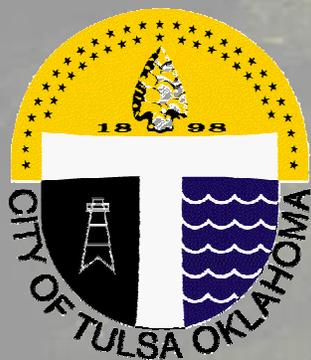


MOOSER CREEK GREENWAY

Restoration and Preservation of a Historic Pristine Stream

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Prepared for the City of Tulsa, Oklahoma
by R. D. Flanagan and Associates and
HNTB Corporation
April 2004

FOREWORD: PRESERVING AND ENHANCING SOUTHWEST TULSA

Since 1976, Tulsa, Oklahoma has made great strides in solving its flooding problems. A national study conducted in the mid 1980s identified the Tulsa region as the nation's most disaster prone area.

Today, Tulsa is widely recognized as a national leader in flood and stormwater management, with Tulsa's flood insurance rates among the lowest in the nation.

Tulsa began addressing its flood problems on a comprehensive, watershed basis in 1976, with the pioneering Vensel Creek Master Drainage Plan. Since that time, Tulsa has developed detailed master drainage plans for each of Tulsa's 31 major drainage basins.

The Mooser Creek basin, one of the last natural, pristine streams in the Tulsa area, warranted a unique approach to its planning. The objective of the planning process was to identify ways to preserve the natural beauty and character of the stream corridor and, at the same time, identify solutions to the flooding problems.

This Mooser Creek Greenway Plan celebrates the rich natural, cultural and political history of the basin, and presents a plan developed by the citizens that preserves the best of what is there, while ensuring that quality future growth and development can continue to enhance the livability of the southwest Tulsa area.

We look forward to helping the citizens of the Mooser Basin and southwest Tulsa realize and implement their goals and dreams.



Bill LaFortune
Mayor, City of Tulsa

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TABLE OF CONTENTS

	Page
ACKNOWLEDGMENTS	
FOREWORD	
I	EXECUTIVE SUMMARYI-1
II	BACKGROUND
	HISTORICAL BACKGROUNDII-1
	MOOSER BASIN DEVELOPMENTII-1
	A DIVERGENT COMMUNITYII-6
	A CLOSING WINDOW OF OPPORTUNITYII-8
III	DECISION
	A BRIEF HISTORY OF FLOODING IN TULSAIII-1
	TULSA'S FLOOD AND STORMWATER MANAGEMENT PLANIII-2
	TULSA'S APPROACH TO FLOODPLAIN MANAGEMENTIII-5
	MULTI-PURPOSE GREENWAYSIII-7
	MOOSER CREEK: ONE OF TULSA'S LAST UNDEVELOPED BASINSIII-8
	THE MAYOR'S INITIATIVEIII-8
	WHY A GREENWAY ON MOOSER CREEK WAS NOT AN EASY CALLIII-9
	GOING IT ALONE OR IN PARTNERSHIP: THE TRADE-OFFSIII-12
IV	PUBLIC INVOLVEMENT
	WHERE BLUE-SKY VISION MEETS THE GROUNDIV-1
	PARTNERING WITH THE NATIONAL PARK SERVICEIV-1
	THE TEN-STEP PLANNING PROCESS FOR MOOSER CREEKIV-3
	RECRUITING A MULTI-DISCIPLINARY TEAMIV-4
	INVOLVING THE PUBLICIV-5
	PUBLIC INVOLVEMENT INITIATIVESIV-8
	ASSESSING PUBLIC INVOLVEMENTIV-15
V	ISSUES, GOALS AND STRATEGIES
	PROPERTY OWNER ISSUESV-1
	FLOODING ISSUESV-3
	EROSION AND SEDIMENT CONTROL ISSUESV-5
	DEVELOPMENT ISSUESV-5
	WATER QUALITY ISSUESV-6
	WILDLIFE AND HABITAT ISSUESV-6
	HISTORICAL, CULTURAL AND ARCHAEOLOGICAL ISSUESV-7
	RECREATION MANAGEMENT ISSUESV-7
	PUBLIC AWARENESS AND EDUCATION ISSUESV-9
	GOALSV-9
	STRATEGIESV-10

CONTENTS

Page

VI	RESOURCE INVENTORY	
	GEOLOGY.....	VI-1
	SOILS.....	VI-5
	TOPOGRAPHY AND NATURAL FEATURES.....	VI-9
	HYDROLOGY.....	VI-11
	OIL AND GAS WELLS	VI-13
	MOOSER CREEK BIOLOGICAL SURVEY	VI-14
	CULTURAL AND HISTORICAL RESOURCES.....	VI-20
	TRANSPORTATION	VI-25
	WATER AND SEWER.....	VI-28
	STORMWATER FACILITIES.....	VI-29
	LAND USE.....	VI-32
	PUBLICLY OWNED LAND.....	VI-36
	PRIVATELY OWNED LAND.....	VI-40
VII	ISSUES AND OPPORTUNITIES	
	ENVISIONING SOUTHWEST TULSA.....	VII-1
	RESPECTING PROPERTY RIGHTS AND VALUES	VII-1
	FLOOD MANAGEMENT USING A NATURAL CHANNEL	VII-2
	GREENWAY DESIGN.....	VII-3
	GREENWAY MANAGEMENT	VII-4
	WILDLIFE HABITAT	VII-6
	CULTURAL PRESERVATION.....	VII-6
	PUBLIC EDUCATION AND OUTREACH.....	VII-7
	TURKEY MOUNTAIN PRESERVATION.....	VII-8
VIII	GREENWAY PLAN	
	FLOOD CONTROL MEASURES.....	VIII-1
	RESTORING AND PRESERVING A PRISTINE STREAM	VIII-4
	PARKS, RECREATION AND OPEN SPACE	VIII-4
	MOOSER GREENWAY TRAILS	VIII-5
	TURKEY MOUNTAIN PRESERVATION.....	VIII-9
	REMINGTON-RIVERFIELD DEMONSTRATION GREENWAY	VIII-10
IX	ACTION PLAN	
	ACTIONS	IX-1
	COSTS	IX-3
	FUNDING OPPORTUNITIES.....	IX-3
X	INDEX	

TABLE OF FIGURES

Figure	Page
I EXECUTIVE SUMMARY	
I-1: Mooser Creek Watershed in Southwest Tulsa	I-1
I-2: Mooser Creek Watershed	I-1
I-3: Mooser Greenway and Trail Plan	I-9
II BACKGROUND	
II-1: Mooser Basin Original Land Allotments	II-3
II-2: Mooser Watershed Neighborhoods	II-7
VI RESOURCE INVENTORY	
VI-1: Mooser Basin Geology	VI-2
VI-2: Generalized Mooser Basin Geology	VI-3
VI-3: Soils in Mooser Watershed	VI-7
VI-4: Mooser Basin Topography	VI-10
VI-5: Mooser Watershed Slope and Grade Analysis	VI-11
VI-6: Mooser Creek Reaches	VI-12
VI-7: Mooser Basin Streamflows	VI-13
VI-8: Oil and Gas Wells in Mooser Basin	VI-14
VI-9: Mooser Watershed Biological Survey Areas	VI-16
VI-10: Blue Thumb Water Quality Monitoring Sites	VI-20
VI-11: Turkey Mountain Archaeological Survey Area	VI-21
VI-12: Mooser Basin Archaeological and Historical Sites	VI-21
VI-13: Major Streets and Highways Flooding Problems	VI-26
VI-14: Mooser Basin Water and Sewer Lines	VI-30
VI-15: Mooser Basin Existing Zoning and Land Use	VI-31
VI-16: Mooser Watershed Undeveloped Land	VI-32
VI-17: Mooser Basin Ultimate Projected Land Use	VI-34
VI-18: Mooser Basin in INCOG's Comprehensive Plan	VI-35
VI-19: Mooser Basin Publicly Owned Lands	VI-37
VI-20: Mooser Basin Property Ownership	VI-39
VIII GREENWAY PLAN	
VIII-1: Flood Control Measures from Union Ave. to 33 rd W. Ave.	VIII-2
VIII-2: Flood Control Measures from the Arkansas River to Union Ave.	VIII-2
VIII-3: Flood Control Measures from 33 rd W. Ave. to 49 th W. Ave.	VIII-3
VIII-4: Flood Control Measures on Tributaries MB, MC, MD, and ME	VIII-3
VIII-5: Mooser Greenway and Trail Plan	VIII-6
VIII-6: Turkey Mountain Preservation	VIII-9

I EXECUTIVE SUMMARY

As Tulsa spread out into Broken Arrow and Jenks in the early 1980s, the City began planning water and sewer improvements in Southwest Tulsa that would facilitate the full development of Mooser, Nickel, and Hager Creek watersheds. Tulsa had learned from long experience that urbanization would bring greater amounts of stormwater runoff and flooding. Consequently, in 1988 the City published its Master Drainage Plan for Southwest Tulsa, and in 1994 voters approved \$2.89 million for bridge improvements and flood control measures on Mooser Creek.

Citizens questioned, however, some of the improvements, particularly the trapezoidal, fabriform-lined channels planned for lower Mooser Creek. They asked if there were not a better way. The City reevaluated the proposed changes and authorized a restudy. The result was the Mooser Creek Greenway Plan, a holistic, comprehensive, multi-objective, multi-disciplinary effort with full citizen involvement in goal and policy setting, screening of alternatives, and selection of a final plan.

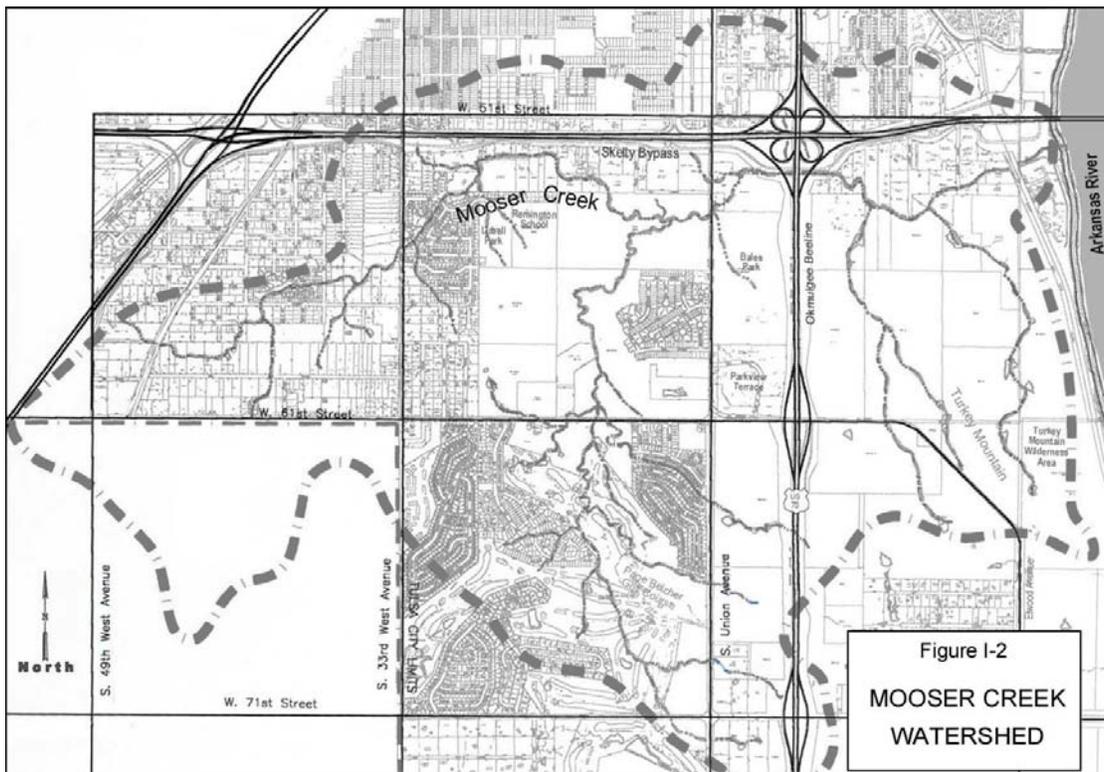
This report presents the proposed plan for the Mooser Creek Greenway. The initial chapters survey the history of the basin, discuss the development of Tulsa’s innovative stormwater management program, describe the genesis of the project, and summarize the results of the public involvement process. The last two chapters present the Final Plan along with a schedule of tasks and a budget.

The Plan’s contents and key recommendations are reviewed in the following chapter summaries.

Figure I-1:
Mooser Creek watershed
is in Southwest Tulsa.



Figure I-2:
Mooser Creek
lies generally
between West
47th Street South
and West 73rd
Street South, and
between the
Arkansas River
and 49th West
Avenue.



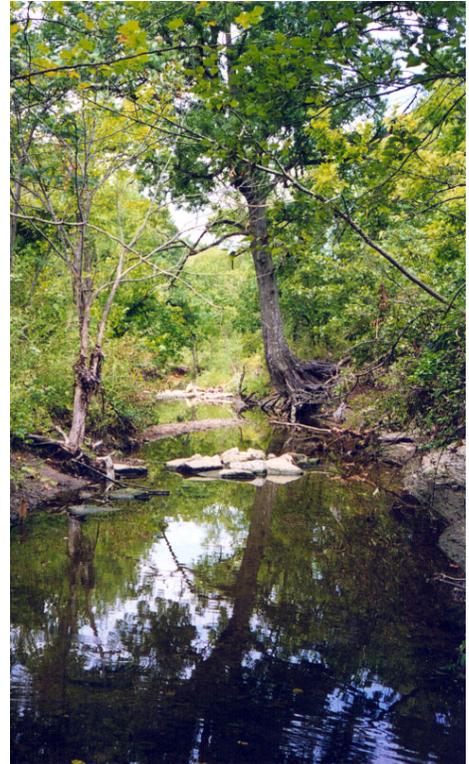
Chapter 2 History of the Watershed

*Mooser Creek near
Riverfield Country
Day School*

Mooser Creek is one of Tulsa's last pristine streams. What will be its fate, once infrastructure improvements planned for Southwest Tulsa are completed? Will it become another Joe Creek with concrete-lined channels? Is there a better way?

Chapter 2 explores the historical background of the Mooser Creek watershed and its development from the Indian Territory era until today. It contains close-up looks at Mooser Naharkey, after whom the creek is named, and the historic black community at South Haven.

Southwest Tulsa's underlying geology has largely determined its development, since it contains the oil and coal that spurred its early growth and the massive sandstone strata that later impeded it. The chapter surveys the impact of the oil industry on Southwest Tulsa, the platting and settlement of Carbondale prior to World War II, and the area's gradual expansion in post-war years. Until the late 1980s, Tulsa grew primarily to the east and south, leaving Southwest Tulsa one of the city's least urbanized districts, and Mooser Creek one of its few remaining natural watercourses. Infrastructure improvements planned for the area, however, would soon trigger the district's full development. What would become of Mooser Creek and Turkey Mountain? Would the watershed retain its rural residential character, or—because of its excellent expressway connections—become a commercial hub like Woodland Hills at 71st and Memorial? Would the creek's largely unspoiled floodplain stay natural, or be straightened and channelized to free up more land for development? These questions concerned residents, stakeholders, and city officials alike.



Chapter 3 Tulsa's Approach to Stormwater Management

Chapter 3 surveys the history of flooding in Tulsa, the development of the City's flood control philosophy and *Flood and Stormwater Management Plan*, and the evolution of its multi-disciplinary, multi-purpose approach to stormwater and floodplain management. This approach was first applied in the award-winning Mingo Creek project in 1989.

When funding was approved for flood control work on Mooser Creek in 1994, and citizens raised questions about the channelization measures proposed for the stream's lower reaches, the City agreed to restudy the plan. That year Mayor M. Susan Savage chose Mooser Creek as her "blue sky" project for the Mayor's Institute for City Design in San Antonio, Texas. A blue-sky project was something the City would do if money were no object and there were no political obstacles. Former District 2 Councilor Darla Hall and Public Works Director Charles L. Hardt also strongly supported the idea of a multi-purpose greenway along Mooser Creek that would prevent flooding, preserve floodplains and wildlife habitat, restore water quality, improve property values, and help meet the area's future transportation, recreation and educational needs.

Chapter 4 The Planning Process

Chapter 4 summarizes the public involvement process the City followed in its restudy of the Mooser Creek project. It includes close-ups of Blue Thumb stream monitoring and creek cleanups, the Southwest Tulsa Historical Society, and environmental education initiatives at Remington Elementary School.

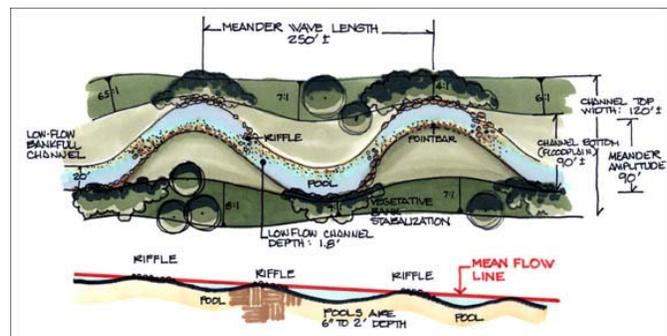
In 1996 the City invited the National Park Service's Rivers, Trails and Conservation Assistance Program (Rivers and Trails) to help it and watershed residents and stakeholders develop a holistic, comprehensive plan for Mooser Creek. A 10-step planning process was developed, and a multi-disciplinary team recruited from local, state and federal agencies to help guide the project and provide technical assistance. The project was officially kicked off on October 29, 1996, with meetings at City Hall and the Westside YMCA. Rivers and Trails' Attila Bality facilitated the formulation of a "Vision Statement" for the basin. At a second public meeting on January 28, 1997, a list of issues and concerns was developed and subcommittees were formed to address these and conduct resource inventories. Public involvement activities included press releases and conferences, a *Mooser Greenway* newsletter, creek clean-ups and walks, an information center at the West Regional Library, and presentations to schools and civic groups. The resource inventories helped galvanize local interest in the project. Innovative environmental programs at Remington and Riverfield Schools made the creek and its ecology integral parts of school life.

Chapter 5 Issues, Goals and Strategies

Chapter 5 examines the major issues raised in the public involvement process. These were grouped into ten categories: Property Owner; Flooding; Stream Channel; Erosion and Sediment Control; Development; Water Quality; Wildlife and Habitat; Cultural, Historical and Archaeological; Recreation Management; and Public Awareness and Education. Citizen subcommittees addressed more than 150 issues, from which were derived 15 action-oriented goals and 55 strategies for achieving them. The chapter includes a close-up of former State Senator Lewis Long's childhood memories of Mooser Creek.

Mooser's channel along I-44 could be reengineered to include meanders, riffles and pools.

The major property owner concerns were privacy, crime and liability exposure, litter and illegal dumping, and property values. Flooding issues centered on watershed-wide, multi-objective planning; widening culverts and bridges; protecting flood-prone structures; and preserving floodplains. Stream channel concerns focused on preserving Mooser's natural channel and using bioengineering and geotextiles to reduce erosion and sedimentation. Regarding development, residents and stakeholders want to keep the upscale, rural-residential character of the watershed and preserve as many of its unique physical and visual features as possible. Water quality should be restored and the creek made safe for children to play and fish in. Citizens believe much of the basin's wildlife habitat can be saved by retaining Mooser's floodplain and riparian borders, preserving steep slopes on Turkey Mountain, and encouraging "green" construction practices. A number of historical, cultural and archaeological sites warrant further investigation. Residents want trails along the creek to comprise an alternative transportation network, but are concerned about creek-side trails in existing neighborhoods, preferring the use of



The mixed-grass prairie remnant in Bales Park was discovered by Oxley Nature Center staff during the biological resource inventory.

sidewalk trails there instead. Public education, which involves both informing people about the Greenway and using the Greenway for educational purposes, should be aggressively pursued.

Chapter 6 Resource Inventories

Chapter 6 details the results of inventorying the basin’s geology, soils, topography and slopes, hydrology, oil and gas wells, biological resources, water quality, fish and wildlife, cultural and historical sites, transportation, water and sewer, stormwater, current and future land use, and land ownership. It includes close-ups of Checkerboard limestone, Quaternary deposits, the Bales Park mixed-grass prairie, and prehistoric occupation sites in the watershed.

The basin’s geological resource is of interest because of its coal and oil deposits and scenic beauty. Mooser soils are primarily weathered from sandstone, limestone and shale, but Quaternary soils dating from the last Ice Age can be found in the stream’s lower reaches. The watershed’s rugged topography is, itself, a valuable resource. Mooser’s biological resources are among the best in the city. Its forests of flowering hardwoods are

Bales Park prairie



healthy and varied, as is its wildlife. A 17-acre mixed-grass prairie relic in Bales Park should be protected. Beaver are present in the watershed, along with deer, coyote, fox, bobcat and mink. The creek’s water quality is good for an urban stream. Archaeological and historical resources include a prehistoric habitation site near Remington Elementary School, an unusual incised stone found in Lubbel Park, graffiti-like carvings and markings on the bluffs of Turkey Mountain, and several buildings of interest to local historians. Transportation resources are substantial and include I-44, Highway 75 and section-line arterials. Lack of water and sewer service has hindered the area’s growth, but the completion of a 10-million-gallon water tank on Turkey Mountain and planned water and sewer improvements will provide the necessary infrastructure to accommodate

the basin’s full development. Stormwater facilities will be constructed as part of the Mooser Greenway project. Of the watershed’s 3,236 acres, 65 percent is developed, 34 percent undeveloped, and approximately 40 percent in public or quasi-public ownership, such as parks, roads, schools and housing projects. The watershed’s largest private landowners are Ferris and Hunter, Dyer, Viersen, Lloyds Investments, Rego Enterprises, Okita Corporation, Ozark Commercial, McGehee, Riverfield Country Day School, Pepsi Cola, Butler et al., and Suppes.

Chapter 7 Issues and Opportunities

Chapter 7 looks at how the Greenway will address issues raised by the public involvement process and seize opportunities to help create a sustainable Southwest Tulsa—by building with nature rather than against it, restoring and preserving the environment, rehabilitating neighborhoods, and improving property values.

In response to citizen and stakeholder concerns, no trails are proposed along the stream in existing residential neighborhoods; sidewalk trails will be used instead. The stream’s channel will be kept natural, and bioengineering and other “soft” techniques used to stabilize banks, control erosion and rehabilitate the previously channelized reach

alongside I-44. The bridges at Olympia Avenue and 53rd Street will be replaced along with other flood-prone bridges and culverts in the basin. Union Avenue bridge will be widened, the property immediately downstream recommended for voluntary acquisition, and selected buildings floodproofed. Efforts will be made to save as much native timber as possible. Water quality will be restored, in part, by retaining floodplains and the creek's riparian borders. Water quality monitoring and creek cleanups will be continued. Mooser Creek and Turkey Mountain wildlife habitat will be preserved by combining steep slopes, floodplains and parks into a broad arc of recreation and open space reaching from 71st Street in the south to I-44 in the north, and west to 33rd West Avenue. The Greenway's nature, equestrian and multi-use trails will be designed for beauty, safety and manageability. A Demonstration Greenway will be created between Remington and Riverfield Schools to help inform residents and stakeholders about Greenway benefits and responsibilities. The City will continue publishing the *Mooser Greenway* newsletter and reestablish the information center at the West Regional Library.

The Greenway will link all the watershed's neighborhoods, schools, parks and recreation facilities.

Citizens committees played key roles in all aspects of Greenway planning.

Chapter 8 Recommended Final Plan

Chapter 8 surveys the main elements of the proposed Mooser Creek Greenway Final Plan. Figure I-3, a fold-out map of the proposed plan, is inserted following page I-8. A smaller version of the plan is contained in Figure VIII-5 on page VIII-6.

The Greenway reaches from the Arkansas River to 33rd West Avenue, and south from the mainstem to 61st Street along Tributaries MB, MC, MD and ME. Its width is generally defined by the 100-year floodplain, although it also includes some steep slopes on Turkey Mountain. Except where the mainstem passes through the Mountain Manor Subdivision, the Greenway's network of hiker-biker, nature and equestrian trails will link neighborhoods with schools, employment, shopping and recreational facilities. The Plan's major recommendations are summarized in the paragraphs that follow.



Stream Restoration and Preservation. The Greenway will preserve Mooser Creek's largely unspoiled natural channel, floodplain and riparian vegetation. By stabilizing banks where needed with bioengineering measures and geotextiles, the Greenway project will help reduce erosion, restore water quality, preserve and create wildlife habitat, and allow fish populations to rebuild. Environment-friendly designs and developments will be encouraged within the basin.

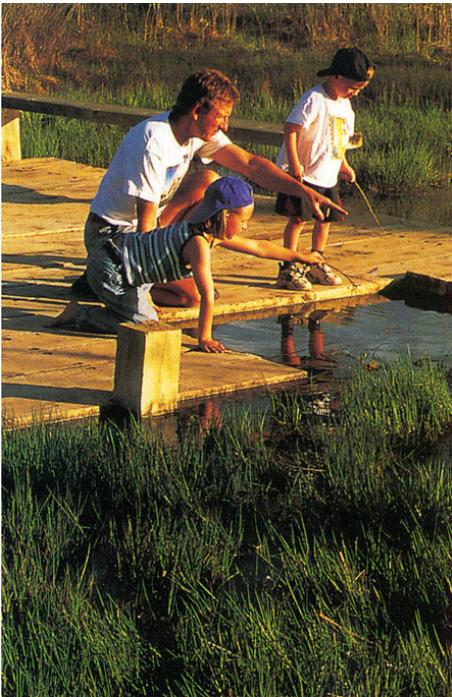
Flood Control. The Greenway's watershed-wide, multi-objective approach to flood control will retain Mooser Creek's natural channel and 100-year floodplain. Between 24th and 29th West Avenues, where the stream was straightened during construction of I-44, the channel will be reengineered to include natural vegetation, pools and meanders. Bridges at Elwood Avenue, Olympia Avenue, Union Avenue and South 53rd Street will be enlarged to eliminate backup flooding, as will a number of culverts. Bioengineering and geotextiles will be used to stabilize eroding banks and slow stormwater runoff. The City will propose voluntary acquisition of the Smith property.

Wildlife Habitat. By keeping the creek and its floodplains natural, and protecting the steep slopes of Turkey Mountain, the Greenway will create a large, crescent-shaped

wildlife habitat reaching from 71st Street and the Arkansas River north to I-44, west to 33rd West Avenue, and south along Tributary ME to Page Belcher Golf Course.

Greenway Trails. The Greenway's more than 25 miles of proposed sidewalk, multi-use and equestrian trails will make up an alternative transportation system linking neighborhoods and housing projects with schools, parks, shopping, employment, recreation and entertainment. In existing residential neighborhoods, sidewalk trails will connect to the Greenway at 33rd West Avenue, at West 61st Street South, across from West Highlands Park, and at Union Avenue. Trails will also tie into Tulsa's expanding city-wide trail system through the River Parks network, sidewalk trails on Elwood Avenue, Union Avenue and 33rd West Avenue, and the proposed Tulsa-Sapulpa Trail.

Greenways offer extensive recreational and educational opportunities.



Jenny Hager, Alpine Images

Recreational Facilities. Mooser Creek Greenway will link together the watershed's major recreation areas and facilities, as recommended in INCOG's Comprehensive Plan. A multi-purpose trail on the north side of Mooser mainstem will connect with the River Parks' system on the west bank of the Arkansas River. Nature trails will link Page Belcher and West Highlands Park with Lubell Park, Bales Park, and the YMCA Camp via Riverfield Country Day School and Remington Elementary School. A series of nature/equestrian trails will follow the west bank of the Arkansas River, loop up the south side of Mooser Creek to Bales Park, and ascend Tributaries MB and MD to parking facilities at 68th Street and at 63rd and Elwood, in the Turkey Mountain Wilderness Area.

Educational Opportunities. Greenway trails will allow citizens access to the watershed's many educational opportunities and institutions. A Demonstration Greenway will connect Remington Elementary and Riverfield Country Day School. Riverfield's 68-acre campus is situated astride one of the stream's loveliest reaches. Remington Elementary offers an environmental center specializing in Mooser Creek ecology and is next door to 16-acre Lubell Park, where an amphitheater is planned. A multi-purpose gravel fines trail from Mooser mainstem south to 61st Street will connect the two schools and run through Lubell Park. A nature trail will follow the east side of Tributary ME from Mooser mainstem to 61st Street. A branch of this trail will connect Riverfield to the gravel fines trail at Remington Elementary School. These trails will allow safe access to Remington from homes in Woodview Heights, West Highlands, and Parkview Terrace.

Greenway Design and Management. Mooser Creek Greenway trails and facilities are located so as not to interfere with homes and businesses in the watershed. Trail design minimizes potential user conflicts by providing separate trails for competing uses, wider trails, longer views, and fewer surprises. Providing adequate lighting, keeping trails open to public view, and routing trails along roadways will help ensure user safety. To keep trails from becoming a source of litter and stream degradation, trash receptacles will be located throughout the trail network and serviced by regular pickups.

Turkey Mountain Preservation. INCOG's Comprehensive Plan recommends low intensity zoning for the Turkey Mountain Special District, the extension of River Parks' trail system into and through the district, the protection of the river bluff areas, and the acquisition of additional park land by the City. It also calls for the identification of Development Sensitive Areas that should be least disturbed by development, such as floodplains, steep slopes, forests and wildlife habitat. The Mooser Creek Greenway

provides a vision and rationale for achieving many of these objectives. Development Sensitive Areas—primarily floodplains and steep slopes—were identified and mapped during the planning process and incorporated into the Final Plan. The result is a spectacular network of public parks, trails and open space unmatched in the city.

River Parks' all-purpose paved and lighted trail will branch off from Mooser Creek alongside the Missouri-Pacific Railroad grade to a planned Information and Nature Center at 71st Street. On the east side of the railroad, a nature/equestrian trail will run up the Arkansas River from 71st Street to Mooser Creek, turn west to the YMCA Camp, then follow Tributary MC south to 61st Street, before turning east to Elwood and south again to 71st Street. This 6-mile loop, along with other nature/equestrian trails on Turkey Mountain, will create equestrian opportunities just 10 minutes from downtown Tulsa.

Chapter 9 Action Plan

Chapter 9 outlines the individual projects that would implement the Mooser Plan, identifies the agencies or departments responsible for their completion, and lists proposed funding sources, cost estimates, current status, and estimated completion dates.

II BACKGROUND

The 3,325-acre (about 5 square miles) Mooser Creek watershed lies largely in Tulsa County on the west side of the Arkansas River, and is bounded, generally, by 47th Street on the north, I-244 on the west and 73rd Street on the south. Its major features are Interstate Highway 44 (Skelly Bypass); US Highway 75 (Okmulgee Expressway); Turkey Mountain; the Page Belcher Golf Course; and the major north-south arterial streets Elwood Avenue, Union Avenue, and 33rd West Avenue; and the east-west arterials 51st Street, 61st Street, and a short stretch of 71st Street.

HISTORICAL BACKGROUND

The earliest prehistoric artifacts found in the Mooser drainage basin date from the Woodland or Caddoan Periods, from 500-1500 A.D. These objects, discovered on Turkey Mountain in 1979, consist largely of arrow points and chips and a sandstone anvil. In the summer of 1998, archaeologists turned up what appears to be evidence of a long-term prehistoric habitation near Lubell Park and Remington Elementary School.

The first documented European presence in the Oklahoma area is that of the Spanish explorer Coronado in 1542, who passed through the extreme western part of the state. In 1682, Ferdinand LaSalle claimed the region for France, and in the century that followed French traders—like Rene Choteau—were increasingly common.

By the early 1700s, the Osage Indians were claiming the Tulsa area as part of their hunting grounds and fought fiercely to keep intruders out. They were eventually forced to cede their Oklahoma, Arkansas, and Missouri lands to the United States in 1825. Cherokees from Georgia and Tennessee had begun moving to, what was then, Arkansas Territory in 1812, and were soon followed by Creeks from Alabama and other eastern seaboard tribes. The mass migrations associated with the Indian removals began in 1834, and by 1836 more than 10,000 Creeks had moved to the new country. One group of Lochapoka Creeks settled at sites that would later become Tulsa, Sapulpa, Coweta and Sand Springs.

Several parties of explorers traveled along the Arkansas River in the early 19th Century: Lt. James B. Wilkinson, of Zebulon Pike's expedition in 1806; Capt. John Bell in 1820; Thomas James in 1821; Nathan Boone in 1843. The best-known early visitor, however, was Washington Irving, who passed through the present site of Tulsa on October 14, 1832, and described the area in his *A Tour of the Prairies*.

The Civil War divided the Creek and Cherokee Nations and forced many Creeks into exile in Kansas. A Civil War battle between Union and Confederate Creeks was fought in 1861 near present-day New Mannford. Subsequent battles were fought at "Caving Banks" on Bird Creek near Turley, and at Chustenalah. No Civil War activity is known to have occurred within the Mooser basin.

