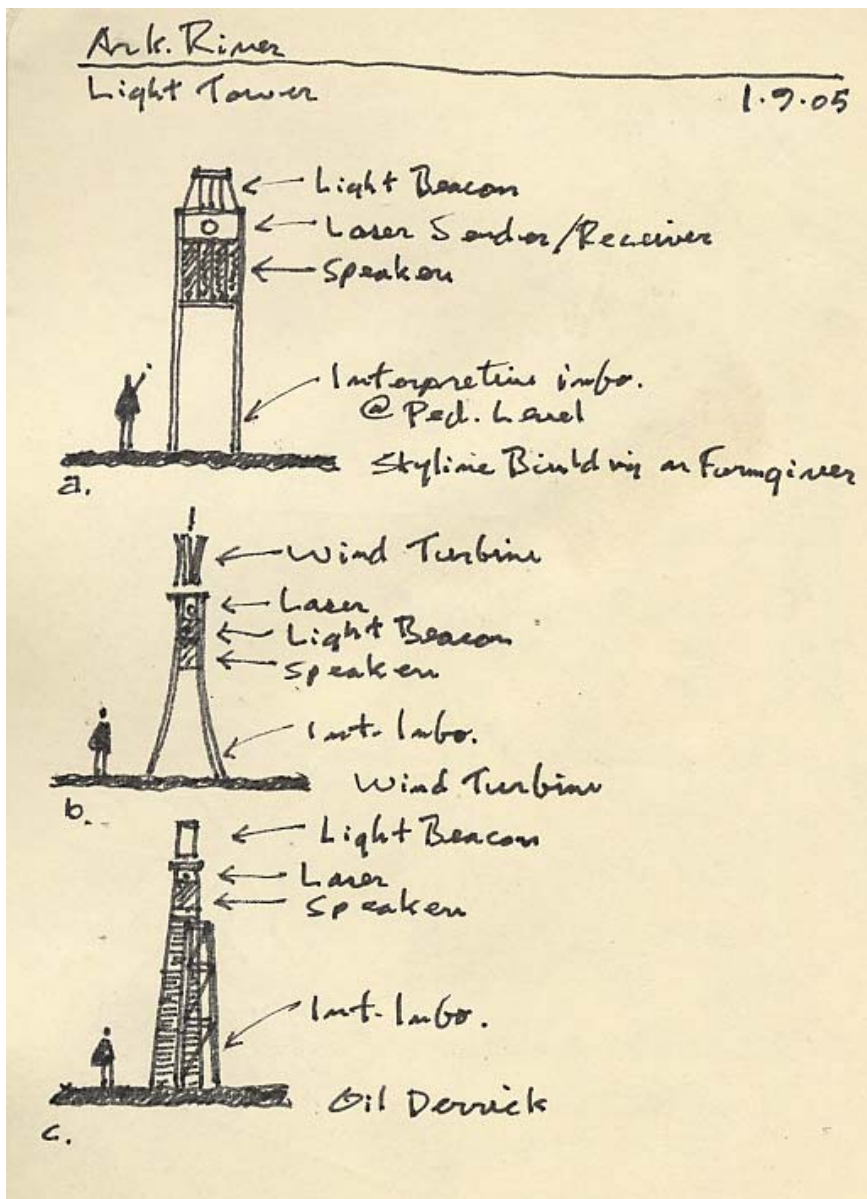


Concept: River Overlook at night

The following pages depict conceptual sketches of possible light tower locations, and design.



Concept: Light Tower Locations



Concept: Light Tower Character Sketches



Gateways: The area along Riverside Drive directly south of the 21st Street Bridge is identified in the master plan as a major gateway to downtown Tulsa. Proposed architectural elements and new landscaping consistent with the identity of Tulsa and the riverfront development are proposed in this area. The intersection of Riverside Drive and Denver Avenue has also been identified as a gateway to downtown Tulsa, and is proposed as a location for architectural signage and enhanced intersection treatment. A major gateway is also proposed at the I-244 Bridge across the Arkansas River.

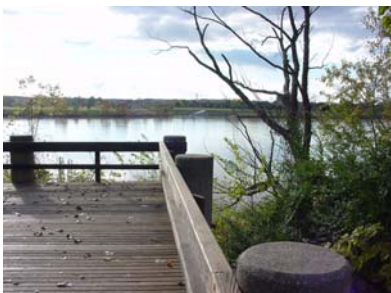
Figure 8.4-4 illustrates a conceptual design for a new gateway structure that can be used throughout the entire river corridor to create continuity within all the five communities that are connected by the Arkansas River. The gateway structure integrates design features that reflect the “past, present, and future” for each community. The proposed design includes a stone monolith with a standardized sand-blasted river corridor medallion identifying each city and representing past events. A stainless steel cabinet is proposed with an icon that reflects the current image/theme that is unique to each community. A curved light tube integrates these two elements, representing future events.



Route 66 Center and Plaza: A proposed Route 66 cultural center is illustrated at the intersection of 11th Street and Riverside Drive on a scenic hilltop that overlooks the River. The proposed facility provides an additional cultural attraction in the area, and complements the other proposed uses in the plan. A master plan for the Route 66 corridor through Tulsa is in progress, which will require continued coordination with the Zink Lake Riverfront Conceptual Plan.



Residential Redevelopment: As illustrated in Figure 8.4-2, the Riverside Drive frontage provides several opportunities for market-driven residential redevelopment, that capitalize on the desirability of river access and activities. As development on the riverfront continues, there will be added pressure to provide updated housing near the river. Residential redevelopment will need to respect both the historic nature and the established views of the existing neighborhoods.



Multi-Use Development: The proposed site plan includes a mixed-use development at the intersection of Riverside Drive and Denver Avenue. This property has existing approval for mixed-use development. This highly visible location creates an exceptional opportunity for a “signature” project that will also serve as a gateway to downtown from Denver Avenue.

Existing Uses: The proposed conceptual plan recognizes that the River Parks area has many popular existing uses that should remain and be enhanced. Trail use, fishing, rowing, kayaking, picnic areas, and the River Skate Park are popular activities that will remain as active uses in River Parks.

Traffic Calming: A major element of the Phase I Vision Plan was the addition of traffic calming elements to assist the movement of pedestrians and cyclists across Riverside Drive. The proposed traffic calming elements for the 21st Street and Riverside Drive intersection include the addition of specialty pavement that is raised six inches. This creates an elevated traffic table which requires drivers to slow down. Other improvements in this area would include improved ramps, signalization, and trail connections. These elements will create more awareness of pedestrians in the area and reduce traffic speeds.

Riverside Drive West: The Zink Lake riverfront area includes the proposed development of a major segment of Riverside Drive West. This new boulevard will connect to Southwest Boulevard, following the existing alignment of Jackson Avenue on the west edge of the festival park and the new baseball stadium.

Zink Lake Rehabilitation: An important component of this plan is the rehabilitation of Zink Lake. Additional gates are recommended for the center section of the dam. Due to a lack of initial capital funding when the Zink Dam was constructed, the number of bascule gates was reduced from the original design. This reduced the dam's capability to pass sediments during high flow events.

By adding a new section of gates to the dam, sediment transport and scouring would improve, thus reducing the amount of sediment accumulated behind the dam. Sand and gravel operators in the areas have requested the opportunity to review the quality of quantity of the sand and gravel in Zink Lake. If the sand and gravel in Zink Lake are desirable, the sand and gravel operators would consider removing the accumulated material at little or no cost. They would be able to sell the recovered material to cover the dredging costs. This operation would require a staging area for storage, handling, and loading.

Discussions have been raised regarding the use of an upstream siltation basin as a possible solution to the existing sedimentation issue in Zink Lake. The primary issue with this concept is the river's approach velocity from the existing rock sill upstream of the I-244 Bridge to the downstream side of the new 11th Street Bridge. There is an eroded section of the river bed near all of the bridge piers that is

Final Arkansas River Corridor Phase II Master Plan and Pre-Reconnaissance Study
in excess of 12 feet deep due to the high velocities. Therefore, an upstream sedimentation basin would not be applicable in this reach of the Arkansas River.

8.4.5 CONCLUSIONS / RECOMMENDATIONS



Blair Fountain / Zink Lake

The Zink Lake area of the Arkansas River is an example of the long term success of well planned riverfront recreational activities. The success of the Zink Lake area in many ways revolves around the permanent pool of water impounded by Tulsa's first low water dam near 31st Street. The new uses proposed in the concept plan for this area build upon and integrate with the established use patterns of this very successful riverfront district.

The addition of several large scale attractions on the west side of the River strengthens the economic viability of the west bank with the addition of a minor league baseball stadium, cultural facility or museum, and an expanded venue for festivals and musical events. The proposed mixed-use developments and Route 66 Center and Plaza on the east side of the River are also important additions to the commercial fabric of the district.

The proposed pedestrian promenades and river overlook focal points bring visitors down to the edge of the riverfront and allow for closer interaction with the streambank vegetation, water, and recreational activities. These new promenades also provide additional trail options in an already heavily used area. Aesthetic and functional improvement of pedestrian ways on the 21st Street



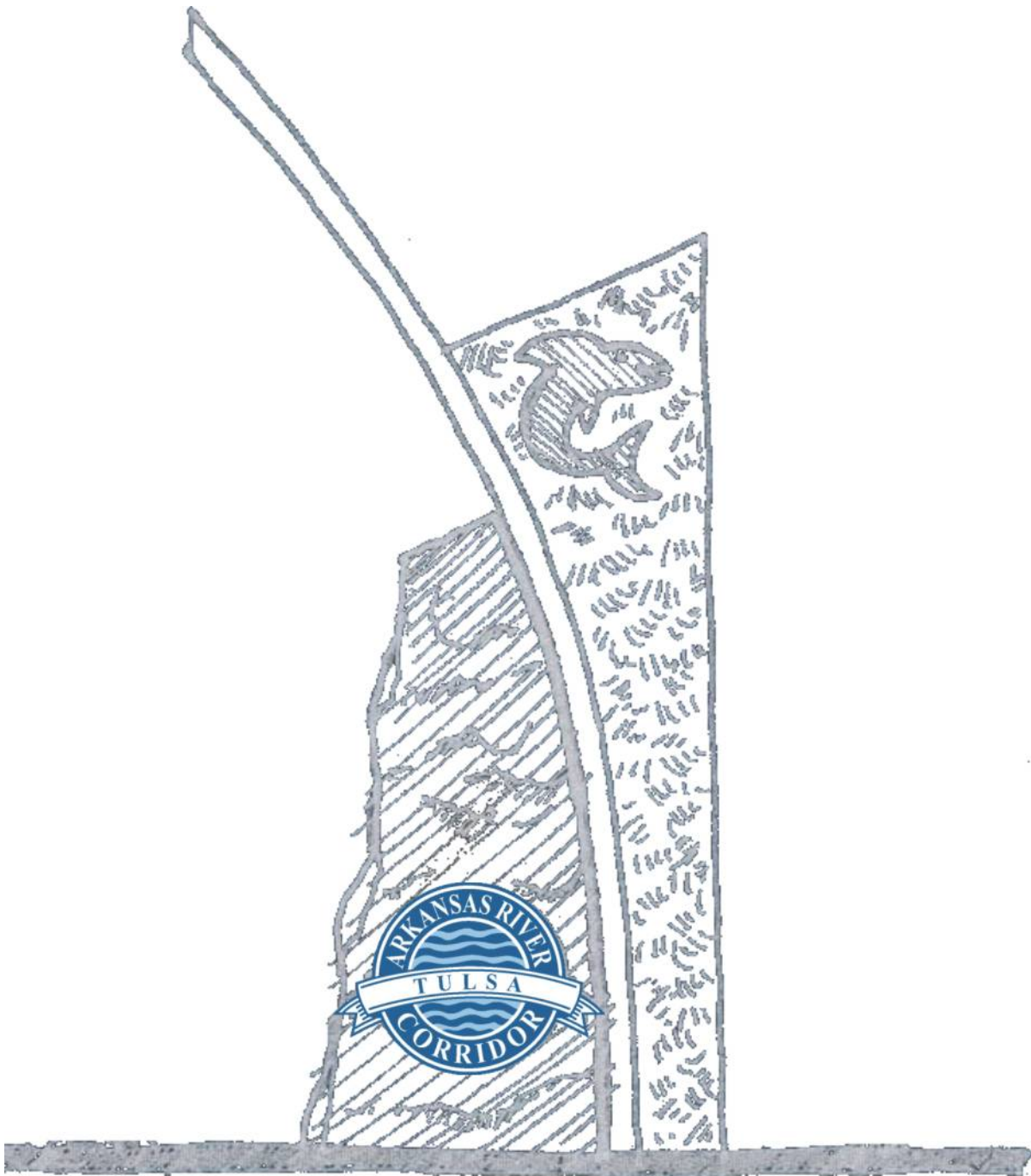
Enhancement of Zink Lake's east and west banks can be a great benefit to downtown Tulsa

Final Arkansas River Corridor Phase II Master Plan and Pre-Reconnaissance Study
and 11th Street Bridges, along with the addition of pedestrian river overlooks on the bridges, encourage a more interesting and enjoyable pedestrian experience while walking or biking across the River.

Visual elements that add interest and a special visual identity to the Zink Lake area include underside bridge lighting, enhanced pedestrian lighting, gateway architectural elements, and the proposed light towers. The light towers will provide not only an architectural element unique to the Zink Lake area, but will provide exciting and changing visual interest with laser light presentations at night and during special events.

Areas of residential redevelopment along Riverside Drive will keep the area vibrant and growing, while at the same time integrating into the existing residential fabric of the area. In all, the concept for the Zink Lake area presents a mixture of uses that build upon existing activity and success, and embrace the River as the focal point for the future success of the district.

8.5 CROW CREEK CORRIDOR CONCEPTUAL PLAN



8.5 CROW CREEK CORRIDOR

8.5.1 BACKGROUND AND REQUIREMENTS



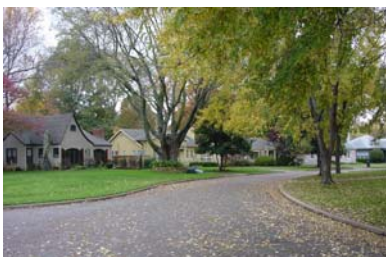
Crow Creek



Vacant Lot – Former Boy Scout Office



Apartment / Potential
Redevelopment Site



Residential Neighborhood North of
Crow Creek

Crow Creek was identified in the Phase I Vision Plan as a significant natural feature connecting the vibrant Brookside neighborhood to the river corridor. The study recommended consideration for the expansion of Crow Creek as a water feature providing a centerpiece for a mixed use, pedestrian oriented urban district extending from Brookside to the Arkansas River. The Crow Creek corridor also contains significant potential for upgrade of the natural riparian habitat. The Crow Creek development could be used as a model for future connections between other neighborhoods and activity centers to the Arkansas River along creek corridors. Figure 8.5-1 depicts the site location of Crow Creek.



CROW CREEK REDEVELOPMENT SITE LOCATION MAP FIGURE 8.5-1



8.5.2 DESCRIPTION OF PLAN AREA



Residential Neighborhood
South of Crow Creek

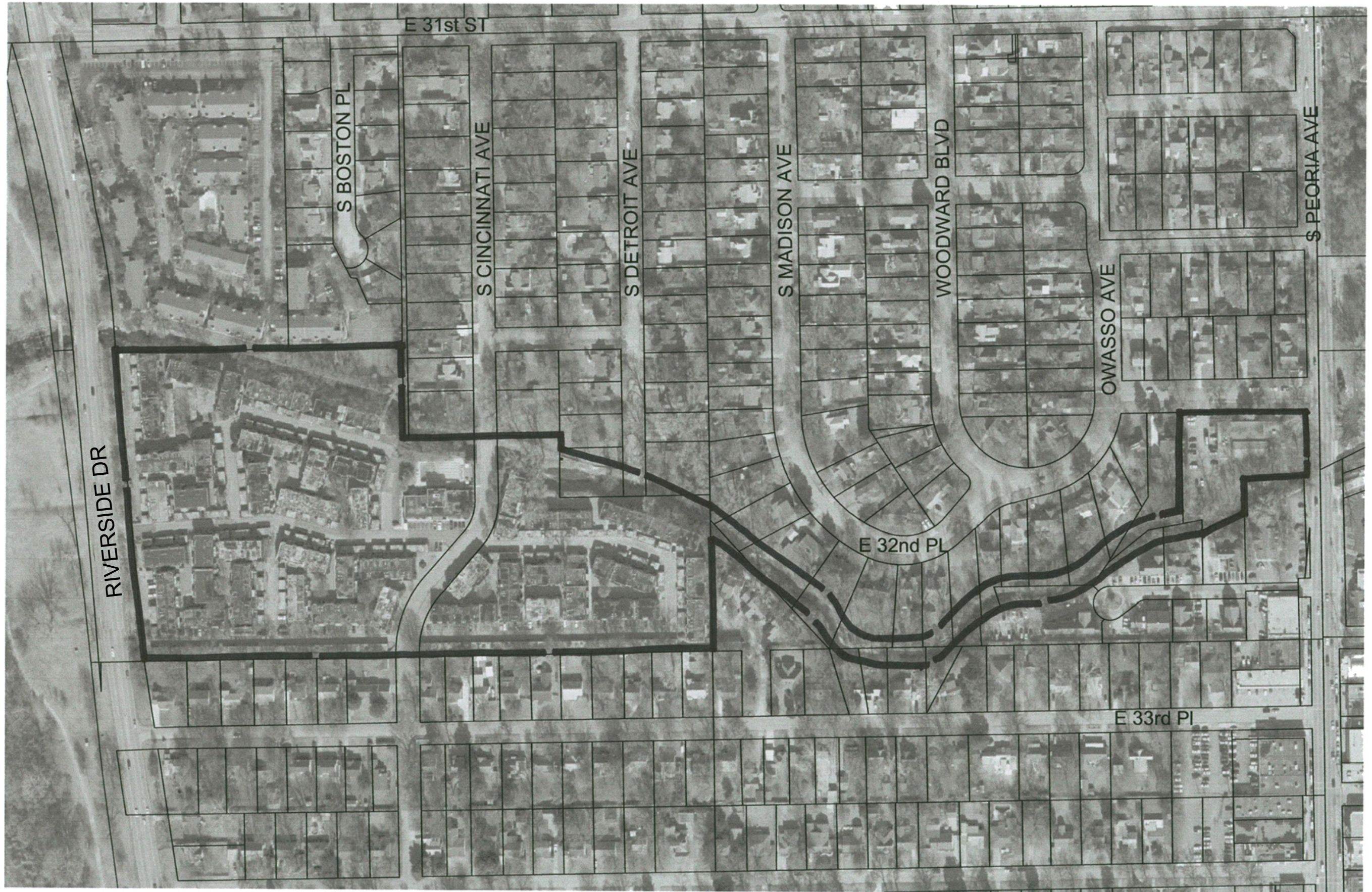
The proposed plan area for the Crow Creek site is shown in Figure 8.5-2. The Crow Creek corridor is bounded on the west by Riverside Drive, on the east by Peoria Avenue, on the north by a single-family residential neighborhood with an apartment development fronting Riverside Drive, and on the south by a single-family neighborhood with commercial uses fronting Peoria Avenue. In addition to the creek corridor itself, the plan area includes a vacant 1.16-acre parcel at the northwest corner of Peoria and E. 32nd Street. The site has been recently cleared after many years of use as the local headquarters for the Boy Scouts of America. The location of the site has been identified as the major northern gateway to the Brookside commercial district. The study also encompasses a 9.85-acre potential redevelopment site which is currently occupied by an aging apartment complex in need of extensive repair. The site is included in the study for redevelopment consideration due to the present underutilization and poor condition of the property. Two single family residential lots north of Crow Creek, one on Detroit and the other on E. 32nd Place, have been acquired by the City of Tulsa for access to the Crow Creek channel area.



Crow Creek Office Park

The residential neighborhood to the north consists of well-maintained cottage style homes generally built in the 1930s to 1940s. The curved and non-through street configuration helps to discourage “cut through” traffic from Peoria to Riverside. The residential area to the south mostly consists of smaller bungalow style homes, circa 1940s, on smaller lots, aligned on linear streets. The quality of maintenance and general condition in the neighborhood ranges from high to medium. Linear streets between Peoria to Riverside south of Crow Creek allow for commercial traffic to “cut through” the neighborhoods.

Crow Creek crosses Peoria Avenue at the northern border of the Brookside commercial district. The Brookside commercial district is a thriving neighborhood scale commercial district that has undergone substantial successful redevelopment in the past decade.



PLAN AREA

FIGURE 8.5-2



Efforts have been underway by both the business and residential communities to encourage commercial and residential infill in the Brookside area, at the same time emphasizing the goal to provide sufficient buffering and visual separation between the residential and non-residential uses. A study titled *"Brookside Infill Development Design Recommendations"* was prepared by the Brookside Infill Task Force in cooperation with the City of Tulsa and released in 2002. The study identifies the Crow Creek trailhead site as a major gateway into the Brookside commercial district. This "gateway" is an opportunity to create a highly visible point of entry into the Brookside district. Recommendations in the study concerning use compatibility and appropriate scale of infill development have been considered and incorporated into the proposed Crow Creek plan.