MOOSER BASIN DEVELOPMENT

The end of the Civil War ushered in an era of ranching, railroad building, and gradual white settlement. Texas ranchers drove their cattle through Indian Territory to railheads

*Washington Irving,
about the time he
wrote A Tour of the
Prairies.*



MOOSER CREEK NAMED FOR MOSES (MOOSER) NAHARKEY



Moses (Mooser) Naharkey

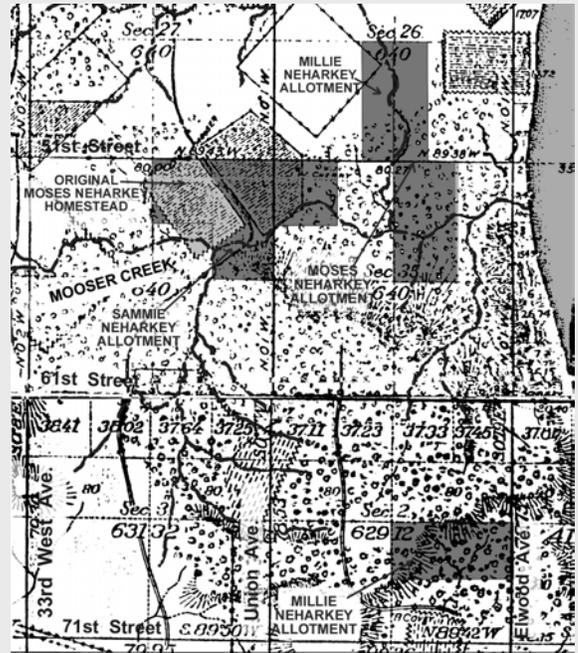
Little is known about Moses (Mooser) Naharkey, after whom Mooser Creek is named. He was a Lochapoka-Talasi Town leader and member of the Creek House of Warriors in Okmulgee.

By 1898, when the first survey map of the area was made, preparatory to assigning allotments, Moses Naharkey was homesteading an 80-acre parcel of Mooser Creek bottomland northeast of the future site of Remington Elementary School. His property reached from about 51st south to 53rd Street, and between 26th West Avenue and Yukon Avenue. His neighbor to the east was J. W. Cherry, after whom Cherry Creek is named.

The period from the end of the Civil War until the breakup of the Indian tribal lands around 1900, is considered by many historians to have been a kind of Golden Age for the Five Civilized Tribes. It was a time of comparative abundance. Each family farmed and ranched parcels of 80 or so acres, and hunted and gathered on the tens of thousands of acres of unsettled lands they held in common.

This idyllic era was being battered by economic and social forces of considerable magnitude. One was the passing of the western frontier and free land. New white immigrants looked with envy upon these sparsely settled lands from across the borders of Kansas and the recently opened Cherokee Strip. Another was white cattlemen from Texas and Oklahoma, who drove their herds slowly through Indian lands—so slowly that it appeared to many Indians that they were actually trying to occupy and lay claim to the open range. The most dramatic force, however, was the discovery of oil in Indian Territory in 1889.

Oil had long been known to be under the Oklahoma hills. In places it literally seeped from the ground like black, viscous springs. But the development of engines and machines in the last half of the 19th Century increased enormously the demand for petroleum as both a fuel and lubricant. To eastern entrepreneurs and speculators, it was as if gold were being squeezed up out of the Indian earth.



The original Naharkey homestead is in brown, the Naharkey family allotments in yellow.

Over a period of almost 20 years, beginning in the 1890s, the Indian lands were mapped and then broken up—usually with a quarter section allotted to every man, woman and child.

Mooser, Millie (his wife) and Sammie (his son) Naharkey each received parcels in the vicinity of the present day Mooser Creek watershed. Mooser's allotment was between Highway 75 and Elwood Avenue, from about 46th to 56th Streets. One of his wife's adjoined his to the west, between 46th and 51st Streets; the other was on the west side of Elwood between 65th and 68th Streets. Sammie received a quarter section on the south side of 51st Street, from Highway 75 to about 25th West Avenue.

Mooser lived on his wife's allotment until her death in 1902, and then on his own property until his disappearance in 1905.



Photographs courtesy of David Breed

Mooser Naharkey is in the back row, far left. Chief Pleasant Porter is seated in the center, with Robert Fry to his right.

The home of Leon Smith (now deceased), on the original Sammie Naharkey allotment, is one of the oldest structures in the watershed.



“South Haven.” Lot sales on the unimproved land were slow, but when blacks fled Tulsa in the wake of the Race Riot of 1921, South Haven became a significant black settlement. The community did not have water, sewer, or improved streets until annexed by the City of Tulsa in 1966. South Haven’s elementary school, which opened in 1919, still stands at 5409 S. 40th West Avenue. It was expanded with a brick wing in 1953, but was closed in 1967 when its 92 pupils were integrated into Remington Elementary. For a time the school buildings served as a community center, but are now being used as a residence. Black high school students were bused across town to Booker T. Washington until Webster was integrated in 1955, more than 10 years before other Tulsa public schools.

Carbondale, on the northern boundary of the watershed, was platted in 1921 and incorporated in June 1925. Named for the Sunlight Carbon Co., which was located just outside the basin at Yukon Avenue and West 46th Street South, Carbondale was a blue-collar town whose residents largely worked at Sunlight or in the refineries of West Tulsa. When the carbon factory was destroyed by fire in 1928, economic difficulties forced the town to request annexation to Tulsa. The oldest buildings in Carbondale cluster around the intersection of West 48th Street South and 31st West Avenue, on the extreme edge of Mooser basin. These include a two-story drugstore, known as the Blackburn Building, and an old grocery and barbershop at 4812 and 4814 South 31st West Avenue.

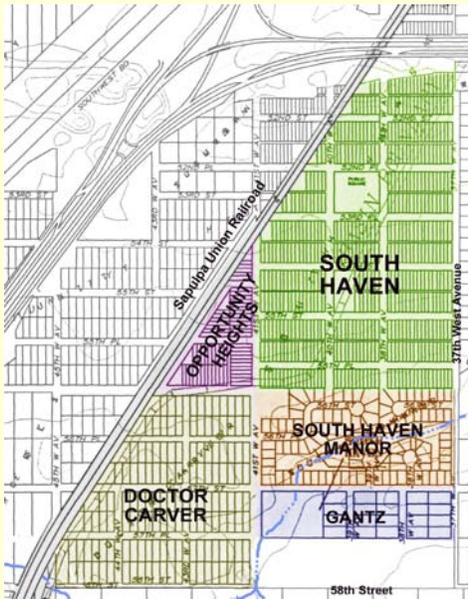
Carbondale Elementary School was built in 1929, but was soon renamed Alice Robertson Elementary in honor of Oklahoma’s first female member of the U.S. Congress. It is located at West 48th Street South and 27th West Avenue, on the northern edge of the basin. Students in Carbondale attended Clinton until 1938, when Webster High School was opened. Clinton then became the area’s Junior High School.

U.S. Highway 66, from Chicago to Los Angeles, was completed in 1937. The 2,400-mile-long “Route 66” was the first east-west transcontinental highway in Oklahoma. It followed Southwest Boulevard through Red Fork and Carbondale, generally parallel and to the west of the Tulsa-Sapulpa Union Railroad tracks. None of the highway’s historic buildings are within the Mooser watershed.

Except for the completion of Highway 66, the Depression and World War II years were quiet ones for Mooser basin. There was little new construction between 1930 and 1945 other than the Union Avenue Bridge, which was a Works Progress Administration (WPA) project.

The post-war “baby boom” period, however, brought changes to the basin almost as dramatic as the discovery of oil 50 years earlier. Plats were filed for Summit Park on the northeast corner of 61st Street and 33rd West Avenue in 1946; Dr. Carver between 56th and 58th Streets and 42nd and 45th West Avenues in 1947; Southwest Gardens, south of 51st Street between 35th and 37th West Avenues, in 1948; and Valley Homes, to the east of Southwest Gardens, in 1949. Construction of the 51st Street Bridge over the Arkansas River was completed in February 1953, and the Turner Turnpike opened the following

HISTORIC SOUTH HAVEN COMMUNITY



Historic South Haven actually included parts of neighboring subdivisions, like Opportunity Heights and Doctor Carver.

“South Haven was a wonderful place to grow up,” said Johnny Bruce Elliott, leaning back against the fender of his car in his old neighborhood in the northwestern sector of the Mooser basin. “We moved here in 1939.”

His friend of more than 50 years, Eleanor Walker Ross, agreed. “I loved living here,” she said. “We were a very close community. No one locked their doors. There were no streetlights, so it got very dark at night. But we girls played all up and down these streets. Nothing ever happened. It was a great place to raise kids.”

Johnny Bruce and Eleanor Ross have been friends since they were in the Third Grade at South Haven School. They went on to Booker T. Washington together. Johnny Bruce and Jerry Ross, Eleanor’s husband, were best buddies throughout their childhood and played baseball and football on the same teams. Johnny Bruce was a star halfback, and Jerry a tackle and tight end. Johnny Bruce went on to play for the Army; Jerry stayed home and married his high school sweetheart when she graduated from Oklahoma State University in 1959. It’s clearly been a good life. Jerry and Eleanor Ross live in one of South Haven’s finest

homes, roomy and well cared for, with a large, neatly kept lawn.

Johnny comes back to South Haven twice a year to see the Rosses and other old friends. He lives in Alabama, now, and works for the U.S. Army Aviation and Missile Command at the Redstone Arsenal. His father was an electrician at Douglas Aircraft.

He can’t believe how empty South Haven has become over the years.

“When I was a boy, there was a house on every lot in South Haven. Since the lots were only 25 feet across, many of them weren’t very big—but everybody owned their own home, and that made a difference. It was a proud community.

“Some of the best athletes Tulsa has produced grew up right here,” he said, gesturing at the surrounding streets and houses, “like J. W. Lockett, who went on to play for the Dallas Cowboys, and Clarence Dickson, who played for the New York Knicks.”

Both Johnny Bruce Elliott and Eleanor Ross are happy about the new Habitat for Humanity houses going up across 41st West Avenue. “It’s good to see new families coming into the neighborhood,” said Mrs. Ross. “We are especially glad that they are going to own their homes and raise children here.”



*Johnny Bruce Elliott:
“South Haven was a great place to grow up.”*



*Eleanor Walker Ross
has lived in South Haven since 1939.
“We were a very close community.”*



Photo courtesy of Eleanor Ross

In 1997 former residents of South Haven gathered at the Northwest Tulsa home of Mrs. Laura Dickson Lewis, mother of basketball star Clarence Dickson. Those attending included Dorothy Jefferies Wood, Maxine Pegues Wood, Idella Curtis, Jerry and Eleanor Ross, Carolyn Campbell McCondieche, Tommy Zachary, Laura Dickson Lewis, Richard McCondieche, Laverne and John Gill, Mabel Campbell, Vonzel Washington Graham, Mr. and Mrs. Alex Zachary, Rev. and Mrs. Leroy K. Jordan, and Paul Reed.

Residential and retail development in the watershed has been slow, hampered by the area's rugged terrain and inadequate infrastructure—particularly water and sewer.

May; I-44 (Skelly Bypass) was built around Tulsa in 1956; the Southside Wastewater Treatment Plant was dedicated in 1957; and the Okmulgee Expressway finished in 1958.

Because of its odor, the wastewater treatment plant was perhaps the most controversial of these developments, but I-44 was to have a more profound impact on the basin. Although not its intention, the Bypass encouraged the development of a commercial/industrial strip along the south side of the highway that obliterated the view of the creek and changed the basin's rural character and landscape.

South Haven's annexation to the city in 1966, and the improvement of water and sewer service that accompanied the development of Mountain Manor, Summit Park and Remington Elementary School, brought a new surge of development in the Mooser basin. This was the time of Tulsa's rapid expansion southward into Jenks and Broken Arrow.

Mountain Manor was platted and developed in 1965; Remington Elementary School opened in 1967; the Westside YMCA moved to its Olympia Street location in 1969; South Haven Manor was completed in 1971; West Highlands began development in 1972 and continued through the next decade; Parkview Terrace was built in 1975; Page Belcher Golf Course opened in 1977; Riverfield Country Day School was founded in 1984; and Stone Creek expansion of Page Belcher Golf Course began operation in 1987.

Two of these developments would have a significant impact on the social composition of the watershed. The South Haven Manor public housing project was built on 20 acres of low-lying floodplain adjacent to the old South Haven community. South Haven Manor was something new in Tulsa public housing at the time, as it was made up of low-density single-family and duplex townhouses with five units to the acre. Parkview Terrace, the basin's other public housing project, was built on high, rocky ground at West 61st Street and Union Avenue.

A DIVERGENT COMMUNITY

Although the Mooser watershed has had excellent expressway access to metropolitan Tulsa, its residential and retail development has been slow, hampered by the area's rugged terrain and inadequate infrastructure—particularly water and sewer.

South Haven Manor

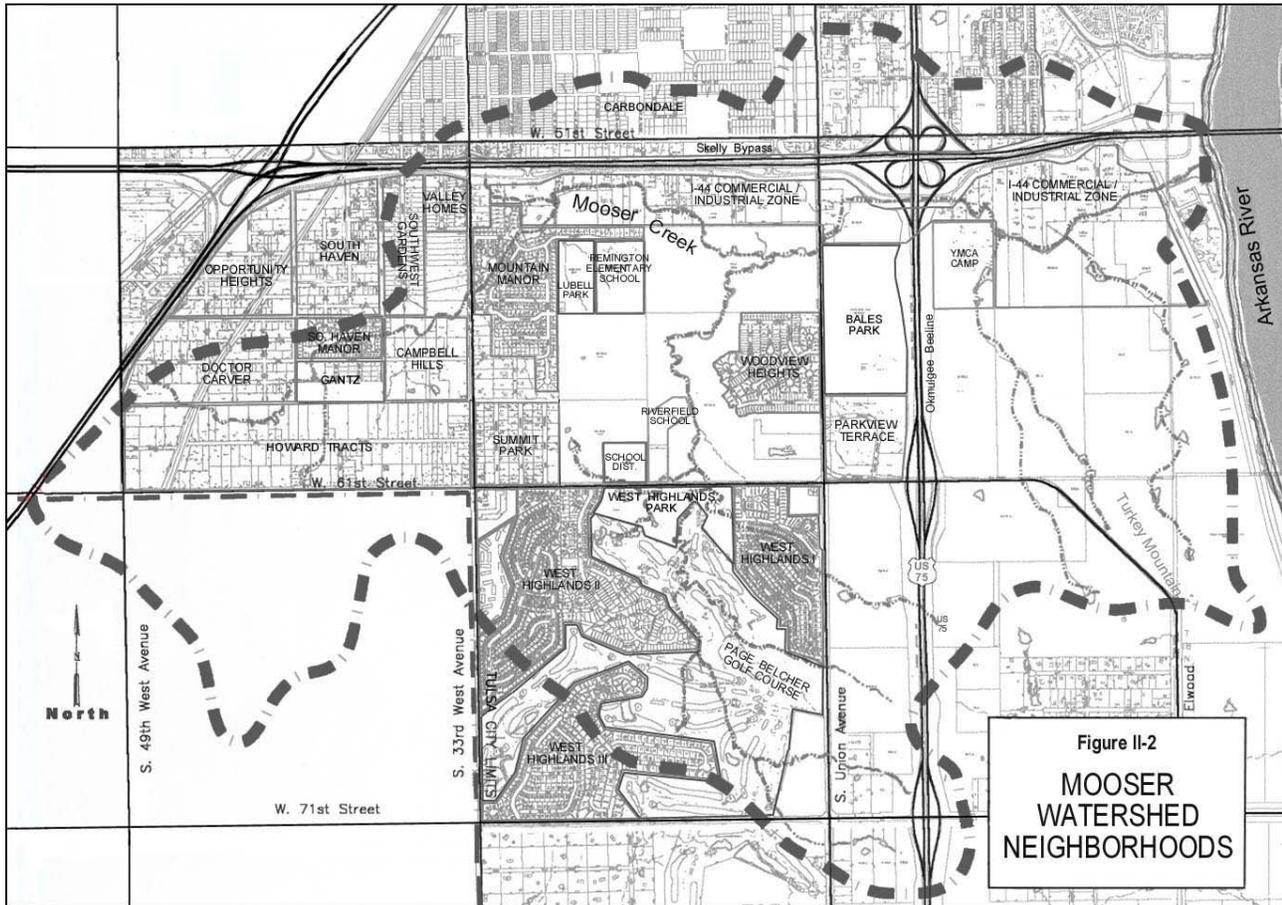


The Southwest Chamber of Commerce has, itself, favored the area's slow, cautious growth. There is a common feeling among Southwest Tulsans that "development" has as often hurt as helped their section of the city. Many residents have a ready list of complaints, such as forced urban renewal, commercial strip zoning along I-44, the "barrens" under I-244 where Southwest Boulevard and old Route 66 used to run, the sewage treatment plant on the Arkansas River, and public housing projects.

Resistance to development reached a boiling point in 1995 when the City approved a new senior citizen housing project in Mountain Manor, next to Remington Elementary School. The local homeowners' association took the City to court over the issue. Although the City won the lawsuit, opposition was so strong the developer was forced to abandon the project.

This is not to say that residents did not appreciate the City's improvement of local water and sewer service, its investment in parks and golf courses, and efforts to fix the odor problems of the sewage treatment plant. But most also prized the rural character and hometown atmosphere of Southwest Tulsa, and feared that its wild streams would be heedlessly turned into concrete channels and its high meadows into sprawling and crowded commercial complexes.

Figure II-2:
Mooser Watershed
Neighborhoods



The divergent forces within the basin were less the City's doing than history's. The working class neighborhoods of Carbondale and South Haven were divided from Mountain Manor and West Highlands by more than I-44 and 33rd West Avenue. The two areas also represented different historical eras and aspirations, age groups and income levels. But even these neighborhoods had more in common with each other than with the commercial/industrial zone on the south side of I-44. And these three groups, as diverse as they were, had a greater community of interest than any had with the owners of the large, empty tracts of land along the Okmulgee Expressway—some of whom probably were nurturing visions of a bustling commercial center rising on the hills of 61st Street and Union Avenue.

But development of some kind was coming to the area, and sooner rather than later. The City had already scheduled new water and sewer mains for the basin, along with several flood mitigation measures—improvements that would open the door to full development.

A CLOSING WINDOW OF OPPORTUNITY

“We have raised generations of fine kids who have played along that creek, and we want to preserve it.”

Walter Hushbeck

As Southwest Tulsa teetered on the brink of rapid and irreversible change, there was one resource that, along with Turkey Mountain, was still virtually undisturbed: Mooser Creek. Blocked from the view of passing traffic on I-44, Mooser enjoyed one of the unintended benefits of its relative neglect—it was now one of Tulsa’s few remaining natural watercourses. Although in places it was manicured and park-like, at least two-thirds of the creek was wild and overgrown with brambles and thickets. It had been an adventure field for generations of Southwest Tulsa youth. Spilling down off Turkey Mountain and winding through the graveled terraces of West Highlands or the backyards of South Haven and Mountain Manor, the creek represented an irreplaceable asset to residents and investors alike. Walter Hushbeck spoke for many Southwest Tulsans when he said, “We have raised generations of fine kinds who have played along that creek, and we want to preserve it.”

What was to be its fate? Would it be channelized to gain the maximum land for development—the Joe Creek solution? Or would it be broken up into sections, and each reach treated differently? Was it possible to leave the stream natural and wild? Was Mooser the private property of those whose land bordered the stream or reached across it? Or was it a community asset in which every watershed resident had a legitimate interest and stake? There was no consensus on these questions, and each group within the basin had its special concerns and fears.

Boys playing along Mooser Creek in South Haven Manor



This lack of agreement on a common vision threatened that nothing would be done (or at best the bare minimum) before it was too late to do anything far-sighted or optimal. This was a practice the City had worked hard to stop, since it usually meant having to go in after a watershed was developed to fix flooding problems that were becoming dangerous and costly. By that time, riprap and concrete channels were usually the only feasible alternatives left.

Whatever was to be its fate, time was running out for Mooser Creek. The City had already financed and scheduled \$2.9 million for channel and bridge improvements on the creek’s lower reach, and there were other projects slated for the basin. These included \$4.2 million for water storage on Turkey Mountain; \$1.3 million for a Mooser relief main; \$11 million for a 36-inch water transmission line; \$11.2 million for a sanitary interceptor; \$5 million for Southside Treatment Plant improvements; \$2.1 million for a second service area trunk line; \$1.2 million for Turkey Mountain land acquisition; and \$1 million for improvements at Bales and Lubell Parks.

These infrastructure improvements would allow the full development of Mooser basin. Some property owners no doubt felt their ship was coming in at last. But for those who wanted to save the natural beauty of Tulsa’s last free-flowing waterway, it seemed they were about to miss the boat entirely. If something was going to be done to protect the Creek, it had to be done soon. The window of opportunity was closing fast.

III DECISION

A BRIEF HISTORY OF FLOODING IN TULSA

Tulsa learned about flood hazard and mitigation the hard way. Located on a wide river in a zone of violent storms, and on a frontier where people prized the right to do what they wished with their property, Tulsa has traditionally been reluctant to impose land use restrictions on its citizens. In any case, people usually avoided building in flood-prone areas without having to be told. But the early settlers' knowledge of land and weather did not go back very far—usually not more than 30 or 40 years—and some creeks did not flood that frequently. The weather patterns were understood quite early. For example, violent storms clustered in spring and fall, around Memorial Day and Labor Day.

As it turned out, much more was involved in flood prevention than knowing the habits of weather and the land. Urbanization itself brought unexpected and unprecedented changes. As the growing city covered the land with roofs, roads, and parking lots, and removed much of the native vegetation, water that used to be captured by plants or percolate into the soil began to run off into culverts, pipes, drains and concrete channels. This surge of new water began to reach Tulsa's meandering waterways in amounts that had never occurred before.

And it proved hard to keep people out of the floodplains, since the flat, soft earth there was considered by some to be prime property for development. Wherever there was a likelihood of flooding, some developers reasoned, drainage channels could easily be made to carry the water away to somewhere else. But fixing problems in one place usually made them worse downstream, with a cascading effect. Some particularly devastating floods resulted.

One of the worst of the early floods came on June 13, 1923, and left 4,000 people homeless. The City's response was to recommend that roads and houses be built on high ground and parks and recreation facilities in the lowlands. It was Tulsa's first attempt at a land use plan.

The Great Mississippi River Flood of 1927 ushered in the era of structural flood controls. The U.S. Army Corps of Engineers was authorized to help local communities build dams and levees to prevent flooding. Nevertheless, the "Great Flood" of May 1943 killed 21 people in Tulsa, injured 26, and again drove 4,000 from their homes; 413 houses were destroyed and 3,800 damaged.

In the post-World War II boom years, as Tulsa's new subdivisions spread south and east into the rolling pastures and meadows drained by Mingo and Joe Creeks, flooding became almost as predictable as the seasons. In 1957, the Arkansas River and many upland creeks overran their banks. On Joe Creek alone, flooding caused \$2.8 million in damage and left 28 families homeless.

"We piped and paved our watersheds. We cemented over our springs. We used our riverfront as a dump, and our creeks as drains and storm sewers. As a result, our history has been haunted by flooding."

Charles L. Hardt

The worst flood in Tulsa history: Mingo Creek, 1984.



The City's reaction to each new flood, too, had a kind of regularity: emergency response, recovery, reconstruction of the damaged properties, a structural quick-fix in the channel, and a hope that the problem had been solved and would never happen again.

But it did, and worse than before. In 1959, flooding damaged 450 homes on Joe Creek and caused \$1 million worth of losses on Mingo Creek. Mingo and Flat Rock Creeks flooded again the next year, and Little Joe Creek in 1968. The 1970 Mother's Day flood did \$1 million of damage on Mingo and Joe Creeks. There was flooding on Flat Rock, Bird, and Haikey Creeks on Labor Day, 1971. Floods caused almost \$1 million of destruction on Bird Creek in April and May 1974. A month later, flooding on Joe, Fry, Haikey, and Mingo Creeks added \$18 million to losses caused by stormwater runoff. On Memorial Day, 1976, flooding along Mingo, Joe, and Haikey Creeks caused three deaths and another \$34 million in damage.

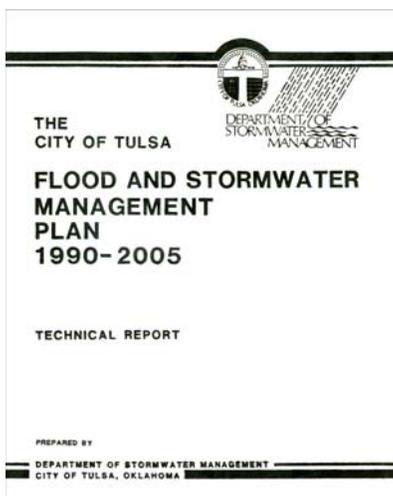
And then came the worst flood of all: 15 inches of rain were dumped onto Tulsa in the early morning hours of Memorial Day, 1984. Flash floods on Mingo Creek carried away automobiles like sticks of wood. In all, 14 people were killed, 288 injured, 7,000 buildings damaged or destroyed, and \$180 million lost. On Mingo Creek alone damage reached \$125 million. The ferocity and suddenness of the flood were unprecedented and stunning.

In the grim aftermath, the mayor and street commissioner pledged that the City would take steps to ensure that a disaster like this would never happen again.

TULSA'S STORMWATER MANAGEMENT PLAN

Between 1970 and 1985, Tulsa had been declared a flood disaster area nine times, with losses totaling more than \$300 million. The city had become known as one of the nation's most disaster-prone areas. After the 1976 Memorial Day flood, the City initiated a thorough study of Tulsa's 31 major watersheds and began compiling master drainage plans for each basin.

Tulsa's first Stormwater Management Plan, 1990-2005.



After the devastating 1984 Memorial Day flood, this effort was intensified. In addition, the City established a Department of Stormwater Management and made it the focus of all flood control and drainage activities. One of its tasks was to create a comprehensive stormwater management plan for the entire city, based upon all projects recommended in each of the master drainage plans. The result was an ambitious 15-year flood control capital facilities plan totaling \$437 million.

To finance this program, citizens approved \$120 million in sales tax and bond issue funds to implement the capital flood control projects recommended in the individual basin studies and comprehensive plan. About \$80 million in Federal funds were also committed to flood control projects on Mingo Creek. In addition, the City initiated a stormwater utility fee that would provide more than \$10 million per year for facilities maintenance and operations.

In 1990, Tulsa published its city-wide *Flood and Stormwater Management Plan, 1990-2005*. In the following years the City added four new master drainage plans and three more basin studies. In 1998, an updated comprehensive plan was issued: *Flood and Stormwater Management Plan, 1999-2014*.

Two decades of hard work paid off. Tulsa's stormwater management program has become a model for the nation. According to the Federal Emergency Management Agency (FEMA), "Tulsa has become one of the most progressive and far-sighted cities in

the nation by promoting the protection of lives and property through the application of exemplary floodplain and stormwater management principles.”

Although Tulsa’s weather remains as predictable as it was 20 years ago, with monsoon-like downpours coming almost every Memorial Day and Labor Day, it has been more than a decade since Tulsa suffered major flood damage.

One of the keys to this remarkable accomplishment is Tulsa’s approach to stormwater management and planning.

Tulsa’s Stormwater Management Philosophy

The City’s stormwater management program is based on four principles:

- | |
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| <p style="text-align: center;">Principles of Stormwater Management</p> <ol style="list-style-type: none">1. The urban environment is a single interacting system.2. Floodplain and stormwater management is a time and space allocation problem.3. Floodplains and floodwaters are resources.4. Floodplain policy should be a multi-purpose, multi-objective effort. |
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These basic principles are applied through a number of corrective and preventive policies. The corrective policies include:

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| <p style="text-align: center;">Corrective Policies</p> <ul style="list-style-type: none">• Use of channel modifications and stormwater detention storage• Acquisition and relocation of chronically flooded properties• Flood insurance• Floodproofing |
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The preventive policies follow these guidelines:

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| <p style="text-align: center;">Preventive Policies</p> <ul style="list-style-type: none">• The best use of the floodplain is for public parks, recreation and open space.• Floodplain planning is based on the 100-year flood under fully urbanized watershed conditions.• Floodplain alterations must be based on a basin master drainage plan and cannot cause off-site problems.• Floodplain uses must not reduce storage or restrict channel conveyance capacity.• All development in the regulatory floodplain requires a permit.• Stormwater runoff on higher ground must be controlled to limit flooding, siltation, and erosion.• Public facilities located in floodplains require special attention.• Other preventive actions are: Acquisition of floodplain land; Disclosure of flood hazard information to buyers and renters; Implementation of flood warning and emergency management systems, public information programs, and post-flood recovery plans. |
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Multi-Objective Planning—Multi-Purpose Solutions

Watershed projects involve multi-disciplinary teams in a web of interrelated issues.



It had long been apparent to the city’s engineering and planning professionals that stormwater problems could not be solved in isolation. In fact, single-purpose solutions often made flooding worse. A meticulously designed housing project high in a watershed, with no stormwater problems of its own, could well cause millions of dollars of damage to businesses and residents many miles downstream. Drawing benefits from these insights, however, was another matter—and highly political. It required the consideration of a new planning paradigm: the watershed.

The problem with watersheds as a planning paradigm is that they rarely, if ever, conform to political jurisdictions, and they often bring together groups of wildly divergent character and interests.

Floodplains, as an example, have a variety of functions. They carry floodwater, contain homes and businesses, fish and wildlife habitats and historic districts, and serve as recreation areas. They are also subject to numerous—and often conflicting—programs and regulations. The use of a single parcel of land might have to satisfy local, regional, state and National Flood Insurance Program building regulations, wetlands development restrictions, historic preservation rules, and water quality standards. One program might approve structures for

flood control, while another might seek to remove the very same “improvements” to preserve natural habitats.

Consequently, while bringing different groups and interests together to work on a watershed might have the political advantage of covering all the bases, it also runs the risk of getting players on the field who are going by different rules and striving toward incompatible goals. In addition, their involvement gives disgruntled participants a chance to monkey-wrench the process or hold it hostage until their special interests are met—usually with more money. People who are risking their own and other’s life savings on the profitability of a development can hardly be blamed for wanting to keep issues simple and solvable.

But simple solutions, whatever their merits, had not solved Tulsa’s flooding problems. The rising death toll and staggering increase in damage costs had forced the City to recognize that floodplain management programs cannot operate in a vacuum or afford the luxury of single-purpose objectives.

The teams assembled in the wake of the disastrous 1984 flood were of necessity multi-disciplinary and multi-agency—funding requirements, alone, would have required it—and consequently had to address a web of connected issues while working toward a number of interrelated objectives.

The goal of multi-objective planning is to accomplish as many public policy objectives as possible with each tax dollar. The benefits of doing so are apparent enough: multi-disciplinary teams recruited from city, county, state and federal agencies and departments not only produce a more complete and scientifically sound product, they also help fund it and present it to the public. A typical team, such as the one brought together to work on the Mooser Creek Greenway Plan, will include urban planners, hydrological

engineers, landscape architects, geologists, soil specialists, environmental scientists, anthropologists, archaeologists, historians, urban foresters, ecologists, public information specialists and, of course, area residents, entrepreneurs, educators and investors.

The role of the public in stormwater management has expanded along with the cost of the City's capital projects. Consequently, the media has taken on an increasingly important role in keeping citizens informed and involved.

Because of the relatively infrequent nature of major floods—Tulsa's occurred about once every four years—and the understandable desire of people to return to normal after a disaster, there is usually a two-year window of opportunity after a flood when public interest and funding can be mobilized for protection and mitigation projects.

Another problem with building support for stormwater management is its rather narrow appeal. Not everyone is directly affected by flooding, and those who are not impacted often resent being forced to bail out people considered foolish enough to build or buy in floodplains. As a result, stormwater managers have had to find allies from other than flood-related interests, such as environmentalists, bird watchers, wetlands preservationists, hikers and bikers, and sports organizations. Combining flood programs with recreational and wildlife uses has proved an excellent way of involving and gaining the support of these larger communities in stormwater projects.

TULSA'S APPROACH TO FLOODPLAIN MANAGEMENT

Tulsa's stormwater management philosophy has been embodied in its expanding system of multi-purpose flood control projects.

Old methods are typified by Joe Creek's steep concrete runways, which are like giant culverts, unattractive when empty, dangerous when full, and requiring fences to keep children from falling into them.

The first basin-wide studies and projects developed in the wake of the 1984 floods were done by the City with the assistance of Wright-McLoughlin Engineers and R.D. Flanagan & Associates, land planning consultants. Their approach did not assume the best stormwater drainage course was the straightest run for the river.

Rather, they considered floodplains to be a vital natural resource serving an indispensable function—a part of nature's circulatory system. Streams and rivers, like blood veins and arteries, need the flexibility to shrink and swell. Rigid, channelized

Natural floodplains are vital resources that slow and store stormwater runoff and prevent flash flooding downstream.



Floodplains have many uses and advocates.

streams are like artificially hardened arteries: perhaps not harmful under normal circumstances, but prone to hemorrhage and catastrophic failure in extreme conditions.

While floodplains are primarily created by nature to convey water, they also act as storage basins to temporarily pond and slow stormwater runoff, thereby preventing its sudden convergence in flash floods downstream. In the Tulsa area, these natural detention sites where ponding occurs might only be used five or six days a year. The rest of the time, many are wetlands or empty fields.

Wright-McLoughlin and Flanagan's solution was simple and multi-purpose. Why not create artificial detention sites that imitate nature by ponding runoff during spring and fall rains, but for the rest of the year serve as parks, playing fields and wildlife habitat?

To do this, however, required a thorough scientific and engineering analysis of rainfall patterns, geology and soils, vegetation, urbanization, channel carrying capacity, streamflow characteristics, and so forth, not just for an individual stream, but for an entire watershed—all the way from rooftop to river. Based on such analyses, channels and detention sites can be designed, with considerable precision, to carry 50-, 100- or even 500-year storms safely.

Ian McHarg



George Pohl

Conceptually, this approach had much in common with the recommendations of Ian McHarg, author of *Design with Nature*, whom the City had hired to help revise its park, recreation, and open-space plan in 1968. McHarg noted that Tulsa tended to locate parks on high ground and homes in floodplains. Since about 10 percent of Tulsa was floodplain, and about 10 percent of the city was needed for parks and open space, he thought these two needs could be combined to accomplish multiple objectives. He suggested an open space concept based on the preservation of drainageways and floodplains as linear park networks throughout the city, which could also form the basis of a community trail system.

The City did not adopt McHarg's suggestions in 1968. His ideas, however, were later to form the basis of the Tulsa Trails program, which seeks, as often as possible, to utilize floodplains and drainage ways for a city-wide chain of hiker-biker trails and open space.

The obvious drawback to a stormwater management plan that requires watershed alterations to be studied in such detail and coordinated with other uses and proposed changes, is its complexity. Decisions that used to be made by a banker, a developer, and perhaps a politician, would now have to pass under the scrutiny of numerous teams comprised of residents and other watershed stakeholders, various local, state and federal agencies, and technical specialists from a dozen different fields. Who is going to pay for all of this? And how long is it going to take?

The answer is that the price is about the same and it takes a little longer. But—and this is the clincher—it works.

The multi-purpose approach to stormwater facilities was first applied on Mingo Creek in 1989. Faced with citizen resistance to a single-purpose design proposed by the U.S. Army Corps of Engineers, the City recruited a multi-disciplinary team to study the basin and recommend solutions. The team developed a multi-objective plan that increased flood storage capacity, preserved existing forests and wetlands, provided areas for sports fields and ponds for wildlife habitat, as well as an extensive public use trail system—all at little additional cost.

MULTI-PURPOSE GREENWAYS

The award-winning, multi-use drainage project on Mingo Creek fulfilled the hopes of early Tulsa planners and the recommendations of Ian McHarg, by turning the city's floodplains into parks and open space—or “greenways.”

Greenways are essentially linear corridors of open space that can serve any number of functions. They can protect scenic areas, such as the banks of rivers and streams, provide wildlife habitat, be belts of farmland around urban areas, or serve as parks and playing fields. The earliest American greenways were designed in the late 1800s as urban traffic ways—“parkways,” they were called—for horses, carriages and cars. Today, however, most greenways are long, narrow parks that cater to “linear” recreational uses, such as jogging, hiking, biking, skating and skateboarding. Greenways usually contain trails and paths for public access—but not always. Greenway trails can range from 3-foot-wide mulched footpaths to paved, 10-foot-wide multiple-use bikeways.

Greenways are, above all, elastic, in that they can be stretched to serve any number of purposes. They can be used to enhance the quality of urban life, provide opportunities for recreation and transportation, improve water quality, preserve wildlife habitat, raise property values, reduce flooding and flood-related damage, and offer economic opportunities for imaginative entrepreneurs. Greenways also give communities ways to define and preserve some of their most precious natural, cultural, and historic resources.

Some of the ecological, economic and quality of life benefits of greenways include:

- Increasing adjacent and nearby property values.
- Rehabilitating old neighborhoods.
- Creating a sense of community, by providing an amenity from which all can benefit.
- Connecting parks and playgrounds to create a network of recreational areas.
- Helping preserve biological diversity by maintaining connections between natural communities.
- Softening urban and suburban landscapes with corridors of vegetation.
- Helping protect the quantity and quality of water.
- Directing development and urban growth away from important natural resource areas.
- Providing alternative transportation routes.
- Serving as outdoor classrooms.
- Preserving natural floodplains as open space where storm water runoff can be temporarily stored, preventing or significantly reducing flood damage.

MOOSER CREEK: ONE OF TULSA'S LAST UNDEVELOPED BASINS

Except for development along the south side of I-44, the Mooser Creek drainage basin remained largely undeveloped from the early 1920s until the 1960s, as Tulsa's growth went elsewhere—mainly to the southeast. With the building boom of the 1960s, the completion of the Okmulgee Expressway, the development of the Oral Roberts University complex across the Arkansas River, and the rapid growth of outlying communities like Jenks, the Mooser watershed began slowly to be settled.

*Former Tulsa Mayor
M. Susan Savage*



Mooser basin growth continued to be hampered, however, by the lack of infrastructure—particularly water and sewer service. Some of the area's older homes were on septic systems, and a few still even had outhouses. As a consequence, the almost five square miles of Mooser basin remained a kind of rural paradise, with an abundance of upland woods, meadows and streams. It was this rugged beauty that made it an ideal location for Page Belcher Golf Course, for West Highlands Park, and for Riverfield Country Day School.

Despite difficult underlying geology and lack of infrastructure, by 1990, development began to loom on Mooser Creek's horizon. Which direction would it go? Would the basin be defined by the commercial strip along I-44, or by the blue-collar neighborhoods of Carbondale?

Or perhaps something quite different would emerge south of I-44 and west of the river: a community with less connection to the past than to the new towns spreading out along Tulsa's southern borders. The placement of I-44, had unintentionally created the possibility of a separate and distinct Southwest Tulsa—a community that was forward looking and confident, and blessed with parks, open space, and unspoiled natural beauty.

THE MAYOR'S INITIATIVE

The Mayor's Institute for City Design, 1994

In 1994, Tulsa's mayor, M. Susan Savage, was scheduled to attend the Mayor's Institute for City Design in San Antonio, Texas. Each year the Institute gave six or seven mayors a chance to work together on city design concepts. The task for this session was to develop a blue-sky project—something their cities might do if money were no object, and there were no political constraints.

A Mooser Creek project was the mayor's dream. The creek was one of Tulsa's last undeveloped and free-flowing streams. The City already planned to spend almost \$3 million on flood prevention along the creek's lower reaches, between 33rd West Avenue and the Arkansas River. What might be done on Mooser was an intriguing challenge.

The City had only recently been honored with numerous national awards for its innovative and successful floodplain management program, and in January 1994 Tulsa had won the National Society of Professional Engineers' "Top 10 Design Award" for the Mingo Creek project. Mayor Savage knew the City had the experience and expertise to do something exemplary on Mooser Creek.

The stream had considerable natural beauty, although much of it was hidden behind roadside advertising and light industrial buildings, and had become polluted and littered with fast-food packaging. Some people had even been using its wilder sections as furtive dumping sites. But it also had good reaches, as in Page Belcher Golf Course and through West Highland Park and Riverfield Country Day School. With some grooming and investment, and a shared vision of its possibilities, something remarkable might emerge from Tulsa's southwestern quarter. Mooser Creek might be at risk, but it was far from being beyond rescue.

"As we complete these greenway areas throughout Tulsa, we will also improve our community's air quality, civic health, livability and quality of life."

Mayor M. Susan Savage

WHY A GREENWAY ON MOOSER CREEK WAS NOT AN EASY CALL

Southwest Tulsa's City Councilor at the time, Darla Hall, was enthusiastic about Mayor Savage's plan to use Mooser Creek as her "blue sky" project at the Institute for City Design. Hall had been pushing for infrastructure improvements in the area, such as the Union Avenue bridge replacement, flood control and better water and sewer service.

But whatever Mooser's promise as a "blue-sky" greenway project, there were already other powerful forces at work there pulling it into the future. Chief among these were the expressways carrying 135,000 vehicles—not to mention millions of dollars—through the watershed each day and promising fortunes to those with the imagination and wherewithal to tap these rivers of wealth.

Large property owners could be relied upon to support a greenway project, so long as it did not limit their options for development. From their point of view, anything that improved the quality of life would increase the value of their investment and everybody else's.

Mingo Creek multi-purpose Greenway

The I-44 commercial strip was another matter. Many of its business and industrial properties reached back into the floodplain, and there were more than a dozen buildings along the creek that would be under a foot or more of water during a 100-year storm. Lawton Industrial Park, for example, sat squarely and entirely within the 100-year floodplain. Some businesses had been dumping asphalt and concrete slabs into the creek to stabilize the banks and extend the usable portion of their properties.

Most Mooser basin residents, however, were homeowners, and the value of their property and safety of their families were what mattered most. Approached in the right way, they could become strong supporters of a greenway project on the creek and its tributaries.



However, homeowner resistance was an equally likely possibility. The area had often been at odds with the city. Feelings were still raw in Mountain Manor from the recent legal battle over the City's approval of a subsidized housing project there. The watershed's uneven social landscape could also prove treacherous. This was not South Tulsa, where everyone lived fairly similar lives and stood to gain or lose equally. It had for decades been a blue-collar stronghold characterized by rural neighborliness and distance. The last 20 years, however, had brought a degree of gentrification and new

HISTORY AND CHARACTER: DARLA COVEY HALL AND SOUTHWEST TULSA



Former District 2 City Councilor
Darla Covey Hall

Almost nobody’s roots go deeper into Southwest Tulsa history than former District 2 City Councilor Darla Covey Hall’s. They reach down more than 100 years. An 1898 map of Creek Indian Territory shows her great-grandfather’s homestead on 81st Street between Union and Elwood Avenue, and her great-uncle John’s farm on 71st Street. When Creek Indian lands were apportioned early in the last century, the family received four quarter-sections of land just south of Mooser watershed.

“Southwest Tulsa is unique,” said Councilor Hall. “We have a small-town atmosphere on this side of the river, where everyone knows everybody else, and families go back four and five generations. We have a rich history and a very special character, and are proud of them. The last thing we want is to be

another Woodland Hills, lost in an anonymous, never-ending commercial swarm.”

Darla’s vision for Mooser Creek has had the same fierce loyalty and pride. “We want to see that stream preserved, not turned into a giant culvert, like Joe Creek. Our children have grown up along Mooser. We want to keep it rural and natural, a place where families can walk and play and see wildlife.

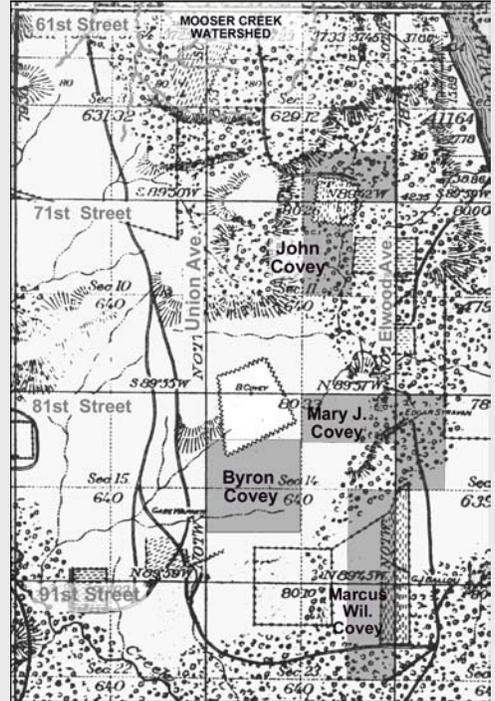
“Tulsa’s new City Council form of government has given us a way to fight for who we are, and what we want to be. It’s not just *my* vision. It is something I have shared with the people who live here.”

Darla credits Southwest Tulsa’s many civic groups, businesses and churches for creating and sustaining the area’s unique spirit—groups like the Southwest Chamber of Commerce, the Red Fork Lions Club, Masonic Lodge, Town West Sertoma, and the Southwest Tulsa Historical Society.

“They are Southwest Tulsa,” she said.

“And don’t forget Webster High School,” she added. “The fight to keep it open galvanized the whole West Side. We have something precious over here, and we don’t want to lose it.”

(Left) The Covey homestead in 1902. Second from left is Darla’s grandfather, Marcus William Covey. Fifth from right is her great-grandmother, Mary Jane Allen Covey. Fourth from right is her great-grandfather, Byron Leroy Covey Sr. At the far right is John Moss Covey, Darla’s great uncle. Standing in front of Mary Covey is Byron Leroy Covey, Jr.



The original Covey homesteads in an 1898 map are shown in white. The Covey allotments are in gray.



Photographs courtesy of Darla Covey Hall

divisions to the community. Southwest Tulsa's cohesion was being lost and social fault lines were beginning to appear based on which side of I-44 or 33rd West Avenue one lived.

Consequently, pushing for a greenway on Mooser Creek was not an easy call for Mayor Savage to make. But if the risks were great, so were the potential benefits.

For over two decades Tulsa had been fighting its way out of flood problems of catastrophic proportions. It had also seen time, economic pressures, and poorly controlled growth aesthetically damage what had once been one of the most beautiful cities in America. Old sections of Tulsa were dilapidated and deteriorating while sleek new bedroom communities were springing up on the southeastern hills. In a sense, Mooser basin was a microcosm of Tulsa's problems, and an opportunity to do things better. If it worked, the "Mooser method" could become a template which the City could use in attacking similar problems elsewhere.

In discussing her motivation to undertake the Mooser project, Mayor Savage said it "was a chance to work with the citizens of the area on a more ambitious and responsible project—one that tied water, sewer, stormwater, flood control, recreation, green space preservation and environmental concerns together with transportation, and public lands, and residential, industrial and commercial properties." She hoped the project would be a "chance to dream" and a model for the future.

The mayor was not alone in her confidence and optimism. In 20 years, Tulsa had gone from being the most disaster-prone city in America to one of the safest. It was a remarkable accomplishment, and the City was ready for new challenges.

"It is not often that we have a chance to be out in front of events," said Charles L. Hardt, Tulsa's Director of Public Works. "It is an unusual opportunity to have a virtually virgin watershed with a minimal amount of development. We have a tremendous opportunity to utilize the natural resources and to preserve one of the most natural watersheds in our community."

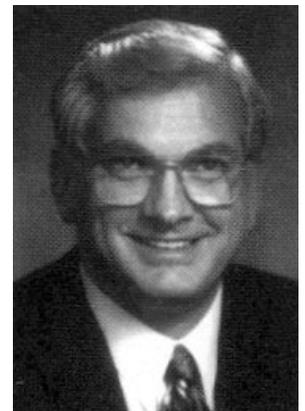
Darla Hall also praised the mayor's initiative. "It's refreshing to get in on the ground floor of something, and to have the City come to us and say, 'You live here. What do you want us to do?' Usually, we hear about things only after the plans are made, when it's like trying to tear down a brick wall to get any changes made."

A successful greenway project could help Southwest Tulsa forge a new identity, forward-looking and affluent, capitalizing on its greatest assets—the Arkansas River, Turkey Mountain, Mooser Creek, Page Belcher Golf Course, excellent parks and schools, and a superior transportation network. In addition, rising property values would encourage the rehabilitation of the watershed's substandard properties.

"It is not often that we have a chance to be out in front of events... to have a virtually virgin watershed with a minimal amount of development."

Charles L. Hardt

*Charles L. Hardt,
Director of Public Works*



GOING IT ALONE OR IN PARTNERSHIP: THE TRADE-OFFS

Acting alone, the City of Tulsa would only have undertaken the work outlined in the Master Drainage Plan. This included enlarging the 53rd Street bridge in Mountain Manor and replacing several other bridges and culverts; building a floodwall in South Haven Manor; floodproofing a number of structures; and channelizing three reaches of Mooser’s mainstem between the 53rd Street bridge and the Arkansas River. The plan also recommended a multi-use detention site west of Union Avenue, with playgrounds and ball fields, and hiker-biker trails along Mooser Creek and two of its tributaries. It was a good plan, so far as it went. It was functional and efficient, and would reduce flooding on Mooser Creek.

*Mooser Creek at the
Arkansas River*



But it lacked a visionary quality, a “blue sky” dimension of hope and possibility. Visionary plans, however, entail compromise and sacrifice and a certain degree of risk—elements engineers are often reluctant to include in their plans. But vision and hope were essential to saving the natural beauty of Mooser Creek and creating a sustainable Southwest Tulsa. To accomplish these goals, the mayor’s blue-sky vision would have to be taken out into the community and find champions and advocates there. Without local support, even the worthiest plan would remain on the shelf and unrealized.

In brief, the City had the choice of fulfilling the mandate of the *Southwest Master Drainage Plan*—the safe, minimalist approach—or attempting something more far-sighted and responsible that would necessarily entail a lengthy public involvement process and its attendant risks. That the City chose the more visionary course was determined as much by the quality of the basin’s resources as by the character of the mayor and her administration. Put simply, saving Turkey Mountain and Mooser Creek was considered worth the risk.

IV PUBLIC INVOLVEMENT

WHERE BLUE-SKY VISION MEETS THE GROUND

At the Mayor’s workshop in San Antonio, Susan Savage presented Mooser Creek Greenway as her “blue sky” project—as something the City would do if there were no citizens groups to engage or budgets to pass. As one of the last free-flowing streams in Tulsa, Mooser was an ideal opportunity for the City to demonstrate what could be done when multi-objective watershed planning took place ahead of development.

The City was poised, in any case, to begin a \$2.9 million flood-control project on Mooser Creek. By expanding it into a greenway, it could at the same time accomplish a number of related objectives with the same amount of money—as had been done on Mingo Creek: provide recreation and open space, establish alternative transportation links, preserve mature tree stands and wildlife habitat, enhance water quality, recharge aquifers and groundwater, and provide nature education trails and markers.

That was the dream, the blue-sky vision. But there were citizens groups to engage, budgets to pass, and a history of division and distrust to overcome before it could be realized. Mooser Creek was already partially developed and there were forces at work in the basin aiming it more towards Woodland Hills and Joe Creek than the City’s blue-sky watershed. In addition, there was a legacy of West Side distrust from past conflicts with the City over the wastewater treatment plant, public housing, the attempted closure of Webster High School, the routing of I-244, and urban renewal.

Mooser Creek in South Haven Manor



PARTNERING WITH THE NATIONAL PARK SERVICE

Ann Patton’s work with Mayor Savage on President Clinton’s Commission on Sustainable Development had brought them into contact with the National Park Service’s Rivers, Trails, and Conservation Assistance Program. Rivers and Trails (as it is known) helps communities preserve or restore the natural beauty of their waterways and wetlands. Its staff works from the “bottom up” to develop a consensus vision of what residents and stakeholders want their watershed to be like in 20 years. Rivers and Trails insists upon a completely open planning process with no hidden agendas or foregone conclusions—other than the guidelines set out in City master plans and other regulations.

Ann Patton invited Rivers and Trails’ Attila Bality to facilitate the development of a greenway plan for Mooser Creek. Bality was an Outdoor Recreation Planner who had been involved in Oklahoma’s Illinois River Management Plan. He would be assisted by Jodi Hernandez, another Rivers and Trails planner, who was working on the Trinity River Trails in the Dallas-Fort Worth area.

Bality insisted that business and property owners be involved from the outset, and that final plans address their needs and concerns.

At a preliminary meeting with the City in March 1996, Bality outlined the three-stage process Rivers and Trails uses to structure greenway planning.

Rivers and Trails Three-Stage Planning Process

In **Stage One**, lasting about a year, the City and Rivers and Trails help watershed residents and stakeholders form committees, hold public meetings, formulate a Vision Statement and list of Issues, and compile an Inventory of the watershed's resources.

During **Stage Two** these Issues and Inventories are turned into Strategies and Activities for achieving the goals contained in the Vision Statement. Alternative plans—for things like trails, parks and channel modifications—are developed and assessed by the various committees.

In **Stage Three**, usually the third year of the project, a Final Master Plan is developed and submitted to the watershed community and City for criticism, revision and/or approval.

“The citizens drive the process, not the City,” Bality explained. “Their participation makes the greenway project their own, not something being done to them.” As outsiders, he said, Rivers and Trails would bring objectivity, fresh ideas and new techniques to the project.

Bality insisted that business and property owners be involved in the project from the outset, and that final plans address their needs and concerns. Rivers and Trails had learned in the Dungeness River Greenway project in Washington State that property owners have to be enrolled early, before media coverage begins and rumors start to fly. “Conservation projects on streams that flow through predominantly private land, like Mooser Creek, are entirely different from those that flow through public land,” he said.

In July 1996 Tulsa and Rivers and Trails signed a *Memorandum of Understanding*. The City agreed to:

- serve as project coordinator;
- provide NPS with relevant information, contacts, and resources;
- provide a wide range of public involvement opportunities;
- develop a public education program with activities ranging from open forums to field trips;
- host and coordinate the Citizens’ and Technical Committee meetings; and
- assign and schedule implementation activities.

The NPS agreed to:

- coordinate project milestones with the City’s implementation schedule;
- design a community-based inventory of project-related resources and assist in its development;
- facilitate a community-based process to develop alternatives for a Mooser Creek Greenway; and
- provide greenway design expertise.

*Rivers and Trails’
Attila Bality*



Both the City and NPS agreed to:

- establish a work plan with resource commitments and milestones;
- set up and facilitate a Citizens' Committee and Technical Committee;
- participate in public forums to review community-based alternatives and receive input;
- develop a demonstration project on a segment of Mooser Creek;
- produce and disseminate public information to promote the project;
- develop and carry out public involvement strategies;
- mobilize resources and experts to help implement plans; and
- prepare a final *Mooser Creek Greenway Plan*.

Bality advised the City not to be wedded to specific outcomes, such as its blue-sky vision. To be successful, he said, preservation strategies had to reflect the social and economic realities of the watershed. Some greenways will have trails and public access, for example, but others might not. These questions should be decided through the planning process, not set up as goals from the start.

THE TEN-STEP PLANNING PROCESS FOR MOOSER CREEK

Although the City had its vision of an ideal Mooser Creek, it knew from experience that the ultimate goal of a planning process was not the production of a "perfect" plan that might never make it off the shelf, but a buildable one rooted in ground-level realities. Working with Rivers and Trails and R.D. Flanagan & Associates, the project's chief planner, the City designed a 10-step approach for Mooser Creek that meshed public involvement into an expanded planning process.

TEN-STEP PLANNING PROCESS

1. Citizen Involvement is continuous and limited only by their available time, talent and interests. Neighborhood groups are encouraged to form around special concerns. Public involvement is flexible and inclusive. The City might bring a number of objectives to the table, but to be effective they must become part of the citizens' plan, with the City acting more as facilitator and technical adviser.

2. Problem Identification begins early and goes on throughout the project, since issues and concerns continue to surface as more citizens become involved, interest groups form, and resource inventories are conducted and alternatives proposed. Some problems only emerge as the project's impacts are defined.

3. Goals and Objectives are formulated to keep the project on track. An initial set might be proposed by the City, but a more comprehensive list should emerge from the public meetings. These must be clearly stated and well publicized, so that everyone knows and agrees with the project's direction.

4. Management Work Plan is an essential project tool when many disciplines and groups are involved in a project. The Plan is a detailed description of how the project will be conducted.

5. Resource Inventory is a major task and can take a year or more to complete. The inventories should not only be of physical features, such as soils and geology, but also of community and City plans and financial resources. As the resource inventory reaches out into the community, conflicts and opposition will be uncovered, as well as new perspectives and directions.

TEN-STEP PLANNING PROCESS (Continued)

6. Analysis. During the Analysis step, the project's various teams and committees forge an understanding of the collected data. What does it mean? How does it relate to other aspects of the project? What conflicts have emerged, and what can be done about them?

7. Alternative Development. There are many ways to accomplish any objective. Alternative solutions to the project and its issues are proposed and screened, taking into consideration such things as cost, environmental impact and political acceptance. Three alternative plans are normally developed and presented to the citizens for their review and response. The final plan is usually a unique combination of the various alternatives.

8. Plan Refinement. Drawings, cost estimates, construction timetables and funding sources are developed in enough detail to give citizens and other decision makers a good understanding of the project's scope and impacts.

9. Action Plan identifies critical tasks, assigns them to the appropriate agencies, and establishes budget sources and timelines.

10. Monitoring and Adjustment. No plan is perfect. As implementation proceeds, flaws and oversights will be discovered and changes will need to be made. In this final step, progress is evaluated and the necessary adjustments made.

Key City and NPS officials tour Mooser Creek. (left to right) River Parks' Director Jackie Bubenik, Public Works' Ann Patton, River and Trail's Jodi Hernandez and Attila Bality, and Public Works' Assistant Director Mike Buchert.



RECRUITING A MULTI-DISCIPLINARY TEAM

Since greenway projects are multi-disciplinary and multi-objective, involving entire watersheds and a complicated web of relationships, the City invited a broad array of organizations and individuals to participate in the planning process. These included, besides Rivers and Trails and Tulsa Public Works professionals and consultants, the following agencies and organizations:

USDA Natural Resources Conservation Service
Oklahoma Department of Transportation
University of Oklahoma Urban Design Center
Indian Nations Council of Governments (INCOG)
Tulsa County Conservation District
Tulsa County Blue Thumb
River Parks Authority
Tulsa Urban Development Department
Tulsa Parks and Recreation Department
Tulsa Parks Oxley Nature Center
Tulsa Metropolitan Area Planning Commission
Tulsa Archaeological Society

*Ann Patton, Public Works
Department, directed Mooser
Greenway public involvement.*



Photo courtesy of Ann Patton

Those who expressed an interest in participating were asked to serve on one of three committees that would direct the project. These were:

The Management Committee, made up of key public officials, consultants, residents and stakeholders. Its job would be to keep the project on track, within budget and in accordance with the law, and facilitate the work of the Citizens' Committee and subcommittees.

The Technical Committee, composed of experts from disciplines related to the project—such as soils specialists, geologists, biologists, archaeologists, environmental engineers, and hydrologists—would provide professional expertise to the Management and Citizens' Committees, as well as to the various subcommittees.

The Citizens' Committee, comprised primarily of watershed residents and stakeholders who support the project, would direct the actual planning process and production of the final plan, serve as ambassadors for the project, share information about the creek corridor and its resources, assure that broader public concerns were addressed, and develop and carry out public involvement strategies.

Ann Patton, Community Affairs Manager for the Public Works Department, arranged a series of preliminary meetings with key officials, West Side business leaders, landowners and stakeholders to apprise them of the project and solicit their participation and support. It was expected that watershed residents and the Citizens' Committee would play increasingly active roles as the public involvement process reached out into the community.

INVOLVING THE PUBLIC

The project was officially kicked off on October 29, 1996, with meetings at City Hall and the Westside YMCA. Facilitated by Attila Bality, the YMCA meeting introduced the project to the community, outlined the multi-objective planning process, explained the functions of the Citizens' and Technical Committees, and developed a Vision Statement for the watershed.

The Vision Statement, Bality told those at the meeting, was to embody residents' and stakeholders' hopes and concerns for Mooser Creek. What did they want the watershed to look like in 20 years? What did they value most? What did they fear? The vision needed to be motivational and inspiring, he said, and provide a common goal for the City, businesses, civic groups, residents and stakeholders to work toward.

The Vision Statement developed at the meeting read:

Mooser Creek Vision Statement

The Mooser Creek Watershed planning process will result in plans for the area that will maintain Mooser Creek in a natural and stable condition, reduce the potential for flooding, enhance scenic views, provide a network of trails, and ensure sustainable development for the watershed. As these plans are successfully implemented, over the next 10-15 years, the Mooser Creek Greenway will emerge as a gateway to West Tulsa. The Mooser Creek Greenway will be a source of pride for Tulsa. The health and diversity of the natural creek corridor will reflect upon the strength and diversity of West Tulsa.

West side citizens and City officials at the first public meeting: (left to right) Grant and Jeanette Easterling, Bill Packard, Mike Buchert and Roy Heim.



This broad vision would be accomplished by focusing on the Vision Statement's four main themes:

Maintain Mooser Creek in a natural and stable condition. Flood damages will be greatly reduced or eliminated by emphasizing non-structural alternatives such as wetlands, naturally vegetated bank stabilization, and watershed growth management plans.

Preserve the natural integrity of the creek corridor, thus enhancing scenic views, providing wildlife habitat, and preserving the archaeological, cultural and historical resources.

Provide a safe, community-patrolled trails network with linkages to recreation, schools, neighborhoods and other points of interest. Trails will also offer opportunities for non-motorized transportation.

Ensure sustainable development of the watershed, stimulating neighborhood and economic revitalization with cooperation from residents, businesses, and the City.

Gaining Momentum

The Mooser Creek Vision Statement was presented to the watershed community at a second public meeting at Remington Elementary School on January 28, 1997. It was attended by Mayor Susan Savage, Director of Public Works Charles L. Hardt, and District 2 City Councilor Darla Hall.

Thirty-four residents also attended the meeting, including prominent landowners, civic leaders and business people, along with 19 employees from the City and other local agencies, Rivers and Trails, and project consulting staff.

In her remarks, the Mayor stressed the importance of getting out ahead of development. "If something good is to be done for the watershed," she said, "it has to begin now. We have funds for a flood control project on Mooser Creek. But we shouldn't let this golden opportunity pass to do something more ambitious and responsible."

The City was aware, the mayor said, that there might be divisive issues concerning the greenway and differing visions of the basin's future. For that reason she had asked the National Park Service to help the community develop a vision for the watershed that embraced everyone's hopes, and a plan that addressed all their concerns.

"The project and the partnership will enable us to do some innovative things in Southwest Tulsa that will serve as a model for initiatives in other parts of the city," Mayor Savage said.

Attila Bality presented the Mooser Vision Statement and encouraged those present to express frankly their concerns and fears about the project. Subcommittees were then formed to address the issues that had been raised.

Although the response to the project was generally positive, there was an undercurrent of caution, if not distrust—not only of the City and its motives, but also of greenways in general and, in particular, the desirability of public-access trails along the creek. Fears clustered around issues of property rights, safety, crime, trespassing, illegal dumping, property values, environmental preservation, and flooding.

Bality recruited volunteers to serve on subcommittees that would research these and other issues and ensure they were addressed at all stages of the planning process. These subcommittees and their concerns included:

Homeowner Rights. Public/private ownership, project impacts on property (corridor, easements), crime concerns, fire hazards, flooding, litter.

Resource Inventory. Wildlife, threatened and endangered species, large tracts, wetlands, beaver control, natural stream channel, archaeological and historical resources.

Recreation. Trails, trails network, connections to River Parks, visitor information and facilities, off-road vehicles, greenway maintenance, parking, access, safety.

Creek Design and Stability. Over-development of the greenway, project viewshed, water quality, maintaining riparian areas, monitoring impacts to creek.

Media coverage was an important part of public involvement. Below, a newspaper clipping showing former Mayor Savage and former Councilor Darla Hall at the January 1997 Mooser meeting.



Education. Schools and parks cooperation, educational opportunities, youth involvement.

Publicity. Corporate sponsorships, civic clubs, publicity and marketing.

The subcommittees were to take the issues raised at public meetings and other venues through a five-step process that would clearly state each issue, define its location and impacts, assign it a priority (high, medium, low), and turn it into a goal statement that addressed its central concern with a positive action.

PUBLIC INVOLVEMENT INITIATIVES

The January 28 meeting generated four newspaper articles and a segment on Tulsa's Channel 8 Evening News. This media coverage and political support from City Hall and community leaders gave the project the push it needed to gain the participation of watershed residents and stakeholders. To keep the project moving, a number of activities were initiated by project participants in the following weeks.

- Tulsa County Blue Thumb sponsored a Mooser Creek Cleanup and stream-monitoring project.
- A *Mooser Greenway* newsletter was established.
- West Regional Library set up a Mooser Greenway Information Center with a bulletin board, sign-up sheets and brochures.
- Committees started meeting and resource inventories began, using a combination of citizens and professional staff.
- Southwest Tulsa Chamber of Commerce conducted a "Walk Along Mooser Creek" to familiarize residents and stakeholders with the watershed.
- Major media connections were used to publicize the Mooser project.
- Remington Elementary School adopted Mooser Creek as a school theme and watershed restoration and preservation as major components of its Mooser Creek Environmental Center.
- Mayor Savage and Director of Public Works Charles L. Hardt discussed the Mooser project on a national teleconference at OSU entitled "Public Works Strategies for Developing Sustainable Communities."

*Laureen Gibson
Gilroy, Community
Involvement
Coordinator for the
Department of Public
Works, organized creek
clean-ups, community
walks, Greenway
briefings and public
meetings.*



Mooser Creek Cleanups

Mooser Creek cleanups have been held each year since 1997 in conjunction with the National River Cleanup Week in May, sponsored by the City of Tulsa, the Mooser Creek Citizens' Committee, Tulsa County Blue Thumb, the Natural Resources Conservation Service, and the Tulsa County Conservation District.