Crow Creek – Typical

A report titled *"Crow Creek Drainage Improvements – Revised Conceptual Design Report"* was prepared by Tetra Tech FHC for the City of Tulsa, and released in March 2004. The report states, "Crow Creek drains approximately 2.14 square miles in central Tulsa. Improvements in the channel are thought to have been made during the 1930s under the Works Progress Administration (WPA), consisting primarily of sloped banks lined with dry stacked cut stone. Much of the stream lining has failed and approximately half has been replaced with concrete, rip rap, or has natural vegetation that has become established along the banks."

"The (total) width of the riparian habitat for Crow Creek is very narrow due to urban development. The width of the riparian zone is estimated to be 50 feet. The riparian zone provides a travel corridor for wildlife such as fox, squirrels, and raccoons. Migratory birds breed and feed in the riparian zone." Strong potential exists to restore the riparian zone and enhance the habitat value in the corridor.

8.5.3 DESIGN CRITERIA/LIMITATIONS



Crow Creek at Peoria

The identified objectives for the Crow Creek site are to develop a pedestrian link between Peoria and Riverside Drive along the Crow Creek corridor, develop a public space amenity at the east end of the corridor, and provide a conceptual layout for a potential multi-use redevelopment site fronting Riverside Drive.

The pedestrian link would connect two major activity centers in the area, the Brookside district and the Arkansas River park activity. The new public space adjacent to Peoria Avenue, due to its location at the northern edge of the Brookside commercial district, would also function as a major gateway to Brookside. At the west end of the study area, the existing apartment site provides an opportunity for a mixed-use redevelopment. This site creates opportunities for compatible residential development, and also provides for the introduction of neighborhood-scale commercial development along Riverside Drive.

The pedestrian linkage along Crow Creek is limited by the availability of space, stream flooding, and habitat considerations. According to the Tetra Tech report, permanent drainage easements will be necessary to allow channel improvements to be constructed and maintained. The original WPA stone bank stabilization should be incorporated into future channel improvements where possible. The design of the trail and associated lighting and buffers will take into account the limitations. The landscape buffers may be used for riparian habitat mitigation.

The potential redevelopment of the apartment site adjacent to Riverside Drive may include the introduction of some new uses into the neighborhood. The redevelopment, although not officially in the Brookside area, should be designed in a manner compatible with the scale and land use separation guidelines that are recommended in the *Brookside Infill Development Design Recommendations*. The gateway and trailhead area should also conform to the Brookside design guideline recommendations in the selection of site materials, site furniture, lighting and gateway monument design. Water feature design must take into account stream flooding and habitat considerations.

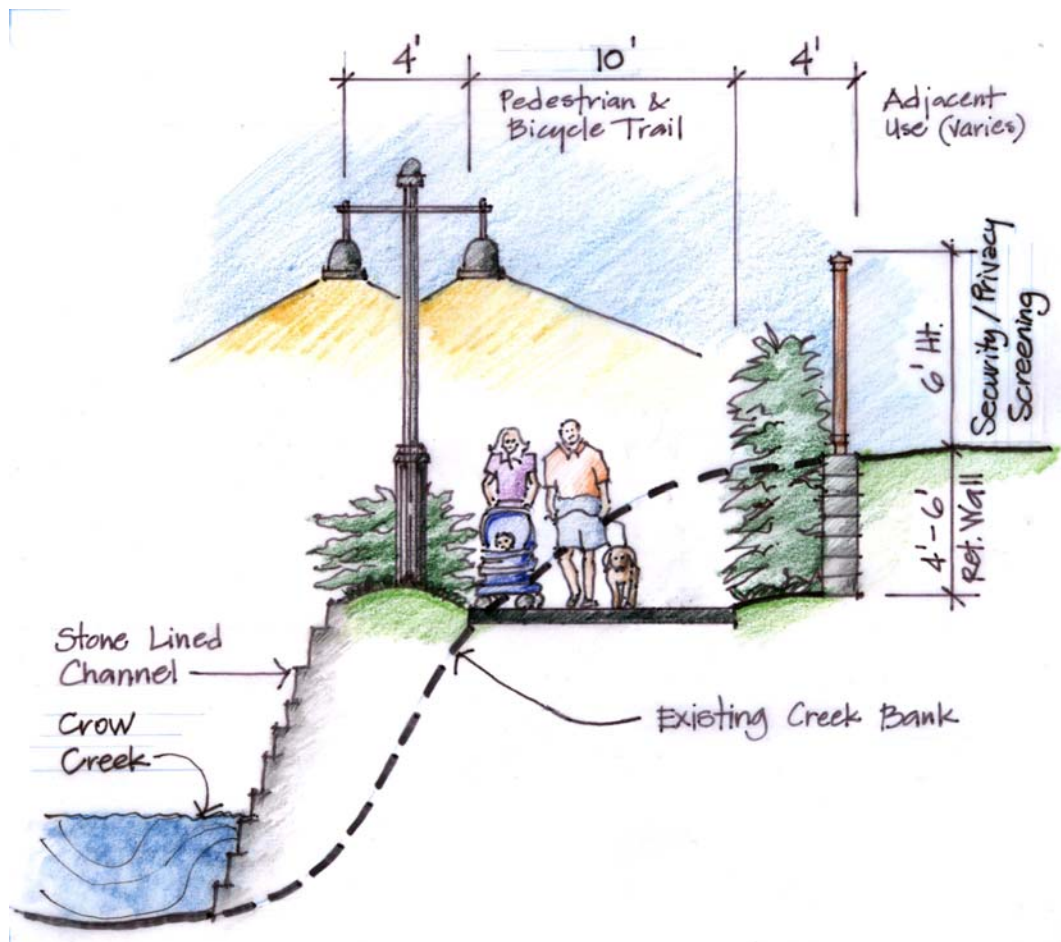
The USACE Crow Creek Section 206 Aquatic Ecosystem Restoration Feasibility Study is currently underway. The conceptual designs presented in this Master Plan may not be compatible with the ecosystem restoration mission of the USACE. Coordination should continue to occur with the USACE throughout the Section 206 study to identify opportunities for collaboration on Crow Creek.



Existing stone lined bank along a portion of Crow Creek

8.5.4 AREA/SITE PLAN

The proposed conceptual plan for the Crow Creek site is illustrated in Figure 8.5-3. The proposed pedestrian link along Crow Creek includes stream bank restoration, a lighted and landscaped pedestrian walkway along the stream corridor, and security/privacy screening for the adjacent residents. Stream bank restoration should incorporate the original WPA stone that exists on portions of the creek banks. Adjacent to Detroit Avenue, one access point to the trail from the neighborhood to the north will be developed on property presently owned by the City of Tulsa. The proposed trail is located adjacent to the creek, with a hard surface width of 10 ft. Through the residential neighborhoods, the trail is proposed to be located approximately four to six feet lower than adjacent residential lots to provide separation between public and private uses, with an additional six-foot high security/privacy screening at the private lot level (see sketch below).



Proposed Crow Creek Pedestrian Trail

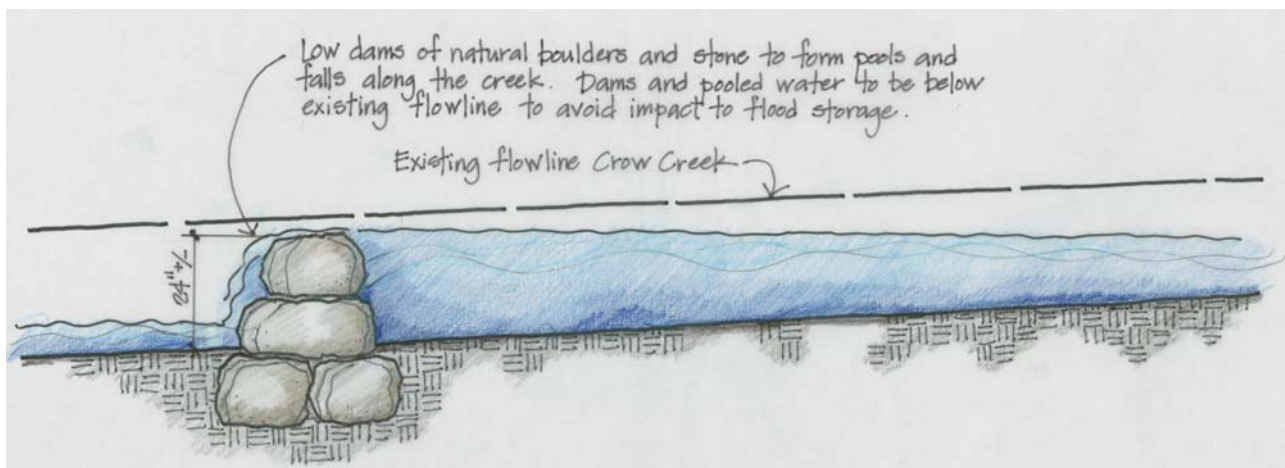


CROW CREEK REDEVELOPMENT AREA

FIGURE 8.5-3

Lowering the trail provides for additional privacy for the homeowners adjacent to the trail, and allows for trail lighting that does not encroach into the backyards of the neighbors. The security/privacy screening fence provides an additional six feet of separation, and aids in screening the trail lighting from the private lots. A landscape buffer or railing will be installed on the creek side of the trail where required for safety.

Small natural stone dams located along the creek can provide a series of low waterfalls for aesthetic interest along the trail. As shown below, the proposed dam locations below the existing creek bottom do not interfere with the flood carrying capacity of the creek. Plantings along the trail corridor will consist of native trees and plants to serve as wildlife habitat mitigation.



Concept: Small Dams in Crow Creek

The Brookside Gateway is planned at the site just north of Crow Creek fronting Peoria and 32nd Street. The gateway site provides a connection to the new pedestrian walkway, a gathering place for the neighborhood, and a visual entry into the Brookside commercial district. As shown previously in Figure 8.5-3, a large pond and wetland water feature supplied with creek water provides a visual amenity as well as a small area of riparian habitat restoration. The water feature will provide a dramatic natural waterfall that is visible from Peoria Avenue, with water from Crow Creek recirculated to the upper pool.

North of the proposed water feature, a pedestrian promenade and gazebo creates a scenic area for overlooking the pond and waterfalls. The proposed park design integrates historic elements

and markers to celebrate the heritage of Brookside and old WPA features along Crow Creek. The plaza also creates opportunities for public art. At the southwest corner of Peoria Avenue and E. 32nd Street, an architectural gateway structure is proposed that reflects the design proposed in the *"Brookside Infill Development Design Recommendations"* (May 2002). A kiosk may also be integrated into the plaza design to create a space for communication of Brookside area announcements and events.

Columns or overhead structures located at the Crow Creek bridge function as the major northern gateway into Brookside and complements the activity at the trailhead. The final design of enhancements to the Crow Creek bridge should create continuity with planned improvements to the Arkansas River, as well as reflect the unique character of the Brookside district.

Adjacent to Riverside Drive, a potential multi-use redevelopment could replace the existing multi-family housing complex, as shown in Figure 8.5-3. The conceptual plan proposes attached single-family and multi-family housing on the eastern two-thirds of the site, and an area of mixed retail, commercial and residential on the western one-third of the site. The following description summarizes the proposed redevelopment plan:

- **Town homes:** Attached two-story town homes with parking under the units are proposed to occupy the portion of the site east of Cincinnati Avenue. The town homes are oriented toward a central green space and toward Cincinnati Avenue.
- **Apartments/Condos:** The central portion of the multi-use site is planned for three-story apartments and condos, with a mixture of indoor parking and surface parking. Access for the apartments and condos is available from Cincinnati Avenue.
- **Mixed Use:** The frontage along Riverside allows for an area of mixed retail, commercial, and residential development. A water feature and plaza provide pedestrian space within the development, and a connection to the natural area of Crow Creek. The commercial and retail use maintains a neighborhood scale consistent with the Brookside commercial development plan to discourage "big box" development in the area. To minimize impact on residential neighbors, the multi-use

development plan provides parking on-site for the uses involved and maintains a 50 foot landscape screen and buffer between non-residential uses and residential neighbors to the south. The proposed parking structure with retail frontage on Riverside Drive has two enclosed parking levels with 3rd level roof parking. The primary access for the mixed-use development is from Riverside Drive.

- Traffic and Safety Concerns: Riverside Drive will be improved in the area of the new development to incorporate turning lanes that will aid ingress and egress from the development.

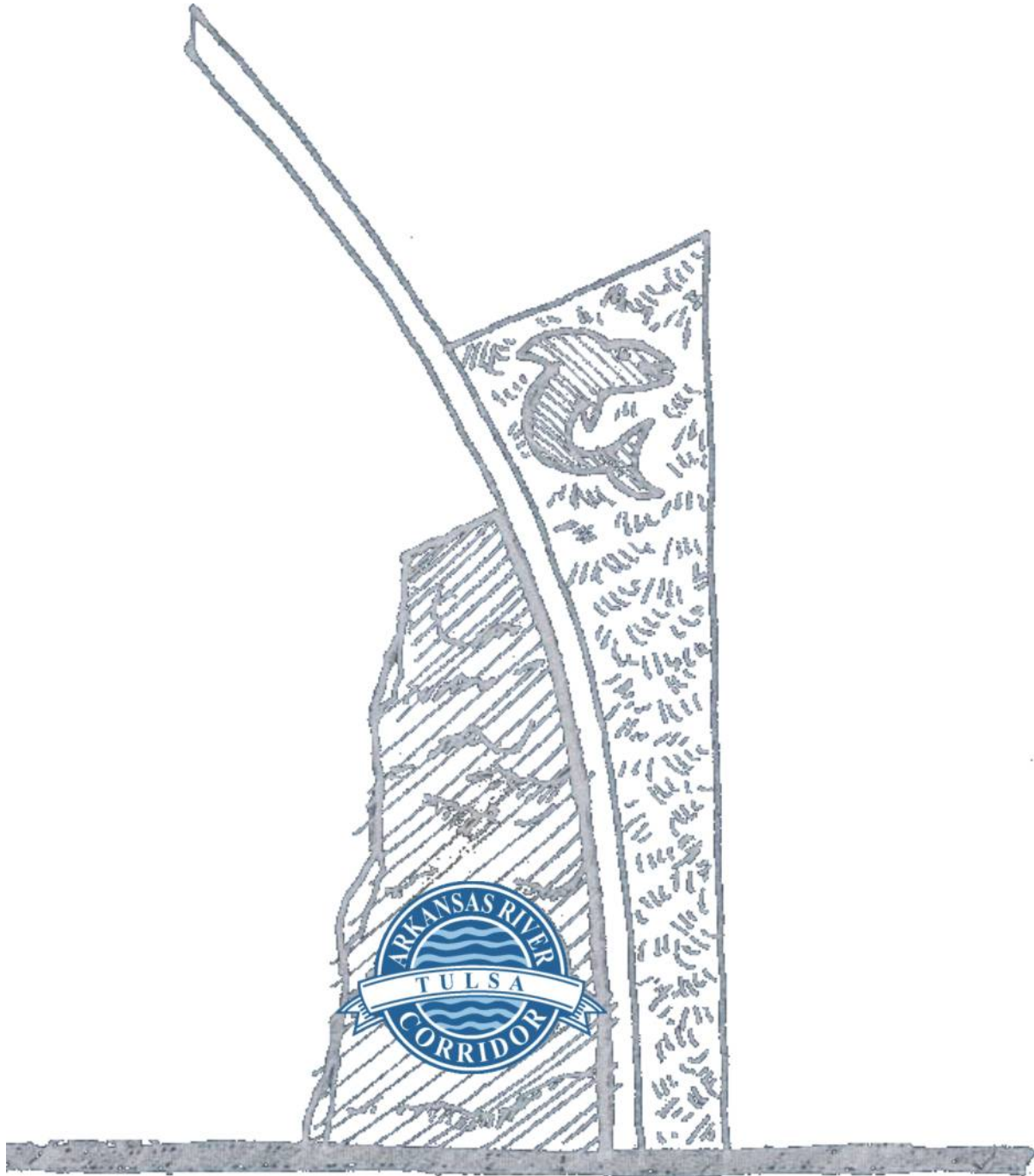


Pedestrian Promenade at Mixed Use Development

8.5.5 CONCLUSIONS/RECOMMENDATIONS

In order to implement the proposed improvements for the Crow Creek area, coordination will be necessary between several agencies and stakeholder groups. The stormwater carrying capacity and flood plain of Crow Creek must also be maintained. The natural habitat improvement to the Crow Creek corridor will require coordination with appropriate wildlife agencies. Continued coordination with the Brookside development and neighborhood associations is essential to address the concerns of the many stakeholder interests in the area. The proposed plan addresses the known concerns as outlined in the *"Brookside Infill Development Design Recommendations"* and also addresses the stormwater and habitat functions of Crow Creek. The plan provides a measure of versatility in order to address market demand for the eventual use of the commercial and retail area.

8.6 71st STREET RIVERFRONT CONCEPTUAL PLAN



8.6 71st STREET RIVERFRONT

8.6.1 BACKGROUND AND REQUIREMENTS



Turkey Mountain Urban Wilderness Area



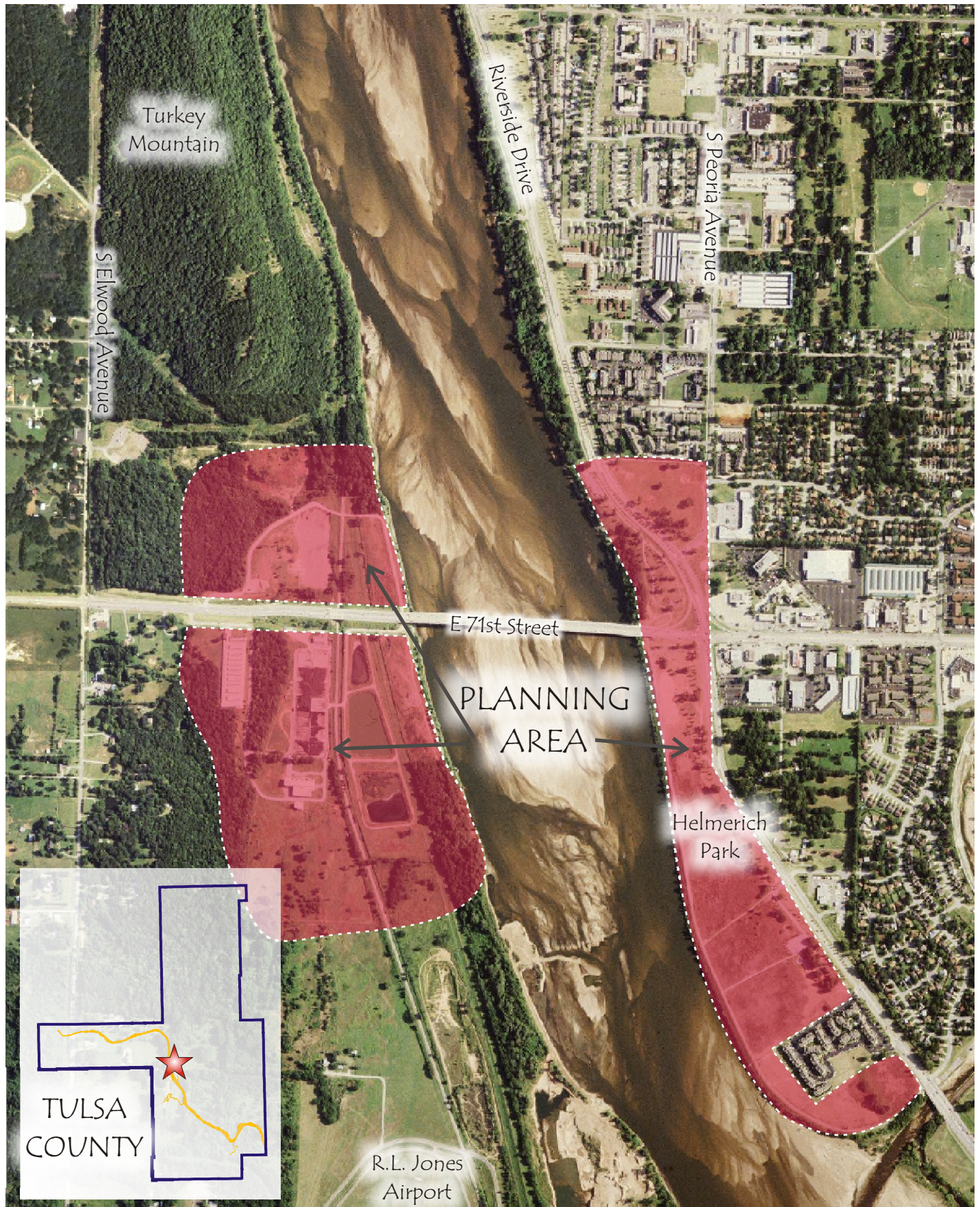
River Parks Trail on east bank

Due to its accessibility and high visibility, the 71st Street area has special prominence within the Arkansas River Corridor. There are also a number of community landmarks that are nearby, including the Turkey Mountain Urban Wilderness Area (TMUWA) and Helmerich Park. As shown in Figure 8.6-1, the planning area for 71st Street encompasses approximately one mile of riverfront, with the primary focus on the east bank.