In 1997 volunteers removed more than 60 bags of litter and trash from the stream, including bedsprings, motorcycles, steel filing cabinets, bicycle frames, refrigerators, car axles, and shopping carts. The City supplied trucks and drivers to haul away the collected refuse. The next year, on May 16, 1998, 30 volunteers broke into four teams and spent the morning cleaning up half-mile sections of the creek.

GOOD CITIZENS KEEP MOOSER CREEK HEALTHY



Corey Williams, Tulsa County Conservation District and Jody Stringer, USDA Natural Resources Conservation Service, led Mooser stream studies.

Urban streams are degraded by a complex of factors, almost all of them connected with human activity. These include such obvious water quality destroyers as septic tank leaks, dumping and littering, parking lot runoff, and fertilizers and pesticides from lawns and fields. The less-obvious enemies to healthy streams are also some of the worst, such as soil erosion from construction sites and streamside clearing of natural riparian borders.

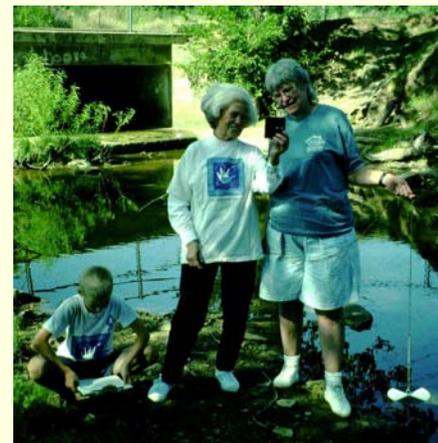
The golf course look of a cleared and mowed stream channel, for example, while attractive, can also be a source of water quality degradation, since it removes underbrush along a creek that normally filters out many common pollutants.

In a similar fashion, urbanization removes or covers over most of nature's water purifiers—native trees and grasses, soils and floodplains. Instead of passing through these natural filters, waste-laden water from roadways and parking lots, for example, is carried through drains and pipes directly into the stream channel.

Consequently, civil engineers and biologists, like Jody Stringer of USDA's Natural Resources Conservation Service, and Corey Williams of Tulsa County Conservation District, have become advocates of natural stream channels. Their research and experience are two of the reasons why the City of Tulsa and Mooser Creek stakeholders are in favor of a Greenway solution that retains the stream's riparian habitat.

Tulsa County Blue Thumb has been monitoring water quality on Mooser Creek since 1997. Monitoring includes bacteria and chemical tests and the collection of fish and microinvertebrates. The fish population in the creek is surprisingly good for an urban stream. Fourteen species were found among the 1216 fish that were collected and released, including channel catfish, four kinds of sunfish, three species of minnow, two types of shiner and bullhead, along with central stoneroller and smallmouth buffalo.

Chemical tests showed relatively high levels of chlorpyrifos, orthophosphate phosphorous, fecal coliform and e.coli (all bad signs), and low levels of ammonia nitrogen and nitrate nitrogen (good signs). Dissolved oxygen was low (not good), and pH levels were between 7.5 and 8.5 (good).



Forrest Cheadle, Lali Price and Mary Sue Herron at Blue Thumb's South Haven monitoring site.

Although Blue Thumb monitoring data are raw and require further study, the survey team believes Mooser Creek has good water quality and a good aquatic community. One of the primary reasons for this, according to Jody Stringer, is the remaining riparian areas, which protect the stream from some of the negative impacts of urban development.

(Right) South Haven Manor youth join Lauren Gibson Gilroy, Tulsa Public Works (front row right), in a "Clean Up the Creek Day."



Blue Thumb volunteer and City employee Mike Perkins at Elwood Avenue monitoring site.



Mooser Creek has good water quality and a good aquatic community largely because its unspoiled riparian areas protect it from some of the negative impacts of urban development.

On April 22, 1998, the Southwest Tulsa Historical Society and AmeriCorps recruited about 25 Webster High School students for a “Project Cleanup.” The students engaged in a combined creek cleanup and historical reconnaissance near Remington Elementary School. On October 9, 1999, Lauren Gibson Gilroy, Tulsa Public Works Department, and Sharon Davis, South Haven Manor, organized a cleanup of Mooser Creek in the public housing project. Dozens of children and adults participated. “It is important to get kids picking up trash,” Gilroy said, “because it teaches them not to litter.”

Stream Monitoring

Tulsa County Blue Thumb began monitoring water quality and fish resources at three sites on Mooser Creek in 1997. Monitoring includes bacteria and chemical tests and the collection of fish and macroinvertebrates. Bacteria and pesticide tests have been done monthly between May and September, and chemical tests each month, year-round. Water quality tests have been made for chlorpyrifos, dissolved oxygen, ammonia nitrogen, nitrate nitrogen, acidity and alkalinity, orthophosphate phosphorous, fecal coliform, and e.coli. Blue Thumb believes Mooser Creek to have good water quality and a good aquatic community largely because the unspoiled riparian areas protect it from some of the negative impacts of urban development.

Mooser Greenway Newsletter

The Mooser Greenway newsletter kept citizens and project professionals abreast of events in the watershed.

The *Mooser Greenway* newsletter, edited by Kimberly MacLeod, Public Works Department, began appearing in March 1997. Its purpose was to keep watershed residents and stakeholders apprised of the project and stimulate citizen participation. In keeping with their MOU, the newsletter was a joint effort of the City and Rivers and Trails, with strong support from the Natural Resources Conservation Service and the Tulsa County Conservation District. The newsletter is mailed out to basin residents and property owners, distributed at Remington Elementary School and the West Regional Library, and handed out at Mooser planning meetings.



The first issue described the watershed and the project, presented the Vision Statement, explained greenways and the planning process, and announced the upcoming Mooser Creek Cleanup. The second issue, June 1997, reported on the Mooser Creek Cleanup and water quality monitoring, provided some historical background on the name “Mooser,” reviewed subcommittee activity, and reprinted an article on greenways, crime and real estate values. The third newsletter, January 1998, carried the results of some of the resource inventories and listed the Project Goals developed at the October 14, 1997, public meeting. The April 1999 issue carried articles on Remington Elementary School nature trails and Environmental Center, Union Avenue bridge design, and Bales Park prairie.

Mainstream Media

Ann Patton’s office of Community Affairs and Planning used local print and television media—particularly the *Tulsa World*, *Community World*, *Urban Tulsa*, *Southwest Tulsa News*, and Channel 8 Television News—to reach the wider community with news of the Mooser Creek Greenway.

Of special importance were lengthy articles in the *Tulsa World* by Curtis Killman (“Mooser Creek to Be Improved,” January 29, 1997), Stephen Gay (“Shaping a Vision: Residents Respond to Mooser Creek Project,” February 5, 1997), Janet Pearson (“Public Job in Harmony with Nature? It’s Possible,” June 22, 1997), Tim Ashley (“Mooser Creek Plans Continue to Move Forward” and “Hearing Focuses on Mooser Creek Flood Prevention,” April 29, 1998), and Steven James (“Digging Into the Past,” May 13, 1998).

The Greenway project received excellent coverage in Tulsa’s newspapers.

Lorri Lagorin’s excellent article in the weekly *Urban Tulsa* (“Living on the Edge of Green,” June 1997) gave Ann Patton an opportunity to present the City’s perspective on the Mooser Creek project, public involvement and the planning process.

There was also a run of brief and informative articles in *Southwest Tulsa News*, which did a good job of keeping the Mooser Creek Greenway alive to those on the west side who were not actively involved in the project. The weekly newspaper did an especially fine job of publicizing the nature trail and other environmental initiatives at Remington Elementary School.

By Tim Ashley
World Staff Writer

Mary Sue Herron said she envisions the day when an informational center for Mooser Creek will be located at Remington Elementary School, 3124 W. 31st St.

Herron, who at the close of the school year will retire from teaching at Remington, knows her ideal is not yet reality.

However, if plans succeed for a \$20,000 grant from the Environmental Protection Agency, the ideal would be one step closer to reality.



Community photo by Tim Ashley
Two Remington Elementary School students show off some of the rocks they found along hiking trails close to the school.

Mooser Creek Plans Continue to Move Forward

The grant would provide for a mobile classroom outside of Remington on school grounds and would provide a convenient location for an informational center, Herron said.

Remington is located in the Mooser Creek watershed area and near tributaries that run off the creek.

Plans continue to move forward on the Mooser Creek Greenway Project according to City Of Tulsa Public Works Department officials, who spoke at a public meeting April 16 at Remington.

The officials unveiled a flood control plan for Mooser Creek for the next 100 years, just one aspect of the Greenway Project. Also included in the plan are jogging and riding trails and the preservation of natural resources.

Mooser Creek is about three miles long and stretches from the Arkansas River west to about 49th West Avenue, south of I-44.

It is considered one of the last remaining natural corridors in Tulsa, still retaining a considerable amount of natural vegetation.

Tulsa residents voted in February of 1990 to spend \$2.9 million from a three-penny sales tax on flood plain improvements along the lower Mooser Creek corridor.

Future developments in the area would likely impact the entire creek corridor, on the City of Tulsa is working with local residents, businesses and the National Park Service to develop a suitable plan for the entire watershed.

Administration Manager for Public Works, said roughly one third of the watershed is undeveloped thus far.

Although the planning process for flood mitigation is not over yet, Reynolds said funding from the 1990 sales tax is in place to replace the Linum Avenue bridge over Mooser Creek.

“That would be our first major activity,” he said.

The bridge would be widened and would help hold back some of the water in the event of a flood, Reynolds added.

“I think we have looked at this part of the project enough and we are making specific recommendations now,” he said. “The next step would be

Dale Reynolds, Project See Mooser on What 3

Working Through Community Groups

The Southwest Tulsa Historical Society was a constant source of information and material on Mooser Creek. Local historians Roy Heim and David Breed tracked down biographical information on Mooser Naharkey, after whom the creek is named, located a photograph of him with other tribal leaders, and found historical maps depicting the watershed in the late 1890s. They also looked into the history of the ruined stone buildings, once known as “Clarence’s Back Door,” across Union Avenue from the entrance to Page Belcher Golf Course.

Heim and Breed also facilitated contacts between project volunteers and staff and the Southwest Tulsa Chamber of Commerce. Chamber meetings have been a venue where Mooser team members could meet with west side politicians like Randi Miller, Darla Hall and State Senator Lewis Long, local businessmen such as John Hardison (West Highlands Plaza), David Reid (Quik-Trip), and Tom Clark (Riverfield Country Day School), and large property owners like Craig Ferris.

Library Information Center

An important information outlet in the Mooser Creek watershed has been the bulletin board and table in the entry of the West Regional Library. Stocked with newsletters, fliers, newspaper articles, sign-up sheets, announcements of upcoming meetings, videotapes, and technical literature on greenway issues, the table and bulletin board have kept local citizens informed of project activities and upcoming events. Assistant Librarian Karen Pope has been a regular at public meetings, an active member of the Education Subcommittee, and an unflinching participant in Mooser Creek Cleanups.

Resource Inventories

*West Regional
Assistant Librarian
Karen Pope has been
a constant source of
support for the
Greenway project.*



Public involvement and public education often run together, since people learn first of all by doing. Recruiting citizens to work on greenway subcommittees broadened public support for the project and brought residents and stakeholders together over the task of restoring and preserving their community's natural resources. The resource inventories bridged old differences, focused attention on the watershed's future, and allowed interest groups to form and new leaders to emerge. For most, working on a greenway committee was a galvanizing experience. It also produced some remarkable results.

For example, the archaeological inventory team, led by Jean Sinclair of the Tulsa Archaeological Society, spent hundreds of hours scouring the rugged Mooser terrain. At the Lubell Park site near Remington Elementary School, they turned up stone mortars and pestles and a large, incised sandstone slab that indicated long-term prehistoric occupation. Dr. Robert Brooks, of the Oklahoma Archaeological Survey, has said there is nothing like the Lubell site anywhere else in the state.

The biological inventory, conducted by Tulsa Parks' Oxley Nature Center, discovered an unspoiled remnant of mixed-grass prairie in Bales Park, between Union Avenue and the Okmulgee Expressway. Now that it has been identified, efforts are underway to preserve the 17-acre prairie remnant.

Nature Stewardship at Remington Elementary School

Three enthusiastic recruits to the Mooser Creek Greenway project have been Judy Fessenden, principal of Remington Elementary School, and teachers Gwen Maxwell and Mary Sue Herron.

Fessenden sees the greenway project as an opportunity to teach students about environmental stewardship. The school has adopted Mooser Creek and nature as its themes. Murals depicting local plants and animals decorate Remington's hallways and cafeteria walls. Turtles, lizards, rabbits and other animals are brought into the classroom to teach about wildlife behavior and care. A shelter has been constructed to serve as an outdoor classroom. Birdhouses for purple martins have been placed on poles around the school, and bird and squirrel feeders set up outside classroom windows. Gwen Maxwell's fifth-grade class has built a nature trail from school grounds into neighboring Lubell Park that will later link up with trails to Riverfield Country Day School and Mooser Creek Greenway. Mary Sue Herron is establishing a Mooser Creek Environmental Center in two mobile classrooms next to the school. The Center will have nature displays and research materials, and sponsor nature walks, creek cleanups, picnics, and other environmental activities.

OSU Teleconference

In June 1997 Mayor Savage and Public Works Director Charles L. Hardt presented the Mooser Creek Greenway project at a national teleconference at Oklahoma State University on "Public Works Strategies for Developing Sustainable Communities."

Mayor Savage spoke on sustainable development from the perspective of her role as Tulsa's mayor and as a member of the President's Council on Sustainable Development. The Council is looking for global solutions to common problems shared by communities. Sustainable development, said Savage, is "meeting the needs of the present without

NATURE AND NURTURE: REMINGTON SCHOOL ADOPTS MOOSER CREEK



Three inspired educators bring nature into the classroom: Judy Fessenden, Mary Sue Herron, and Gwen Maxwell.

The Mooser Creek Greenway project found imaginative partners in three inspired educators at Remington Elementary School—principal Judy Fessenden, science teacher Gwen Maxwell, and Environmental Center curator Mary Sue Herron.

Many schools have animal mascots, like wildcats or eagles. But not many have a mascot that's a creek. In having adopted Mooser Creek as its symbol, Remington is probably unique. The creek and its care are themes that shape almost all aspects of school life. The hallways and cafeteria are decorated with murals of streams, flowering woods, sunlit fields and wild creatures with friendly aspects. Everywhere you look, there are ant boxes, terrariums, aquariums, and well-lit glass cases with snakes and salamanders. Any student can show you where the two-headed lizard lives—actually, it has a tail that mimics the appearance of its head, so there is no “behind” for predators to sneak up on!

Each week, Mary Sue Herron brings animals like the two-headed lizard from the Tulsa Zoo to show the children. Spiders, turtles, rabbits and birds have all crawled, slithered and hopped across Remington's tables to the delight and edification of everyone. Ms. Herron uses these opportunities to talk about respect for nature and being good stewards of the environment, as well as animal behavior and habitat.

In her “Eco-Inquiry” section, Gwen Maxwell uses nature's ways to explore concepts like system, community, interdependence, adaptation, and responsibility. “Bringing nature into the classroom is one way to make learning relevant and interesting. It's hands-on and brain friendly. Once kids see the connection between learning and their own lives, they get hooked on it.”



Embraced by woods and streams, Remington has one of the loveliest natural settings of any school in Tulsa.

The school has bird and squirrel feeders on window ledges and an outdoor classroom where learning and nature can be together. Students have helped build a nature trail in Lubell Park, and have put up birdhouses in the woods for purple martins to nest in.

A Mooser Creek Environmental Center is being created in two mobile classrooms next to the school. The Center will house, among other things, butterfly, vegetable, herb and water gardens, an environmental library, alternative energy displays, and computers with links to other nature sites.

(Below, left to right) Zoo animals make regular visits to Remington's classrooms. Student puts up his birdhouse. Remington boys and girls team up to build nature trails in nearby Lubell Park.



Photographs courtesy of Remington Elementary School

PUBLIC INVOLVEMENT HIGHLIGHTS

Public Meetings

- October 29, 1996. Public meeting, Westside YMCA. Project introduced and Vision Statement developed.
- January 28, 1997. Public meeting, Remington Elementary School. Mayor Savage, Darla Hall and Charles L. Hardt attend. Vision Statement presented, issues listed, and subcommittees formed.
- April 17, 1997. Public meeting, West Regional Library. Issues are turned into goals. Sen. Lewis Long attends.
- July 7, 1997. Public meeting. West Regional Library. Alternatives are developed.
- October 14, 1997. Public meeting, Remington Elementary School. Alternatives are prioritized.
- April 16, 1998. Public meeting, Remington Elementary School. Flood control plan for Mooser Creek is presented.

Information Center at Library

- February 1997. Resource center is set up at West Regional Library.

Creek Cleanups and Walks

- March 2, 1997. Walking tour of Mooser is led by Roy Heim.
- May 17, 1997. Mooser Cleanup, sponsored by City, Blue Thumb and Rivers and Trails.
- April 21, 1998. Creek Cleanup by Webster HS students organized by AmeriCorps and David Breed.
- May 16, 1998. Mooser Cleanup, sponsored by City, Blue Thumb and Rivers and Trails.
- October 9, 1999. Mooser Cleanup, organized by the City and South Haven Manor.

Newsletters and Fliers

- November 1996. Vision Statement is sent out for review and comment.
- March 1997. *Mooser Greenway* newsletter 1-1. Greenways, planning process, Mooser basin, creek cleanup.
- May 1997. Mooser Greenway calendar is sent out.
- May 1997. Mooser cleanup flier is sent out.
- May 1997. *Mooser Greenway* newsletter 1-2. Cleanup, stream monitoring, OSU teleconference, Mooser history, greenways and crime.
- June 1997. Mooser Creek Greenway brochure, "The Vision."
- January 1998. *Mooser Greenway* newsletter 2-1. Resource inventories, trails, wildlife, project goals.
- April 1999. *Mooser Greenway* newsletter 3-1. Remington trail, Union Ave. bridge, Bales Park prairie.
- May 5, 1998. Results of October 14, 1997, public meeting on project priorities.

Newspaper Coverage

- October 24, 1996. *SW Tulsa News*. "Mooser planning to begin."
- November 14, 1996. *SW Tulsa News*. "SW Tulsans begin 'envisioning' future of Mooser basin."
- December 5, 1996. *SW Tulsa News*. "Mooser envisioned as SW 'Gateway'."
- December 19, 1996. *SW Tulsa News*. "Creek study includes South Haven families."
- January 29, 1997. *Tulsa World*. "Mooser Creek to Be Improved."
- January 30. *SW Tulsa News*. "Future vision accepted for SW basin."
- February 5, 1997. *Tulsa World*. "Shaping a Vision."
- June 18, 1997. OSU Teleconference: Public Works Strategies for Developing Sustainable Communities.
- June 22, 1997. *Tulsa World* (editorial). "Public Job in Harmony with Nature? It's Possible."
- June 1997. *Urban Tulsa*. "Living on Edge of the Green."
- April 17, 1998. *Tulsa World*. "Mooser Creek Watershed Proposal Unveiled."
- April 23, 1998. *SW Tulsa News*. "Mooser future to stay 'natural'."
- April 29, 1998. *TW Community World*. "Mooser Creek Plans Continue to Move Forward."
- April 29, 1998. *TW Community World*. "Hearing Focuses on Mooser Creek Flood Prevention."
- April 29, 1998. *TW Community World*. "Cleanup Effort Helps Beautify Mooser Creek Area."
- May 6, 1998. *Tulsa World*. "No walk in the park."
- May 13, 1998. *Tulsa World*. "Digging into the past" on historical inventory.
- May 17, 1998. *Tulsa World*. "It's a dirty job. Creek project volunteers find weird variety of litter."
- November 18, 1998. *TW Community World*. "Logging camp." (on Remington nature trail)

Stream Monitoring

- July 1997. Blue Thumb begins monitoring on Mooser with volunteers.

School Activities

- April 21, 1998. Jean Sinclair tells Webster HS students about prehistoric site at Remington Elementary School.
- Summer 1998. Remington Elementary School outdoor classroom, Nature trail.
- Summer 1999. Remington Elementary School Environmental Center trailers put on site.

compromising the ability of future generations to meet their own needs.” Among other things, it involves partnerships of citizens, businesses, non-profits and governments focusing on how to improve and reuse abandoned industrial sites, neighborhoods, and detention ponds.

Hardt surveyed some of the negative impacts on watercourses and natural resources of earlier City practices, and proposed a new approach—the Mooser ten-step, multi-objective planning process—as one more in harmony with nature. “We piped and paved our watersheds,” Hardt said. “We cemented over our springs. We used our riverfront as a dump, and our creeks as drains and storm sewers. As a result, our history has been haunted by flooding.”

“We are rediscovering the vision of Tulsa’s early founders,” Hardt continued, “who envisioned a network of walking trails along carefully preserved creeks throughout the city.”

Hardt went on to describe the Mooser Greenway planning process and ended with a series of questions that more or less summarized the Mooser approach: “Can we develop partnerships that begin in grassroots neighborhoods and involve all stakeholders? Can we work together to reach the compromises we will inevitably have to make and to provide truly equitable, win-win solutions to the challenges we face? Can we integrate planning across entire watersheds, not just segment-by-segment or function-by-function? Can we restore long-term natural balance in streams and watersheds long neglected or exploited for short-term gains? Can we provide for both growth and environmental quality? Can we learn to live lightly on the land, which is surely at the heart of what is today being called sustainable development?”

ASSESSING PUBLIC INVOLVEMENT

One of the major reasons for the success of the Mooser Creek public involvement program was the candor and sensitivity with which it was conducted by both the City’s Ann Patton and Rivers and Trails’ Attila Bality

This is not to say that the process was without difficulties or disappointments. For one thing, the City was unable to gain the participation or public support of some of the major businesses along I-44 whose properties backed into the creek—such as Pepsi Cola. Nor did it generate the support needed to initiate a blue-sky greenway project along the entire length of Mooser Creek. There were simply too many issues separating the various socio-economic groups within the watershed.

The purpose of the public involvement process was to find out what kind of project the watershed community would support, just as the overall goal of the planning process was to design a project that could be built. The answers that came back might not have been the ones the City had hoped for, but they were the ones it needed in order to move on to the design phase of the project.

In fact, the disappointments were proof that the public involvement process had functioned very much as designed. At the first meetings between

“Can we develop partnerships that begin in grassroots neighborhoods and involve all stakeholders? Can we integrate planning across entire watersheds and restore long-term natural balance in streams long neglected or exploited for short-term gain? Can we provide for both growth and environmental quality? Can we learn to live lightly on the land?”

Charles L. Hardt

Residents and stakeholders were involved in all aspects of greenway planning.



Rivers and Parks and the City, Attila Bality had warned officials not to be too strongly tied to their blue-sky vision, but to allow a citizen consensus to emerge on the future of the watershed that reflected the social and economic realities of the community.

V ISSUES, GOALS AND STRATEGIES

One of the tasks of public involvement is to elicit and address resident and stakeholder concerns, or “issues,” about the Greenway. What do citizens value most in their watershed and want to preserve? What would they like the basin to be like in 20 years? What resources do they consider unique, critical or irreplaceable?

An initial list of citizen concerns was developed at the January 28, 1997, public meeting and sorted into ten general categories.

- Property Owner
- Flooding
- Stream Channel
- Erosion and Sediment Control
- Development
- Water Quality
- Wildlife and Habitat
- Cultural, Historical and Archaeological
- Recreation Management
- Public Awareness and Education

Subcommittees were then formed to examine these concerns and add to them, as needed, using feedback from public meetings and presentations before community groups, and the results of the resource inventories.



Residents and stakeholders want to preserve the watershed's natural beauty.

PROPERTY OWNER ISSUES

Several property owner issues emerged at the first public meeting that significantly influenced both the planning process and final design. Concerning security, privacy, trespass and crime, would a greenway with public trails increase liability exposure and disturbances to properties bordering the creek? Would public access mean more trash in Mooser Creek? And what effect would a greenway with trails have on property values?

Privacy, Trespass, Crime and Liability Exposure

Property owner concerns about privacy, trespass, crime, and liability exposure were addressed by Attila Bality at the January public meeting, and in the *Mooser Greenway* newsletter for June 1997.

Studies have shown that urban trails do not result in increased disturbances to properties adjacent to greenways and trails. One survey of Denver-area trails found public safety incidents had not increased after the trails were built. In a study of Seattle's Burke-Gilman Trail, police officers patrolling the trail said there had been no increase of burglaries or vandalism to adjacent properties since the trail opened. A 1988 review of greenways in several states found no serious problems of vandalism, crime, trespass, or

“Mooser Creek is a major part of a major drainage system, and its maintenance should not be the responsibility of private property owners.”

Charles L. Hardt

John Hardison, West Highlands Shopping Center, has been a strong advocate of cleaning up Mooser Creek.



invasion of privacy to neighboring properties—although fears of such had been a common homeowner concern prior to their construction.

Furthermore, urban trails have often reduced disturbances due to a “crime watch” effect created by trail users, who are usually local citizens. For example, a three-mile stretch of waterfront trail in Long Beach, California, which had had a significant transient population, experienced a drop in criminal activity after a trail was put in.

Litter, Trash, and Illegal Dumping

Illegal dumping, a long-standing problem on Mooser Creek, was one of the concerns most frequently voiced at public meetings.

Although the creek has many pristine reaches, there are also stretches where dumping and litter had created appalling accumulations of refuse—shopping carts, automobile transmissions, mattresses, 50-gallon drums, tractor tires, and thousands of fast-food containers and plastic bottles. It was the debris of decades.

Business leaders, like John Hardison, have been urging the City to enforce its dumping regulations and take action against violators. INCOG’s Comprehensive Plan for District 8 also calls for the elimination of illegal dumping through neighborhood vigilance and prosecution. Annual Mooser Creek cleanups had removed much of the garbage, but much work remains to be done.

One source of trash and dumping has been the gradual depopulation of South Haven in the wake of desegregation. Another is tenant turnover at South Haven Manor, a public housing project, that straddles Mooser’s mainstem from 37th West Avenue to South 57th Street. There are also some businesses along I-44 that are suspected of unauthorized dumping.

Trash and litter are particularly important issues for creek-side homeowners and businesses since City codes hold them responsible for the cleanliness of their properties. If the public is given access to the creek, will local agencies step in to help with the maintenance? Poor maintenance has, in fact, led to the closure of several public trails in other parts of the country.

Citizens want to see a continuation of annual Creek Cleanups and a greater involvement of civic groups and schools in adopt-a-trail and environmental stewardship programs.

Property Values Along Greenways

The impact of trails on property values is one of the most studied aspects of urban greenways—but also one of the most difficult to quantify. In general, however, greenways almost always increase property values.

For example, surveys of property values near greenways indicate that property prices decline with the property’s distance from the open space. In Boulder, Colorado, housing prices fall an average of \$4.20 for each foot of distance from a greenbelt up to 3,200 feet, and the average value of property adjacent to a greenbelt is 32 percent greater than similar properties 3,200 feet away. In Salem, Oregon, urban land adjacent to a rural greenbelt is worth \$1,200 more per acre than urban land 1000 feet away. Reports from the New Jersey Open Space Fund and the University of Akron’s Center for Urban Studies have shown that publicly-owned open space adds 15 to 20 percent to the value of nearby properties.

On the other hand, property value near open space with *active recreational facilities* is more complicated. Generally, properties that *face* such parks have higher value than those that *back up against* them. For example, properties facing passive parks in Columbus, Ohio, sell for between 7 to 23 percent more than homes one block away, while homes that back up to the park have no increased value. A study of four parks in Worcester, Massachusetts, found that homes located 20 feet from a park sell for \$2,675 more than comparable houses 2,000 feet away—so long as the property is not adjacent to active recreational facilities. For parks with active recreational facilities, property values begin increasing one block away. Property near *but not on* the Burke-Gilman Trail in Seattle sells for an average 6.5 percent more than similar property elsewhere; property *adjacent* to the trail, however, has neither decreased nor increased in value.

These studies suggest that a greenway without trails will have the most beneficial impact on property values in Mooser watershed's *existing* residential communities. A greenway with trails will increase property values generally, but not for homes that back up to it. Property values in undeveloped parts of the basin will increase in any case, since new construction can be oriented to face the green space—thereby maximizing its positive effects.

A greenway corridor along the creek with trails in undeveloped areas, but not in existing neighborhoods, will likely have the greatest overall positive impact on property values within the watershed.



Residents and stakeholders were kept abreast of every aspect of the project. R.D. Flanagan, the principal planner, discussing the Greenway with the Southwest Tulsa Chamber of Commerce.

FLOODING ISSUES

Since the Mooser Creek watershed is largely undeveloped, flooding has been sporadic and not extensive. Citizen complaints and engineering studies have identified several areas that will be subject to flooding during a 100-year storm:

- Ten commercial buildings between Olympia Avenue Bridge and the Arkansas River.
- Nine commercial buildings and two residences between Olympia Avenue Bridge and 53rd Street Bridge.
- Five residences in Mountain Manor, with 15 homes experiencing backyard flooding.
- Twenty-three residences between 33rd West Avenue and 49th West Avenue, most of them in South Haven Manor.

“The users of the creek, for the most part the people who live here, want it to remain a natural area.”

**Sherry Heim,
West Highlands**

Sherry Heim



- Several streets, bridges and culverts, the most troublesome being the bridges at Olympia Avenue, Union Avenue, and 53rd Street, and the culverts at 37th West Avenue, 57th Street, and along 61st and 71st Streets.

Revision of the *Southwest Master Drainage Plan*

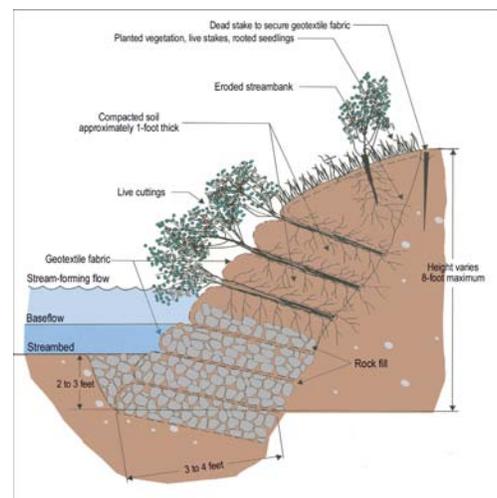
Mooser residents and City officials alike voice a strong preference for adopting a watershed-wide, multi-objective approach to flooding issues—one that combines “natural” flood control measures with trails, parks, playing fields and wildlife habitat. Above all, they do *not* want a solution with trapezoidal, fabriform-lined channels.

The recommended changes include replacing and widening Union Avenue bridge; voluntary acquisition for three commercial and two residential properties east of Union Avenue; replacing Olympia Avenue bridge; voluntary floodproofing of seven commercial structures between Olympia Avenue bridge and the Arkansas River; encouraging donation or acquisition of easements or rights-of-way for maintenance, erosion control and other Greenway goals; and greater emphasis on enforcing floodplain regulations.

This recommended revision of the *Southwest Master Drainage Plan* for Mooser Creek is one of the most important outcomes of the public involvement process. The revised plan was presented to the watershed at a public meeting on April 16, 1998. If the Mayor and City Council approve the revised plan, it will trigger major changes in related issues, such as stream channel, erosion and sediment control, development, water quality, and wildlife and habitat.

Watershed residents and stakeholders strongly support the use of natural materials and techniques to control flooding and preserve Mooser’s largely unspoiled stream channel. This more naturalistic approach will require floodplain preservation, channel reconfiguration to create various in-stream habitat and flood control structures, and bank stabilization using geotextiles and native vegetation.

Bioengineering methods, such as brush-layered geogrids (shown below) can be as effective as traditional channelization techniques in controlling flooding and erosion. Here, geotextiles (burlap, plastic netting, etc.) and live branch cuttings are being used to stabilize a badly eroded stream bank.



These methods can be as effective as hardened concrete structures in controlling flooding and stabilizing banks. Stream-channel engineering and landscaping can be designed to filter out pollutants, provide wildlife cover and habitat, shade and cool water temperatures, and create aesthetically pleasing views.

Residents want as much of Turkey Mountain's unspoiled natural beauty preserved as possible.

EROSION AND SEDIMENT CONTROL ISSUES

Watershed development will increase runoff and sediment loading which, in turn, can alter stream flow patterns, erode property, decrease channel capacity, create stream bank safety hazards, undermine drainage structures, and damage fish habitat. Sediment loading from construction, for example, is one of the primary causes of water quality degradation and fish loss in urban streams.

Residents want to see erosion and sedimentation controlled using naturalistic stream channel engineering and environment-friendly construction methods that remove less ground cover and native vegetation. It is hoped that the City will encourage landowners and builders to use such techniques, and that informational material about these practices will be made available at libraries, public meetings, Chamber of Commerce gatherings, zoning hearings and similar venues.

DEVELOPMENT ISSUES

Watershed development is certain to create problems that will have to be addressed by City officials and the community—such as increased flooding, land use controversies, loss of wildlife habitat, stream channel modifications, and alteration of aesthetic values. The Mooser Greenway Plan will provide decision-makers with a yardstick for evaluating and encouraging appropriate development within the watershed.

Basin citizens and stakeholders want Mooser Creek to become the “gateway” to Southwest Tulsa. The creek’s broad floodplain and riparian woodlands would announce to travelers their entry into a quarter of the city characterized by carefully preserved natural features, spacious and upscale neighborhoods, extensive parks and trails, excellent schools, and well-planned commercial corridors and nodes. The Greenway will anchor this vision and help shape future development.

Turkey Mountain, looking north between Elwood Avenue and Highway 75

The INCOG Comprehensive Plan for District 8 calls for maintaining the area’s low-density rural-residential character (except for the Skelly Bypass (I-44) and Okmulgee Expressway Special Districts); preserving as much of the district’s unique physical and visual features as possible (such as Turkey Mountain bluffs, Arkansas River frontage, and Mooser Creek floodplains); identifying areas where horses can be kept in residential lots; establishing equestrian trails; linking River Parks with the YMCA Camp and Bales Park; creating and maintaining open, spacious neighborhoods that retain their underlying natural beauty; and rehabilitating deteriorated neighborhoods and substandard areas.



In line with the Comprehensive Plan, residents want to see as much of the basin's wildlife habitat and vegetation retained as possible, its floodplains and steep slopes protected, and its rural-residential character preserved. Although the Okmulgee Expressway Corridor is zoned for commercial development, there is a clear consensus against the creation of a sprawling, high-intensity, 24-hour business complex like the one at Woodland Hills, which would obliterate the watershed's natural beauty and unique character.

Residents hope that City officials and members of the Citizens' Committee will monitor zoning and building applications and other land-use actions for their conformance with the Vision Statement and Greenway Plan.

WATER QUALITY ISSUES

Over the years, West Tulsans have seen a steady degradation of Mooser Creek's water quality. According to Senator Lewis Long, who grew up in Carbondale and swam and fished in the stream as a boy, people used to bring buckets down to a pool alongside the Sapulpa-Union Railroad tracks to get drinking water. The pool was surrounded with watercress in those days, he said, and never went dry.

Like Senator Long, residents and stakeholders would like to see the creek restored to its original condition and preserved as a historic, pristine stream. This would involve retaining as much riparian border and native vegetation as possible, keeping the stream channel natural, reducing pollution from septic tanks, lawn fertilizers, streets and parking lots, controlling litter, and stopping illegal dumping.

Although the creek has been damaged—for example, there are no mussels in Mooser, although they are common in other area streams—biologists believe it can rebound. Preserving the creek's natural floodplain and riparian border will help improve its water quality. Vegetative or agricultural buffers along waterways can remove up to 50 percent of nutrients and pesticides and 75 percent of sediments that would otherwise end up in rivers and streams.

WILDLIFE AND HABITAT ISSUES

Since there are no threatened or endangered species in the watershed, concerns about fish, wildlife and habitat issues largely focus on preserving riparian areas that support local animal populations.

Residents hope that some of the watershed's large tracts of native vegetation can be preserved for animal habitat, along with corridors to link them. The Mooser basin has excellent stands of flowering hardwoods that are home to a wide variety of animal life, including white-tailed deer, beaver, coyote, mink, armadillo, opossum, raccoon, red fox and bobcats—not to mention a wide variety of game and song birds.

Beaver are easily the most controversial animal, since they are considered an asset by some and a nuisance by others. Although beaver activity would enhance environmental education programs along the creek, they can also negatively impact flood management goals.

There is strong interest in preserving the mixed-grass prairie discovered in Bales Park by naturalists from the Oxley Nature Center (see p. VI-15 to 18). Residents want to see this prairie relict exempted from the City's mowing regulations and made more accessible with parking, trails, interpretive signs and literature.

HISTORICAL, CULTURAL AND ARCHAEOLOGICAL ISSUES

Although there are no structures within the basin that appear to qualify for the National Register of Historic Places, there are a number of sites that intrigue the historical and archaeological survey team. These include the stone building on the south side of Mooser Creek, behind the Smith property; the ruined stone buildings, known as “Clarence’s Back Door,” across Union Avenue from Page Belcher Golf Course; and perhaps old South Haven Elementary School.

Carvings in the Seminole sandstone at the base of Turkey Mountain.

According to David Breed of the Southwest Tulsa Historical Society, there are petroglyphs on the Dyer property and several graves rumored to be on the south side of Mooser Creek near the YMCA Camp. These should be located and evaluated. In addition, a number of historic carvings have been scratched into the sandstone bluffs along the Arkansas River at the base of Turkey Mountain. Their historical value should also be assessed.



There are two registered archaeological sites within the watershed. One, identified in 1979, is on Turkey Mountain. The other, discovered by the historical and archaeological survey team, is in Lubell Park near Remington Elementary School (see p. VI-20 to 23). These sites, and especially the finding of an unusual incised tabular boulder near Remington School, have spurred local interest in creating an anthropological or historical museum in the watershed.

RECREATION MANAGEMENT ISSUES

The largely unspoiled character of Mooser Creek, with its sandstone bluffs and shale flats, wild reaches and stands of native timber, give it considerable potential as a recreation corridor.

While many citizens would like the Greenway to be the spine of an alternative transportation network linking Mooser neighborhoods to schools, libraries, recreation and shopping, others worry that trails will adversely affect riparian areas and private property rights, or lead to an influx of undesirable users. There is considerable resistance to creek-side trails in residential neighborhoods. Equestrian trails have been suggested for lower Mooser Creek and Turkey Mountain Park. Residents are opposed to the use of off-road vehicles on any Greenway trails.

There is a strong consensus that public use of the Greenway should be balanced with community needs for privacy, safety and stable or rising property values. Some residential areas or private school grounds, for example, should be closed to public use, and more emphasis placed on the creation of attractive neighborhood sidewalk trails.

It is expected that Greenway maintenance will be shared by several City agencies, supplemented with volunteer help from adopt-a-trail programs, citizen safety and litter patrols, and community service groups. According to Public Works Director Charles L. Hardt, “Mooser Creek is a major part of a major drainage system, and its maintenance should not be the responsibility of private property owners.”

OLD FRIENDS: STATE SENATOR LEWIS LONG AND MOOSER CREEK

Former State Senator Lewis Long probably knows as much about Southwest Tulsa and Mooser Creek as anyone in the city.

Senator Long was born in Carbondale, in a small frame house on 36th West Avenue (see photo), just south of 51st Street. His father and both his grandfathers worked at the DX Refinery in West Tulsa. When he was a boy, Carbondale was a rural village on the outskirts of Red Fork. To get to Mooser Creek, all he had to do was step out his front door and head downhill across open countryside.

“I grew up on this creek,” Long said, picking up a stick from the edge of the road. He had stopped his car on 45th West Avenue, alongside the Sapulpa-Union Railroad tracks.

“I know every inch of it,” he said, gesturing eastward, “from here all the way to the Arkansas River. This is where we boys lived in the summer. We camped out along the creek, fished here, and hunted squirrels and rabbits. It was a paradise for kids.



Senator Lewis Long's birthplace, on 36th West Avenue just south of 51st Street in Carbondale, is on the northwest edge of Mooser watershed.

“We swam in a long S-shaped pool just west of 33rd West Avenue, where the creek was protected by a grove of trees. The water there was about 5 feet deep.

“The deepest hole, though, was in Mountain Manor, where the 53rd Street bridge is now. The pool is still there. That is where we fished. We caught perch and catfish in that hole.”

Long knows exactly where Mooser Creek begins. “Some people think it starts south of 61st Street, but it doesn't. It begins right here.”



Senator Lewis Long. “Now that we have sewer lines in the watershed, we can return this creek to its original beauty and cleanliness.”



The spring-fed pool alongside the Sapulpa-Union Railroad, where people used to fill their buckets with drinking water. In those days the pool was surrounded with watercress.

He was standing alongside the road, where the railway grade and 45th cross over the creek. There is a murky, algae-coated pool there with fast food trash littering its banks.

“In the old days, before we had City water, people came down here with buckets to get drinking water. There is a spring here, where crystal clear water bubbled up into this pool. In those days it was surrounded with watercress. Upstream from here the creek would go dry, but not here. We drank from this stream.”

Senator Long is unhappy about how dirty Mooser Creek has become and would like to see it restored to its original condition. He has offered to match with State money every dollar the City of Tulsa raises to clean up the creek.

“Now that we have sewer lines in the watershed,” Long said, bending down to pick up a fast food container at the pool's edge, “there is no reason for the stream to be so polluted. I would like to see it returned to the way it was when I was a boy, with safe, secluded swimming holes and spring-fed pools surrounded with watercress.”

PUBLIC AWARENESS AND EDUCATION ISSUES

Public understanding and support of the Greenway project are essential to obtaining easements and funding and to influencing the decisions of zoning boards, developers, and businesses. It is thought that a demonstration project along a portion of the creek—most likely between Remington and Riverfield Schools—will be the most effective means of informing the public about the costs and benefits of greenways.

Residents and stakeholders, particularly teachers at Remington and Riverfield Schools, are interested in the Greenway's educational potential, and want to see a wide range of interpretive signs on local and natural history throughout its length.

More attention needs to be given to educating area residents and the public about the civic responsibilities required for successful greenways, such as nature stewardship, cleanliness and safety, and respect for property and privacy. To be successful, public trails require a heightened sense of ecology—of how the human and natural world interlace, and the benefits and costs of this interdependence. The nature programs and Environmental Center at Remington Elementary School are steps in this direction, and should be supplemented with programs at the West Regional Library, YMCA Nature Center, and public housing projects. It is also felt that the *Mooser Greenway* newsletter should be published more frequently and the Library's Information Center reopened.

Riverfield's Jeanette Easterling has been active in all phases of Greenway planning.



GOALS

The subcommittees, formed at the January 1997 public meeting, examined over 150 issues raised by citizens and public officials. These were consolidated and refined by the subcommittees into action-oriented goal statements. Each subcommittee submitted the four or five goals they felt best addressed their most critical issues. These, in turn, were boiled down into 15 goals, which were published in the January 1998 issue of the *Mooser Greenway* newsletter.

GOALS

1. Develop trails system within Mooser watershed, connecting school and educational facilities.
2. Use Mooser Creek's natural environment for environmental opportunities.
3. Establish programs to involve service clubs, student groups and youth organizations.
4. Preserve, enhance, and create fish and wildlife habitat.
5. Promote natural alignment and techniques for bank stabilization, flood control, erosion and sediment control.
6. Encourage land use and facility development to support the Final Greenway Plan.
7. Preserve and improve water quality.
8. Identify, evaluate, and protect cultural, historical, and natural sites as warranted.
9. Minimize watershed erosion and sedimentation.
10. Developers and businesses are good land stewards and support the implementation of the Mooser Greenway Plan.
11. Increase knowledge and interest of Mooser Creek with various outreach techniques.
12. Forge public and private partnerships to enhance cooperation for Greenway development.
13. Assure that future management of the Greenway addresses property owner concerns about preservation, maintenance, trespassing, and criminal activity.
14. Protect the integrity of open space and its natural conditions by eliminating dumping and environmental pollution.
15. Maintain and preserve the waterway as a safe, natural environment to raise healthy, well-rounded youth on Tulsa's Westside, offering opportunities for recreation, fishing and exploration.

STRATEGIES

In addition to these Goals, each subcommittee developed a list of Strategies (or measurable targets) that could be used to achieve them. These were prioritized according to whether, among other things, they addressed critical goals, conflicted with other goals or City policies, were feasible, had political or administrative support, were championed by the community, and would help build support for the Greenway and watershed planning generally.

These Greenway Strategies were mailed to residents and stakeholders in May 1998.

GREENWAY STRATEGIES

Property Owners

High

- The City respects private property and will continue to involve owners in Greenway planning, implementation and maintenance.
- Post "Public Access Permitted" signs and educate public that if there is no such sign, then it is not public land.
- Provide current information about crime, vandalism, trespassing and property values to property owners at least once a year.
- Develop Greenway management/maintenance guidelines that address property owner concerns.
- Utilize maintenance access trails for trash and illegal dump cleanup.
- Continue Mooser Creek cleanups.
- Research existing River Parks policies on prohibiting off-road vehicles on trails.

Floodplain Management

Medium

- Expand bridge opening at sewage treatment plant to reduce upstream backwater.
- Develop flood control/channel improvement plans to provide 100-year protection.
- Explore programs that offer incentives to developers to protect the watershed and floodplain.
- Provide training on stream geomorphology and soil bioengineering for planners and engineers assigned to the Mooser project.
- Assist Tulsa Housing Authority with South Haven Manor concerns about stream safety.
- Make video or slide presentation at South Haven Manor on bioengineering techniques. Include residents in design process.
- City should accept/acquire easements from adjacent property owners for stream corridor maintenance.

Low

- Accept lower level of protection for industrial areas.
- Explore floodproofing alternative for individual buildings.
- Coordinate Greenway planning with ODOT on Interchange reconstruction to accommodate Greenway and floodplain.

Wildlife Habitat and Watershed Ecosystem

High

- Preserve the intact prairie association found within Bales Park.

Medium

- Enhance wildlife habitat through food plots, nesting boxes, and vegetation selection.

Low

- Continue Blue Thumb water quality monitoring and storm drain stenciling.
- Explore opportunities for a more extensive water quality monitoring program to determine long-term effects of urbanization through university programs and agencies.

GREENWAY STRATEGIES (Continued)

Wildlife Habitat and Watershed Ecosystem (Continued)

Low

- Encourage developers to preserve native trees during planning and construction.
- Support the identification and protection of historical and cultural sites in the watershed.
- Educate and encourage adjacent businesses to develop natural areas on their property as well as utilize public areas for employee and wildlife benefits.

Priority Not Noted

- Analyze watershed locations that could serve as stormwater detention basins and offer wildlife habitat.
- Maintain a corridor of riverside vegetation between the creek and trails.
- Encourage use of Mayor's Action Line or 911 to report illegal activities in the watershed.
- Pursue grant sources to enhance multi-objective projects within the basin.
- Approach the Regional Land Trust about voluntary purchase of land for watershed protection.
- Encourage stringent and uniform enforcement of sediment and erosion control ordinances for construction sites.
- Encourage multi-purpose easements that may facilitate public use.

Trails and Access

High

- Mooser Creek trails should provide linkages to other trail systems and destinations, such as parks, schools, and commercial centers.
- Design Union Avenue bridge replacement to accommodate safe trail access.
- Evaluate existing and future easements for public use alternatives.
- Develop a Model Greenway that incorporates all of the Mooser Creek Greenway goals as a demonstration project.
- Establish pedestrian/bicycle routes on Union Ave.
- Provide some hard surface trails that accommodate people with disabilities.
- Consider trail design and construction in relationship to water quality impacts (impervious surfaces, erosion, destruction of riparian areas).
- Provide a "safe trails" protection plan including police and volunteer patrols.
- Develop sidewalks along arterial streets leading to Mooser trails.
- Establish an Adopt-a-Trail program.

Medium

- Designate some trails for hiking only—keep mountain bikes off.
- Equestrian trails should be located in areas that do not impact creek resources.
- Trail management should be a joint effort between various City agencies and organizations.

Low

- Develop 2-3 trailheads for Greenway access with parking, litter receptacles, and sanitation facilities.
- Develop low impact trails for wildlife observation.
- Provide picnic tables or group areas (amphitheater) for school groups.
- Encourage corporate involvement and sponsorship by businesses along the creek to adopt sections of the Greenway.

Education and Outreach

High

- Develop presentation and traveling exhibit that explains Mooser watershed and promotes the Greenway Plan.
- Create opportunities for youth and civic club involvement.
- Create a Mooser watershed community group to be active in watershed issues.
- Establish visitor contact station to provide information on resources and recreational and educational opportunities within the watershed.
- Create interpretive signage along Mooser trails system with rules, regulations and resource information.
- Encourage establishment of a Mooser water festival.
- Develop school-based curricula related to Mooser watershed.

A PARADISE FOR KIDS ON MOOSER CREEK: RIVERFIELD COUNTRY DAY SCHOOL



Tributary ME is one of the loveliest and wildest sections of Mooser Creek. Flowing, as it does, fresh from the graveled terraces and manicured links of Page Belcher Golf Course, the reach north of 61st Street has the basin's best water quality and most varieties of fish. It is here, along a half-mile of the creek, that Marty and Tom Clark, backed by a team of talented and dedicated teachers and parents, have created an educational paradise for children—Riverfield Country Day School.

Founded in 1984, Riverfield moved to the banks of Mooser Creek in the autumn of 1991. Surrounded by the flowering hardwoods of Turkey Mountain, the school provides children from 8 weeks through the 8th Grade with an unmatched human and natural environment for learning, growing and exploring.

Every summer Riverfield becomes “Camp Raven” for boys and girls from the 1st through 7th Grades. The Camp makes full use of the woods and creek with nature walks, boat races, picnics and exploring on Riverfield's 88-acre campus. Children have dozens of activities to choose from in the arts, academics and technology, sports and the outdoors, and special classes on such things as cooking and construction. For example, in the “Creek Exploration” session, campers wade the waters of “Beaver Branch” of Mooser Creek (Riverfield's name for Tributary ME), searching, observing and releasing all forms of wildlife they come upon. In the “Science and Nature” option, children collect specimens from woods and creek to study under microscopes in the school's laboratory. In the “Hiking” course,

campers learn the fundamentals of backpacking on school and local trails. And in the “Biking” session, children are taught the rules of the road while bicycling Tulsa's trails.

Riverfield's Tom and Marty Clark, and Jeanette Easterling of Camp Raven, have been strong supporters of the Mooser Creek Greenway and active participants in its public meetings and committees. The school and the camp have also been staunch advocates of a Demonstration Greenway between Riverfield and Remington Elementary School. As planned, the model greenway would have a gravel fines trail along the east side of Remington and the west side of Riverfield, and a nature trail on the east side of Tributary ME between 61st Street and Mooser mainstem. (See the close-up on “Remington-Riverfield Demonstration Greenway” on page VIII-10.)



Top left: Riverfield Country Day School, looking north from above 61st Street. Downtown Tulsa is on the horizon.

Left: A “Camp Raven” map of Riverfield's 88-acre campus, showing “Beaver Branch” of Mooser Creek, campsites, trails, roads and other points of interest.

Below left: Campers engaged in nature study.

Below: Campers try out their hand-made boats on Mooser Creek's “Beaver Branch.”

Right: Raven Campers on their way to the creek.



All photographs courtesy of Riverfield Country Day School

VI RESOURCE INVENTORY

GEOLOGY

The geology of the Mooser basin dates from the Pennsylvanian Epoch of the late Carboniferous, a time of great economic significance to northeastern Oklahoma. It was during this period, approximately 300 million years ago, that vast swamp forests covered much of the region and became the basis of northeast Oklahoma's fossil fuel industry. The rising and lowering sea levels of the Pennsylvanian created a unique cyclic sequence of sandstone, coal, shale, and limestone that is the period's primary identifying feature. The invading sea brought with it rich marine environments of brachiopods, bryozoans, crinoids and calcareous algae. When it retreated, coal marshes and swamps flourished in the low-lying coastal areas.

There are three Pennsylvanian formations exposed in the Mooser basin: (1) Coffeeville sandstones, shale and coal; (2) Checkerboard limestone; and (3) Seminole sandstones, shale and coal. (See Figure VI-1.)

Coffeeville sandstone, the youngest, uppermost layer, caps much of Turkey Mountain and underlies most of the watershed's high ground, such as at Bales Park, Woodview Heights, Mountain Manor, and South Haven. Checkerboard limestone meanders throughout most of the Mooser drainage east of 33rd West Avenue. Slightly older Seminole sandstone and shales comprise the rolling upland platform upon which Page Belcher Golf Course, West Highlands Park, Riverfield Country Day School, and West Highlands I are built. The lower reach of Mooser Creek, from about 30th West Avenue to the Missouri-Pacific Railroad bridge, flows through Quaternary terrace deposits laid down by the Arkansas River about one million years ago. From the Missouri-Pacific railroad bridge to its mouth, Mooser Creek cuts a steep channel through recently deposited Arkansas River alluvium.

Coffeeville Formation

Many Tulsa hills, such as Reservoir Hill, Standpipe Hill, Lookout Mountain, and Turkey Mountain, are crowned with massive sandstone ledges of the Coffeeville Formation. Overall, the Coffeeville strata comprise about 200-300 feet of lenticular shales, sandstones and siltstones with very little fossil material. It is bracketed by Hogshooter limestone above (there is no Hogshooter limestone in Mooser basin—the nearest is in Chandler Park) and Checkerboard limestone below.

The Coffeeville Formation is the result of rising sea levels and the uplifting of the Ouachita Mountains, which dumped sediment northwards into the subsiding Arkoma basin and spilled over into the Tulsa area. Carboniferous marshes and swamps developed during shoaling phases. The Layton Sand of the upper Coffeeville Formation is a prolific reservoir for oil and gas in north central Oklahoma.

Coffeeville sandstone caps much of Turkey Mountain and the high ground near Remington Elementary School (below).

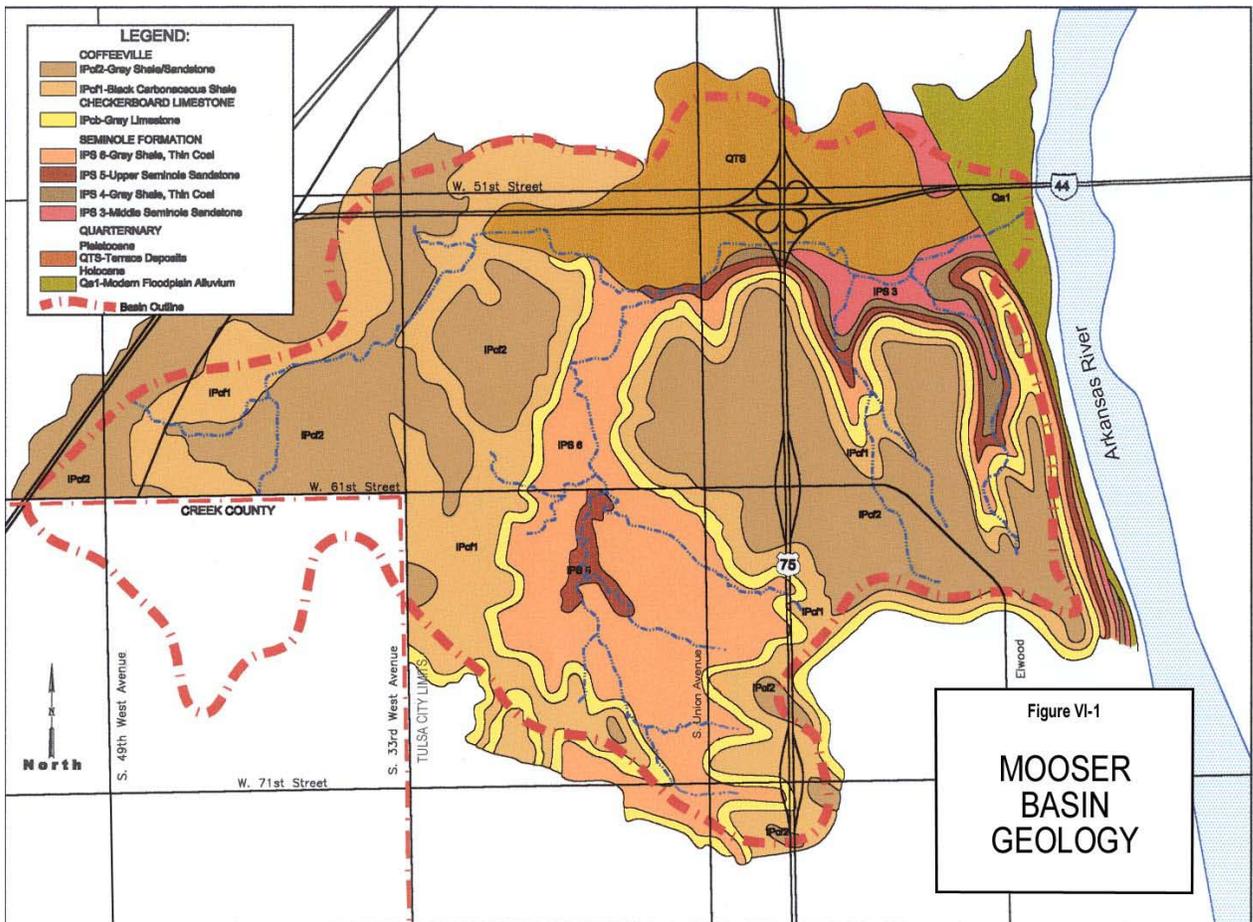


Coffeeville sandstone is one of the factors that has limited the westward expansion of Tulsa. Its extensive ridges and mesas increase considerably the cost of putting in utilities, roads and building foundations.

Checkerboard Limestone

A relatively thin—only 2-3 feet thick—stratum of Checkerboard limestone runs through much of western Tulsa County. The limestone rests on a layer of upper Seminole coal and gray shale with limestone concretions. Checkerboard limestone was probably an extensive subtidal shell flat, and is rich in brachiopods, bryozoans and crinoids. This prolific marine community was inundated by the black marine muds that make up the bottom layer of the Coffeeville Formation. A new, thinner limestone shell flat again flourished for a time before being, in its turn, covered in more black Coffeeville muds.

Figure VI-1:
Mooser Basin
Geology



During the Carboniferous, brachiopods and mollusks lived close to shore in muddy water, while corals and bryozoans required clear, quiet water. The presence of bryozoans, crinoids and fusulines in Checkerboard limestone indicates that the seas had advanced during this period and the region was a considerable distance offshore in quiet, clear marine waters.

The light gray Checkerboard limestone weathers to yellow rounded boulders in the soil profile. It is a mild nuisance for construction because of its poor rippability.

Although Checkerboard limestone underlies much of Tulsa County, it is rarely exposed. Consequently, its outcroppings in the Mooser drainage represent an unusual resource for natural history education.

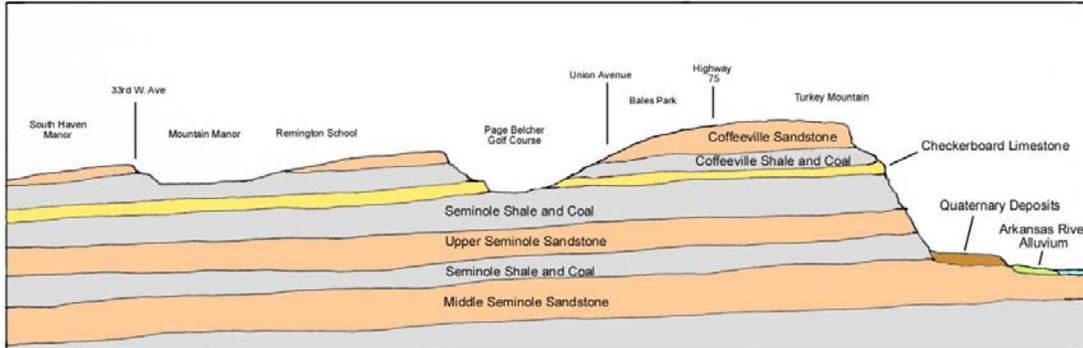


Figure VI-2:
Generalized Mooser
basin geology (not to
scale)

Seminole Formation

The Seminole Formation is about 200 feet thick and comprised of three sandstone layers separated by clayey and sandy shales. The middle sandstone layer is up to 85 feet thick and underlies the lower reach of Mooser Creek and the Arkansas River, and outcrops at Cascia Hall School, Woodward Park, Philbrook Museum and Utica Square Shopping Center. Upper and middle Seminole sandstone is visible along Mooser Creek near Highway 75 and on the eastern face of Turkey Mountain.

Almost the entire length of Tributary ME, the main southern branch of the creek, flows through Seminole sandstone and shales. Upper Seminole sandstone is exposed in Page Belcher Golf Course and West Highlands Park. At Riverfield Country Day School, Mooser Creek runs over the softer, more easily eroded shales. Since Seminole sandstones have produced considerable volumes of oil and gas in Osage, Creek and Pawnee Counties, its visibility here presents another good opportunity for natural history education.

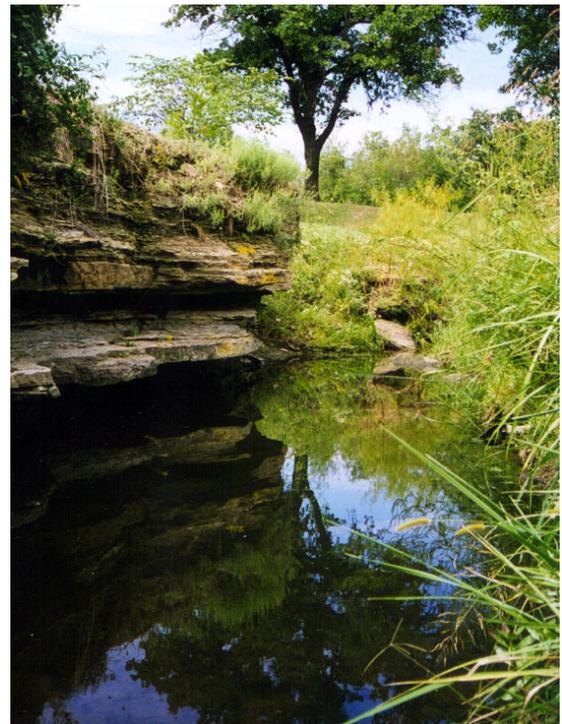
Seminole sandstone has fair to good rippability because of its abundant bedding planes and relative softness. It is strong enough, however, for most structures.

Quaternary Deposits

From about 30th West Avenue to the Missouri-Pacific Railroad bridge, Mooser flows through Arkansas River alluvium laid down during the Quaternary Epoch. These older deposits, about 50 feet above the present valley floor, are probably Pleistocene in age. They were left during the waning stages of the last glacial retreat, when melting ice in the Rocky Mountains provided the river with more water than it now carries.

These Quaternary deposits are an opportunity for a natural history education marker showing the flora and fauna of the Pleistocene era, when mammoths, giant sloths, and bears roamed the Oklahoma plains.

*A beautiful outcropping
of Seminole sandstone in
Page Belcher Golf
Course.*



CHECKERBOARD LIMESTONE



Checkerboard limestone boulders fill Mooser Creek near 25th West Avenue.

Checkerboard limestone is a 2- to 3-foot thick stratum of light-gray, fossil-bearing rock that was deposited about 300 million years ago during the Pennsylvanian Epoch. It divides the 200-foot-thick Seminole Formation beneath it from the 200 to 300-foot-thick Coffeeville Formation above.

As shown in the map below, a pale blue band of Checkerboard limestone meanders through the central and eastern portions of the watershed, encircling Turkey Mountain and looping south around Page Belcher Golf Course before crossing Mooser Creek mainstem at about 25th West Avenue.

Although it is a persistent formation in Tulsa County, Checkerboard limestone is sometimes difficult to identify in the landscape because its yellowish coloring, when weathered, makes it easy to mistake for sandstone.

Consequently, its visibility near 25th West Avenue is relatively unique. Here, as seen in the photograph (above left), the formation's massive, squarish boulders are vividly displayed, like ancient building blocks that have tumbled into the stream.

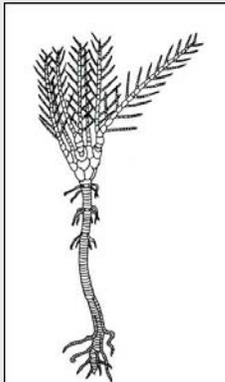
During the Pennsylvanian Epoch of the late Carboniferous Period, shallow, equatorial seas covered much of the central United States. When these seas retreated, vast swamp forests formed along the shoreline; when the seas advanced again, the swamps were covered with sand near the shore and, farther out, by shell flats and coral reefs.

The presence of bryzoans, crinoids and corals in the Checkerboard limestone indicates that the seas had advanced during this period and Mooser basin was a considerable distance off shore in quiet, clear marine waters. As a rule, brachiopods and mollusks lived close to shore in muddy water, while corals and bryzoans required a more serene environment. Thus Checkerboard limestone probably represents an extensive subtidal shell flat, since it is rich in brachiopods, bryozoans and crinoids. This prolific marine community was later covered by the black marine muds that make up the bottom layer of the Coffeeville Formation.

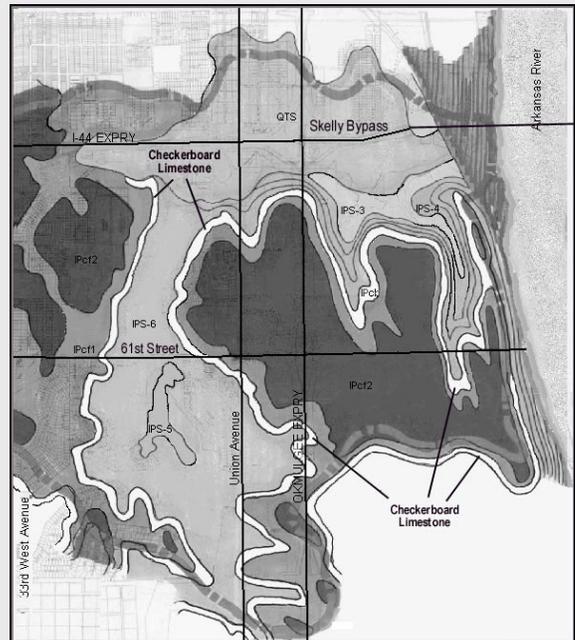


(Left) Checkerboard limestone crosses the Arkansas River just west of the 11th Street bridge.