The Phase I Vision Plan for the Arkansas River Corridor proposed a key redevelopment zone on each end of the 71st Street Bridge. On the east bank, the Vision Plan also envisioned a waterfront/mixed-use development area at the south end of Helmerich Park. New mixed-use development was proposed on the west bank, primarily between the Arkansas River and Elwood Avenue on the south side of 71st Street. The TMUWA is a significant natural feature for preservation. The future Riverside Drive West was proposed along the west boundary of TMUWA, connecting with 71st Street at the existing Elwood Avenue intersection. The Phase I Vision Plan illustrated a potential low water dam south of the 71st Street riverfront, located north of 81st Street and the Joe Creek confluence with the River (refer to Section 8.6.3 for further discussion).



The 71st Street Bridge provides a strong vehicular and pedestrian linkage across the Arkansas River.



71st STREET RIVERFRONT SITE LOCATION MAP

FIGURE 8.6-1

8.6.2 DESCRIPTION OF PLAN AREA

On the east bank of the Arkansas River, the planning area generally extends one-quarter mile north of 71st Street and south of 71st Street to the southern edge of Helmerich Park. These two areas create a linear strip between Riverside Drive and the Arkansas River. On the west bank, the planning area is located south of 71st Street and encompasses approximately one-half mile of river frontage.



Trails at Turkey Mountain area



Parking for Turkey Mountain trails



Scenic trails at Turkey Mountain Urban Wilderness Area



North of 71st Street on the west bank of the Arkansas River, the Turkey Mountain Urban Wilderness Area's spectacular topography has become a well-known landmark for Tulsa.

The TMUWA consists of over 300 acres of undeveloped property that stretches along the riverfront from the Tulsa Southside Wastewater Treatment Plant near I-44 to 71st Street and west from the River to Elwood Avenue and beyond. At 300 feet above the Arkansas River, the summit offers a panoramic view of Tulsa. The park is heavily wooded and has two large ponds. There is no water or electric utility service on the property. Dirt trails wind throughout the property for hiking and mountain biking. TMUWA's public parking lot at 69th and Elwood provides a good trailhead and also accommodates horse trailers. The TMUWA is the only portion of River Parks that allows horseback riding. Trails include the one-mile Lower Trail Loop; the two-mile Pond Trail Loop; and the five-mile Ridge Trail Loop. Future trail linkages are also planned along the west bank of the River as part of the trails

master plan for the metropolitan area. The City of Tulsa has also used the area southeast of TMUWA for recycling green waste into bark chips.



Turkey Mountain Trails

At the far south end of TMUWA, the River Parks Authority with approval from both the City and County has agreed to lease 40 acres to the National Indian Monument and Institute. A Phase II environmental study has been completed for this site, which is planned to accommodate an American Indian Cultural Center and Museum Complex. This new facility will be accessed from Elwood Avenue and will include a visual easement between the new museum and the River.

Consideration is being given to linking TMUWA with the Westside YMCA, including complementary facilities, such as equestrian trails and stables, to support the YMCA equestrian program. The TMUWA represents a unique natural asset within the Tulsa metropolitan area. It is strongly recommended that this asset be preserved in its natural state to ensure that this unique resource will remain for future generations.



View looking east from bluff on south side of 71st Street.

The area southwest of the 71st Street Bridge crossing is currently occupied by a variety of land uses. The majority of the property between Elwood Avenue and the River is either open space or low-density development. A mini-warehouse storage facility has been built approximately one-quarter mile west of the River on a scenic bluff. East of this development, a wooded slope provides a transition to a City of Tulsa biosolids treatment facility. Due to its proximity to the Arkansas River and potential for a “higher and better” use, consideration for redevelopment of this site has been explored. It appears that there is potential to eliminate the drying beds once used for sludge dewatering. There are also large waste lagoons, no longer in use, that are between a railroad track and large overhead electrical line. Treatment facilities that would need to remain in their current location include a biosolids de-watering facility that is one-quarter mile south of 71st Street.



Sewage treatment facility on west bank (south of 71st Street)



Prairie Rose Retirement Community
(east of Helmerich Park)



Entrance to Helmerich Park from
Riverside Drive



Helmerich Park Splash Pad

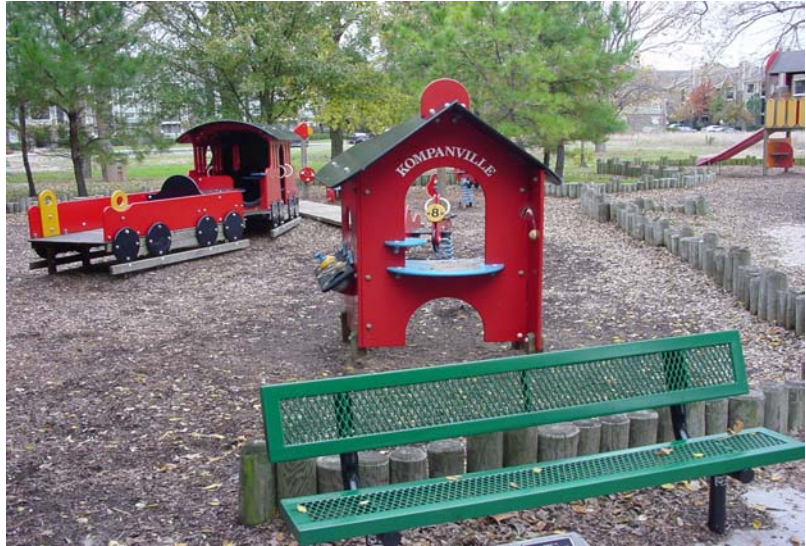


Open space at north end of
Helmerich Park



Helmerich Park's sand volleyball
courts

The area east of the 71st Street Bridge is more heavily urbanized with commercial, office, and multi-family development flanking both sides of 71st Street. Riverside Drive parallels the Arkansas River, creating a scenic recreational area between the boulevard and the River. South of 71st Street, Helmerich Park extends approximately seven-tenths of a mile south of 71st Street along the riverfront. The park varies in width from 500 feet, adjacent to 71st Street, to approximately 1,100 feet at its southern edge.



At the south end of Helmerich Park, a large kids' play area accommodates themed play equipment, a splash pad, a restroom, and off-street parking.

Helmerich Park is under the jurisdiction of the Tulsa Parks Board and its recreational facilities are a great asset to the community. Helmerich Park is a well-used recreational area that includes youth play areas, sand volleyball courts, and large open spaces. Vehicular access to the park is provided at two median breaks in Riverside Drive. The north end of Helmerich Park is undeveloped, with the exception of sand volleyball courts that are popular during the summer months. This area of the park also provides a flexible space for festivals and events, such as the annual United Way Sandblazer Run. The central area of Helmerich Park is bisected by a large drainage swale and is generally in natural condition without much recreational use. Soils in this area are very sandy to the point that tree growth is not naturally supported. Along the top of the River bank at the west edge of Helmerich Park, the River Parks trail system continues in both directions.

Planning for the 71st Street riverfront site also includes the east bank area that extends approximately one-quarter mile north of 71st Street. The focal point for this location is a water feature/sculpture that is northwest of the intersection of 71st Street and Riverside Drive. Constructed in the summer of 2002, BOK Plaza has become one of Tulsa's new landmarks.



BOK Plaza features the "Bruins River Park Picnic" bronze sculpture, which integrates a native Oklahoma black bear mother playing in a waterfall with her cubs. The artwork was created by Jim Gilmore of Alamosa, Colorado.



BOK Plaza Photographs



Arkansas River Otters Sculpture

River Parks is home to the city's largest collection of outdoor wildlife bronze sculptures. The sculptures are gifts to the citizens of Tulsa from NatureWorks, Inc., a local organization which promotes wildlife conservation and education. To create BOK Plaza NatureWorks, teamed with generous support from the Bank of Oklahoma (BOK), created a destination that is envisioned as a community-gathering place, including weddings, ceremonies, and group events.

The Arkansas River Otters sculpture, located south of BOK Plaza, creates another focal point in River Parks. The bronze sculpture was dedicated to Kenneth R. Greenwood in 1997 for his commitment to wildlife conservation.



Arkansas River Otters sculpture in BOK Plaza

The park area that surrounds BOK Plaza has a looped trail system that connects under the 71st Street Bridge to the south and provides excellent access to the west side of the Arkansas River via a pedestrian bridge that parallels 71st Street. Approximately 500 feet north of BOK Plaza, the Arkansas River Otters sculpture provides another focal point that can be viewed from Riverside Drive. The nearest parking for this area of River Parks is a small off-street lot that is one-quarter mile north on Riverside Drive.



Planned retail development at
Riverside Drive / Peoria Avenue

Northeast of this River Parks area, a 95,000 square foot retail development has been proposed. Preleasing for retail space and outparcels is underway for the 7000 Riverside Parkway project that fronts Peoria Avenue and Riverside Drive.

8.6.3 DESIGN CRITERIA / LIMITATIONS

A key consideration during concept development for the 71st Street riverfront was the infeasibility of constructing a low water dam and river lake in this reach of the Arkansas River. The Phase I Vision plan for the Arkansas River Corridor identified a possible low water dam, located north of 81st Street/Joe Creek that would create a river lake at 71st Street. However, hydraulic modeling for this proposed dam has produced undesirable results. The proposed downstream Creek Turnpike Dam would create a backwater effect throughout the pool of the 81st Street Dam during periods of high flow. Preliminary modeling for the proposed Creek Turnpike Dam indicates that its river lake would tail out approximately 3,100 feet downstream of the 71st Street Bridge near the location of the Helmerich Park playground. Multiple modeling runs were evaluated for the 81st Street low water dam with none of the scenarios meeting the "no-rise criteria" for new low water dams. Each trial run reduced the size of the low water dam by 0.5 feet until a dam height of three feet was reached. Dams this size and smaller would be considered economically infeasible.

Additionally, due to the presence of the existing City of Tulsa Southside Wastewater Treatment Plant on the downstream side of I-44, the discharge from the treatment plant would flow directly into the river lake created by the low water dam. It has been determined that water quality impacts associated with the proposed 81st Street low water dam would cause degradation of water quality below current standards.

As a result of issues that were revealed during hydraulic modeling, water quality modeling, and engineering evaluation of the proposed low water dams, the 81st Street low water dam is not recommended at this time. Therefore, the proposed conceptual plan for the 71st Street riverfront, described in Section 8.6.4, illustrates proposals for this site that can be successfully implemented without the presence of a river lake at 71st Street.



71st Street Bridge (with Turkey Mountain Urban Wilderness Area in background)



Native vegetation at Turkey Mountain



Helmerich Park

The master plan for the 71st Street riverfront should take full advantage of the strong circulation connections, visibility, and prominence of the 71st Street and Riverside Drive corridors. The 71st Street riverfront also has a number of natural resources and community landmarks to build upon. Opportunities also exist to promote public access to the Arkansas River, including the development of overlooks, boardwalks, and promenades. Other issues and opportunities that need to be addressed in the master plan are described below.

- Preserving the TMUWA from development should be a high priority due to its unique environment and location within the metropolitan area.
- Future development for the west bank area that is south of 71st Street must integrate the biosolids treatment facility components that must remain in their current locations. A more detailed study should be performed to verify the feasibility of relocating the drying beds and removing the sludge lagoons.
- For the Helmerich Park area on the east bank, future planning will need to carefully balance the preservation of open space with opportunities for river-oriented development. Future planning should also maintain compatibility with the large children's playground zone.
- Opportunities exist along both banks for ecosystem restoration including riparian habitat and prairie meadow habitats in conjunction with outdoor education.
- New off-street parking areas should consider the use of pervious materials and/or natural filters to reduce cumulative effects from surface runoff throughout the entire project corridor.

8.6.4 AREA / SITE PLAN



Native vegetation at Helmerich Park

The proposed conceptual plan for the 71st Street riverfront is illustrated in Figures 8.6-2 and 8.6-3 on the following pages. The proposed plan addresses three quadrants of the 71st Street Arkansas River area. In the northwest quadrant of this site, the TMUWA is recommended for preservation and continued trail use.

The most significant proposals for the 71st Street riverfront are illustrated along the east bank of the Arkansas River to the south of 71st Street. The north end of Helmerich Park is proposed to retain its current function as an attractive open space that accommodates informal activities as well as festivals and other events. The existing sand volleyball courts are retained and can expand as needed.

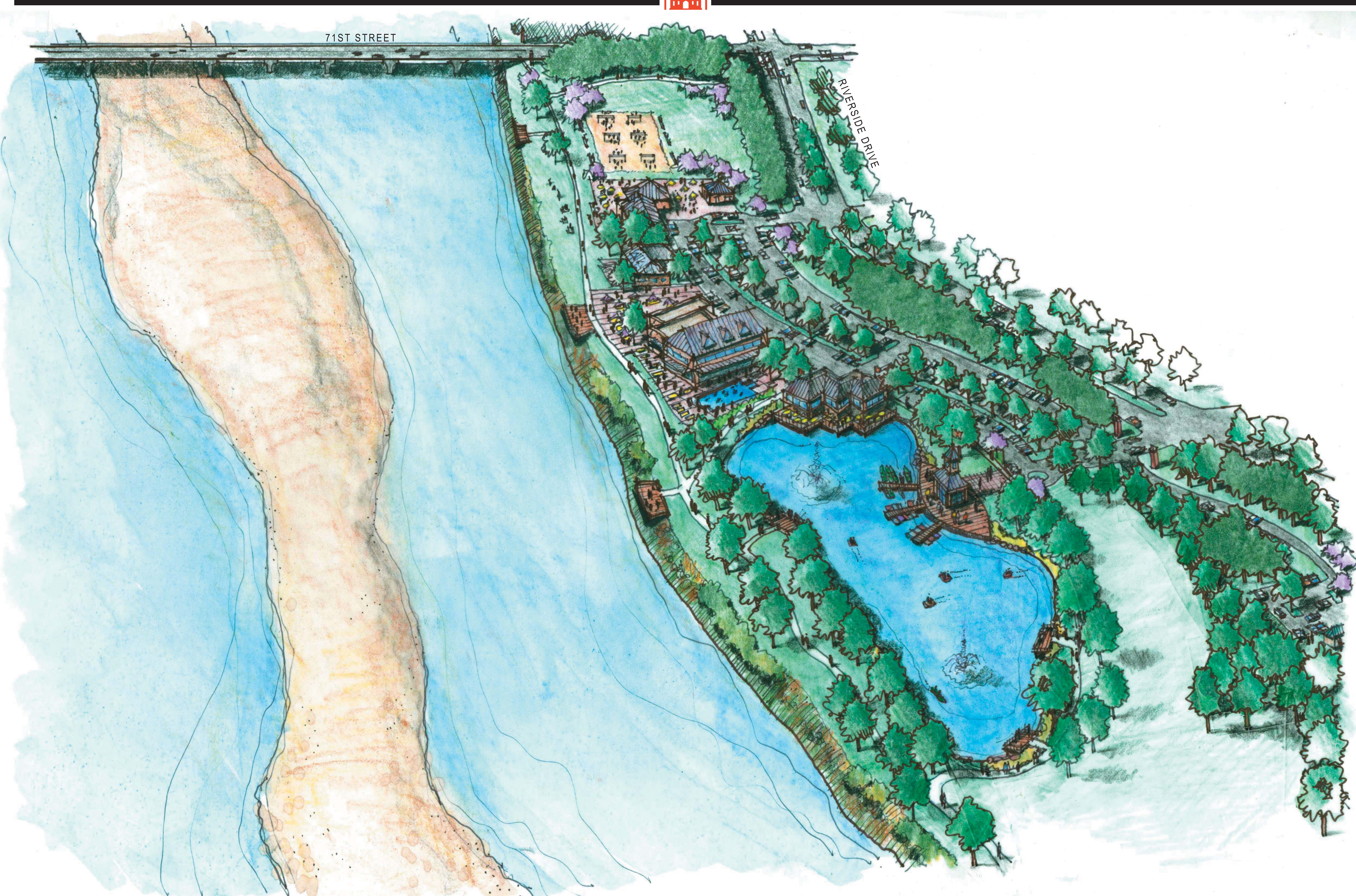
In the center of the Helmerich Park area, Figures 8.6-2 and 8.6-3 illustrate the potential for creating a community health and fitness complex that could provide a dynamic new activity center. This new facility might include indoor and outdoor pools, a gym, exercise equipment/classrooms, cafes, and other complementary activities as desired. A large public plaza creates a scenic setting for outdoor dining or relaxing and separates the health and fitness complex from a riverfront restaurant. Airplanes that are taking off or landing at the R.L. Jones airport, across the River immediately to the west, add to the interesting views. The existing drainageway that crosses this area of the site is proposed to be piped below ground.

The proposed activities in the park are supported by new landscaped parking areas, as shown in Figure 8.6-2. These new off-street parking lots are accessed from Riverside Drive at the existing median breaks. Proposed parking, a restaurant/outdoor patio, and restrooms would also benefit the sand volleyball users, as well as participants at festivals and other events. South of the new fitness center, a seven-acre lake is proposed that integrates fishing piers, a lakeside restaurant, overlooks, and walkways. A small boat dock is also suggested to accommodate paddleboats and remote-controlled model boats. The existing Helmerich Park playground and parking lot is maintained in the southeast corner of the park, with adjacent areas reserved for future recreational expansion.



71ST STREET RIVERFRONT CONCEPT PLAN

FIGURE 8.6-2



71ST STREET RIVERFRONT CONCEPT SKETCH

FIGURE 8.6-3

The final element of the proposed enhancements to Helmerich Park is the creation of a meandering trail system along the River's edge, including overlooks for enjoying scenic vistas. South of the existing apartments that are located south of Helmerich Park, the plan illustrates the potential for a new riverfront mixed-use development.



BOK Plaza

North of 71st Street along the east bank, the open spaces near the BOK Plaza and the otter sculpture are proposed to be maintained. This area should continue to be a focal point from Riverside Drive and 71st Street, as well as functioning as a "community crossroads" for the adjacent trail users. Approximately one-quarter mile to the north, the existing parking lot is proposed for expansion and a new restroom is proposed to better accommodate groups that visit these monuments. Proposed improvements for this area include a new pavilion for hosting events, depicted on Figure 8.6-2 to the south of the expanded parking lot. A potential feature is also depicted in the open space south of the otter sculpture.

Figure 8.6-2 illustrates potential redevelopment for the west bank of the Arkansas River south of 71st Street to take better advantage of the riverfront setting. The existing biosolids facilities can be consolidated as shown, creating an opportunity for a significant sports complex. Access to this complex would be provided from 71st Street at the existing driveway that is one-quarter mile west of the River's edge. The proposed recreational development includes eight adult soccer fields. New parking and restrooms are also illustrated to support the proposed sports fields.

West of the proposed sports fields, Figure 8.6-2 illustrates the possible redevelopment of the existing mini-storage facility into multi-family housing. The northeast corner of this site also provides an opportunity for a destination restaurant that enjoys scenic river views from its location on the top of a ridge. These proposals would be market driven, with the goal of creating uses that maximize the value of a scenic riverfront location.