(Below) A 30-inch thick layer of Checkerboard limestone (shown in white) snakes through the eastern half of Mooser watershed.



*Crinoid drawing (above left) and fossil (above right). The presence of crinoids in Checkerboard limestone indicate that lush tropical seas had advanced and Mooser basin lay in quiet, clear marine waters. (Figure and photograph courtesy of *Illustrated Encyclopedia of Fossils*, Giovanni Pinna, Facts on File, NY, 1990. Photo by Gianalberto Cigolini.)*



Natural History Education Markers

The geology of the Mooser basin, like that of northeastern Oklahoma generally, has had an enormous impact on the region's development. Most significantly, the Pennsylvanian formations are rich in coal and oil deposits. The massive sandstone strata, which caps Turkey Mountain and underlies much of Southwest Tulsa, has inhibited construction and urban development. The basin's geology is also directly connected to its soils, streams, vegetation and wildlife.

The occasional bold exposure of this underlying geology along Mooser Creek presents an opportunity for natural history education markers and brochures portraying the dramatic changes that occurred during the Pennsylvanian and Quaternary Epochs. An example of what information such signs and brochures might contain—in this instance for Quaternary deposits along Mooser Creek—is shown on page VI-6.

SOILS

The soils of the Mooser Creek watershed were mapped by soil scientists from the Soil Conservation Service in 1975 during work on the *Soil Survey of Tulsa County, Oklahoma*, published in 1977. Field observations were made by Rick McCright, Resource Soil Scientist with the NRCS, during the week of June 9-13, 1997, to assess the current status of the area and possible presence of hydric soils and wetlands. No wetlands were found.

There are essentially three kinds of soils in Mooser watershed. (See Figure VI-3, *Soils in Mooser Watershed*, page VI-7.) The most common are upland soils weathered from sandstones and shales of the Pennsylvanian Epoch, like the Niotaze-Darnell and Coweta-Bates complexes. These are found on most of the watershed's higher ground, on Turkey Mountain and at Bales Park, Parkview Manor and Woodview Heights in the eastern part of the basin and, farther west, at Mountain Manor, Lubell Park, and Remington Elementary School. The second most common soils are alluvial silts and loams in the lower ground and floodplains, which were either washed down from the basin's uplands, or deposited as sediments thousands of years ago during the Quaternary period. These include, among others, Choska, Severn and Radley soils. The third type of soils common to Mooser is the urban complexes, like Dennis urban.

⁸ Choska-Severn urban land complex. These soils are made up of very fine, sandy loams, which are used mostly for urban development, particularly along the west side of the Arkansas River. The water table is at a depth of more than 6 feet. The soils are well suited to trees, shrubs, flowers and lawn grasses, and moderately well suited to garden plants. Due to flooding, they have slight limitations for paths and trails in recreation areas, and moderate limitations for dwellings, commercial buildings, camp and picnic areas, playgrounds, roads and streets. They have severe limitations for septic tank filter fields, sewage lagoons or sanitary landfills because of permeability and of the shallow depth to the water table.

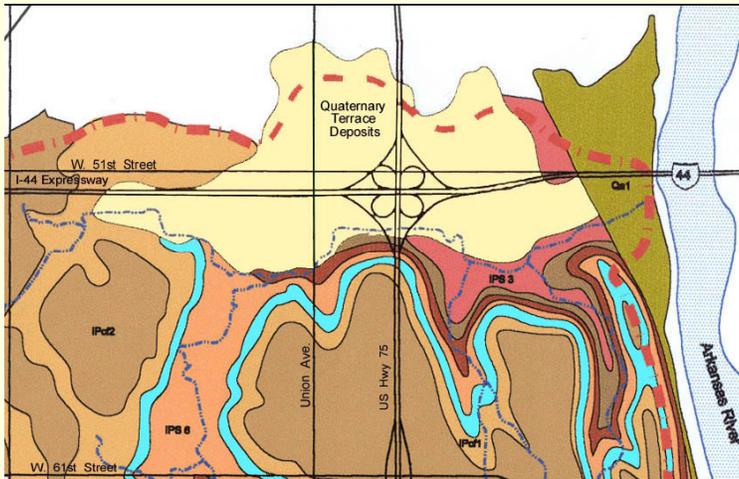
¹⁰ Coweta-Bates complex. These soils are very gently sloping to sloping soils on broad, smooth ridge crests and on the side slopes of uplands. Depth to bedrock is usually about 1-3 feet. The main concerns are depth to bedrock, soil texture, and moderate shrink-swell potential. They are well suited to most shrubs, flowers, garden plants and lawn grasses, and have slight limitations for paths, trails, and camp and picnic areas. They have moderate limitations for commercial buildings, roads and streets because

QUATERNARY DEPOSITS ON MOOSER CREEK

From about 30th West Avenue to the Missouri-Pacific Railroad bridge, Mooser Creek flows through terrace deposits laid down by the Arkansas River during the Pleistocene Epoch, when mammoths, giant bears and elk, and other prehistoric animals roamed the great American steppe land. This “Mooser Creek Terrace” is at about 660-670 feet above sea level, or around 50 feet above the current Arkansas River flood plain, indicating the deposits are more recent than either the Yale Avenue Terrace (740 feet) or Newblock Terrace (710 feet).



Quaternary terrace deposits on Mooser Creek mainstem between Waco and Yukon Avenue.



Quaternary deposits in Mooser watershed reach from about 30th West Avenue to the Missouri-Pacific Railroad Bridge.

(called aggradation)—when the Sand Springs, Yale Avenue and Newblock Terraces were formed—were apparently followed by drier cycles and significantly reduced stream flows.

Although no soil tests have been made, these terrace deposits along Mooser Creek might well date from the last great glacial retreat, ten to fifteen thousand years ago, when America’s prairies were being formed. If so, they nourished the teeming wildlife of the Pleistocene, and witnessed, too, the sudden and mysterious extinction of many of its most interesting creatures.

As you stand here, imagine a vast steppe sweeping away to the east where hundreds of large, strange animals hunt and graze. Mammoths and giant bison are among them. There is still a bite to the warming air. The river is swollen and silt laden, as in spring.



Artist’s conception of what a Pleistocene prairie looked like, based on the fossil record. (Courtesy of the Natural History Museum of Los Angeles County.)

Mooser Creek’s Quaternary deposits are strikingly displayed along the south bank of the mainstem, between Waco and Union Avenue. The tightly packed, almost rock-like sand and loess are clearly of a much greater age than the looser soils of the current floodplain. These deposits were most likely the result of glacial melting, which dumped enormous amounts of fine-grained silt and sand into the Arkansas River. These periods of deposition

Into this landscape come the Clovis people, who some believe were responsible for the mass extinctions of the Pleistocene. Their arrow and spear points have been found in Oklahoma, embedded within the rib cages of mammoth and giant bison skeletons. They might have stood on the heights near Remington Elementary School gazing east across the vast river and even vaster prairie.

of their shrink-swell potential and depth to bedrock. They have severe limitations for septic tank filter fields, sewage lagoons and trench-type sanitary landfills. The soils are mainly used for native grass.

11 Coweta-Eram urban land complex. These soils are gently sloping to strongly sloping soils on prairie uplands. Depth to bedrock is about 1-3 feet. The soils in this complex are used mostly for urban development. The main concerns are shallow depth to sandstone, high shrink-swell clays, rockiness and strong slopes. The soils are well suited to lawn grasses, flowers, most shrubs and garden plants. They have slight limitations for paths and trails in recreational areas. In areas where sandstone is shallow, there are moderate limitations for underground utilities, dwellings, commercial buildings and roads or streets. They have moderate limitations for camp and picnic areas because of the strong slopes. Because of the shallow, clayey soil in shale areas, they are poorly suited for trees and have severe limitation for septic tank filter fields or sewage lagoons.

Figure VI-3:
Soils in Mooser
Watershed

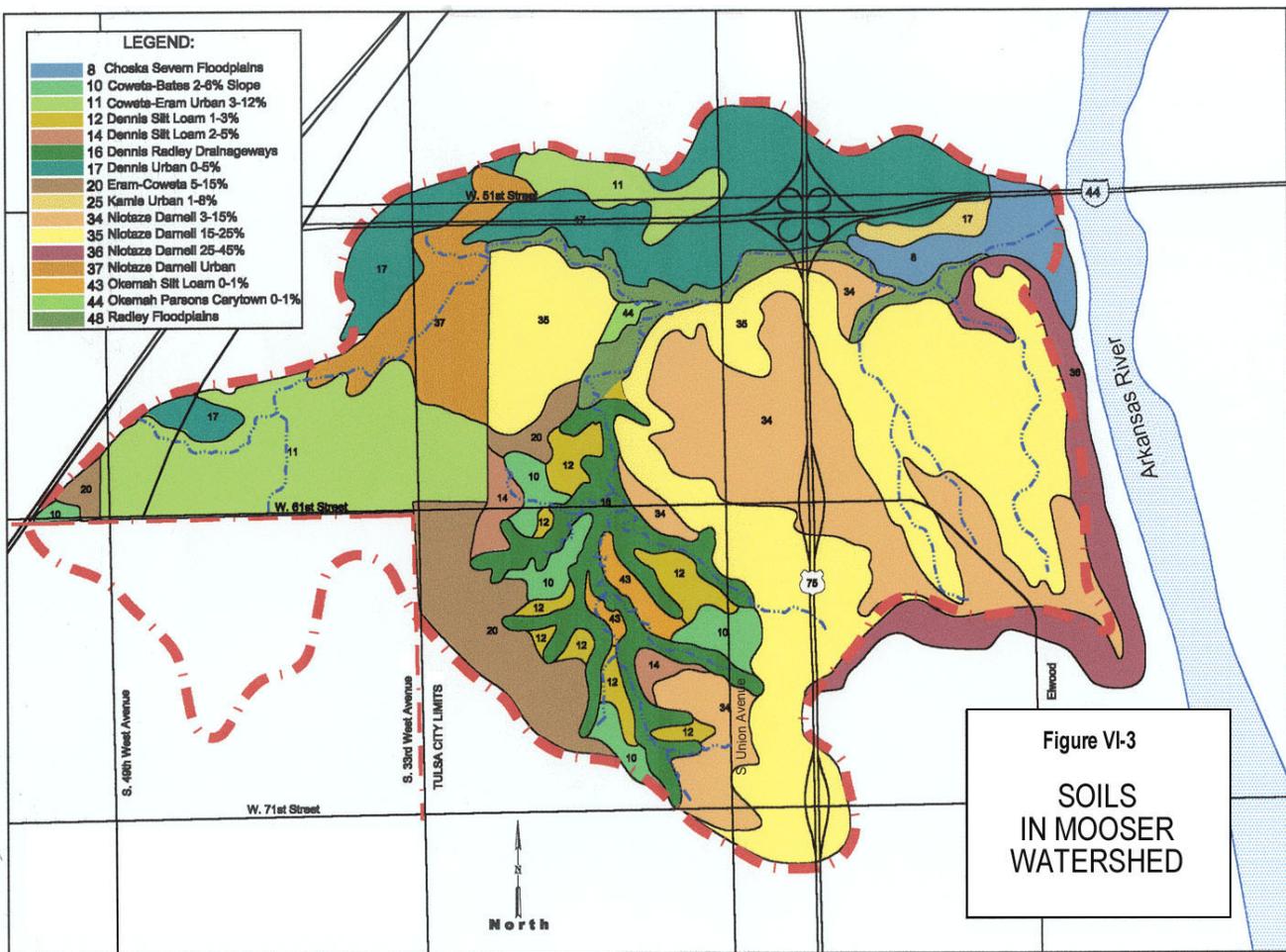


Figure VI-3
SOILS
IN MOOSER
WATERSHED

14 Dennis silt loams. These soils are on very gently sloping through sloping, slowly permeable soil on broad, smooth ridge crests on uplands. The water table is at a depth of 2-3 feet. Depth to bedrock is more than 6 feet. The main concerns are slow permeability, wetness, high shrink-swell potential and the texture and acidity of the subsoil. It is well suited to lean grasses, flowers, most shrubs and garden plants. They have slight

limitations for picnic areas or paths and trails. They have moderate limitations for sewage lagoons, camp areas and playgrounds because of gentle slopes and surface wetness. They have severe limitations for dwellings, septic tank filter fields, commercial buildings, and roads or streets because of the slow permeability and high shrink-swell potential of the clayey subsoil. Soil management is needed to control erosion and maintain fertility. In sloping areas vegetative cover can reduce erosion.

16 Dennis-Radley complex. These soils are made up of the moderately well drained, slowly permeable Dennis soil and the moderately well-drained, moderately permeable Radley soil. This complex is found in drainageways 180-600 feet wide and 10-40 feet below the surrounding prairie uplands. Depth to bedrock is usually over 6 feet. The main concerns are flooding, slope, slow permeability, wetness, high shrink-swell potential and the texture and acidity of the subsoil. These soils are poorly suited to most urban uses since they have strong slopes or are flooded. These soils need grass cover to prevent erosion during floods.

A steep bank of floodplain soils and Seminole sandstone on lower Mooser Creek.



17 Dennis urban land complex. These soils are made up of nearly level to gently sloping soils on prairie uplands. The soils are in such an intricate pattern with buildings, streets, and roads that it is impractical to separate them from the urban land. Depth to bedrock is more than 6 feet. The soils in this complex are used mostly for urban development, including industry. The main concerns are slow permeability, wetness, high shrink-swell potential, and the texture and acidity of the subsoil. The soils are well suited to lawn grasses, flowers, most shrubs, and garden plants. They have slight limitations for picnic areas or paths and trails, and moderate limitations for sewage lagoons, camp areas, and playgrounds mainly because of gentle slopes and surface wetness. They have severe limitations for dwellings, septic tank filter fields, commercial buildings, and roads or streets because of the slow permeability and high shrink-swell potential of the clayey subsoil.

20 Eram-Coweta complex, 5-15% slopes. These soils are a complex of moderately well-drained, slowly permeable Eram soil and the well-drained to excessively drained, moderately permeable Coweta soil. These are sloping to moderately steep slopes on ridge crests and side slopes of uplands. The depth to bedrock is about 1-3 feet. The concern in urban areas is shallow depth to sandstone, high shrink-swell clays, rockiness, and steep slopes. The soils are well suited to lawn grasses, flowers, most shrubs and garden plants. They have slight limitations for paths and trails and moderate limitations for underground utilities, dwellings, commercial buildings and roads and streets where the soils are underlain at a shallow depth by sandstone. Because the soils are shallow and clayey in shale areas, they are poorly suited to trees and have severe limitations for septic tank filter fields and sewage lagoons. In shale areas, the soils have severe limitations for roads or streets, dwellings, commercial buildings and underground utilities. The soils are mainly used for native grass.

25 Kamie urban land complex. These soils are very gently sloping through sloping soils on timbered uplands usually more than 6 feet deep. The soils in this complex are used for urban development, including industry. The main concerns are slope and soil acidity. These soils are well suited to trees, garden plants, shrubs and flowers. They have slight limitations for paths, trails and camp or picnic areas, and for septic tank filter fields, sanitary landfills, dwellings, commercial buildings, roads and streets.

34-37 Niotaze-Darnell complex. These soils are somewhat poorly drained, slowly permeable Niotaze soil and the well drained to somewhat excessively drained, moderately rapidly permeable Darnell soil. The depth to bedrock is about 1-3 feet. The main concerns are depth to bedrock, permeability, slopes, rockiness and wetness. The soils are well suited to lawn grasses, flowers, shrubs, trees and most garden plants. They have moderate limitations for shallow excavations and roads or streets because of shallowness of soil, rockiness and wetness. The soils have severe limitations for septic tanks absorption fields, dwellings, camp areas, playgrounds and picnic areas because of rockiness, depth to bedrock, permeability, wetness, and moderately steep slopes.

43 Okemah silt loam. This is a nearly level, moderately well drained, slowly permeable soil on broad, smooth uplands. The water table is at a depth of 2-3 feet during December through April. Bedrock is more than 6 feet. The main concerns of this soil in urban areas are slow permeability, wetness, high shrink-swell potential, and the texture and acidity of the subsoil. The soil is well suited to lawn grasses, flowers, most shrubs, and garden plants. It has slight limitations for picnic areas or paths and trails. It has moderate limitations for camp and playground areas because of surface wetness. This soil has severe limitations for dwellings, septic tank filter fields, commercial buildings and roads and streets because of the slow permeability and high shrink-swell potential of the subsoil. Controlling erosion is a maintenance concern.

44 Okemah-Parsons-Carytown complex. This is a complex of the moderately well drained, slowly permeable Okemah soil; the somewhat poorly drained, very slowly permeable Parsons soil; and the poorly drained, very slowly permeable Carytown soil. The water table is at a depth of about 1-3 feet during December through April. Bedrock is more than 6 feet. The main concerns in urban areas are wetness, very slow permeability, slope, the clayey and acid subsoil, low strength, and high shrink-swell potential. These soils have slight limitations for sewage lagoons in nearly level areas. Wetness is the most restrictive soil feature for picnic areas, paths and trails. Proper structural design must compensate for high shrink-swell potential and low strength when used for dwellings, commercial buildings, roads and streets.

48 Radley floodplains. These soils are nearly level, moderately well drained and moderately permeable Radley soils and Cleora and Wynona soils. Depth to bedrock is more than 6 feet. The main concern in urban areas is frequent flooding. It is well suited to trees, shrubs, paths and trails. Flooding limits the use of these moderately well suited soils for flowers and lawn grasses. They are poorly suited to garden plants. They have moderate limitations for picnic areas and severe limitations for camp and playground areas, dwellings, commercial buildings, roads and streets because of frequent flooding.

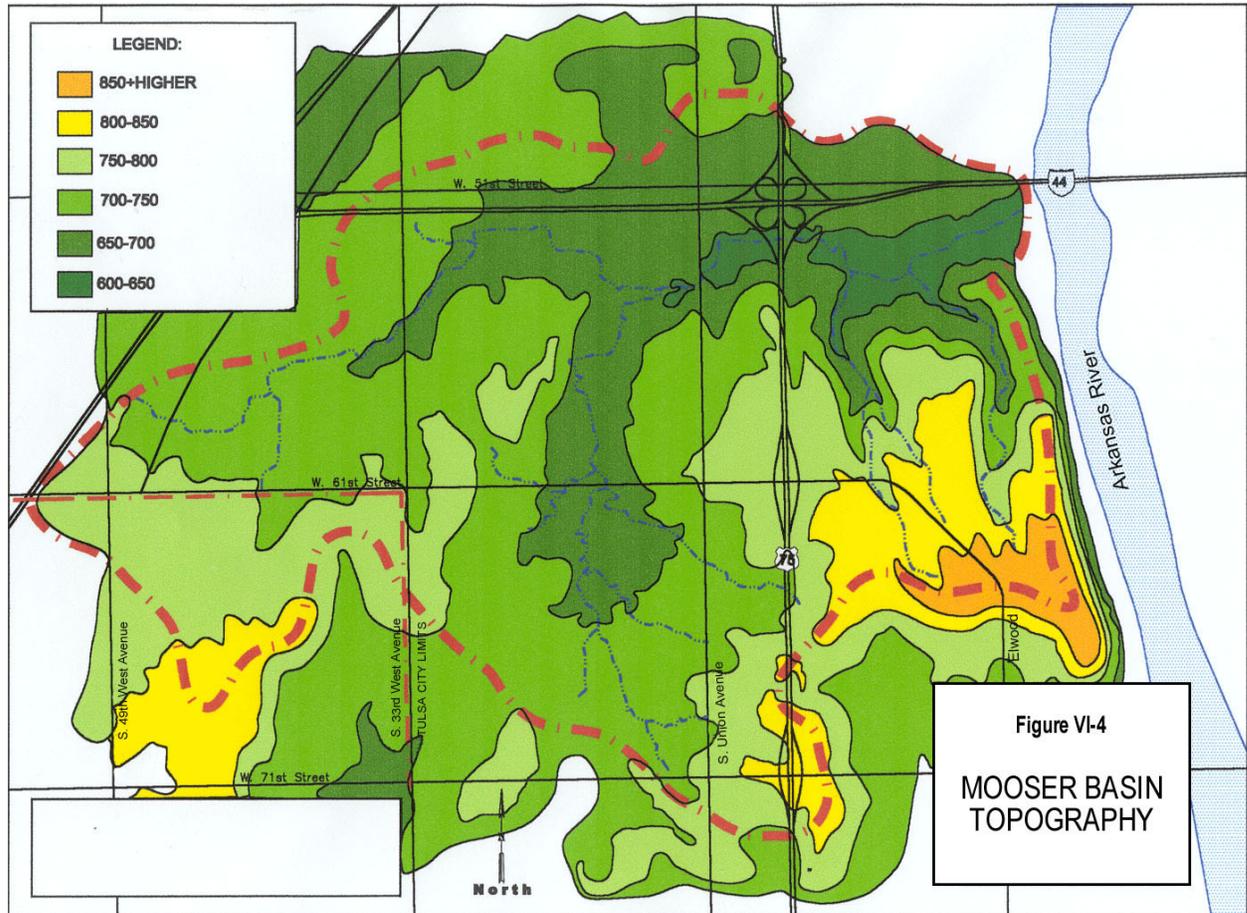
TOPOGRAPHY AND NATURAL FEATURES

The 3,325-acre Mooser watershed lies along the west bank of the Arkansas River, between about South 47th and 73rd Streets, and stretches three miles westward, to just beyond 49th West Avenue. The basin encompasses approximately five square miles of rolling hills that gradually dip to the northeast at about 50 feet per mile. This southwestern part of Tulsa County, being underlain by relatively resistant sandstone and limestone, is higher and more rugged than central and eastern Tulsa, which is underlain predominantly by shales. These sandstone and limestone strata produce a series of *cuestas*, or ridges, running generally north-south with east-facing escarpments—the most prominent of which is Turkey Mountain.

The rolling hills of Mooser watershed are covered mainly with post oak-blackjack oak scrub forest with mixed hardwoods typical of the Arkansas River valley and the Ouachita and Ozark physiographic provinces.

The Turkey Mountain plateau is strewn in places with boulder fields that have, along with the underlying Coffeeville sandstone, been an impediment to development. The slightly lower rolling hills of Page Belcher Golf Course, West Highlands Park, Riverfield School, and West Highlands I housing tract are composed of the relatively softer Seminole sandstone and shales. These rolling upland hills fall away rather abruptly into the Mooser Creek floodplain at about South 54th Street.

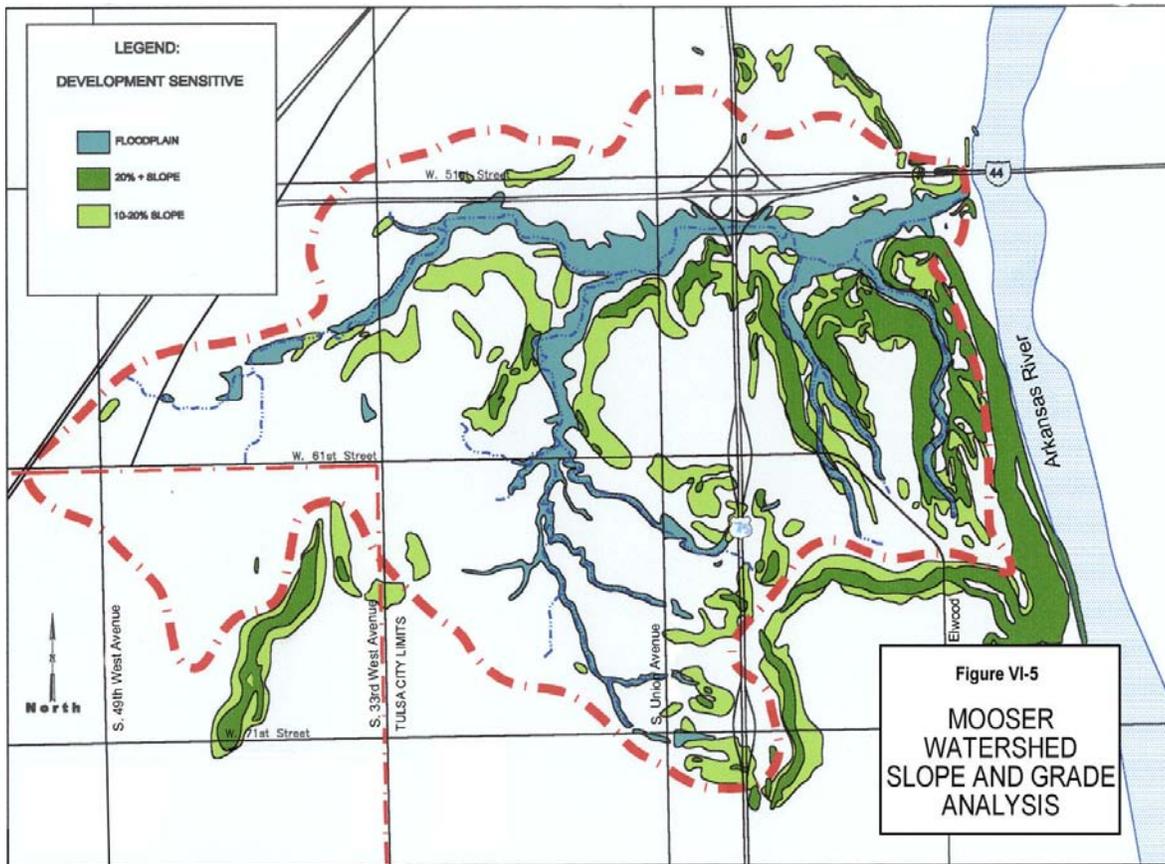
Figure VI-4:
Mooser Basin
Topography



Mooser Creek and its southern tributaries have worn steep channels into the northern end of Turkey Mountain. Most slopes exceeding 20 percent occur here, where streams have cut through the more resistant Coffeeville sandstone cap into the underlying shales producing a number of fine cliffs and bluffs. (See Figure VI-5, Slope and Grade Analysis, on page VI-11.)

While such slopes pose special problems for builders, they can be important scenic, recreational and educational resources for trails and open space. Slopes in excess of 12 percent are also problematic for many land use practices and have been classified as “development sensitive” in INCOG’s Comprehensive Plan.

Figure VI-5:
Mooser Watershed Slope and
Grade Analysis



HYDROLOGY

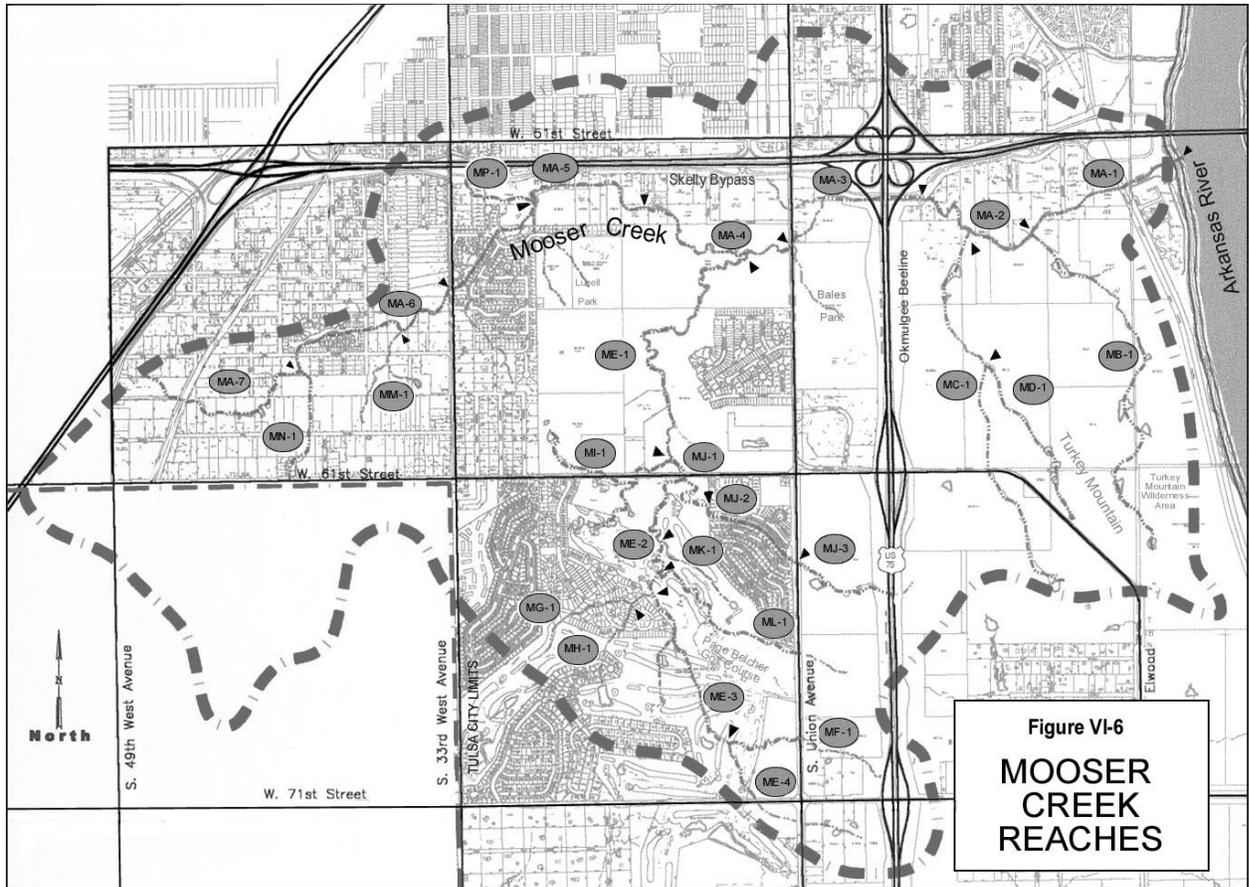
Mooser Creek is one of the least disturbed streams in Tulsa, due to its location, rugged terrain and underlying geology. The stream banks are mostly natural, except for a storm sewer system in West Highlands I subdivision, some backyard landscaping in Mountain Manor and other subdivisions, and a channelized stretch between 24th and 29th West Avenue.

A detailed hydrological study of Mooser Creek was made by Wilbur Smith and Associates, Inc., as part of the *Southwest Master Drainage Plan* (October 1988). Their study divided the watershed into 32 subbasins. These subbasins are identified in the Mooser Creek Reaches map, Figure VI-6, on page VI-12.

Stream flows were measured under existing conditions (in 1988) and estimated for full urbanization based on Tulsa's Comprehensive Plan. The study found that full urbanization would increase flows in the almost fully developed northwest portion of the watershed by 6 percent, and in the less developed southern reaches by 16 percent. These stream flows are shown in summary form in Figure VI-7, Mooser Basin Streamflows, on page VI-13. Ultimate development flows are given inside parentheses.

On Mooser Creek mainstem, 100-year event flows are 2842 cfs (2959 cfs when fully urbanized) at 33rd West Avenue bridge; 3481 cfs (3559 cfs fully urbanized) at 24th West Ave, just before being joined by Tributary ME; 7224 cfs (7466 cfs fully urbanized) at Union Avenue bridge, before being joined by Tributaries MC and MB; and 9058 cfs (9229 cfs fully urbanized) when entering the Arkansas River.

Figure VI-6:
Mooser Creek
Reaches



The vertical drop of Mooser Creek and its tributaries is summarized below:

Stream Reach or Tributary	Reach Length (ft)	Begin Elevation (ft)	End Elevation (ft)	Vertical Drop (ft)	Stream Reach or Tributary	Reach Length (ft)	Begin Elevation (ft)	End Elevation (ft)	Vertical Drop (ft)
MA	22,000	747	615	132	MI	1,600	682	667	15
MB	6,450	858	628	230	MJ	6,000	791	666	125
MC	6,350	843	630	213	MK	1,400	690	672	18
MD	3,250	826	675	141	ML	4,700	750	680	70
ME	13,800	758	643	115	MM	2,200	731	689	42
MF	2,100	756	723	33	MN	2,000	737	714	23
MG	1,750	714	689	25	MP	1,100	686	667	19
MH	800	705	694	9					

There is little historical information on flooding in the Mooser basin. The severe storm of May 1984, which resulted in extensive damage in other parts of the city, caused almost no flooding along Mooser Creek. However, when Keystone Dam increased outflows to 300,000 cfs in October 1986, there was backwater flooding on the lower

portions of the creek, mainly in Subbasin MA-1. If the historical record is scanty, the natural record is more eloquent, with its testimony of alluvial soils. These soils, which have been repeatedly deposited over the centuries, are a key element in defining the stream's 100-year floodplain.