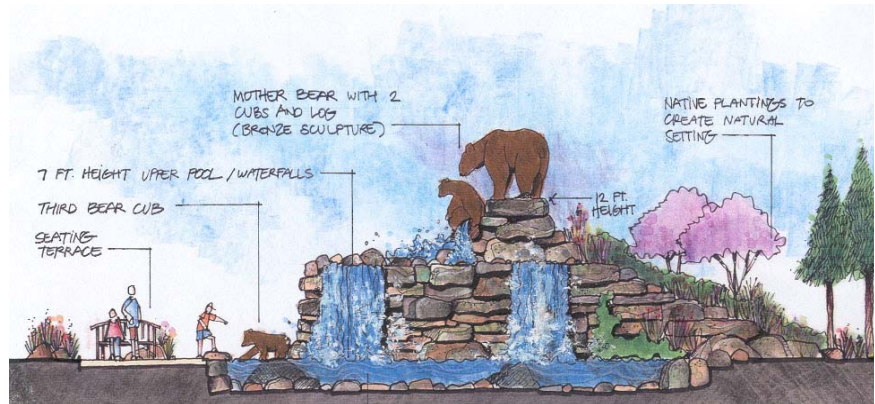
8.6.5 CONCLUSIONS / RECOMMENDATIONS



Arkansas River / 71st Street
riverfront

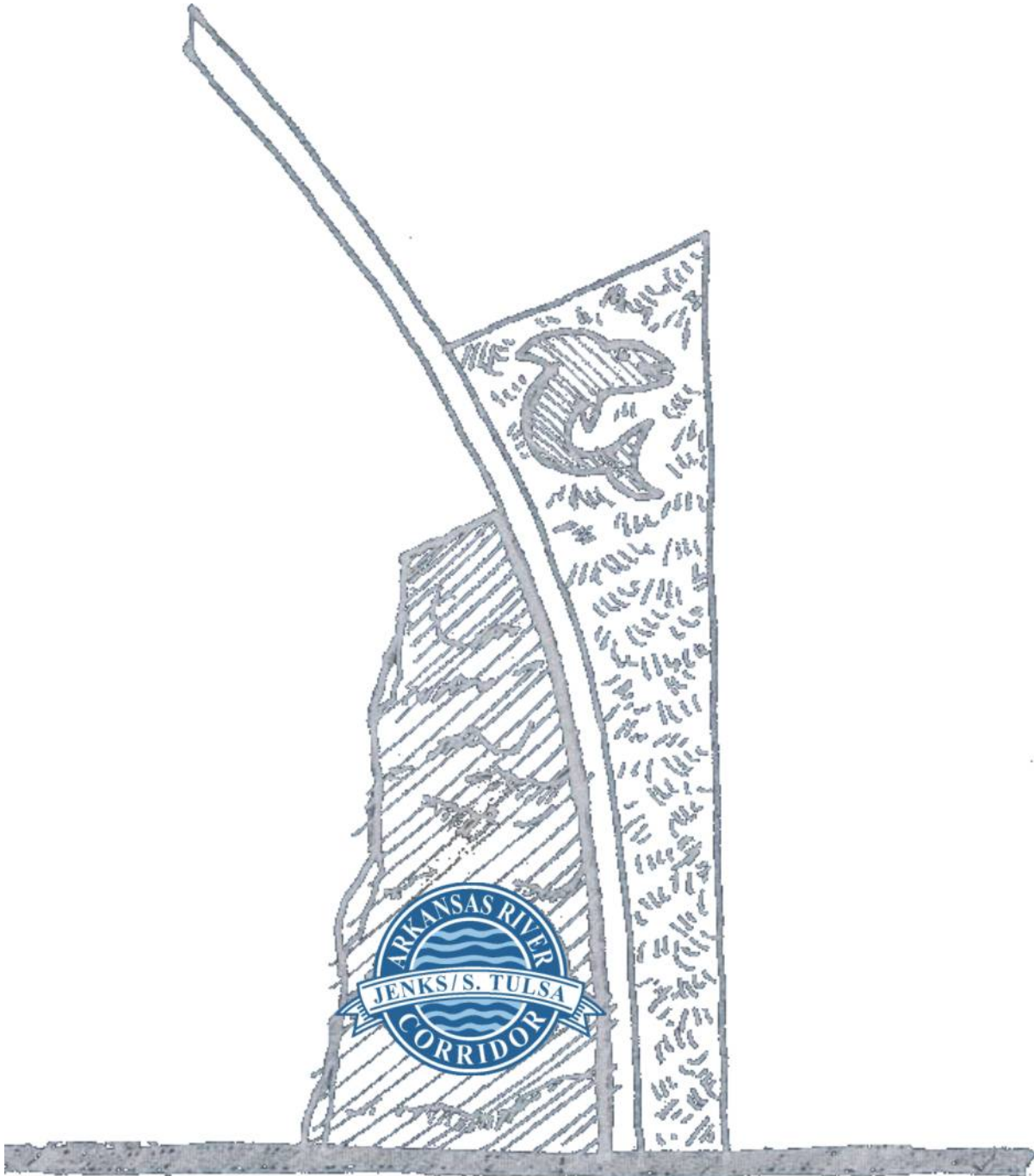
During public surveys that were performed during Phase I of the Vision Plan, a frequent response was the desire for “riverfront-oriented” restaurants and other uses. The goal of promoting public access to the River’s edge was also identified as important to create a true sense of place. The 71st Street riverfront has an opportunity to become a community-gathering place by building on its existing assets.

The east bank, in particular, presents a great opportunity for new health and fitness themed activities that complement the mission of River Parks. Through a plan that carefully balances open space with new uses, a dynamic riverfront can be achieved that can be enjoyed by the Tulsa area for many years.



Bok Plaza Sketch

8.7 JENKS / SOUTH TULSA RIVERFRONT CONCEPTUAL PLAN



8.7 JENKS / SOUTH TULSA RIVERFRONT

8.7.1 BACKGROUND AND REQUIREMENTS



Oklahoma Aquarium

The Jenks/South Tulsa riverfront creates unique opportunities, due in large part to significant river-oriented developments that have been recently constructed or are underway. This location has been identified as a high priority for a low water dam that will create a river lake and a great asset to new developments. As illustrated in Figure 8.7-1, the planning area for the Jenks/South Tulsa riverfront generally extends along the west bank of the River from 91st Street to approximately one-half mile south of the Creek Turnpike and along the east bank from approximately 91st Street to approximately one-quarter mile south of 101st Street.



New hotel adjacent to Oklahoma Aquarium

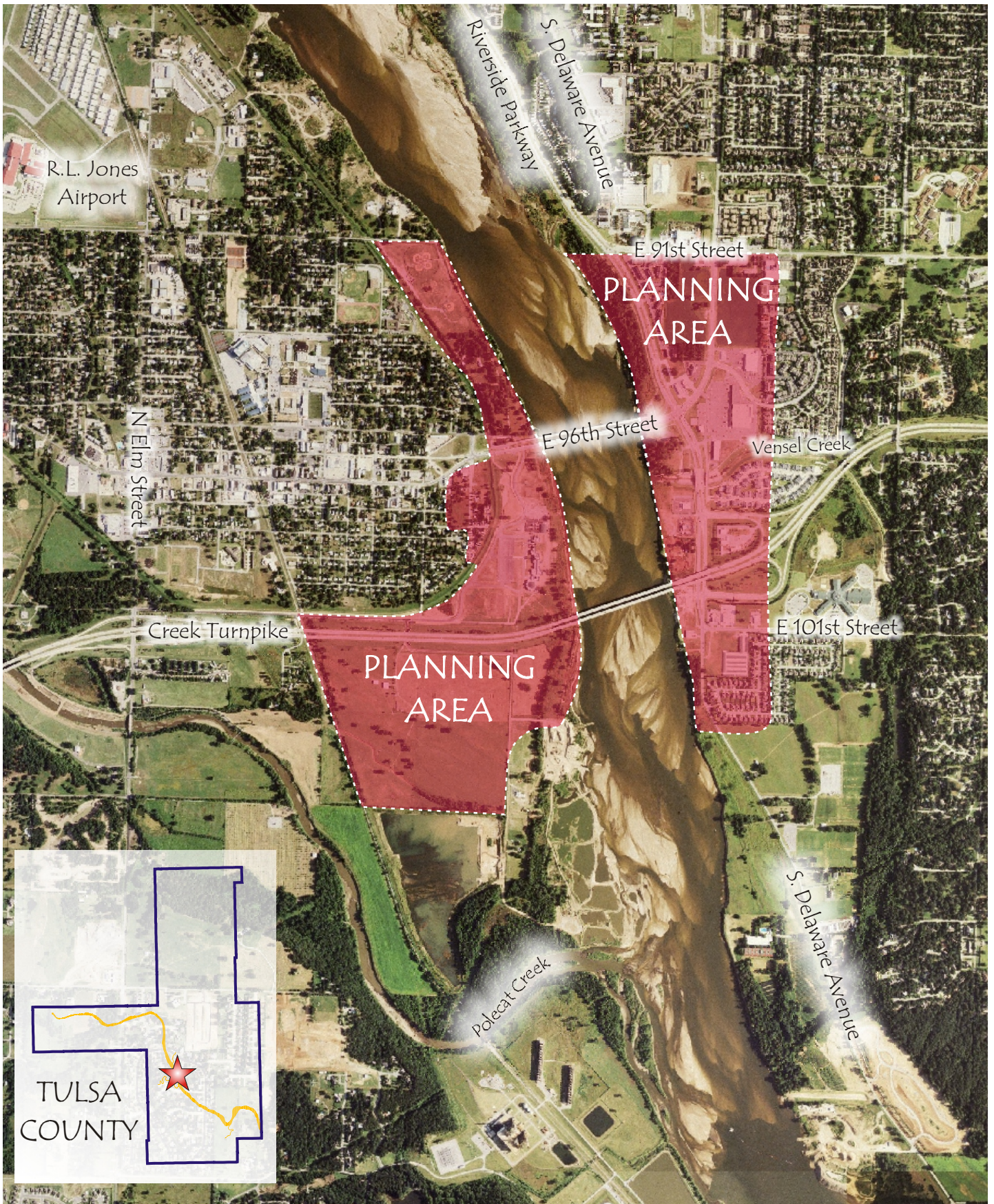
Exciting new developments on the west side have created a strong beginning of a retail/entertainment district that can connect to the proposed Muscogee Creek Nation Casino, the proposed King's Landing, and other restaurant/retail nodes on the east bank via water taxis. The Jenks/South Tulsa riverfront benefits from excellent access and visibility from the Creek Turnpike, 96th Street Bridge, and Riverside Drive. In addition to a low water dam, the Phase I Vision Plan proposes mixed-use developments and trail linkages that create diversity for the Jenks/South Tulsa riverfront.



West Bank of Arkansas River adjacent to RiverWalk Crossing



The first phase of the new RiverWalk Crossing development is nearing completion on the Jenks riverfront.



JENKS/SOUTH TULSA RIVERFRONT SITE LOCATION MAP FIGURE 8.7-1



8.7.2 DESCRIPTION OF PLAN AREA



Jenks Pedestrian Bridge

The planning area for the Jenks/South Tulsa riverfront site is extensive, spanning a distance of 1½ miles along the west bank of the Arkansas River. The 96th Street and Creek Turnpike bridges bisect the Jenks/South Tulsa riverfront, providing excellent access to the larger metropolitan region. A newly painted and lighted pedestrian bridge is located on the north side of the 96th Street Bridge, providing a strong trail linkage between the east and west sides of the River. By using the 96th Street Pedestrian Bridge, trail users can readily access the River Parks trails that extend north along the east bank, as well as the trails that are routed under Riverside Drive and extend east along the Creek Turnpike.



Retail development near 96th Street / Riverside Drive

The Jenks/South Tulsa riverfront area is also influenced by the significant commercial growth in the 96th Street/Riverside Drive area on the east side of the River. Recent commercial developments include a Neighborhood Market, Kohl's, and a number of restaurants and shops. New riverfront developments are also planned or under construction on the east bank between 96th Street and the Creek Turnpike. These developments include a recently opened Johnny Carino's restaurant and the proposed King's Landing. Located just north of the turnpike, King's Landing will create a 50,000 square-foot dining and retail development with mission style architecture. Farther to the north along the east bank, the expanded Creek Nation Casino development will create a substantial entertainment use that can be linked to the west bank by water taxi. The east bank also includes a large eagle habitat area that is bounded by Riverside Drive to the east, Fred Creek to the north, and 96th Street to the south.



New Restaurant on East River Bank

The Jenks/South Tulsa riverfront is home to several premier attractions that are potential catalysts for future riverfront development throughout the entire Arkansas River corridor. At the north end of the study area, RiverWalk Crossing will anchor the Jenks riverfront with a variety of uses that take full advantage of views to the Arkansas River. The Oklahoma Aquarium, located between the 96th Street and Creek Turnpike Bridges, is an outstanding cultural and educational facility that expects to attract more than a half-million visitors annually. Opened in May 2003, the Oklahoma Aquarium has become one of the top tourist destination points in the region.



Aquarium Drive
(view looking west)



The Oklahoma Aquarium attractions include over 200 exhibits and a wide variety of habitats; the Sigfried Family Shark Exhibit; the Karl and Beverly White National Fishing Tackle Museum; and the Zebco Casting Pond.

The Aquarium was the first step in creating an area of town centered on the River, and has a total site area of 66 acres that is envisioned for other cultural anchors and supporting commercial development.

The campus that surrounds the Oklahoma Aquarium is within the City of Jenks Riverfront District (see Section 8.7.3 of this study). Bounded by the levee on the west and the River to the east, this large site includes significant acreage for development of cultural or commercial uses that are complementary to the Aquarium. The City of Jenks has invested in creating a solid infrastructure for this campus that includes new streets, trails, and themed lighting. A hotel has recently been constructed north of the Oklahoma Aquarium.



Large tract of land south of
Creek Turnpike

South of the Creek Turnpike, a large undeveloped tract of land creates additional opportunities for the Jenks Riverfront. Accessible by several underpasses below the Creek Turnpike, this approximately 145-acre site has outstanding visibility from the turnpike. The current street infrastructure is limited. 101st Place parallels the turnpike for approximately one-quarter mile and connects to unpaved Lewis Avenue which extends south along the west side of the River to Watkins Sand and other uses. This site is

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bounded on the west by the Union Pacific Railroad, and is bisected by Wilmott Creek in the southwest corner of the property. The site benefits from approximately one-quarter mile of frontage along the Arkansas River.



Intersection of Lewis Avenue /
101st Place

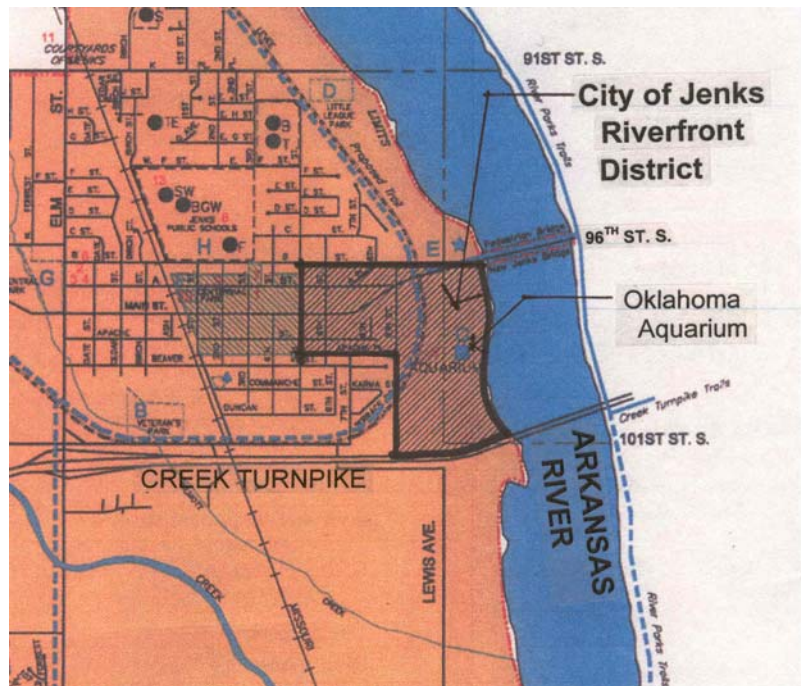


Visitors at the Oklahoma Aquarium

8.7.3 DESIGN CRITERIA / LIMITATIONS

As defined in the Phase I Vision Plan, the primary focus for future development of the Jenks/South Tulsa riverfront is the creation of a retail/entertainment district. This district should build on exciting new anchors, including the Oklahoma Aquarium and RiverWalk Crossing, with linkages to retail and entertainment uses on the east bank. The Jenks/South Tulsa riverfront can benefit tremendously by the planned addition of a low water dam, to be located downstream of the Creek Turnpike Bridge and upstream of the Polecat Creek confluence with the Arkansas River (refer to Section 8.7.4 for additional discussion).

The City of Jenks has established an appearance review district that provides guidance for future riverfront development. As shown below, the Riverfront District extends along the Jenks riverfront between 96th Street and the Creek Turnpike and encompasses the Oklahoma Aquarium campus and adjoining property to the west.



Jenks Riverfront District - (map source: INCOG)

The Riverfront District Guidelines provide design criteria for appearance/design, building materials, landscaping, fencing, signage, lighting, and outside storage/outbuildings.

There are several other criteria and constraints that will need to be addressed in the design of the Jenks/South Tulsa riverfront planning area. These include:



Overhead Electrical Lines



Downtown Jenks businesses

- There are a number of major utility lines, pipelines, and easements that exist throughout the planning area. These include a large overhead electrical transmission line that bisects the planning area with a north-south orientation, generally aligned with Lewis Avenue. South of the Creek Turnpike, there are also several pipeline easements that cross the planning area.
- Riverfront planning for new site areas must provide required flood control. The Polecat Creek confluence with the Arkansas River is also an important factor in the location of the proposed low water dam.
- West of the Riverfront District, downtown Jenks has become highly successful and is known as the "Antique Capital of Oklahoma." Planning for the Jenks riverfront should build upon and connect with Main Street to maximize economic opportunities.
- A large sand and gravel mining operation is located south of the Jenks riverfront planning area. Truck traffic from this business travels north, since there are no through roads to the south. Future planning for the tract south of the Creek Turnpike will need to address this traffic issue.
- Projects will be subject to local, state, and Federal laws. Prior to implementation, a detailed National Environmental Policy Act (NEPA) analysis will be conducted to address potential impacts to environmental resources.

8.7.4 AREA / SITE PLAN

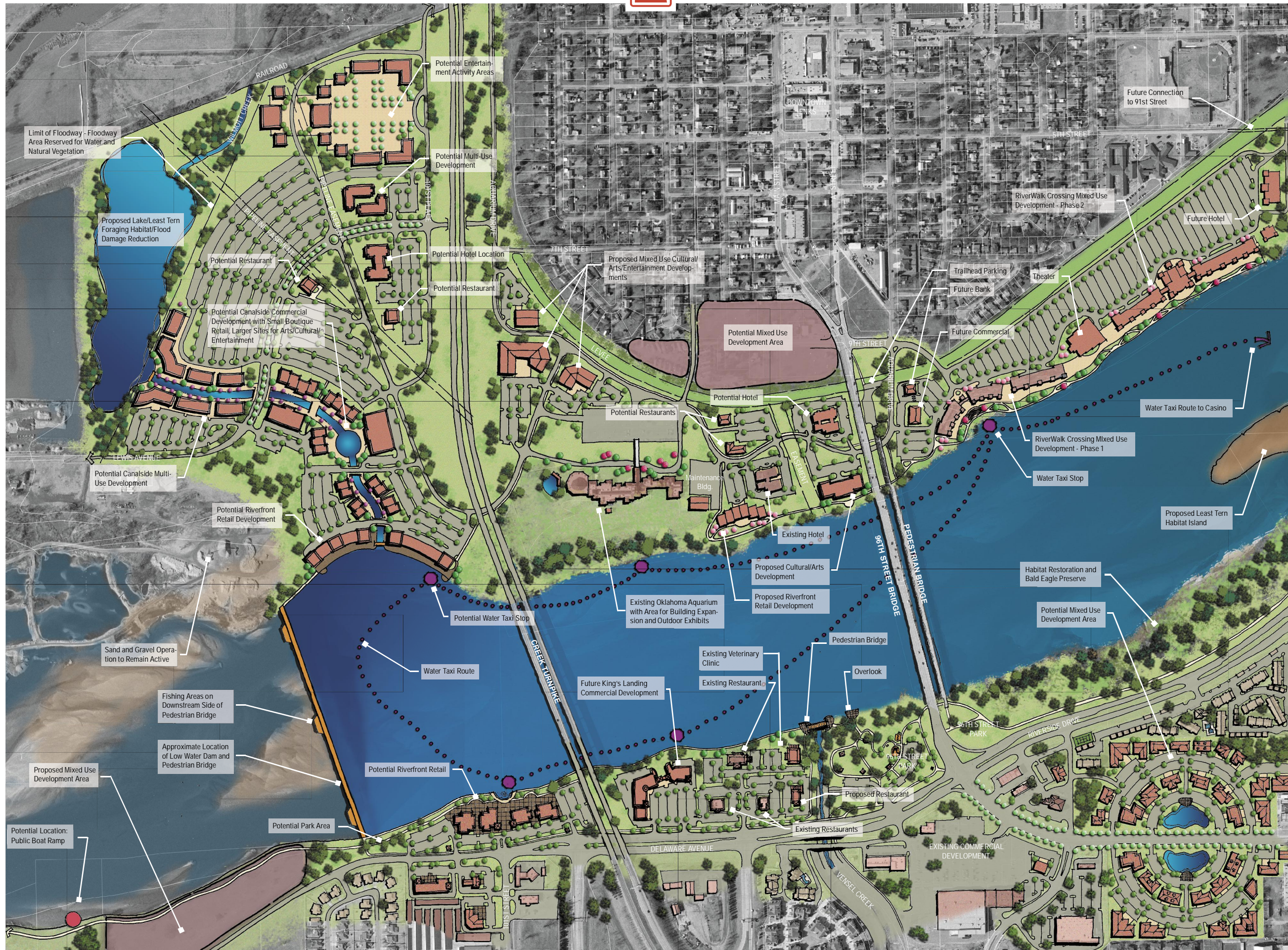


Arkansas River
(view looking east)

The proposed conceptual plan for the Jenks/South Tulsa riverfront area is illustrated in Figures 8.7-2 and 8.7-3. The proposed low water dam, to be located south of the Creek Turnpike Bridge, will have a tremendous impact on the existing and planned developments on both banks of the Arkansas River. This location will provide visual and vehicular access to the low water dam and river lake area from both the eastbound and westbound traffic on both bridges. The new dam can also enhance the Oklahoma Aquarium, the RiverWalk Crossing area and the proposed Creek Nation Development through the creation of a recreational lake that will reach approximately 2.9 miles upstream of the dam. There is also an existing sand and gravel operation downstream of this location on the west bank that could be incorporated into the operation and maintenance of the new river lake. The extensive commercial, recreational, and residential development in this area would currently classify this dam site as a Tier 1 location, or a high priority for development. It is recommended that this site be considered as one of the first two locations for funding a low water dam.



A new low water dam is proposed for construction south of the Creek Turnpike Bridge.



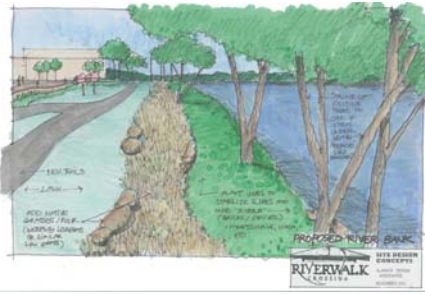
JENKS/SOUTH TULSA RIVERFRONT CONCEPT PLAN

FIGURE 8.7-2

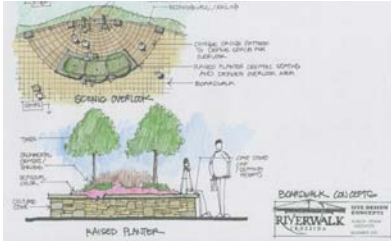


JENKS RIVERFRONT CONCEPT SKETCH

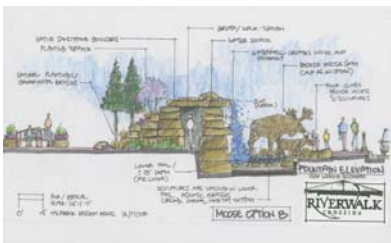
FIGURE 8.7-3



RiverWalk Crossing – trail concept



RiverWalk Crossing – overlook concept



RiverWalk Crossing – fountain concept



RiverWalk Crossing – outdoor fireplace



RiverWalk Crossing – amphitheater

RiverWalk Crossing is a new mixed-use development, located between 91st Street and 96th Street, which will anchor the north end of the Jenks riverfront district. This exciting project is the metropolitan area's most significant river-oriented development to date. RiverWalk Crossing has been planned as a lifestyle center with a unique mix of restaurants, retail shops, offices, a hotel, and a theater. RiverWalk Crossing is being developed in several phases, and the initial phase opened in May 2005. The project also includes several outparcel sites, one of which will accommodate a branch bank facility. The development is oriented toward the River with a continuous boardwalk that includes diverse amenities that encourage patrons to spend the day there. Amenities include a large amphitheater, water features/fountains, outdoor fireplaces, bronze sculptures, river overlooks, and outdoor dining areas. Primary access to RiverWalk Crossing is provided from a signalized intersection at 9th St. and 96th Street. The City of Jenks is also planning to extend 5th Street over the levee to connect with 91st Street, which will result in improved access at the north side of the development.



Bronze sculptures and colorful paving are part of the new boardwalk at Riverwalk Crossing.



Oklahoma Aquarium

The central area of the Jenks riverfront district spans a distance of one-half mile between the 96th Street and Creek Turnpike bridges. The Oklahoma Aquarium, as discussed earlier, provides an outstanding cultural facility that is the focal point for the surrounding campus. Access to this area of the riverfront is provided by Aquarium Drive, which connects with 96th Street and loops under the 96th Street Bridge. As shown previously in Figure 8.7-2, Aquarium Drive winds through the campus area and extends west to Elm Street parallel to the Creek Turnpike and the levee.

The riverfront area immediately east of the Aquarium accommodates long-range expansion of the facility, as well as future outdoor exhibits. The conceptual plan for the central area of the Jenks riverfront illustrates a variety of proposed uses that would complement the Oklahoma Aquarium to create a unique riverfront entertainment district. As shown, possible new uses include a hotel, cultural/entertainment attractions, restaurants, and mixed use development. A vehicular connection to the area west of the levee is also proposed, creating opportunities for additional mixed-use redevelopment. There is also excellent potential for adding cultural or retail uses that face the River and provide opportunities for continuation of a boardwalk.

South of the Creek Turnpike, a large tract provides great potential for river-oriented development that can complement the Aquarium area. As shown in Figure 8.7-2, access to this site from Aquarium Drive can be accommodated in three locations that cross under the turnpike. The primary point of vehicular entry is proposed at the existing underpass, closely aligned with 7th Street. A curvilinear boulevard is proposed that bisects the site and connects with Lewis Avenue to provide access to existing businesses to the south. Adjacent to the Arkansas River, a retail development is proposed with a boardwalk facing the new river lake that will be created by the low water dam. A new canal is also proposed to create a pleasant promenade for additional retail and cultural uses that flank each side of the water, as illustrated in Figure 8.7-3.

The central area of this development site accommodates parking that will support the new developments. In the northwest corner of the site, a large-scale entertainment or mixed-use development is illustrated, taking full advantage of views from the Creek Turnpike. The highway frontage also provides a good location for potential

restaurants, a hotel, and additional mixed-use development that is illustrated. In the far southwest corner of the site, the existing floodway that follows Polecat Creek does not allow for development. A large lake and open space are proposed for this area, which will create an excellent amenity to the new developments. This 30-acre area also provides desirable opportunities for interior least tern foraging habitat and added flood storage.

As illustrated in Figure 8.7-2, the east river bank is less expansive in area, with Riverside Drive creating a linear riverfront area. The riverfront area north of 96th Street is in a natural condition, with large trees and thick understory growth creating wildlife habitat. This area is proposed to remain as a bald eagle preserve and habitat restoration area. In addition, two interior least tern habitat islands are proposed in the new recreational river lake created by the low water dam. South of 96th Street, the existing park/trailhead is proposed for expansion in the open land immediately north of Vensel Creek. Proposed improvements include new parking, trails, and picnic areas. A new pedestrian bridge over Vensel Creek is illustrated, creating a scenic overlook with views to the Oklahoma Aquarium.

As described previously in this report, the east bank between the 96th Street Park and the Creek Turnpike has been developed recently with restaurants, and will be the home for the planned King's Landing dining and retail development. The east bank area that is south of the Creek Turnpike provides an opportunity for a new river-oriented commercial development, which can include a boardwalk adjacent to the River. South of the proposed low water dam along the east bank, a 15-acre site is proposed as a potential mixed-use development. This site provides excellent views of the River and future low water dam, and could accommodate river-oriented development with retail, restaurants, and entertainment venues.

The areas east of Riverside Drive have had significant commercial development within the past five years, especially near 96th Street. As illustrated, there are also undeveloped properties in this area that have excellent potential for commercial or mixed-use development. These new developments can benefit from the existing transportation system that includes the Creek Turnpike,

96th Street, 101st Street, and Riverside Drive. Opportunities for strong pedestrian connections to the River should be maximized to take advantage of this natural asset.

Trails are another key element of the Jenks/South Tulsa riverfront plan. Significant trail segments have already been constructed, including a riverfront trail system adjacent to RiverWalk Crossing and an extensive trail that parallels Aquarium Drive west to Elm Street. This trail also links to the 19-acre Veteran's Park, which will be built northeast of 101st and Elm Streets. The newly renovated 96th Street pedestrian bridge also creates a direct linkage to the River Parks trails on the east side of the Arkansas River. The proposed low water dam is also planned to include a pedestrian bridge which will further strengthen the trail connections between the east and west banks. The trail system is also well developed on the east bank of the River, as shown in Figure 8.7-2. Existing River Parks trails parallel Riverside Drive through the natural area north of 96th Street, with a connection under the 96th Street Bridge. An existing trail linkage at the Riverside Drive Bridge over Vensel Creek provides a connection east to the Creek Turnpike Trails. New trails are also planned along Riverside Drive and the east bank of the River. One such trail is the proposed trail extension south of 101st Street and continuing around the River bend. As envisioned in the Phase I Vision Plan, water taxis also have the potential for a unique form of transportation between the Jenks riverfront and new developments on the east bank.

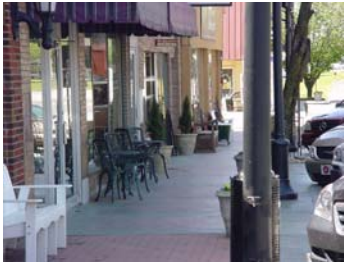


New trails adjacent to Aquarium Drive

8.7.5 CONCLUSIONS / RECOMMENDATIONS



RiverWalk Crossing signage



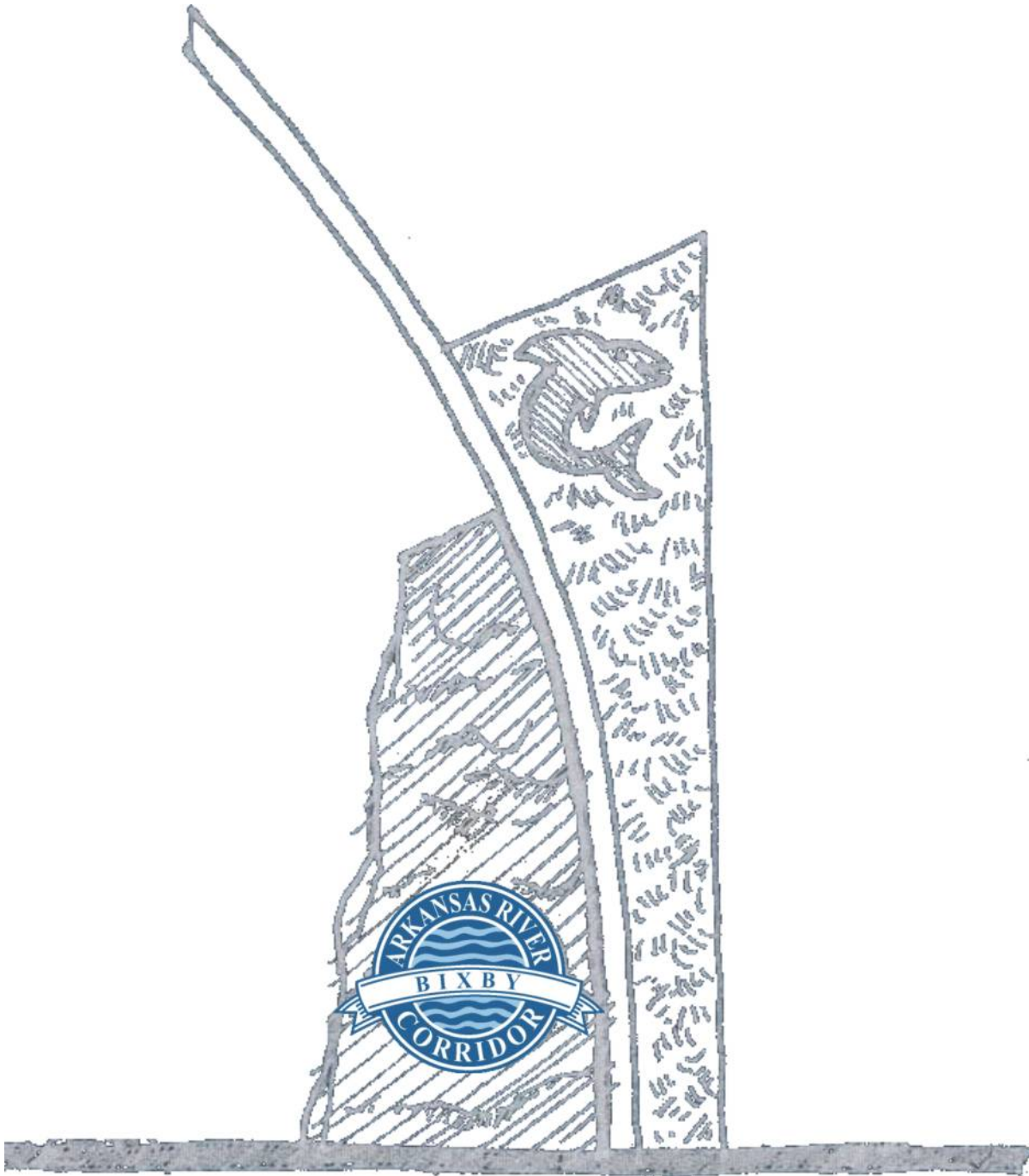
Downtown Jenks



Oklahoma Aquarium

The Jenks/South Tulsa riverfront has nearly unlimited potential for development of a dynamic riverfront entertainment district. There is already a tremendous amount of momentum that has been generated by the Oklahoma Aquarium, RiverWalk Crossing, and recent commercial development on the east bank. These attractions will anchor the riverfront and can stimulate new river-oriented development. The planned construction of a new low water dam will create a seasonal river lake, bringing aesthetic benefits and a greater connection to entertainment uses on the east bank. The creation of guidelines for a riverfront district will further enhance the potential for creating a cohesive riverfront. There are also a number of issues that will require careful planning and coordination. Flood control will continue to be an important component for all new developments, as well as coordination with the Watkins Sand operation to maximize their operations adjacent to the planned low water dam. Site planning must also accommodate the large power lines and pipeline easements that cross many site areas.

8.8 BIXBY RIVERFRONT CONCEPTUAL PLAN



8.8 BIXBY RIVERFRONT

8.8.1 BACKGROUND AND REQUIREMENTS



Commercial development on Memorial Drive



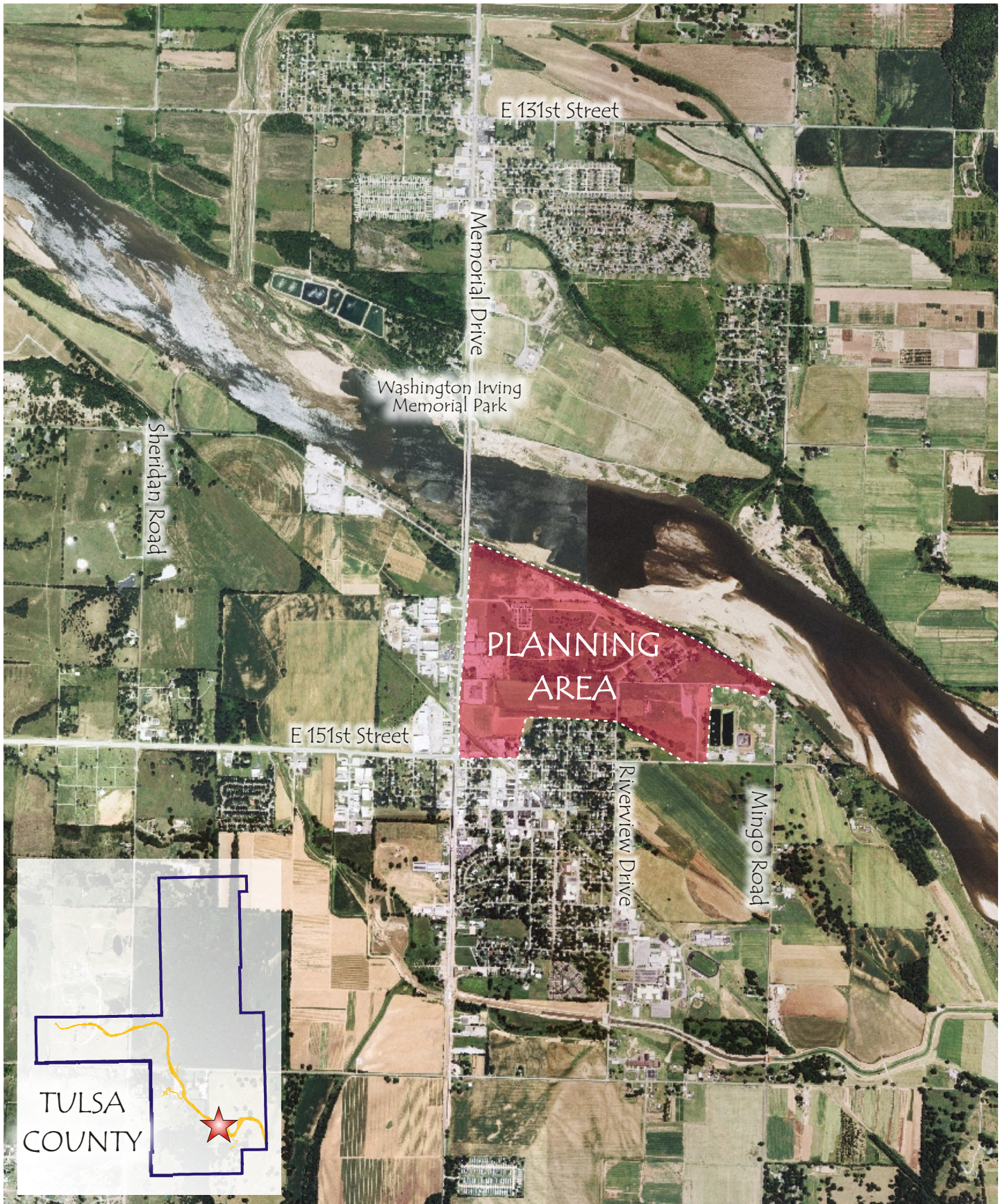
Trails at Washington Irving Memorial Park

As illustrated in Figure 8.8-1, the planning area for the Bixby riverfront is bounded by the Arkansas River to the north; Memorial Drive to the west; 151st Street to the south; and Mingo Road to the east. Existing land uses for this expansive area of over 300 acres vary considerably, including a combination of developed and undeveloped property.

The Phase I Vision Plan illustrated the potential for a low water dam approximately one-half mile east of Memorial Drive/Bixby Spartan Pass. Section 8.8.3 of this study discusses the proposed dam further. The Vision Plan also recommended enhancements to the existing city sports facilities and mixed-use development along the Memorial Drive corridor. Expansion of the existing trail system was also proposed and would extend riverfront trails to the east and west of Bixby's riverfront.



East of Memorial Drive, the south bank of the Arkansas River is in natural condition with very limited access.



BIXBY RIVERFRONT SITE LOCATION MAP

FIGURE 8.8-1



8.8.2 DESCRIPTION OF PLAN AREA



Memorial Drive / Bixby-Spartan Pass



Existing hike / bike trail along south bank of Arkansas River



Sand / gravel mining operation near Memorial Drive

Memorial Drive/US Highway 64 provides an excellent vehicular linkage to the Tulsa metropolitan area via the Bixby-Spartan Pass across the Arkansas River. This heavily traveled roadway is undergoing significant commercial growth as it extends north across the river through Bixby and into south Tulsa. On the south edge of the Bixby planning area, 151st Street is a two-lane road that connects with Mingo Road. Keas Road and Riverview Road also provide circulation through the east end of the Bixby riverfront site. The site benefits from recent trail construction that includes a three-quarter mile long trail along the River's south bank, connecting under the Memorial Drive Bridge and then north across the River via a dedicated pedestrian bridge.

The areas that are adjacent to the 300-acre Bixby riverfront site vary in usage and include a number of large-scale industries. North of the River, sand and gravel mining operations are located on both sides of Memorial Drive. Sod farms are also a major agricultural use in the low-lying areas north of the River. South of the river and west of Memorial Drive, there are several major industrial operations that include a sand/gravel mining operation and a concrete plant.



Alongside the Bixby-Spartan Pass, an old bridge has been converted for pedestrian use. This pedestrian link connects to Washington Irving Park and will eventually connect to trails north of the River.

Washington Irving Memorial Park is located immediately north of the Arkansas River and west of Memorial Drive. This scenic park includes looped trails, a large trailhead parking lot, and a new amphitheater.



Washington Irving Park's memorial from the World Trade Center



North of the Arkansas River, an arboretum is integrated into a wooded setting in Washington Irving Memorial Park.



Memorial Drive commercial development

Between 151st Street and the Arkansas River, Memorial Drive has generally developed with strip commercial on each side of the thoroughfare. The quality of the existing development varies significantly, from unattractive metal buildings to the relatively new Citizens Security Bank.



The Citizens Security Bank building on Memorial Drive establishes an image of quality through its architecture.



Signalized intersection at 148th Street / Memorial Drive



Open space east of Memorial Drive



Pecan Valley housing area

Older shopping centers and retail buildings, such as the Spartan Family Center, could benefit from renovations to better capitalize on Memorial's traffic and visibility. At the southwest corner of 148th Street and Memorial Drive, Carmichael's Produce is a popular location to buy pumpkins, Christmas trees, and other seasonal agricultural products. This business positively reflects Bixby's agricultural heritage and motto of the "Garden Spot of Oklahoma." The Memorial Drive corridor also includes significant undeveloped properties, particularly adjacent to the River where flooding has been an issue in the past.

The Bixby riverfront includes residential uses of varying densities that are dispersed throughout the 300-acre planning area. An older single-family neighborhood is located immediately north of 151st Street, approximately one-quarter mile east of Memorial Drive. There is also a small neighborhood of single-family homes near the center of the site, south of the Arkansas River and north of Keas Road. In the northwest corner of the site, Pecan Valley has been developed as a small neighborhood of four-plexes with access from 141st Street and Memorial Drive.

Sports fields are also a major land use within the Bixby riverfront area. At the east end of the study area, a large City of Bixby sports complex spans the one-half mile between Riverview and Mingo Road.



Southeast of Keas Road / Riverview, Keas Field provides a modern facility for Bixby Youth Soccer.