Figure VI-7:
Mooser Basin
Streamflows

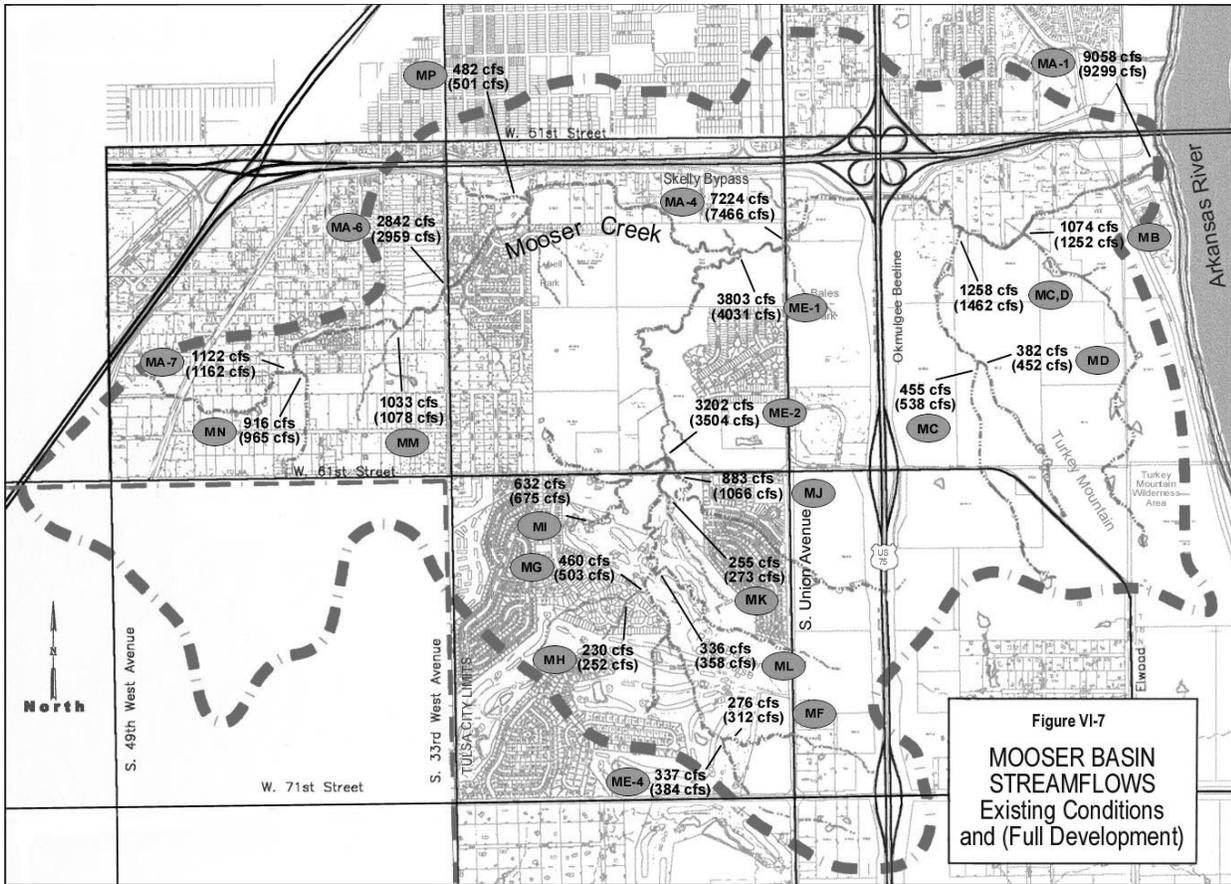


Figure VI-7
MOOSER BASIN
STREAMFLOWS
Existing Conditions
and (Full Development)

OIL AND GAS WELLS

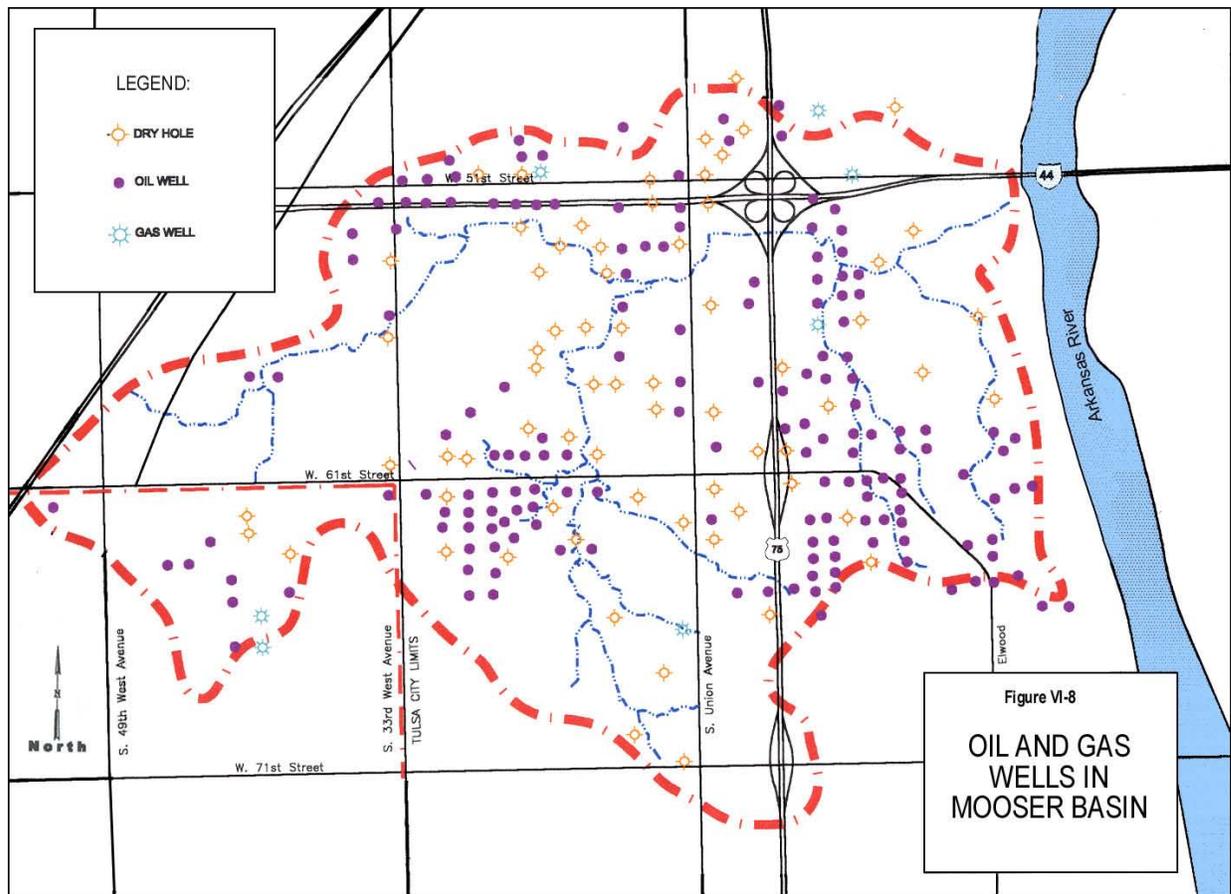
In the years following the oil discovery at Red Fork, 241 oil and gas wells were drilled in the Mooser watershed. Of these, there were 168 producing oil wells, 7 producing gas wells, and 66 dry holes. These are shown in Figure VI-8 on page VI-14.

The wells in the watershed are relatively narrow in bore and have been capped. They do not represent a hazard under normal circumstances. However, construction and landscaping crews need to be aware of their location and exercise caution when working near them.



One of the many oil well platforms in the watershed—this one on Turkey Mountain

Figure VI-8:
Oil and Gas Wells in Mooser
Basin



MOOSER CREEK BIOLOGICAL SURVEY

The Mooser Creek biological survey was conducted by the City of Tulsa’s Oxley Nature Center during four weeks in June 1997. The Oxley Center’s staff made numerous walks through the watershed, listing all the plants and animals they encountered, or for which there were signs—such as animal tracks, scat, homes, or similar evidence. Time constraints and the need for landowner permission to do the surveys, forced the teams to concentrate on six representative sites shown in Figure VI-9, on page VI-16. These were (1) Bales Park, (2) West Highlands Park, (3) Lubell Park and Remington Elementary School, (4) Riverfield Country Day School and environs, (5) the YMCA Camp and environs, and (6) the Mooser Creek main channel between Union Avenue to the Arkansas River.

The teams were not able to survey Mooser’s main channel west of Union Avenue and south of I-44, due to the lack of landowner permission. This heavily wooded reach would have provided a much better understanding of Mooser’s natural habitat. The survey also did not include residential areas and industrial sites along I-44.

Vegetation

The remaining natural areas of the Mooser basin are composed of a post oak-blackjack oak association of plants common to the southwestern reaches of America's Central Hardwood Forests. These forests developed over the past 18,000 years on marine sedimentary soils and substrates of the Paleozoic era.

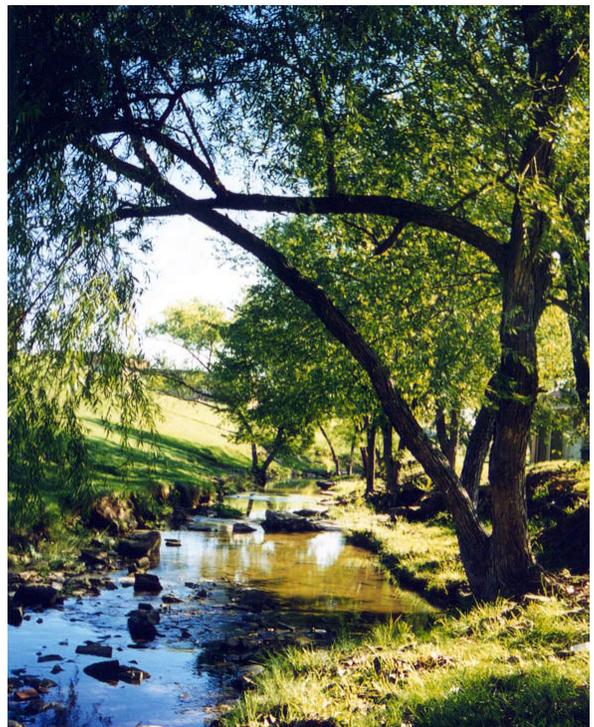
Although a considerable amount of development has occurred within the basin, a significant portion of the watershed remains in its natural state. These native stands appear to be in excellent health, with surprisingly few introduced (exotic) plant species. Of 16 trees suitable for backyard planting, 10 might be found in the local nursery, but all 16 species are present in the basin. Some trees are more than 100 years old; including a redbud that was the largest that one member of the survey team had ever seen.

Willows, like this one in South Haven Manor, are common along Mooser Creek.

Altogether, more than 220 plant species were identified. Among these were 40 species of trees. These included an abundance of post oak, blackjack oak, black oak and black hickory on the upland areas, along with white ash, black cherry and bitternut hickory. A small population of horse chestnut was also found—a tree not at all common in this part of Oklahoma. Hackberry, redbud, black willow, sycamore and cottonwood are present in streamside areas.

The watershed's flowering hardwoods support a wide variety of wildlife, particularly songbirds, turkey, grouse, squirrel, raccoon, opossum, rabbits and deer. Among those which produce good or excellent food for wildlife are bitternut hickory, pecan, roughleaf dogwood, persimmon, red mulberry, black cherry, blackjack oak, post oak, american elder, and black willow. These species represent an important resource for the watershed's wildlife. They also offer an opportunity for nature education markers that point out the relationships between hardwood fruits and flowers and the animal populations they support.

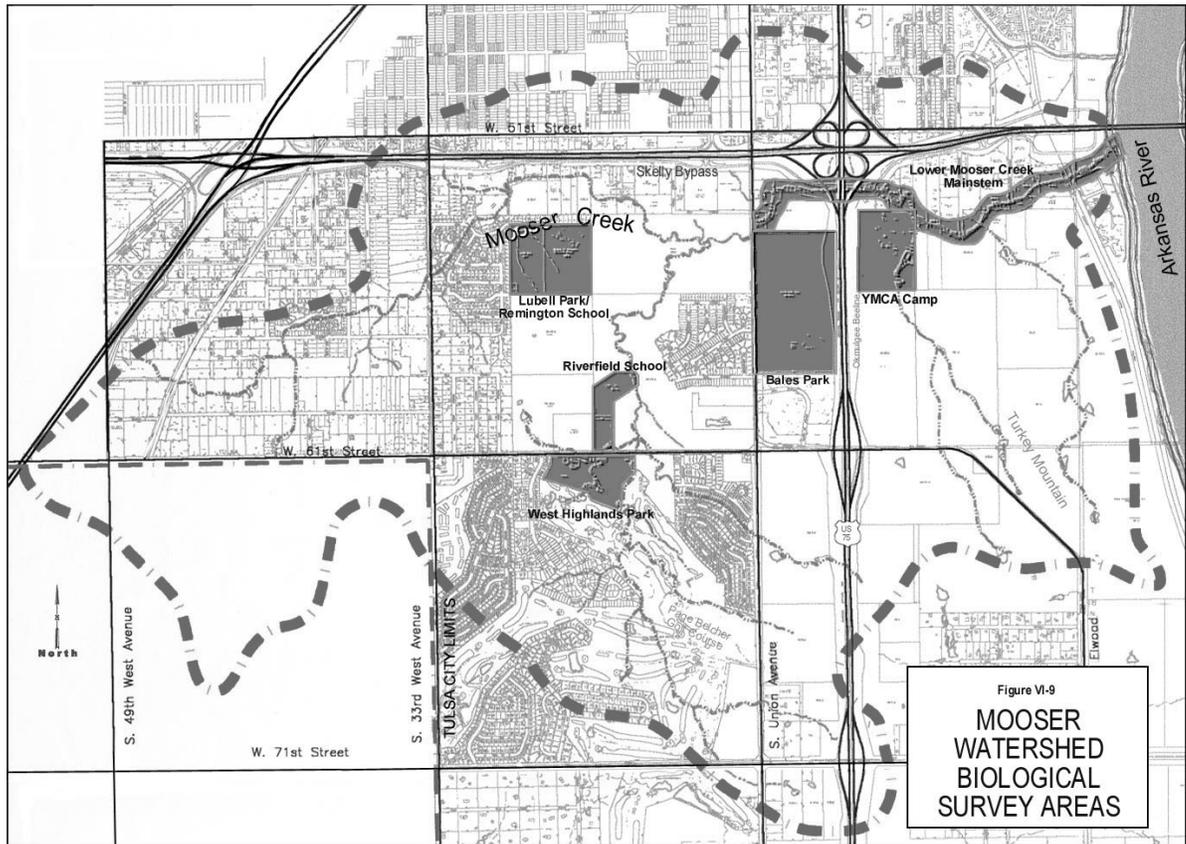
Most of the exotic flora is limited to road edges, the creek bank, and other disturbed areas. Particularly troubling is a rather large infestation of *Chinese lespedeza* on the lower reaches of Mooser Creek. This plant is known to be rapidly invasive, taking hold anywhere it can gain a foothold, to the detriment of native plants.



Bales Park Prairie

An unexpected find in the Mooser watershed is an intact mixed-grass prairie relict in the interior of Bales Park, just west of Highway 75. This 17-acre native prairie contains classic grasses like big bluestem, little bluestem, broomsedge, buffalo grass, Canada wild rye, switchgrass, and purple top, along with an abundance of colorful prairie flowers, including pale purple coneflower, fleabane, black-eyed Susan, goldenrod, Indian paintbrush, Neptune, and hairy ruellia. The presence of wild legumes, such as leadplant, purple prairie clover, and wild indigo, are signs of the prairie's authenticity, since they are among the first plants to vanish from tamed land and often the last to return.

Figure VI-9:
Mooser Watershed Biological
Survey Areas



The Bales Park prairie represents a valuable resource and efforts should be made to maintain the site in a natural condition. Its proximity to schools, the YMCA Camp, and other recreation facilities makes it ideal for nature walks and botanical studies. Since America’s grasslands, like its Central Hardwood Forests, date from the time of the last glacial advance, Bales Park prairie also presents an excellent opportunity for a natural history education marker.

Mammals

Mammals are abundant in the Mooser watershed, due in part to its extensive areas of natural vegetation. The survey teams found physical evidence for 14 mammals and identified 18 others that they would expect to find had they been able to do a more thorough inventory. None of these are endangered. The mammals for which they found tracks, scat, or other signs are beaver, coyote, eastern cottontail, eastern mole, fox squirrel, gray squirrel, mink, nine-banded armadillo, opossum, raccoon, red fox, white-tailed deer, woodchuck and woodland vole. The species the survey teams would expect to find upon closer inspection include shrews, gophers, mice, bats, voles and rats, as well as striped skunk, gray fox and bobcat.

By far the most controversial of these mammals is the beaver. While some residents consider beavers to be a romantic presence in the watershed, others view them as a nuisance. If it is decided to allow the controlled presence of beaver along Mooser Creek, their small dams and lodges, would make excellent wildlife viewing areas and nature education resources.

Birds

By far the largest number of animal species in the Mooser watershed are birds. The Oxley Nature Center identified 271 species expected in the basin, based on the records of the Tulsa Audubon Society. Of these, 105 are possible nesting species. No endangered species are expected, although the endangered least tern does nest in the Arkansas River. Bald eagles, now listed as Threatened, have nested along the river in recent years, and might roost in the watershed during winter months.

Mooser's extensive tracts of natural vegetation are an important source of food, cover and nesting for local bird and mammal populations. To maintain this wildlife resource, citizens and naturalists urge that efforts be made to keep some of these tracts unspoiled and to encourage builders to retain as much natural habitat as possible as a feature of development.

Fish

The fish resources of Mooser Creek were surveyed in June 1997 by the U.S. Fish and Wildlife Department, and in June 1998 by the Tulsa County Conservation District.

The U.S. Fish and Wildlife survey of June 1997 looked at stream reaches at South Haven Manor, Remington Elementary School, Riverfield Country Day School, West Highlands Park, Page Belcher Golf Course, Union Avenue Bridge, and the Southside Wastewater Treatment Plant. The greatest number of species was found in the Mooser tributary ME at Page Belcher Golf Course and Riverfield Country Day School. A total of seven fish species were identified, including fighting minnow and red trout. There were three species of amphibians, three of crayfish, and several orders of arthropods and gastropods. No mussels were found—which indicates poor water quality.

The more thorough survey done by Tulsa County Conservation District in June 1998 included both seining and shocking. Three sites were investigated: (1) a 400-meter reach upstream from the Elwood bridge; (2) a 400-meter reach downstream from Riverfield Country Day School; and (3) a 400-meter reach upstream from South Haven Manor and South 57th Street. Fourteen species were found among the 1216 fish that were collected and released. These included channel catfish, four kinds of sunfish, three species of minnow, and two types of shiner and bullhead, along with central stoneroller and smallmouth buffalo.

These fish captures show Mooser Creek to be in remarkably good shape for an urban stream. For example, similar surveys of other urban streams found an average of five fish and three species on Crow Creek, and 231 fish and four species on Fred Creek. On the other hand, a 400-meter reach of Posey Creek, which is a rural stream, produced 24 species and a total of 724 fish (compared with Mooser's 14 species and 400 fish average per reach).

BALES PARK MIXED-GRASS PRAIRIE



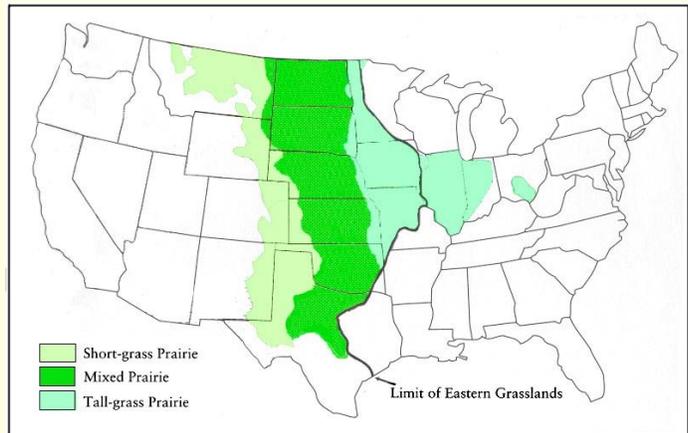
Oxley Nature Center Naturalists who discovered Bales Park Prairie (l-r): Donna Horton, Bob Jennings, Lynda Fritts and Eddie Reese

The great tall-grass, mixed-grass and short-grass prairies, which once stretched from the Mississippi valley westward to the Rocky Mountains, were America's equivalent to the Russian Steppes or the Argentine Pampas. These grasslands took shape during the most recent glacial advances of the Pleistocene, and were once roamed by mammoths, giant elk, bear and bison. Although the great wild animals have largely gone, the wild grasses upon which they fed have, in a few odd corners, managed to survive.

That is why they are so exciting to find and preserve.

In the course of surveying wildlife resources in the Mooser Creek watershed during the summer of 1997, naturalists from Tulsa Park Department's Oxley Nature Center stumbled upon a wonderful discovery. In a forgotten corner of Bales Park in Southwest Tulsa, they found an intact mixed-grass prairie remnant, or relict. They could hardly have been more surprised had they found a mammoth wandering along the west side of the Okmulgee Expressway instead. How had this fragment of America's prehistoric grassland managed to survive?

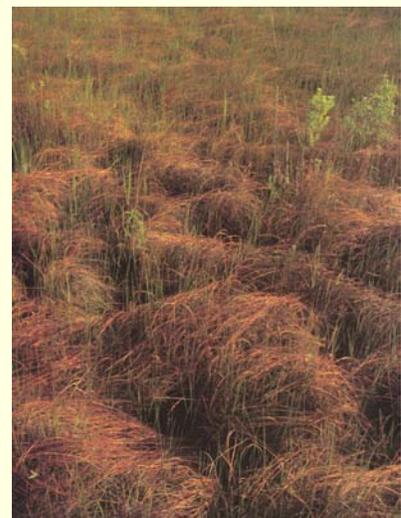
The 17-acre prairie contained all the classic grasses, like big and little bluestem, broomsedge, buffalo grass, Canada wild rye, switch-grass, purple top, and Indian grass. There was also an abundance of colorful prairie flowers, including pale purple coneflower, fleabane, black-eyed Susan, goldenrod, Indian paintbrush, Neptune, and hairy ruellia. The presence of wild legumes, such as leadplant, purple prairie clover, and wild indigo were signs of the prairie's authenticity, since they are among the first plants to vanish from tamed land and often the last to return.



The three prairie regions of the Central United States



Members of Tulsa's Native Plant Society explore Bales Park Prairie.



A typical mixed-grass prairie

Water Quality

Tulsa County Blue Thumb has been monitoring water quality at three sites on Mooser Creek since 1997. These are shown in Figure VI-10, p. VI-20. Monitoring includes bacteria and chemical tests and the collection of fish and macroinvertebrates.

Bacteria and pesticide monitoring has been conducted monthly between May and September at the Elwood bridge and South Haven Manor sites and chemical monitoring monthly, year round. Oklahoma Water Quality Standards consider chlorpyrifos (a pesticide) levels to be chronically toxic for aquatic organisms at above 0.041 ppb (parts per billion) and acutely toxic at levels above 0.083 ppb. Since Blue Thumb's immunoassay test has a detection limit of 0.1 ppb, only results above the acutely toxic level were recorded. The Elwood Bridge site had chlorpyrifos levels of 0.125 ppb in July 1997 and 0.12 in September 1998, while South Haven Manor had levels of 0.58 ppb in May 1997, 0.145 ppb in June 1997, 0.12 ppb in August 1997, and 0.27 ppb in September 1998.

Toxicity varies from organism to organism. Generally, however, a chronically toxic environment will likely only affect an organism at the most sensitive stage of its life cycle, such as the larval phase, while an acutely toxic one will kill an organism, usually in less than a day.

Dissolved oxygen is another measure of stream health. As a rule, it must be greater than 3 mg/L, but should be above 5 mg/L. Low dissolved oxygen levels are common in summer, because warm water holds less oxygen. Mooser Creek had low dissolved oxygen levels from June to September 1998 at the Elwood bridge test site, and from May through July and September at South Haven Manor.

Ammonia nitrogen levels should be less than 0.4 mg/L; levels at 1.0 mg/L and above are toxic for many fish. Ammonia levels have been low, measuring 0.30 mg/L at South Haven Manor in September 1997 and in June and July 1998.

Nitrate nitrogen should be less than 1.0 mg/L. Levels of 1.0-2.5 mg/L are cause for concern, while levels above 2.5 mg/L can result in major ecological problems. Nitrate levels did not exceed 0.51 mg/L at any time at either monitoring site.

The acidity or alkalinity of streams is expressed as a pH number, where neutrality is 7 and lower numbers indicate increasing acidity and higher numbers increasing alkalinity. Mooser Creek pH levels should be between 5.5 and 9.5. Monitoring results showed that pH varied between 7.5 and 8.5 at both Elwood Bridge and South Haven Manor.

Orthophosphate phosphorous in an urban stream should be less than 0.03 mg/L. Levels of 0.03-0.05 mg/L are not desirable; 0.05 mg/L is cause for concern; and 0.1 mg/L is a sign of serious problems. Orthophosphate levels at South Haven Manor were high in February and November 1998, and at Elwood Bridge in December 1997 and November 1998.

Another measure of stream pollution is the level of fecal coliform and *E. coli*. Fecal coliform should be less than 400 colonies/100 mL for human contact, and *E. coli* below 200 colonies/100 mL. Fecal coliform were at 3000 in September 1997 at Elwood bridge,

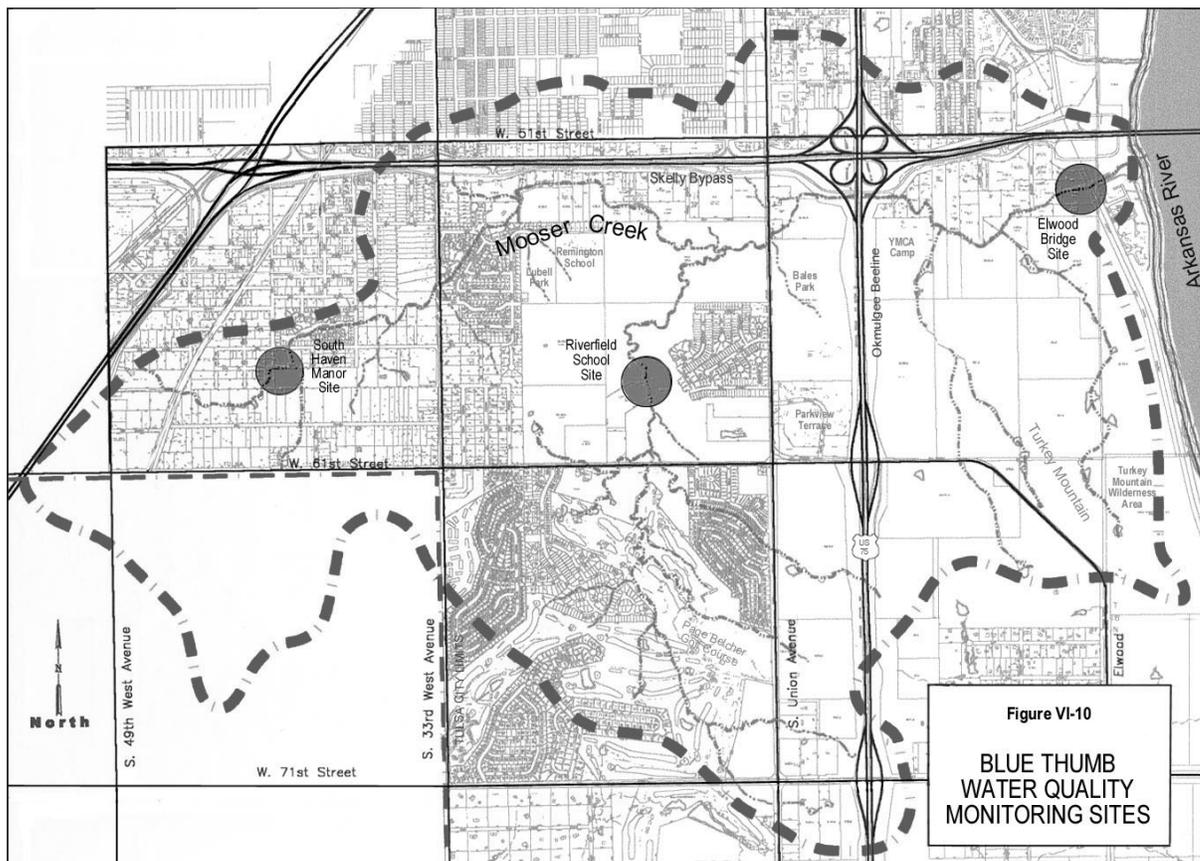
*Blue Thumb
volunteers measure
Mooser's water
quality monthly.*



and at South Haven Manor reached 150,000 in May 1997, dropping to 440 in June and rising to 630 in July of the same year. Colonies of *E. coli* at Elwood Bridge were measured at 370 in June and 460 in August 1998, and at 1400 in May and 1600 in June 1999. South Haven Manor registered 2400 in June 1999.

Figure VI-10:
Blue Thumb Water Quality
Monitoring Sites.

Although these are raw data and require further study, the Blue Thumb survey team believes that, overall, Mooser Creek has good water quality and a good aquatic



community. One of the primary reasons for this, the team believes, is the remaining riparian areas, which protect the stream from some of the negative impacts of urban development. South Haven Manor has higher pollution levels because the banks there are mowed to the stream's edge.

CULTURAL AND HISTORICAL RESOURCES

Archaeological Resources

Two archaeological surveys have been conducted in the Mooser watershed. The first, limited to Turkey Mountain Park, was made by Charles S. Wallis, Jr., of the Oklahoma Conservation Commission, in 1979. The second, which covered the entire watershed, was done by Jean Sinclair and the Tulsa Archaeological Society between July 7, 1997, and July 25, 1998.

Both surveys were somewhat handicapped by the Mooser watershed's heavy ground cover, which leaves only about 4 percent of the ground surface visible. There is a strong likelihood that more extensive research and even excavation would uncover more artifacts and evidence of prehistoric habitation.

The Wallis survey found a Matamoros dart point and Scallorn arrowhead, flake debris, and a sandstone anvil or "nutting stone" dating from the late Woodland or early Caddoan Periods, between 500 to 1500 A.D. The location of these finds, in the extreme southeastern part of the Mooser watershed, was registered as Turkey Mountain site 34Tu-22 with the Oklahoma Archaeological Survey.

Wallis found no prehistoric or historic archaeological sites within Turkey Mountain Park that might qualify for the National Register of Historic Places. The reason for finding no evidence of a Caddoan farming village or hunter-gatherer campsites along the lower bluff edge might have been the absence of notable fresh water springs. The prehistoric population of the area might have preferred to utilize water from the fresher side tributaries rather than the Arkansas River.