Keas Field is a relatively new 14-acre soccer complex with central pavilions, restrooms, and concessions. East of these fields, an older sports complex provides youth baseball fields, tennis courts, a rodeo arena, and horseshoe pits. This complex is generally outdated and will be taken out of service for expansion of the wastewater treatment facility. In the center of this complex, the City of Bixby has several maintenance buildings and sewage lagoons for wastewater treatment.



Existing rodeo arena



Existing youth baseball fields

The Bixby riverfront area also has exciting new developments that are underway. A master plan has been completed for the new Bentley Park sports complex that will accommodate youth baseball, softball, T-ball, multi-purpose fields, hard surface courts, and other recreational facilities. A portion of the new ball fields are funded and under construction. Bentley Park is partially located within an area previously planned for residential development, in which streets were constructed but no homes built. The park utilizes the original street layout as part of the new circulation system. In addition to these sports fields, the Bixby riverfront planning area also includes a number of open fields that are in agricultural use.



South of the new Bentley Park sports complex, 148th Street is under construction. This new street will provide a linkage between Memorial Drive and the Riverview / Keas Road intersection.

8.8.3 DESIGN CRITERIA / LIMITATIONS

As defined in the Phase I Vision Plan, the primary focus for the Bixby riverfront will be on expanded sports facilities and new mixed-use development. New development should take full advantage of proximity to the river, and should also reflect Bixby's unique image as the "Garden Spot of Oklahoma." Opportunities should also be explored to reinforce Bixby's agricultural heritage through development of farmers' markets or similar activities.



Arkansas River (view looking upstream from Bixby-Spartan Pass)

An important element of the proposed Bixby riverfront plan was the initial possibility for a low water dam that would create a river lake. The Phase I Vision Plan illustrated a potential low water dam approximately one-half mile to the east of the Bixby-Spartan Pass Bridge. Analyses conducted in conjunction with the Master Plan indicated that the Bixby low water dam was technically feasible from an engineering perspective; however, it would produce negative water quality impacts. Therefore, a low water dam is not feasible at this time in this location. The concept presented for the Bixby Riverfront in Section 8.8.4 would be feasible without a river lake as a resource.

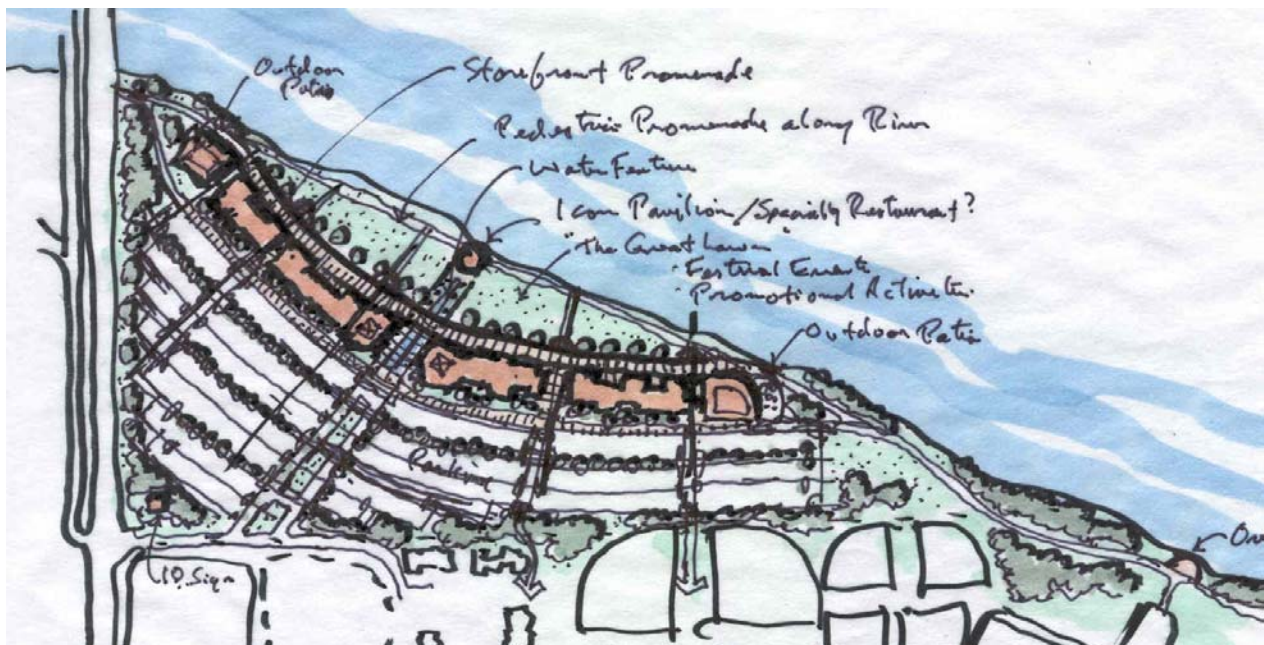
There are also several other opportunities and constraints that will impact the Bixby riverfront plan. These include:

- The proposed Bentley Park sports complex will create an excellent recreational facility for Bixby's riverfront.
- The Bixby riverfront is flat and low lying from a topographic viewpoint. Future planning for this area must address flood issues and regulations. Flood protection could be addressed in conjunction with the 4-to-Fix Program.
- Current land use relationships and development patterns within the study area are generally not well organized, which will be a challenge to creating a cohesive riverfront district.

8.8.4 AREA / SITE PLAN

The proposed plan for the Bixby riverfront is in Figures 8.8-2 and 8.8-3. The plan illustrates several main elements that have the potential to create an exciting riverfront district for the City of Bixby. Adjacent to the south bank of the Arkansas River, a new retail/entertainment development is proposed as a major attraction. Recreational facilities will continue to be an important element, with the new Bentley Park complex to complement the existing sports fields. The proposed plan also includes new residential and commercial infill developments in several locations.

One of the highest public priorities that have been identified during planning for the Arkansas River is the creation of riverfront-oriented retail shops and restaurants. Promoting access to the River's edge creates opportunities for activities that are unique and exciting. The proposed plan for the Bixby riverfront illustrates the potential for "Bixby Landing" to establish a landmark destination. The proposed plan for this new retail/entertainment area, as shown in the sketch below and in Figure 8.8-2, encompasses a site area of approximately 25 acres.



Conceptual Sketch: New riverfront retail / entertainment area for the south bank of the Arkansas River



BIXBY RIVERFRONT CONCEPT PLAN

FIGURE 8.8-2



Bixby Landing

BIXBY RIVERFRONT CONCEPT SKETCH

FIGURE 8.8-3

Pedestrian scale shops, restaurants, and entertainment uses face the Arkansas River, with a continuous promenade that spans the length of the development. This new boardwalk provides excellent panoramic views of the River and accommodates a place for sidewalk cafes, festivals, or just relaxing. A large overlook is also proposed in the center of Bixby Landing, and a spacious lawn creates a scenic location for festivals, concerts, or informal gatherings (refer to Figure 8.8-3). This proposed development would have excellent visibility from the Bixby-Spartan Pass Bridge, with access from 141st Street via Memorial Drive. To maximize its orientation to the Arkansas River, parking and service functions are proposed on the south side of the new buildings.

As described earlier, the first phase of the Bentley Park sports complex is under construction. These new sports fields will provide an excellent recreational facility for Bixby's riverfront. Primary access to Bentley Park will be provided by an extension of 148th Street from Memorial Drive. Planned facilities include a youth baseball four-plex, four smaller children's baseball fields, two T-ball fields, and a softball 4-plex. As shown in Figure 8.8-2, Bentley Park will also accommodate multi-purpose fields, hard surface courts, playgrounds, picnic areas, and spray pools. Parking areas make use of existing/unused streets that were constructed for a subdivision that was never completed. The park also features a large plaza area that can be used for festivals and other events.



Keas Field

The Keas Field complex, located southeast of Riverview and Keas Road, will continue as an important soccer facility within the Bixby riverfront district. This complex includes seven fields, with centralized support facilities. The east edge of Keas Fields abuts a gravel parking lot, which is proposed to be paved for better all-weather use. The east end of the planning area includes existing sports facilities that border the north and east side of municipal maintenance buildings and wastewater treatment facilities. At the northeast corner of this park area, an existing parking lot provides parking for the sports fields and also creates an excellent trailhead for River access. These older sports fields will be taken out of use, providing space for expansion of the wastewater treatment facility.

The 300-acre planning area also includes a number of sites that are well suited for infill development. On the west side of the new Bentley Park sports complex, a new medium-density residential

area is proposed for town homes or apartments. Residential development of this 10-acre site would complement the small Pecan Valley housing area that borders the east edge of this site. South of the new 148th Street extension, an open field creates another opportunity for infill development that can strengthen Bixby's riverfront area. Figure 8.8-2 illustrates a proposed 35-acre multi-family development for this site that could include first-floor garages that are integrated with each housing unit. A central open space and water feature for this complex creates a natural amenity and stormwater detention.

At the northeast corner of 151st and Memorial Drive, the existing commercial development is low-density, with a significant area standing vacant. The proposed plan for the Bixby riverfront illustrates redevelopment of this location with a new retail center that establishes a quality image and takes advantage of excellent visibility and access. This new retail center could include a farmer's market with an architectural style that reflects Bixby's agricultural heritage. A water feature is also proposed along the alignment of an existing drainage swale. For the remaining Memorial Drive corridor between 151st Street and the Arkansas River, market-driven redevelopment of under-utilized commercial properties is encouraged to achieve "highest and best use" and an attractive entry to Bixby.

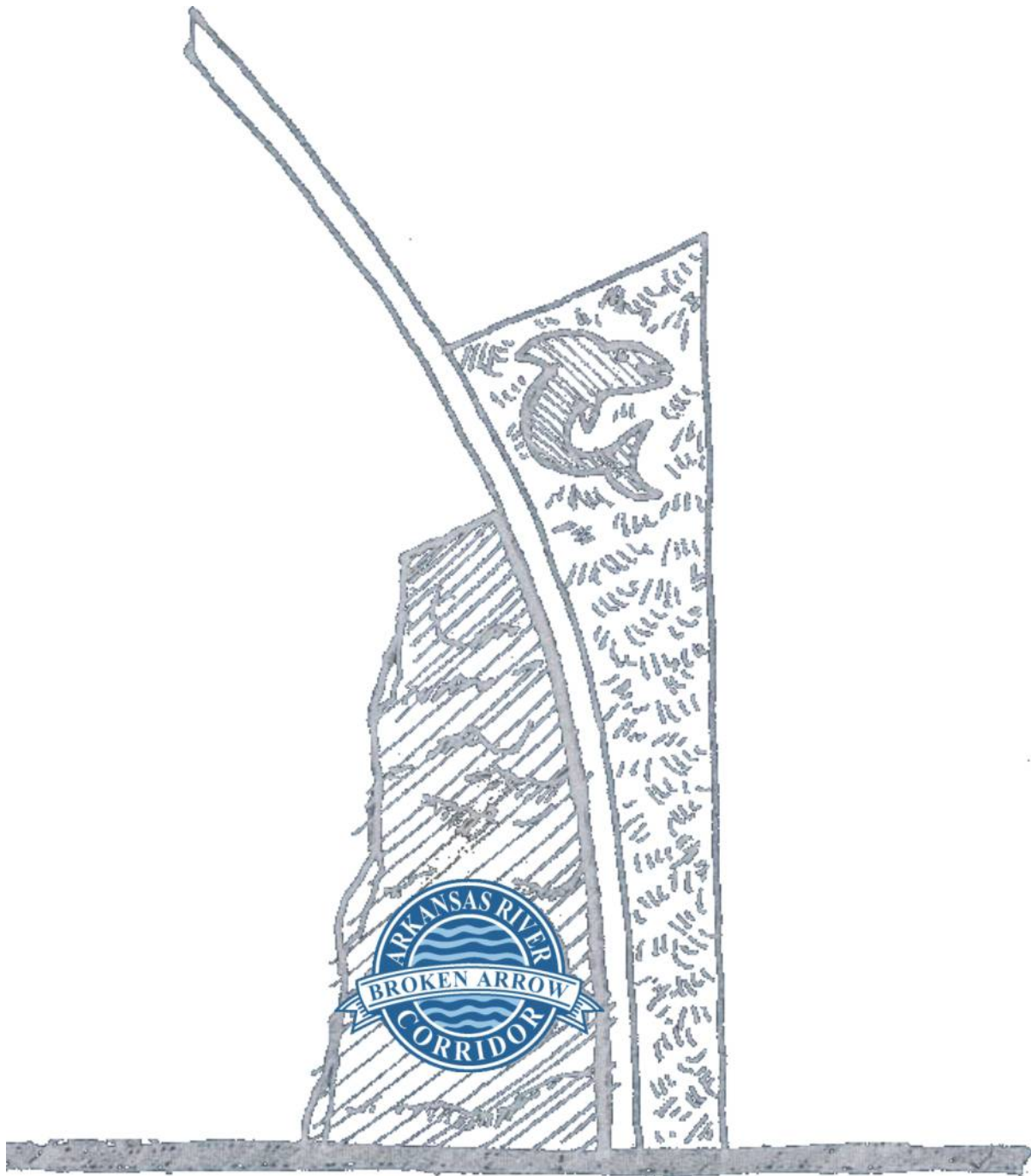
Trails and pedestrian linkages will be an important component of Bixby's riverfront. As shown in Figure 8.8-2, the existing trails along the River's south bank will be expanded to connect with future regional trails to the east. The existing pedestrian bridge across the Arkansas River also creates a great trail linkage to the north. The master plan illustrates new pedestrian linkages within the riverfront area to create a walkable district, as well as linkages to the south that connect with Bixby's high school and sports complex.

8.8.5 CONCLUSIONS / RECOMMENDATIONS

The City of Bixby has an opportunity to create a vibrant riverfront district that can become a focal point for the entire community. The existing and planned recreational uses provide a strong anchor to build upon, with infill residential and commercial developments adding diversity and economic value. The creation of a river-oriented destination is also an essential component of the master plan. The proposed "Bixby Landing" retail/entertainment center provides opportunities to enjoy and access the Arkansas River while dining, shopping, or participating in festive events.

Developing a riverfront district in Bixby presents several challenges that will need to be addressed. New development will need to integrate flood control to address the existing floodplain issues. Another key ingredient to a successful riverfront district will be the eventual market-driven redevelopment of existing uses that do not achieve their highest and best use. Through good planning and dedication to a long-term effort, Bixby can enjoy an exciting riverfront that reflects its unique identity and heritage.

8.9 BROKEN ARROW RIVERFRONT CONCEPTUAL PLAN



8.9 BROKEN ARROW RIVERFRONT

8.9.1 BACKGROUND AND REQUIREMENTS



Baseball Fields at Indian Springs Sports Complex



Arkansas River (south of Indian Springs Sports Complex)

The planning area for the Broken Arrow riverfront site, as illustrated in Figure 8.9-1, is approximately two miles in length. Located on the southern edge of Broken Arrow, the site encompasses the 164-acre Indian Springs Sports Complex and substantial natural areas to the east and southwest.

The Phase I Vision Plan proposes improvements to the sports facilities and the extension of Aspen Avenue southward to create better accessibility to the Arkansas River. Another major proposal for this site from the Phase I Vision Plan includes the creation of a nature center for the wooded area to the east of the sports complex. A possible low water dam is also illustrated in the Vision Plan, to be located adjacent to the east end of the nature center (refer to Section 8.9.3 for additional discussion).



The Indian Springs Sports Complex is an outstanding facility that brings many visitors to Broken Arrow.



BROKEN ARROW RIVERFRONT SITE LOCATION MAP **FIGURE 8.9-1**



8.9.2 DESCRIPTION OF PLAN AREA



Newly signalized intersection at Aspen Ave. / Jasper Street



Convenience Store (Aspen Ave. / Jasper Street)



Indian Springs Apartments (east of Aspen Avenue)



Large home west of the sports complex

The Broken Arrow riverfront site is located approximately one-half mile south of Jasper Street/South 131st Street, with arterial access provided by South Aspen Avenue/145th East Avenue. Although the site and sports complex are on the southern edge of the metropolitan area, access has been greatly improved by the completion of the Creek Turnpike South Loop. This new turnpike runs east-west on the north side of Tucson Street/121st Street, providing connections to Tulsa's highway network. Full interchanges with the Turnpike South Loop are located just one mile on each side of Aspen Avenue.



Aspen Avenue has recently been widened to four lanes, providing much better traffic movement to the sports complex.

The area surrounding the Indian Springs Sports Complex is primarily single-family housing. On the east side of Aspen Avenue, the Indian Springs Country Club Golf Course and neighborhood lie immediately north of the planning area. Neighborhoods also abut the north edge of the sports complex on the west side of Aspen Avenue, including Bentley Village which is under construction. Large lot estate homes are located on the west edge of the sports complex. To the east of the planning area, the Broken Arrow Wastewater Treatment Plant abuts the wooded area that is proposed as a nature center.

The Indian Springs Sports Complex is a very significant facility within the framework of the 802 total acres that are managed by the Broken Arrow Parks and Recreation Department. The park accommodates 16 lighted baseball fields, 26+ soccer fields, two adult softball fields, three picnic shelters, and a number of restrooms and concession buildings. The park has been developed in two major phases. The original complex is located east of Aspen Avenue, with a recent expansion west of Aspen Avenue.



Picnic shelter in central open space



The soccer fields at the Indian Springs Sports Complex are heavily used during youth soccer leagues and tournaments.



Play equipment near soccer fields

The original sports field development includes a large soccer complex at the western end, with baseball fields located at the east end. Access through the park is provided from Aspen Avenue by West Shreveport Street, which connects with South Fawnwood Court and the Indian Springs Country Club neighborhood. A one-way looped drive in the soccer complex creates a central open space that is approximately five acres in size. This open space is a wonderful asset to the sports complex, providing space for picnic shelters, playgrounds, restrooms, concessions, informal play and events. The fields for the younger ages are located north of Shreveport Street, with older players accommodated on larger fields south of this street. Fall and spring soccer leagues represent the periods of heaviest use. Many of the larger fields are lighted for nighttime play.



Intersection of Aspen Avenue /
West Shreveport Street



In the center of the original soccer complex, a large open space provides a great location for organizing tournaments and for casual play.



One-way looped drive through
soccer complex



Existing drainageway that
separates soccer and baseball fields

Parking for the soccer fields is very well dispersed with almost all spaces provided on both sides of West Shreveport Street and the looped drive that surrounds the central open space. There are also gravel roads that provide access to unpaved parking areas on the north and east perimeters of the soccer fields. The advantage of this parking arrangement is the ability to park relatively close to most fields, which is particularly desirable during inclement weather. However, the extensive "on-street" parking results in significant congestion as cars attempt to back out onto busy drives. There are also frequent conflicts with pedestrians needing to cross streets.

A large drainageway flows in a southerly direction through the center of the original "eastside" sports facilities. The areas east of this drainage channel are dedicated to youth baseball, with fields of varying sizes that accommodate a full range of age groups. The 16 lighted baseball fields are arranged in three four-plexes and two two-plexes. The Jay O. Gregg Playing Fields are the largest fields, located immediately east of the large drainage channel. Farther east of this four-plex, Pee Wee and 8 & Under fields have been built along with restrooms, concession buildings, dugouts, and bleachers.



Jay O. Gregg Playing Fields



Typical Concession Building in Baseball Complex



Wayne Bennet Playing Fields



The Indian Springs Sports Complex is an outstanding baseball facility that is host each year to two or three youth baseball World Series events with teams participating from all over America and other parts of the world. The Indian Springs Complex plays host to the 2005 Super Series National Championships.

Primary access to the baseball complex is from Aspen Avenue, via West Shreveport Street through the soccer complex. Off-street parking is provided through five large lots that are dispersed throughout the complex.



Indian Springs Elementary School is located immediately northwest of the baseball complex, with access from West Shreveport Street and South Fawnwood Court.

The Indian Springs Sports Complex grew dramatically several years ago with the construction of a second major development phase, entirely on the west side of Aspen Avenue. A new park road, approximately one-quarter mile in length, provides access via Aspen Avenue. The expansion includes 11 soccer fields, two adult softball fields, two new concession/restroom buildings, sports lighting, and two large parking hubs. Significant areas of the site are left in their natural wooded state to provide a pleasant environment for the sports facilities.



New park road through westside expansion area



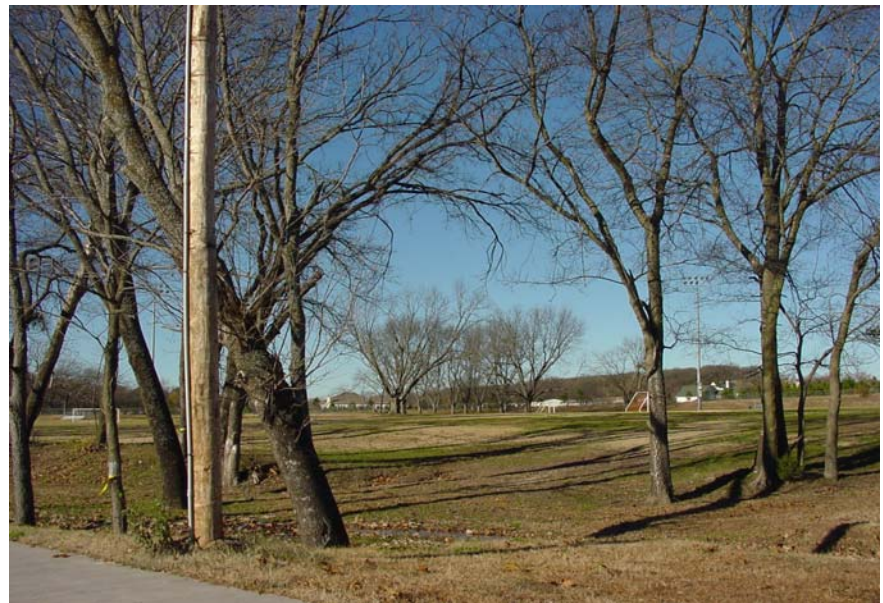
Concession Building at softball fields



Pedestrian Crossing (north of softball fields)



New parking lot at Westside soccer fields



New soccer fields have been constructed on the west side of Aspen Avenue. Large trees and open spaces have been preserved, creating a natural setting for the new activities.

The new sports fields have been constructed in two main areas with a large wooded area/drainageway in between. Three new soccer fields have been constructed immediately west of Aspen Avenue and north of the new park drive. As of spring 2005, a new parking lot is under construction to support these fields. South of these fields and the new drive, the Al Graham Softball Complex was constructed with two fields, a large parking lot, and an attractive restroom/concession stand.

Approximately one-quarter mile west of Aspen Avenue, a second activity area accommodates eight soccer fields of two sizes, a large parking lot of approximately 500 spaces, and a concession/restroom building.



The new concession / restroom building at the west end of the park is accessed by a pedestrian bridge over a drainage swale.

Currently, a drainage swale creates an annoying barrier between the parking lot and soccer fields. The addition of several more pedestrian bridges would improve access to the fields.



City of Broken Arrow
maintenance facility (south of
Aspen Avenue)

In the center of the Indian Springs Sports Complex, a large barn is used by the City of Broken Arrow Parks Department as a maintenance facility. This 3.5-acre maintenance area is located directly south of the termination of Aspen Avenue. Although this area is functional in its current service use, this location could serve a "higher and better use" to provide public access to the River.

As shown previously in Figure 8.9-1, the planning area for the Broken Arrow riverfront includes large natural areas on each end of the sports complex. Immediately east of the baseball fields, a wooded area provides an outstanding natural habitat.



On the east edge of the baseball fields, a natural area provides woodland and riparian habitats. Bald Eagles and Least Terns can be seen along the river, as well as other shorebirds and open country birds.



View of sand bar "island" to the south of sports complex

A second large natural area is within the planning area to the southwest of the sports complex. A large sand bar abuts the south edge of the "westside" sports complex, separated by a waterway that is approximately 100 feet wide. This area is frequently used as a riding area by all terrain vehicles (ATVs). There is also a sand and gravel mining operation that is active at the western end of this sand bar.

8.9.3 DESIGN CRITERIA / LIMITATIONS

One of the most significant elements to the plan for the Broken Arrow riverfront is the potential for a low water dam that creates a river lake. The Phase I Vision plan illustrated a possible low water dam between the extension of 145th East Avenue and 161st East Avenue, located downstream of a future nature park and upstream of the existing City of Broken Arrow wastewater treatment plant. There are currently no bridges crossing the Arkansas River at these locations, but there is a long-range plan for a bridge extending East 161st Street South to connect with South 193rd East Avenue downstream of this low water dam location. The limited potential for commercial, residential, and recreational development for the consideration of a low water dam would currently classify this dam site as a Tier 3 location, indicating that development would not likely occur within the next 15 years. The proposed plan for the Broken Arrow site provides proposals that do not rely on a low water dam feature.

The master plan for the Broken Arrow riverfront is focused on improved public access to the Arkansas River from Aspen Avenue, as well as enhancements to the existing sports complex. Other issues and opportunities that need to be addressed in the plan include:

- The Broken Arrow riverfront represents a great opportunity for enhancement/restoration of riparian habitats, and for environmental education. The creation of a nature center east of the sports complex can preserve the beautiful wooded area and promote ecological learning. Trail zones adjacent to the River can function as riparian wildlife corridors, and opportunities to enhance fishing should also be considered.
- Currently, the Indian Springs Sports Complex has a very limited relationship to the Arkansas River. There is essentially no visual or physical connection between the sports facilities and the River. There is also a lack of activities, restaurants, and related development for use by the large number of sports participants and viewers. The master plan has a tremendous opportunity to create a much stronger orientation to the River and to provide

supporting activities that will enhance the enjoyment of the sports complex for all ages.

- A major goal of the Broken Arrow Parks Department is developing special events, such as Glory Daze fireworks, Tuesday concerts, and numerous other cultural and community festivals. With its parking capacity and open spaces, Indian Springs Sports Complex has great potential to support this objective as a festival location.
- Future planning for the riverfront must ensure appropriate flood control.

8.9.4 AREA / SITE PLAN



Indian Springs Sports
Complex

The proposed plan for the Broken Arrow riverfront is shown on the following pages in Figures 8.9-2 and 8.9-3. The plan illustrates several main elements; these include a new river-oriented activity center at the south end of Aspen Avenue and general enhancements throughout the sports complex. Other major proposals include a large nature center east of the baseball fields.

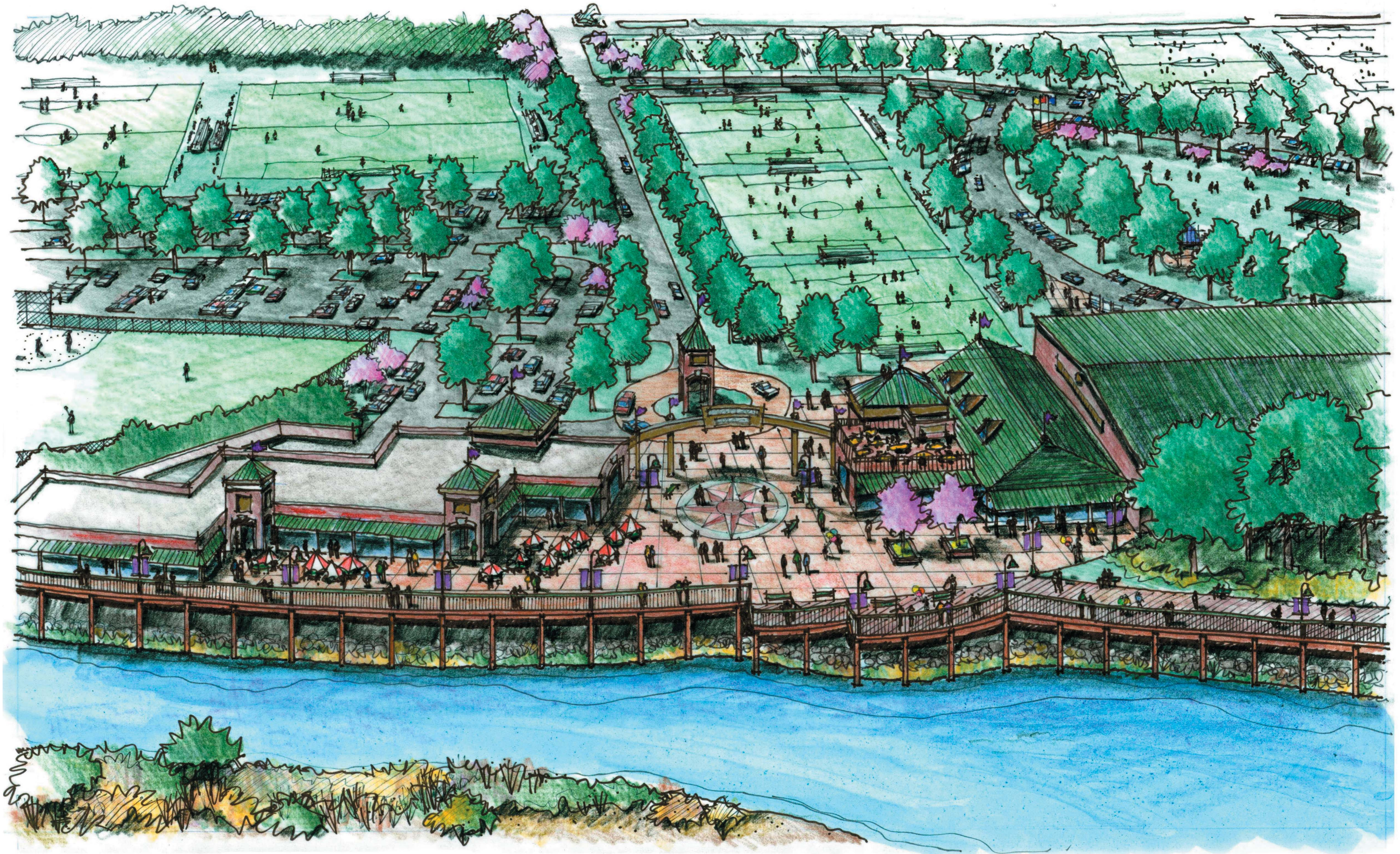
The primary focus of the proposed plan is a new riverfront activity area directly south of Aspen Avenue. This new development is in the center of the Indian Springs Sports Complex and is readily accessible to the community through an extension of Aspen Avenue 400 feet to the south. An indoor soccer facility is proposed immediately to the east of the new terminus of Aspen Avenue. The proposed building footprint, approximately 400 feet by 275 feet, would accommodate two to four indoor fields, depending on the desired field size. Additional square footage is shown within this building to potentially accommodate a family activity center, a food court/concessions, and other complementary activities as desired. The addition of indoor soccer has the potential to bring year-around activity to the existing complex and adds flexibility to hold games whenever weather would not be conducive to outdoor play.

To the west of the proposed indoor soccer facility, a proposed building would accommodate a themed restaurant(s) and several shops that might be tailored toward sports or river-oriented activities. A large elevated pier is proposed to connect these new developments and create an exciting space for outdoor dining, festivals or just relaxing and enjoying scenic views (refer to Figure 8.9-3). Accommodations could also be provided for food vendors that could support tournaments or busy weekends of league play. Adjacent to this large pedestrian area, a piers boardwalk is shown that extends one-quarter mile to the east. This new elevated walkway follows the north side of the existing channel, leading to a large overlook/pavilion that has panoramic views of the Arkansas River.



BROKEN ARROW RIVERFRONT CONCEPT PLAN

FIGURE 8.9-2



BROKEN ARROW RIVERFRONT CONCEPT SKETCH

FIGURE 8.9-3

New off-street parking is shown on the west side of Aspen Avenue, with connections to the softball parking lot. Existing parking on the north side of the indoor soccer facility can also be used to supplement new parking. To create this new riverfront activity area, as shown in Figure 8.9-2, the existing City of Broken Arrow maintenance area and metal building would require relocation. The planned construction of a new maintenance area in north Broken Arrow's Nienhuis Park will help offset this displacement. As needed, a smaller maintenance facility may also be built in another area of the Indian Springs Sports Complex. The indoor soccer facility would also result in the displacement of two outdoor soccer fields.



Central open space in Indian Springs Sports Complex

A second major element of the proposed plan is the recommendation of a number of enhancements throughout the sports complex. The majority of these improvements are focused on the older, original fields that are east of Aspen Avenue. The goal of these proposals is to address problem areas, upgrade older facilities, and to make an outstanding facility even better. Proposed improvements are described below:

- Improved signage/wayfinding to the sports complex should be considered, including more prominent signage at the Jasper Street and Aspen Avenue intersection. Directional signage at the two closest interchanges with the Creek Turnpike, 129th East Avenue and Elm Place, should be considered. The plan also proposes the creation of a new "gateway" entry where Aspen Avenue enters the north side of the sports complex.
- Traffic movement could be improved to minimize congestion and conflicts. On the east side of the complex, most of the congestion results from cars backing out from the "on-street" stalls. In many locations throughout the soccer and baseball complexes, minor adjustments to parking have been illustrated to eliminate stalls at intersections that are particularly difficult to access. The proposed plan also recommends removing on-street parking spaces from West Shreveport Street between Aspen Avenue and the one-way loop where traffic congestion is most prevalent. This new boulevard also creates a more attractive entrance into the sports complex. North of the smallest soccer fields, two new off-street parking lots are proposed to replace lost parking and provide improved

circulation. Pedestrian safety can also be improved by the identification of additional crosswalks between fields and parking.



Concession / restroom facility in newest phase of Indian Springs Sports Complex

- Other improvements to the sports complex include a large concession / restroom building in the central open space; new play equipment; improved pedestrian circulation and new trails. For the new soccer fields at the far west end of the park, new sidewalks and pedestrian bridges are proposed for easier circulation across a drainage swale.



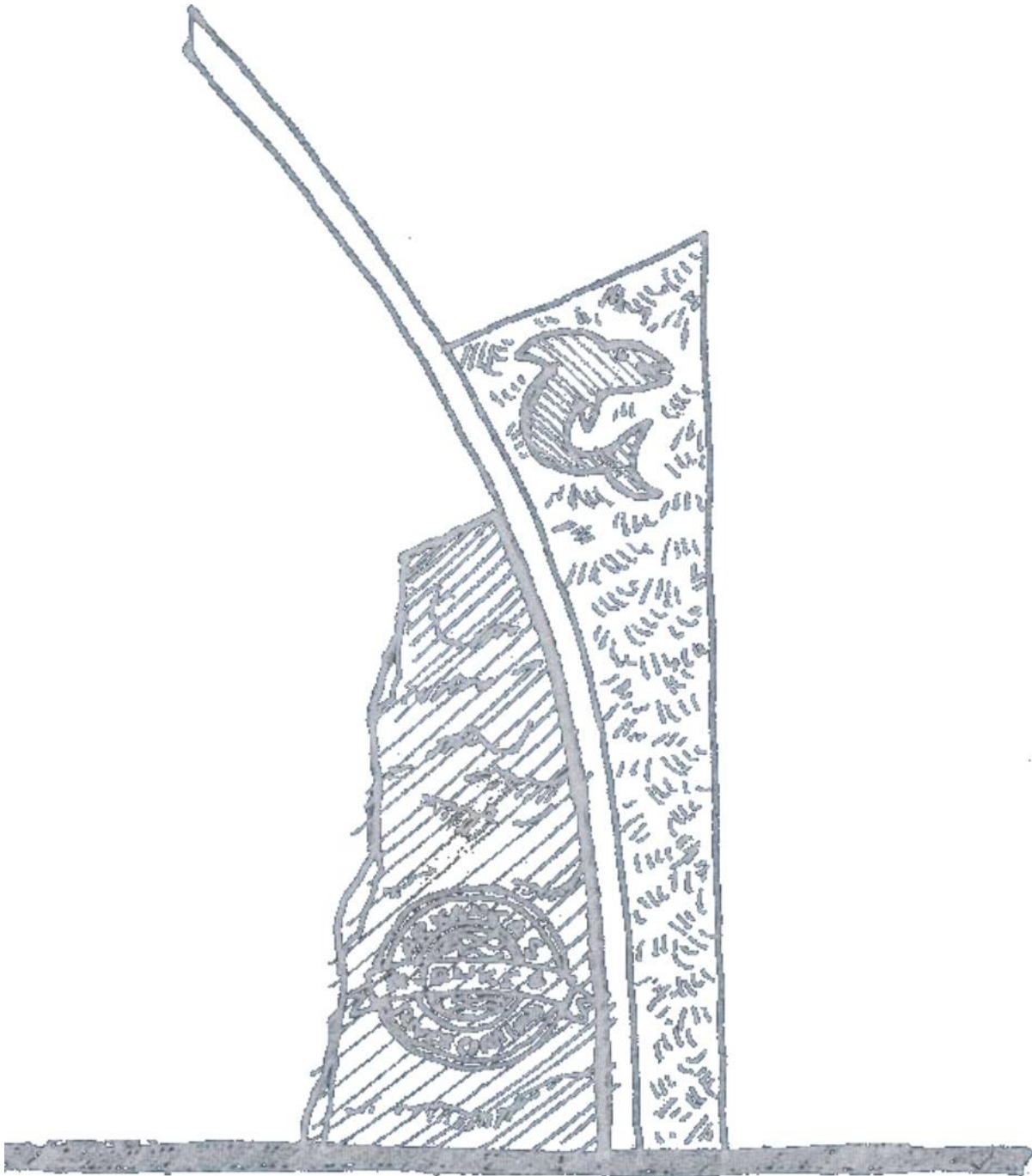
Natural area and creek east of the existing baseball fields

Another major feature of the proposed plan for Broken Arrow's riverfront is the development of a nature center for the forested area east of the sports complex. This scenic property, located south of the Indian Springs Country Club Golf Course, extends east for three-quarters of a mile beyond the sports complex. A new interpretive center is proposed in a clearing at the west end of the nature center. Vehicular access is provided by a new drive that connects with existing parking at the Pee Wee baseball fields. The new curved entry road crosses a creek to provide a linkage to new parking and a drop-off area that accommodates bus circulation. An existing parking lot north of the Wayne Bennet Fields is also shown as a trailhead for adjacent neighborhoods, with a walkway that connects to the nature center. Throughout the nature center, looped walking paths are proposed for pedestrian access. A large island at the east end of the nature center is also accessed by a new pedestrian bridge and trails. In addition to the center's forested land, the riparian habitat along the river's edge adds diversity for environmental education.

8.9.5 CONCLUSIONS / RECOMMENDATIONS

With the Indian Springs Sports Complex as a major anchor to build upon, the Broken Arrow riverfront has great potential. The riverfront area has a built-in advantage of a major sports facility that attracts many participants, family members, and visitors. Currently, there is very limited development near or within the sports complex to provide entertainment, places to eat, shopping, or family activities. The proposed plan can enhance the enjoyment of the Indian Springs Sports Complex by adding a pier and attractions in a unique riverfront setting. The planned riverfront district is designed to initially be supported primarily by visitors to the sporting events. Ultimately, the private market will determine the extent to which additional shops or restaurants can succeed during soccer and baseball off-seasons. Approximately two miles north of the sports complex, the Creek Turnpike corridor provides excellent visibility and access for hotels, shopping, and other facilities that can further enhance the Indian Springs Sports Complex. A critical component to a successful riverfront development will be creating a unique theme or style that is reflected throughout the architecture and landscape elements.

8.10 ECOSYSTEM RESTORATION CONCEPTUAL PLAN



8.10 ECOSYSTEM RESTORATION PLAN

8.10.1 BACKGROUND AND REQUIREMENTS



Lake Keystone reduces downstream urban flooding and provides hydropower

The construction of Keystone Dam was completed in 1964. This project significantly reduced the negative impacts of flooding along the Arkansas River in Tulsa County and contributes to the operation of the McClellan-Kerr Navigation System. Another important purpose of Keystone Lake is the production of hydroelectric power. Millions of dollars in flood damages have been prevented since its construction and the hydropower operations provide electricity during periods of critical peak usage.



Downstream impacts include the loss of riverine habitat, drying out of aquatic habitat, and streambank erosion

Over time, changes have occurred to the natural flow regime of the Arkansas River downstream of Lake Keystone. These changes, in combination with land use changes in the watershed, have significantly altered the River corridor ecosystem. For example, Lake Keystone significantly reduces the amount of sediment that creates downstream island habitat for least terns and aquatic streambed habitat for the native riverine minnows that serve as a food source for the least terns. Frequent and extreme river fluctuations from hydropower operations consist of very high flows immediately followed by very low flows. This has a drying effect on the aquatic habitat.



Striped Bass and other sport fish appear to be more tolerant of the altered aquatic ecosystem than the native riverine fishery

The impacted geomorphology has resulted in streambank erosion problems at various locations and the destruction of riverine wetlands and oxbow habitats that were once important fish nurseries and feeding/resting areas to migrant waterfowl. The destruction of wetlands and oxbow habitats has decreased the species diversity and overall productivity of the remaining habitat downstream of the Keystone Dam. Other watershed concerns include pathogens, pesticides, and organics from commercial, agriculture, municipal, and urban runoff that affect water quality.



The Interior Least Tern is an important wildlife species that utilizes the Arkansas River corridor

Although additional analysis is needed to determine the magnitude of the cumulative effects discussed above, it is likely that the native riverine fish populations downstream of Lake Keystone have been significantly adversely affected. Following the construction of Lake Keystone, sport fish that are more tolerant of the altered aquatic ecosystem that currently exists were introduced in an attempt to

offset the reduction to the native riverine fishery. Sport fish species in the urban area include striped bass, paddlefish, sand bass, largemouth bass, channel catfish, sauger, and sunfish. Other important wildlife species that utilize the Arkansas River corridor in Tulsa County include the Bald Eagle, the U.S. Endangered and Threatened Species Interior Least Tern, and Piping Plover. The riparian and riverine corridor is heavily utilized by migratory waterfowl, resident shore birds, and neotropical migrants.

Since it is not technically practical, nor socially desirable to return the River back to its natural state, potential ecosystem measures were identified that could improve the existing aquatic and riverine ecosystem resources to a much higher sustainable habitat value that would be beneficial to the entire Arkansas River corridor downstream of Keystone Dam. Ecosystem restoration measures, investigated in a future analysis, would be complementary to and support other important initiatives identified in the Master Plan

8.10.2 DESCRIPTION OF PLAN AREA

The initial planning area for ecosystem improvements focuses on the seven key development sites previously described. As more information is developed, additional ecosystem restoration features at other locations and pertinent programs of other federal agencies, such as the Natural Resources Conservation Service, will be identified.

8.10.3 DESIGN CRITERIA / LIMITATIONS

Conceptual ecosystem restoration features were identified using a balanced approach. The future investigation and design of a situational aquatic and riparian corridor ecosystem restoration project would be compatible with existing urban constraints and be in balance with future planned economic development initiatives. There are several criteria and constraints that will need to be addressed in the design of a comprehensive ecosystem restoration plan for the Arkansas River corridor, as outline below:

- Potential ecosystem features to investigate include native vegetation plantings, constructed wetlands, improvement and creation of least tern islands, river lakes with fish passage



Situational aquatic and riparian corridor ecosystem restoration features would be compatible with existing constraints and be in balance with future planned economic development initiatives

features, removal of existing impediments to fish passage, and stream corridor stabilization measures.

- A determination of the composition and magnitude of the existing urban fishery will be necessary to design appropriate ecosystem restoration features to improve habitats.
- The Tennessee Valley Authority has been successful in improving aquatic habitats downstream of their hydropower reservoirs by constructing re-regulation weirs (river lakes). River lakes with fish passage features may provide opportunities to improve aquatic habitat for the sport fishery by increasing wetted areas, improving depth diversity during low flows conditions, and reducing the impacts of extreme river fluctuations on the aquatic ecosystem. A special consideration for river lakes would be a weir design that would result in a safe roller effect immediately downstream of the weir.
- Potential complementary nature-related recreation features to investigate include multi-purpose maintenance and recreation trails, interpretive signage, interpretive centers, and public access facilities.
- The Arkansas River has been included in the listing of *Oklahoma Sensitive Waters and Watersheds Harboring Endangered and Threatened Species and Their Critical Habitat of Concern*. As such, developments along the project corridor are subject to the requirements of the ODEQ's general stormwater permit (OKR10). Consultation with the USFWS and ODWC is required prior to development. Developments are subject to a 100-foot vegetative buffer to protect the listed species and critical habitat.



Many Unimproved/Native Ecosystems exist in the project corridor

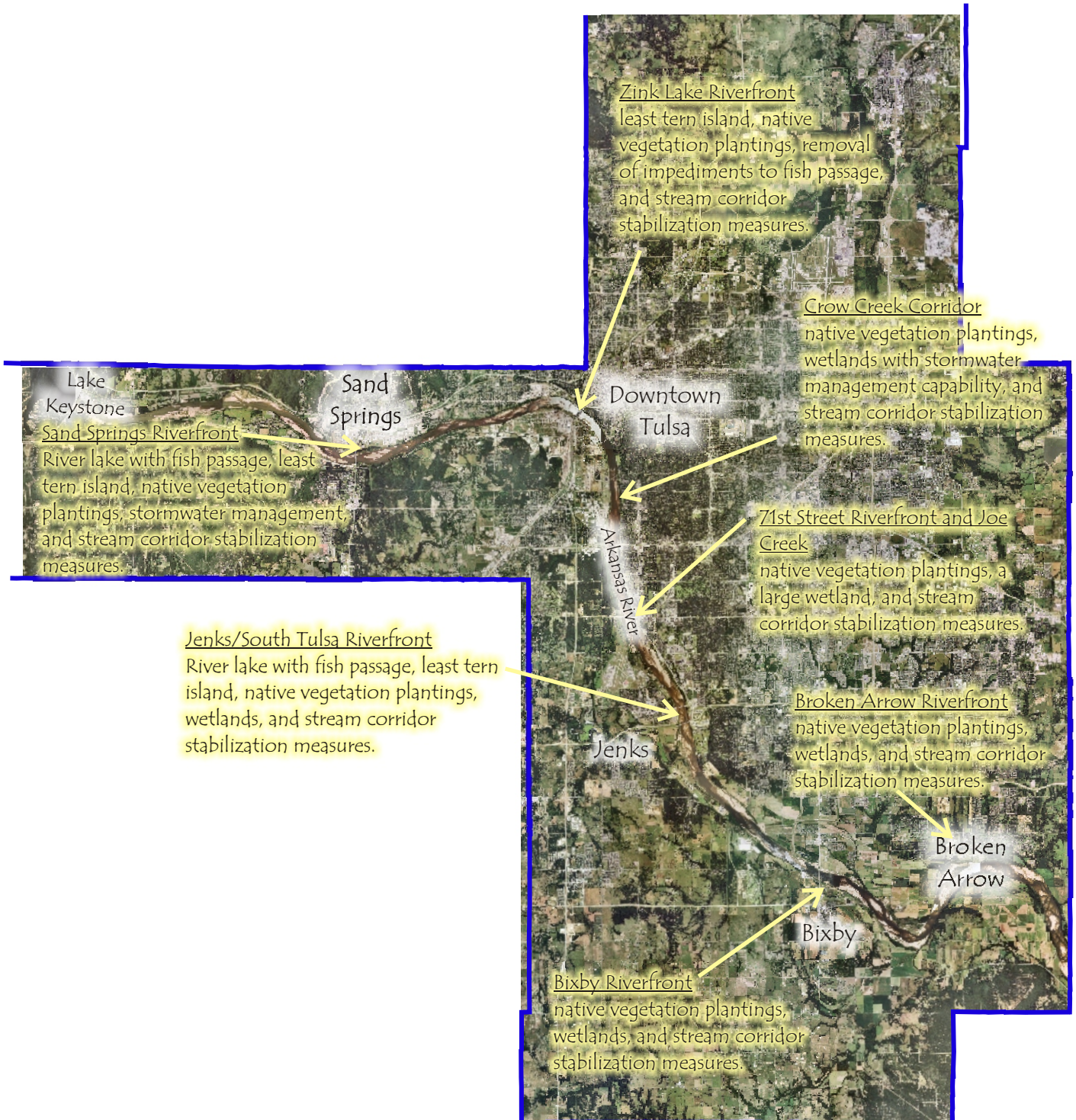
8.10.4 ECOSYSTEM RESTORATION PLAN CONCEPT

The seven key development sites and two proposed low water dam locations, described in Sections 8.1 through 8.9 each include potential ecosystem measures that are described in this section of the report as a preliminary comprehensive corridor ecosystem restoration plan.

Figure 8.10-1 illustrates potential ecosystem restoration features, at seven key development sites, that would be collectively investigated

in a future analysis. The ecosystem restoration project would potentially include the restoration of: (1) open water, riverine habitat/river lakes for the sport fishery; (2) wetlands; (3) native vegetation plantings; (4) least tern habitat and constructed aquatic habitat for the native river minnows that least terns feed on; and (5) stream corridor stabilization measures.

Potential nature-related recreation features that would be investigated as part of the comprehensive ecosystem restoration plan include: (1) multi-purpose maintenance and recreation trails, (2) interpretive signage and outdoor classrooms and, (3) public access facilities.

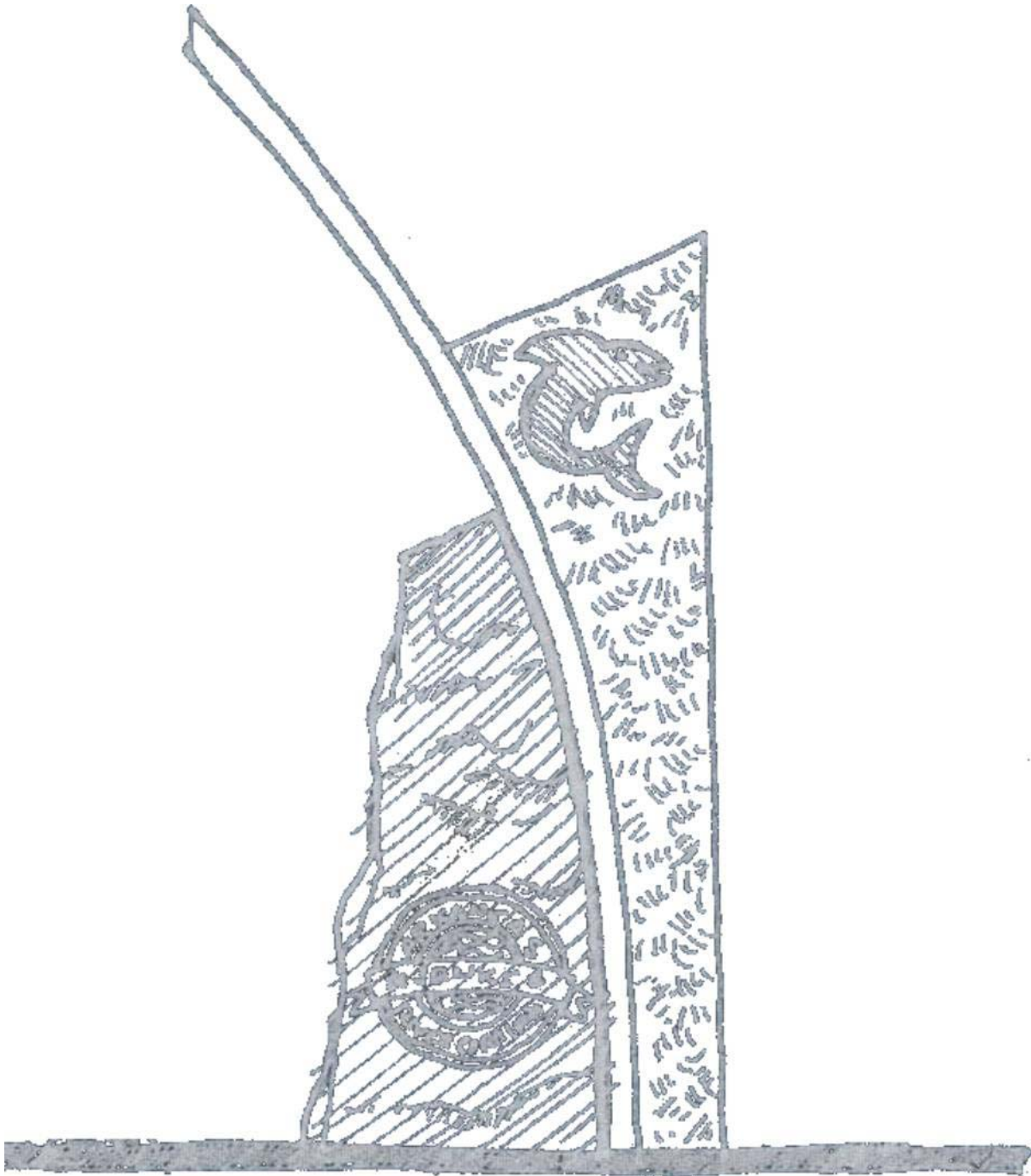


ECOSYSTEM RESTORATION CONCEPTUAL PLAN

FIGURE 8.10-1



8.11 FLOODPLAIN MANAGEMENT CONCEPTUAL PLAN



8.11 FLOODPLAIN MANAGEMENT CONCEPTUAL PLAN

The purpose of this section is to provide a plan of action to assure wise floodplain management practices are followed during development activities in conjunction with the Arkansas River Corridor master planning program. Economic growth can occur along the river corridor while following proper floodplain guidelines to prevent major flood losses during future flood events. All players involved in future development must be cognizant of the hazards and follow a consistent plan of action. The City of Tulsa has one of the most restrictive floodplain ordinances in the country while Tulsa County and Broken Arrow have, or plan to soon have, similar regulations.

Floodplain Management needs to be a team effort among the communities along the River, the Creek Nation, Oklahoma Water Resources Board, INCOG, and Tulsa County. Federal partners include the USACE, FEMA, and others. Technical guidance is provided by the local civil engineering community, city planners, public works officials, and the Oklahoma Floodplain Managers Association.

Lenders, developers, and property owners certainly do not want to invest large sums of money into projects that will be at risk for loss of property or life. Therefore, following appropriate regulations is for the good of the community, its citizens, and the government that could be called on for damage assistance and financial restitution.

Developers can use flood mitigation measures to enhance aesthetics of their property. For example detention facilities can be built with alternative recreational uses. These could include permanent water facilities, parks, or ball fields. Innovative use of berms, flood walls, and ponds can be used to mitigate flood hazards in a more aesthetic way.

8.11.1 HISTORICAL FLOODS

The flood of record on the Arkansas River since Keystone Dam was constructed occurred the first week of October 1986. That flood

had a peak flow of 306,000 cfs. Prior to Keystone Dam the flood of record occurred in 1957 and 1959 with similar estimated flows. The flooding in 1957 and 1959 extended to Peoria Avenue through the Tulsa Brookside area. The 1986 flood caused significant flood damage and was near the top of the levees through Tulsa and Jenks. The 1986 flood is documented by the USACE Water Management Analysis Report dated August 1987.

8.11.2 REGULATORY FLOOD

The regulatory floodplain for development purposes is the 1% or 100-year frequency flood. This is the standard for flood insurance and FEMA regulations. Some communities such as Tulsa and Broken Arrow regulate to a fully urbanized floodplain. They also enforce a "no increase" development policy. This means no development is allowed that would create any increase in flooding.

8.11.3 FLOODPLAIN MAPS

Accurate floodplain boundary maps are the first key to avoiding flood hazard areas. Flood elevations on those maps are used to know how high to build above the hazard. The best way to protect from flooding is to keep from building in these flood areas. The national standard floodplain map is the FEMA Flood Insurance Rate Map. For Tulsa the regulatory map is more extensive than the FEMA map and has been adopted for their use.

8.11.4 FLOODPLAIN MANAGEMENT

Floodplain Management is the process of planning for wise use of flood prone land for development and open space use. This includes the adoption and enforcement of flood plain regulations as well as structural flood reduction projects. The best time for floodplain management is prior to development. However where development has occurred in the past there may be a need for mitigation.

8.11.5 MITIGATION

Mitigation includes a broad range of measures to minimize flood hazards to existing or future development.

8.11.6 STRUCTURAL

Structural solutions to reducing flood risks could include a levee or channel that protect a large area or group of existing structures.

8.11.7 NON-STRUCTURAL

Non-structural flood mitigation includes a wide range of activities. A flood wall or other barrier to protect a single structure may be considered non structural. Acquisition of flood prone properties and structures are common examples of non-structural flood mitigation. When structures are acquired, they can be demolished or moved to high ground. Flood Proofing of individual structures is thought of as non-structural and is discussed below. Other non-structural flood mitigations include Flood Warning and Flood Insurance.

8.11.8 FLOOD PROOFING

Elevation

In some instances it may possible to raise the base elevation of a particular structure, either by lifting an filling under an existing structure or by increasing the pad height/elevation prior to new construction. Raising the base elevation in this manner may move a structure above the flood elevation. It should be noted that in areas where a tributary enters the River the flood elevation can be higher than it is for the River itself.

Acquisition/Relocation

Usually this would apply for existing structures in a flood hazard area. Buying out old structures below flood level and redeveloping the area with elevated buildings would minimize flood damage.

Barriers/ Levees, Berms, Flood Walls

Levees can be constructed to protect from flooding for new development. A flood wall may be more applicable to reduce easement area and allow development closer to the River. Temporary or semi-permanent barriers can be an effective solution where additional flood protection is desired. In most areas there

would be adequate warning time to install these types of barriers. This is an option for riverwalk developments close to the River for protection greater than the 100-year frequency.

Dry Flood Proofing

Dry flood proofing is the process of keeping water from entering a structure. Generally, this means water is allowed to be against the structure which has been protected with an impervious wall covering, shield, or membrane. This method typically can protect against up to three feet of standing flood water, especially when retrofitting existing structures.

Wet Flood Proofing

This method minimizes flood damages while allowing a portion of the structure or area to become wet or flooded. An example would be concrete walls used to construct out-structures like gazebos or restrooms. An outdoor amphitheater or fountain can be built to flood but not be damaged. Another example is to elevate electrical and mechanical components above projected flood elevations.

Flood Insurance

Flood insurance helps relieve financial loss but does not prevent flooding. This is an excellent compensation source for existing structures; however, it does not replace the requirement to build above the flood level. Federally subsidized flood insurance is available for structures built prior to a community entering the National Flood Insurance Program.

8.11.9 EXISTING FLOOD PROTECTION MEASURES

Keystone Dam and Reservoir

Keystone Dam was constructed in 1964 by the US Army Corps of Engineers. Keystone and Kaw Dam at Ponca City reduced the natural 100-year frequency flood flow from about 360,000 cfs to 205,000 cfs. Local officials working with the Corps have an operational procedure to follow to manage flood flow releases from the dam. The Lake Keystone design includes 508,600 acre-feet of storage dedicated for sediment accumulation. However,

recommendations to help assure that Lake Keystone maintains its long-term flood control capacity are discussed in Section 8.11.10.

Tulsa and West Tulsa and Jenks Levees

The Tulsa and West Tulsa levee system (Levee District number 12) was originally constructed by the Corps of Engineers in 1938 with improvements in 1945 and later years. The Jenks levee (Levee District number 13) was constructed by the Corps in April 1949. The levee systems were designed for 350,000 cfs with freeboard. Maintaining the integrity and level of protection of existing flood control projects is a high priority for the Corps of Engineers and those communities protected by the levees. It is recognized that development within the boundaries of the Arkansas River floodplain below the elevation corresponding to a 350,000 cfs flow rate and not within a protected area of the levees has the potential to impact the designed freeboard of the levees thus reducing the overall protection level of the structures. A variety of engineering solutions are available to reduce or eliminate the effects of construction, fill, or similar activities. These solutions should be incorporated into all requests for development within the Arkansas River Floodplain.

8.11.10 RIVER CORRIDOR FLOODPLAIN MANAGEMENT PLAN

Floodplain Management is a decision making process designed to achieve a reduction in the loss of life, disruption, and damage caused by floods, and the preservation and restoration of the natural resources and functions of floodplains.

It is possible that considerable private and public investments will be made in the future to develop along the Arkansas River corridor. To help protect investments FEMA recommends that all property owners purchase and maintain flood insurance. Flood insurance is available to any property owner located in a community participating in the National Flood Insurance Program. To help assure that future development follows consistent and proper floodplain practices, it is recommended that a regional hydrology and hydraulic model of the Arkansas River corridor be developed and used as a tool to help define practical floodplain management practices that could potentially be adopted by various

jurisdictions¹. The model could also be used to help communities prepare or update disaster management plans. The river corridor model would be updated as new information is developed. The following are examples of useful information that a river corridor model will provide:

- Impacts from conceptual full development of the corridor, as shown in the Arkansas River Corridor Master Plan, for the 1986 flood event and the 350,000 cfs flood event.
- Sensitivity analysis
- Identification of a conceptual full development fringe at the 350,000 cfs flood event
- Potential impacts to flood protection capabilities provided by levees
- Dam Breach Analysis

It is also recommended that a new sediment survey be conducted at Lake Keystone. Sediment survey information could then be used to reassess the existing and estimated future impacts of sediment on the authorized purposes of flood control, water supply, hydroelectric power, navigation, and fish and wildlife. The information would also be used to identify potential short-term and long-term alternatives to help assure that downstream flood protection is maintained.

Until additional data are available, it is recommended that communities along the Arkansas River corridor consider the following floodplain management practices:

- When construction or other action is proposed within the River Corridor and within the boundaries of the 500-year floodplain, an evaluation of the flood hazards should be required by the governing jurisdiction.
- Improvements that by design may be flooded (parking lots, open air facilities, etc) during a 100-year flood event should require a hydraulic report showing that zero rise to the 100 year floodplain will occur because of the improvements and a

¹ The Corps is currently working with Tulsa County on the initial development of a regional hydrology and hydraulics model under the authority of Section 206 of the 1960 Flood Control Act.

requirement that the area for conveyance of floodwaters that existed prior to the improvements is maintained.

- Local jurisdictions are encouraged to establish minimum development criteria, in addition to the current minimum FEMA regulations for construction within the boundaries of the Arkansas River Floodplain that requires building construction at a height of one foot above the 1986 flood event (307,800 cfs) along with the requirement for zero rise to the 100 year floodplain and allowing the same conveyance for floodwater. The best information available including FEMA and local regulatory flood maps and the updated hydraulic model of the Arkansas River performed by USACE in December of 2004, as well as the proposed regional model, when available, should be used in the design of construction projects to help reduce the risk of loss of life and property.
- When federal funds are involved with a project within the Arkansas River Corridor, Executive Order 11988 regarding Flood Plain Management will be followed. Unless higher local standards are established pursuant to these recommendations all floodplain development is required to comply with the minimum standards as established by the Federal Emergency Management Agency.

Facilities that are critical to the health and welfare of the general population should not be located in the 500-year floodplain. Critical facilities include nursing homes, shelters, police and fire stations and hospitals.