Figure VI-11:
Turkey Mountain
Archaeological
Survey Area

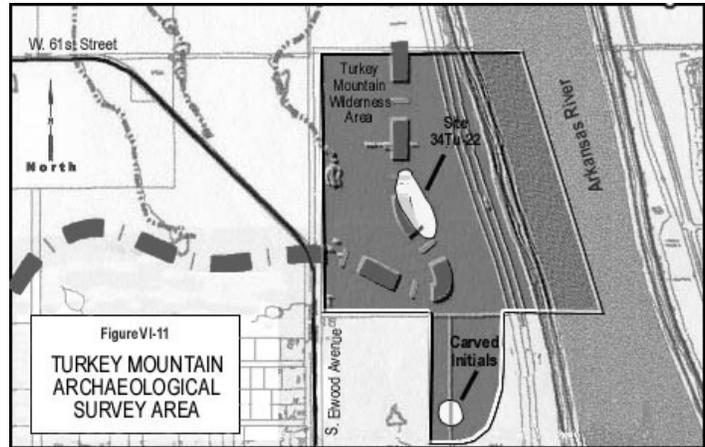
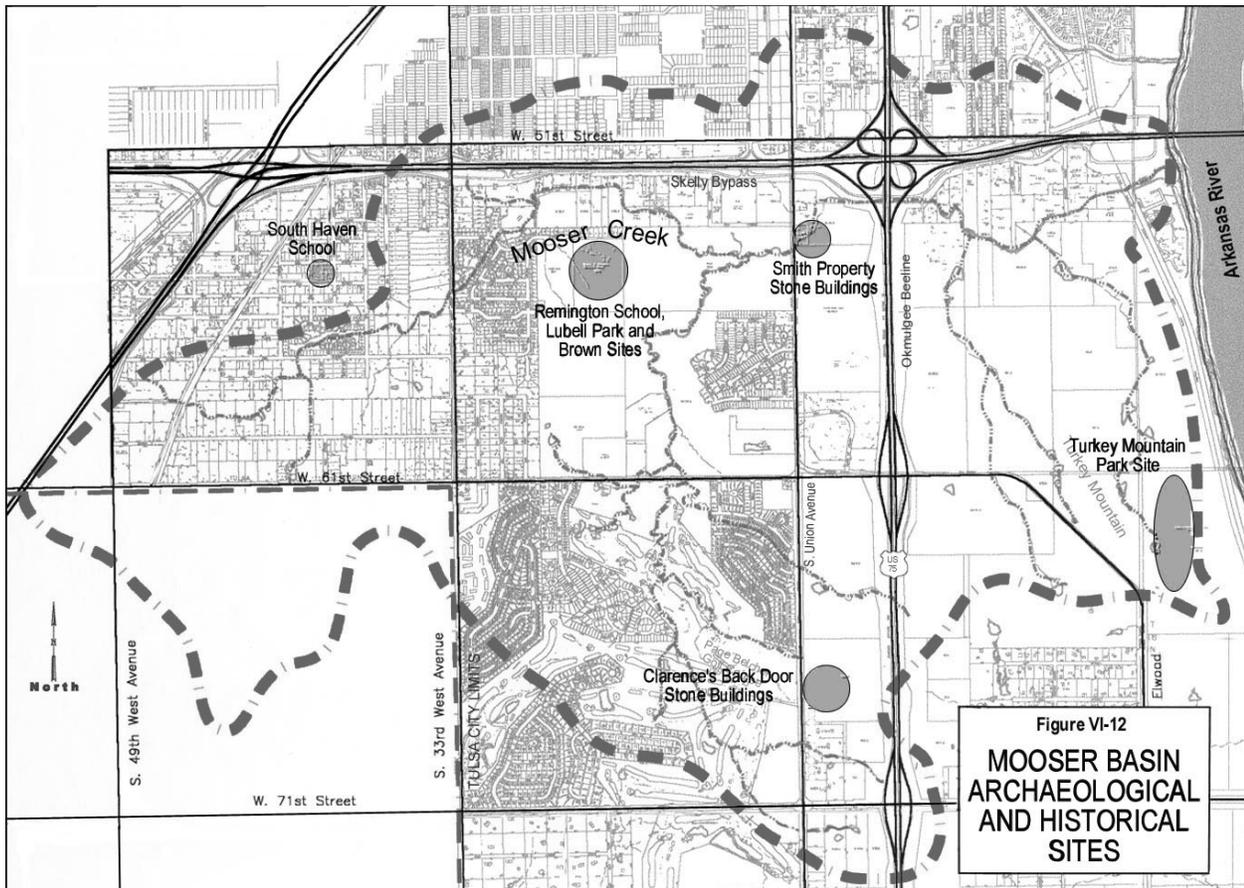
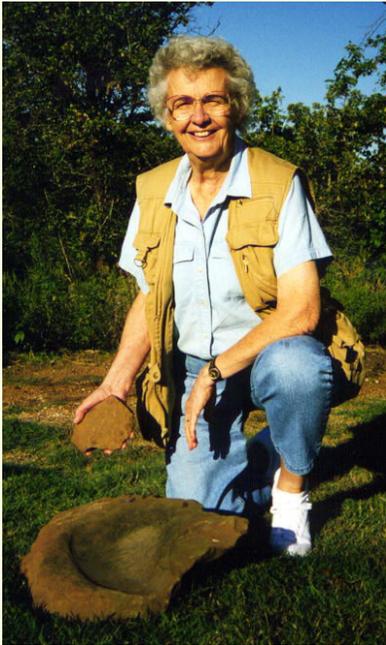


Figure VI-12:
Mooser Basin
Archaeological and
Historical Sites



PREHISTORIC OCCUPATION SITE IN MOOSER WATERSHED



Jean Sinclair with a grinding basin (metate) and pestle (mano) found on the Remington Elementary School site.

From July 1997 to July 1998 a group of amateur and professional archaeologists conducted a survey of historical and archaeological sites in the Mooser Creek watershed, in connection with the Mooser Creek Greenway project. The inventory was led by Jean Sinclair and advised by Dr. George and Frieda Odell of the University of Tulsa and Dr. Robert Brooks of the Oklahoma Archaeological Survey. The bulk of the physical survey and excavation was done by Tulsa Archaeological Society members Sinclair, Leland Leslie, Charlie Gifford, Daryl Coly, Charles Surber, Paul Roberts, Herb Fritz and Bill O'Brien.



Archaeologists wonder if stones like this one – found near Remington Elementary School—were used to sharpen tools.

The survey team discovered two sites of considerable interest to archaeologists and historians—one near Remington Elementary School and the other in Lubell Park. Both sites are on a high knoll overlooking Mooser Creek and one of its main tributaries.

At the Remington site, the survey found several *metates* (grinding basins) and a *mano* (pestle), as well as a number of boulders with distinct grooves in them, where it appears that axes, celts, or other stone tools were manufactured or sharpened.

The most stunning discovery, however, was a 6-foot by 8-foot sandstone slab at Lubell Park with almost map-like engraved patterns on its upper surface. Although archaeologists have studied the unusual markings, no one yet has an explanation of their meaning or purpose. Dr. Brooks, of the Oklahoma Archaeological Survey, said there is nothing like the Remington-Lubell complex elsewhere in Oklahoma.

Photographs courtesy of Jean Sinclair



Amateur and professional archaeologists participated in the Mooser Creek resource inventory.



The tabular boulder, with its unusual engraved markings, continues to mystify archaeologists.

The recent survey by Jean Sinclair and the Tulsa Archaeological Society may have confirmed Wallis' hypothesis in the discovery of what appears to be a long-term habitation along Mooser Creek at Remington Elementary School and at Lubell Park and adjacent properties to the south.

Dr. George and Frida Odell advised the archaeological survey team's work in Mooser watershed.

At the Remington Elementary School site (34Tu132A), the team found a number of large boulders whose top surfaces were covered with distinct grooves thought to be of prehistoric origin. Although their purpose is unknown, these slabs and boulders appear to be locations where items such as axes, celts, or other ground stone tools were manufactured. At Lubell Park (34Tu134B), they discovered a large (6' x 8') sandstone slab engraved with almost map-like patterns.



Just south of the Remington and Lubell sites, on properties owned by Butler, Buford and Brown (known as the Brown site, 34Tu134C), the survey team uncovered a number of artifacts, which suggest the site might have been a prehistoric occupational or special activities area. These include mortar holes, a possible hearth, two complete matate (grinding stones), a matate broken into three pieces, one complete and one broken mano (hand-held stone, or pestle, used to grind against the matate), a flint scraping tool and a number of flint flakes. Dr. Robert Brooks of the Oklahoma Archaeological Survey believes the Remington and Lubell sites to be unique in Oklahoma and worthy of preservation.

Historical Resources

The greatest amount of material documented by Wallis' 1979 Turkey Mountain survey was historic in origin, most of it from 1900-1940. These included clear and purple glass, white and decorated ceramics, nails and bullet casings. The survey also noted the presence of several defunct oil wells and associated dump-site debris which appear to be pre-1925 in date. Of more interest, perhaps, were a number of historic "rock carvings" or carved initials along the upper southern crest where the sandstone rock breaks away from the ridge. The majority of these carvings date from the 1930s.

One site of interest, immediately east of the entrance to the Page Belcher Golf Course, contains four stone buildings that appear to date from between 1925-1935. The structure facing Union Avenue was once (ca. 1930) a bar and barbecue known as "Clarence's Back Door." Area residents report that it had a bad reputation and was a "real dive." It was here that the body of Cleo Epps, Tulsa's "Queen of Bootleggers," was found stuffed into a septic tank on February 25, 1971, about six months after she testified before a grand jury probing criminal activity in Tulsa County.

Surprisingly little remains in the basin from the Indian Nation period of Tulsa County history or from the time of allotment, around 1900. The stone house and buildings on the Smith property on the east side of Union Avenue and just north of Mooser Creek, stand on the Sammie Naharkey allotment, but appear to date from around 1925-1935. The stone barn across the creek appears to be the oldest structure in the area.

WEST TULSA HISTORIANS TRACK DOWN MOOSER PAST



David Breed stands among the ruins of "Clarence's Back Door" (now demolished), where Cleo Epps' body was found in February 1971.

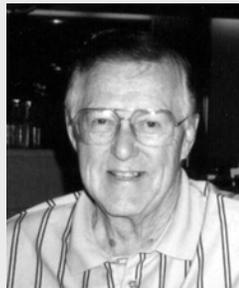
In February 1971, the body of Cleo Epps, the "Queen of the Bootleggers", was found stuffed into a septic tank near an abandoned stone building at 65th and Union Avenue, across from the entrance to Page Belcher Golf Course. She had been missing for three months, after leaving her pickup truck in the shopping center at 51st and Union.

During the 1940s and 1950s, Epps had made a fortune importing illegal booze into Oklahoma from her home on the Tulsa-Creek County line. The former school teacher "with a heart as wide as Texas" had many powerful and well-known friends, including judges and lawmen.

"Cleo Epps was very well thought of in west Tulsa," said City Councilor Darla Hall.

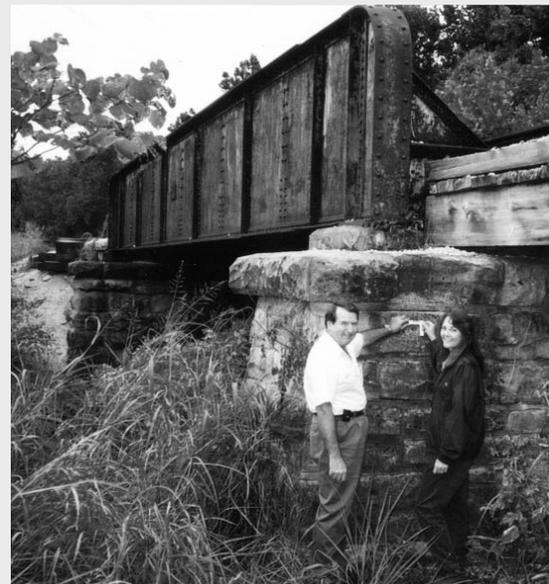
When a Tulsa grand jury began investigating the attempted assassination of District Judge Fred Nelson in October 1970, Mrs. Epps was persuaded to testify and appeared at the hearing disguised in a red wig and long coat. Three weeks later, she was shot in the back of the head and dumped on the grounds of the abandoned Bar-B-Que joint and saloon known as "Clarence's Back Door".

Southwest Tulsa Historical Society members Roy and Sherry Heim, David Breed, David Schumacher (deceased) and Bill O'Brien, among others, have been researching the history of Mooser Creek watershed as part of the Greenway project's resource inventory.



(Above) David Schumacher (left, deceased) and Bill O'Brien (right) have been avid researchers of west Tulsa history and archaeology.

(Right) Roy and Sherry Heim measure the stone-cutter's marks on the Missouri-Pacific Railroad trestle near 51st and Elwood.



(Below) Cleo Epps' body was found stuffed in a septic tank on an abandoned property in Mooser basin.

'Queen of Bootleggers' Knew Too Much

By Tarrell Lester
World Special Writer

She was described as a gracious and caring woman, this onetime school teacher.

She made a lot of money, and she made a lot of friends. Her funeral was attended by legislators and judges and men of powerful ranking. She was front-page news in life and in death. She knew the lawmakers and the law breakers.

She rubbed shoulders with

Tulsa's biggest outlaws and ultimately was rubbed out because she knew too much.

She was Cleo Epps, dubbed the "Queen of the Bootleggers" during the 1940s and '50s before liquor was legalized in Oklahoma.

At one time, it was said that she controlled the wholesale and retail moonshine traffic in several eastern Oklahoma counties.

From her home near the Tulsa-Creek County line between Tulsa and Sapulpa, she imported truckloads of illegal booze from out-of-state. She once told a

friend: "When I invest \$10,000 in a load of whiskey, I'll be doing the driving myself."

After Prohibition was repealed in Oklahoma in 1933, Epps apparently washed her hands of the whiskey business, although an acquaintance said, "She'd still make a dollar on it if she could."

In October 1970, a Tulsa County grand jury was seated to investigate the attempted assassination of District Judge Fred Nelson.

Nelson's car had been bombed, and he was critically

injured. Among the primary suspects was ex-convict Albert McDonald, who had lived in Collinsville and in Creek County. His attorney, in fact, conceded that "it is common knowledge that they are trying to link Al to the Nelson bombing."

Epps and McDonald were close friends — so close, in fact, that they had reportedly planned to marry at one time.

Additionally, Epps was said to have given McDonald and his running buddy, Tom Lester Pugh, some dynamite she had

buried on her farm for dynamiting stumps. A few days later, Nelson's car was bombed.

Still, law enforcement officers were not able to build a case strong enough to arrest McDonald and Pugh.

Tulsa District Attorney S.M. "Buddy" Fallis Jr. persuaded Epps to appear before the grand jury. Epps agreed, but only if she could do so anonymously.

"She was very polite, very calm, very soft-spoken," Fallis said later. "She was very gracious to me."

Wearing a red wig and a long coat, Epps was secretly whisked in and out of the grand jury See Epps on A-21



Cleo Epps

Another historic building that might be worthy of preservation is the old South Haven School, built in 1919. It is located just on the edge of Mooser Creek watershed at South 54th Street and 40th West Avenue. The original frame building was expanded with a brick wing in 1953. It served the black community in South Haven as an elementary school until it was closed in 1967 and its 92 pupils integrated into Remington Elementary. For a time the buildings served as the South Haven Community Center.

TRANSPORTATION

Mooser watershed is served by one of the best transportation networks in the city. This includes three freeways in addition to the usual square-mile grid of major arterial streets.

Interstate-44 (Skelly Bypass), a 6-lane expressway, cuts east-west through the basin just south of 51st Street, with on/off ramps at Elwood, Union Avenue, and 33rd West Avenue. The service road on the south side of I-44 is an important basin thoroughfare, connecting the Industrial Zone to the freeway network and the arterial grid. At Olympia Avenue and at 26th West Avenue, this service road is under water during a 100-year flood.

U.S. Highway 75 (Okmulgee Expressway), a 4-lane north-south expressway, passes through Mooser basin just east of Union Avenue. It has on/off ramps at 61st and 71st Streets, and an interchange with I-44 just southeast of 51st and Union Avenue. As the basin develops, parallel service roads and internal collectors will carry traffic from the freeway network and major arterials to and from the Okmulgee Expressway Corridor's commercial and multifamily uses.

I-244, linking downtown Tulsa's expressway net with I-44, skirts the western boundary of the watershed and intersects with I-44 just south of 51st Street and 41st West Avenue.

The basin's square-mile grid of major arterial streets includes (going east-west) Elwood Avenue, Union Avenue, 33 West Avenue, and 49th West Avenue; and (going north-south) South 51st, 61st, and 71st Streets. Elwood Avenue has not been completed north of 61st Street, but veers northwest at about 65th Street, away from the Turkey Mountain Wilderness Area, to join 61st Street at about Jackson Avenue.

As discussed in greater detail below in "Stormwater Facilities" section, a number of roads and bridges within Mooser basin are flooded and impassable during a 100-year storm. Some of these are scheduled to be replaced under the stormwater facilities plan and have been incorporated into the Mooser Creek Greenway Final Plan. Others will be fixed as part of Tulsa's street and roads maintenance budget.

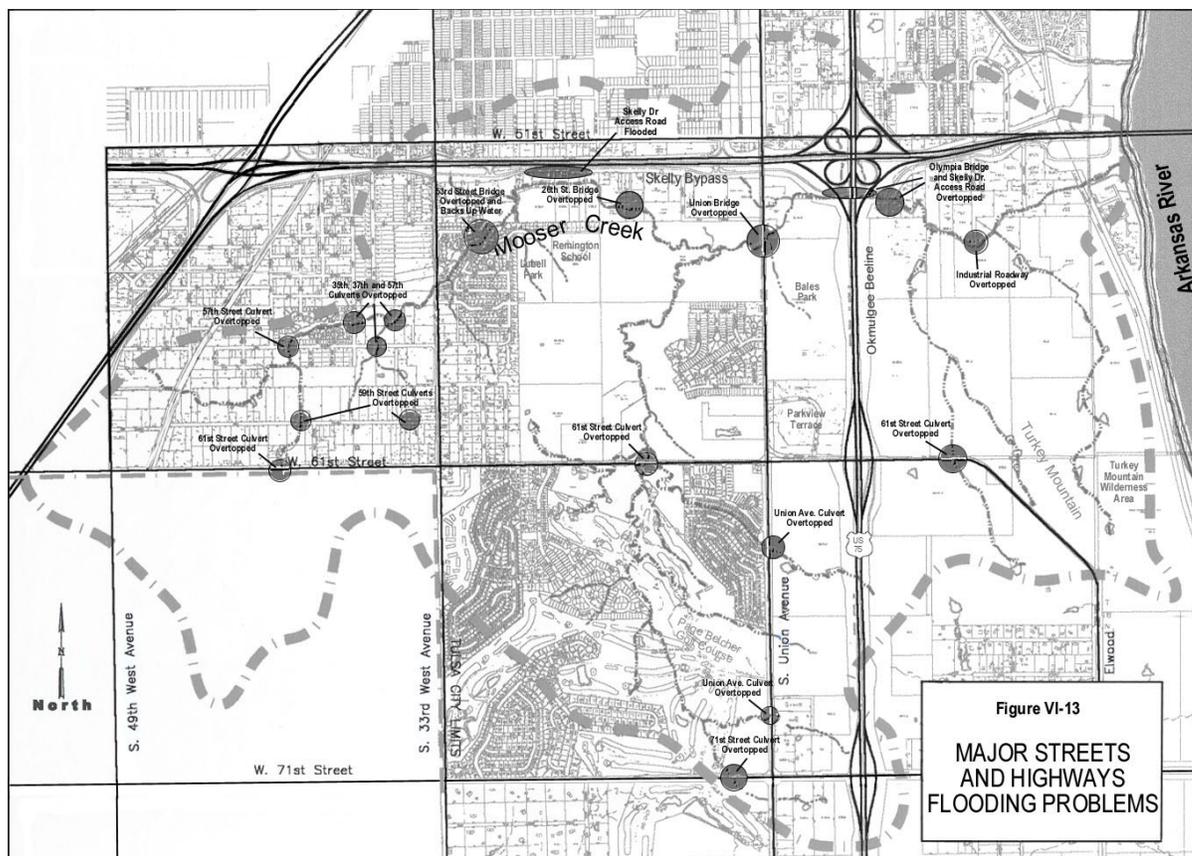
The Okmulgee Expressway—or U.S. Highway 75—looking south from 61st Street



These transportation grid problem areas are listed in the following table and identified in Figure VI-13, below:

ROADS AND BRIDGES FLOODED DURING 100-YEAR STORM		
Basin	Reach Description	Roadway, Bridge or Culvert
MA-2	Tributary B to Olympia Ave. (0.44 miles)	1 industrial roadway would be overtopped by 7.8 feet.
MA-3	Olympia Ave. to Tributary ME (0.63 miles)	I-44 access road overtopped. Union and Olympia Ave. bridges would be overtopped and impassable.
MA-5	24 th W. Ave to 33 rd W. Ave. (0.70 miles)	Flooding of Skelly Dr. access road and one lane of I-44 from 25 th to 29 th W. Ave. 26 th St. bridge overtopped; 53 rd St. bridge backs water and creates high velocities downstream.
MA-6	33 rd W. Ave. to Tributary MN (0.65 miles)	4 road crossings would be overtopped: 35 th W. Ave.; 37 th W. Ave.; 57 th W. Ave.
MC-1	Tributary MC (1.21 miles)	61 st St. culvert overtopped.
ME-1	Tributaries ME, MF, MG, MH, MI, MJ, MK, ML	Bridges and culverts overtopped on ME at 61 st St. and 71 st St.; MI at 61 st St.; MJ at Union Ave.
MM-1	Tributary MM (0.42 miles)	57 th St. culvert overtopped.
MN-1	Tributary MN (0.21 miles)	59 th St. and 61 st St. culverts would be under water.

Figure VI-13:
Major Streets and Highways
Flooding Problems



Public Transportation

Tulsa Transit Bus 17 (“Southwest Blvd.”) serves the Mooser watershed with clockwise and counter clockwise routes. Busses leave each half-hour from Bay 7 at the Denver Avenue Station and travel via Union Avenue, Southwest Boulevard, 51st Street, 33rd and 49th West Avenues, and 61st Street to South Haven Manor, Towne West and Parkview Terrace. A round trip takes about one and one-half hours.

The *Tulsa Bicycle, Pedestrian and Transit Linkages Study Final Report* (1997) does not recommend any additional public transit service to this part of the city.

Sidewalks

There are only two sidewalks along major arterial streets in the Mooser watershed: one running north-south on 33rd West Avenue, and the other going east-west along 51st Street between the Arkansas River and Union Avenue. The *Tulsa Bicycle, Pedestrian and Transit Linkages Study* proposes four additional sidewalks: east-west along 51st Street between Union and 33rd West Avenue; east-west on 53rd Street between 33rd West Avenue and Remington Elementary School; north-south along 33rd West Avenue between 41st and 51st Street; and north-south on Union Avenue between 41st and 61st Street. The study also recommends a sidewalk along 25th West Avenue (an internal collector street) between 41st and 51st Street.

Bicycle Lanes and Paths

At present there are no designated bicycle lanes in the Mooser basin. The *Tulsa Bicycle, Pedestrian and Transit Linkages Study* recommends that lanes be designated north-south along 33rd West Avenue from 41st to 91st Street; north-south along Elwood Avenue between 61st and 91st Street; and east-west along 61st Street between 33rd West Avenue and Elwood Avenue.

Multi-use Hiker-Biker Trails

There are presently no hiker-biker trails in the Mooser watershed.

The *Tulsa Bicycle, Pedestrian and Transit Linkages Study* recommends a multi-use trail along Mooser Creek west from the Arkansas River to 33rd West Avenue, with a southern spur along Mooser Tributary ME to 61st Street. These trails would link to the proposed Sapulpa-Tulsa trail.

Mooser Greenway will have over 15 miles of all-weather hiker-biker trails.

INCOG’s Comprehensive Plan calls for the provision of walkways and bikeways to serve Southwest Tulsa’s neighborhoods, schools, recreation areas and shopping centers.

The River Parks Authority has approval and funding for a multi-use trail along the west side of the Arkansas River from 31st to 71st Street. This has been funded in three sections: (1) the 1.5 mile-long PSO (Public Service Company of



Oklahoma) Trail from the 32nd Street Pedestrian Bridge to the PSO soccer fields; the Cherry Creek/Red Fork Trail, on the Arkansas River west bank from the PSO soccer fields to Cherry Creek (about 49th Street), then northwest along the creek to 41st Street; and the West Bank Trail along the Arkansas River from 49th Street through the Turkey Mountain Wilderness Area to the 71st Street bridge.

Future Trail Connections

Future trails planned for Southwest Tulsa are a 3.25-mile Jenks Missouri-Pacific Trail along the west bank of the Arkansas River from 71st Street to 101st Street; a 13-mile Southwest Boulevard/Old Sapulpa linkage; and a 5.33-mile West 41st Street Trail from Reed Park to Highway 97.

WATER AND SEWER

Lack of public infrastructure, particularly water and sewer service, has been a major factor preventing the full development of Mooser basin. As discussed previously, this has been largely a result of Mooser's geology with its massive sandstone strata. Several recently-funded public works projects are aimed at providing this infrastructure. Existing water and sewer lines in Mooser Creek watershed are shown in Figure VI-14, page VI-30.

Water

In June 1998 there were 2,066 miles of water lines in the City water system providing water at a pressure of at least 40 pounds per square inch. Tulsa serves the Mooser basin through mains running north-south along Union Avenue and 33rd West Avenue, and east-west along 48th Street in Carbondale, along the south side of I-44, and along 61st Street. Distribution lines connect these mains to all subdivisions, homes and businesses in the basin.

*10-million-gallon
water tank on
Turkey Mountain*



The City recently completed two major distribution projects in the Mooser watershed: the 36-inch 9.5-mile Southwest Loop, and the 10-million-gallon Turkey Mountain Storage Tank. The new line connects the 36-inch main that ended at South 131st Street and Elwood to a 36-inch main at South 48th Street and 25th West Avenue. The Loop ties in to the new water tank on Turkey Mountain.

Future water projects related to the Mooser basin are the \$1.9 million cleaning and cementing of the 36-inch 49th Street main from Lewis Avenue to 33rd West Avenue (scheduled for 2000); \$3 million 36-inch 41st Street main from Lewis Avenue to Elwood Avenue (in 2004); and the \$2.8 million 36-inch main along either 61st or 71st Street between Lewis and Elwood Avenue (in 2003 and 2004). Also planned is a \$2.1 million Turkey Mountain Secondary Service Area (for 2003).

Eventually, as demand requires, two new 10-million gallon storage tanks will be built on Turkey Mountain. This additional storage will allow the full development of the Okmulgee Expressway Corridor and Southwest Tulsa and provide additional pressure for the City's water system.

Tulsa's Comprehensive Plan calls for the phasing out of Creek County Rural Water District Nos. 2 and 4, and the provision of water for all the basin's needs, including fire protection.

Sewer

Mooser basin is served by the Southside Wastewater Treatment Plant at 52nd Street and the Arkansas River. The plant has a capacity of 42 million gallons per day and serves both South and Southwest Tulsa.

Many older homes in the Mooser watershed were on private septic systems until the completion of a Mooser relief main from South Haven Manor to the treatment plant in 1996.

Another major interceptor sewer runs down Tributary ME from about 65th Street to Mooser mainstem, where it joins the Mooser relief main. This line services Woodview Heights, Parkview Terrace, Riverfield Country Day School, Page Belcher Golf Course and the West Highlands subdivisions. These lines will be extended eastward to serve the commercial and multifamily uses planned for the west side of the Okmulgee Expressway.

Future interceptor sewer lines will run down Mooser Tributaries MB and MC to serve the residential and commercial uses expected to develop between the Okmulgee Expressway and the Arkansas River.

STORMWATER FACILITIES

Mooser Creek in Tulsa's Master Drainage Plan

The 1988 *Southwest Master Drainage Plan* divided Mooser mainstem into seven reaches (MA-1 to MA-7) and identified 13 tributaries (MB, MC, MD, ME, MF, MG, MH, MI, MJ, MK, ML, MN, MM, and MP). Streamflows for 100-year storms were calculated for current and ultimate development based on such things as land uses, channel characteristics, geology, soils, topography and vegetation. The measurements were summarized in the Hydrology section (p. VI-13).

The study identified seven commercial buildings in the floodplain between the Arkansas River and Tributary MB. Four of these would have flood depths above their first finished floor elevations during the 100-year flood, largely due to Arkansas River backup and channel constriction by the Elwood Avenue Bridge. The SW Master Drainage Plan recommended a 575-ft trapezoidal, fabriform-lined channel, a 717-ft trapezoidal, grass-lined channel, and the replacement of a private bridge on this reach.

From Tributary MB to the Olympia Avenue Bridge, there are three commercial buildings in the floodplain, all of which would have water above their first finished floor elevations in the event of a 100-year storm. In addition, the Olympia Avenue Bridge would be overtopped and impassable. The SW Master Drainage Plan recommended a 1,028-ft trapezoidal, grass-lined channel for this reach and the eventual replacement of the Olympia Avenue Bridge.

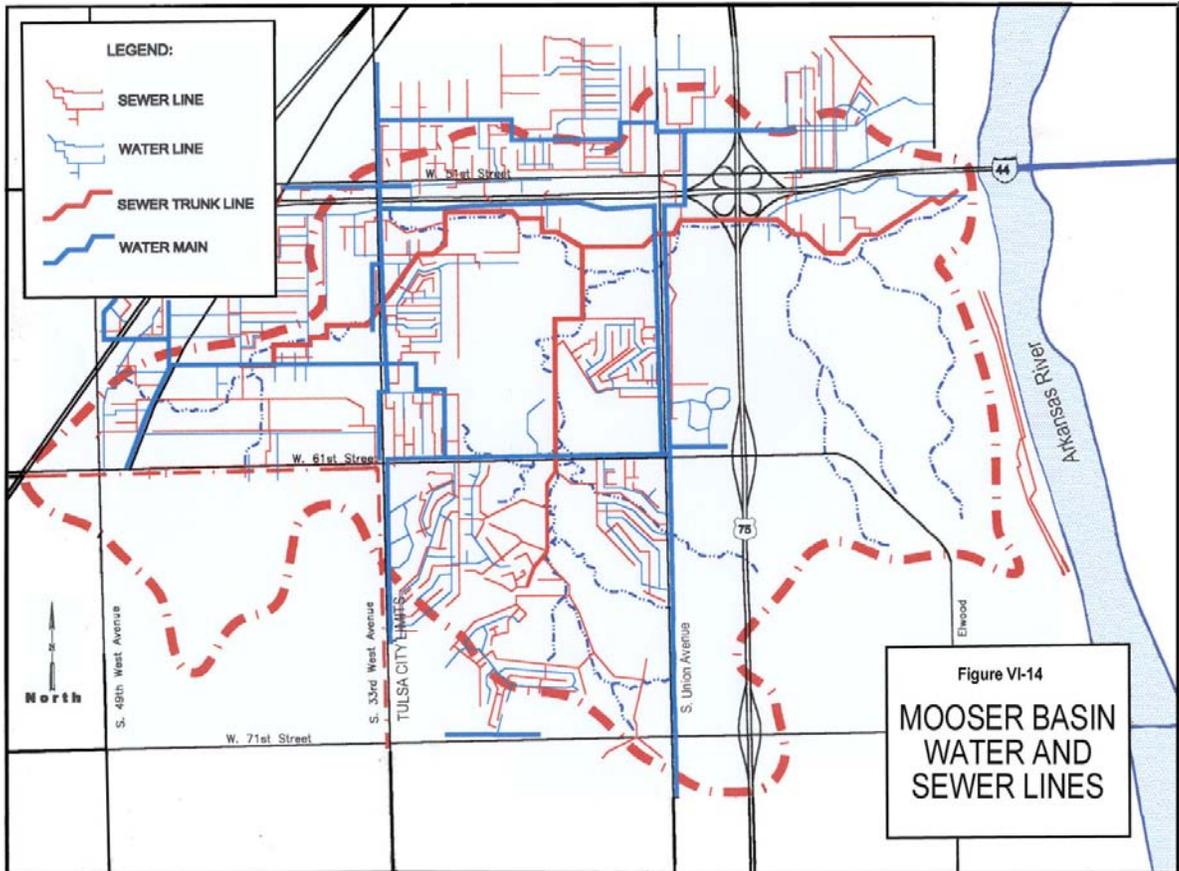
There are four commercial and two residential buildings in the floodplain between Olympia Avenue and Tributary ME. Of these, three commercial buildings and two residences would have water above their first finished floor elevations during a 100-year flood. The I-44 access road and Union Avenue Bridge would be overtopped and impassable. The SW Master Drainage Plan recommended the voluntary acquisition and demolition of two houses, the floodproofing of two residences and two commercial buildings, and the replacement of the Union Avenue Bridge.

Olympia Avenue bridge constricts peak flows and will be replaced.



Figure VI-14:
Mooser Basin Water
and Sewer Lines

From Tributary ME to 24th West Avenue, Mooser's relatively shallow channel would cause the stream to overrun its banks and inundate one commercial building. The SW Master Drainage Plan recommended the floodproofing of this building.



Between 24th West Avenue and 33rd West Avenue, there are eight commercial buildings and eight residences in the floodplain. Five commercial buildings between 24th West Avenue and the 53rd Street Bridge would be flooded during a 100-year storm; the 26th Street Bridge would be overtopped; and the Skelly Drive access road and one lane of I-44 would be flooded and impassable. There are seven residences in the floodplain in Mountain Manor subdivision, between the 53rd Street Bridge and 33rd West Avenue. Five of these would be inundated during a 100-year event, while a total of 15 residences would experience backyard flooding. The SW Master Drainage Plan recommended a 1,300-ft trapezoidal, grass-lined channel and replacing an existing bridge and low-water crossing between 24th and 29th West Avenues; replacing the undersized 53rd Street bridge; and floodproofing one residence.

There are 32 residences in the floodplain between 33rd West Avenue and Tributary MN. Of these, 23 would be flooded during a 100-year storm. In addition, four road crossings would be overtopped: 33rd West Avenue, 35th West Avenue, 37th West Avenue, and 57th Street. The SW Master Drainage Plan recommended the construction of a 4-ft high floodwall on the south side of the channel between 37th West Avenue and 57th Street; replacing the culverts at 37th West Avenue and 57th Street; floodproofing five residences; and improving a stretch of 57th Street.

There are no structures in the floodplains of Tributaries MB, MC or MD. The culvert on Tributary MC at 61st Street would be overtopped during a 100-year event. The SW Master Drainage Plan recommended enlarging this culvert.

53rd Street Bridge causes backup flooding and will be enlarged.

Tributary ME runs south from Mooser mainstem at about Waco Avenue, and carries the runoff from Tributaries MF through ML. The following structures would be overtopped on these tributaries during a 100-year flood: 61st and 71st Street culverts on ME; 61st Street culvert on MI; and the Union Avenue culvert on MJ. The SW Master Drainage Plan recommended enlarging these culverts.

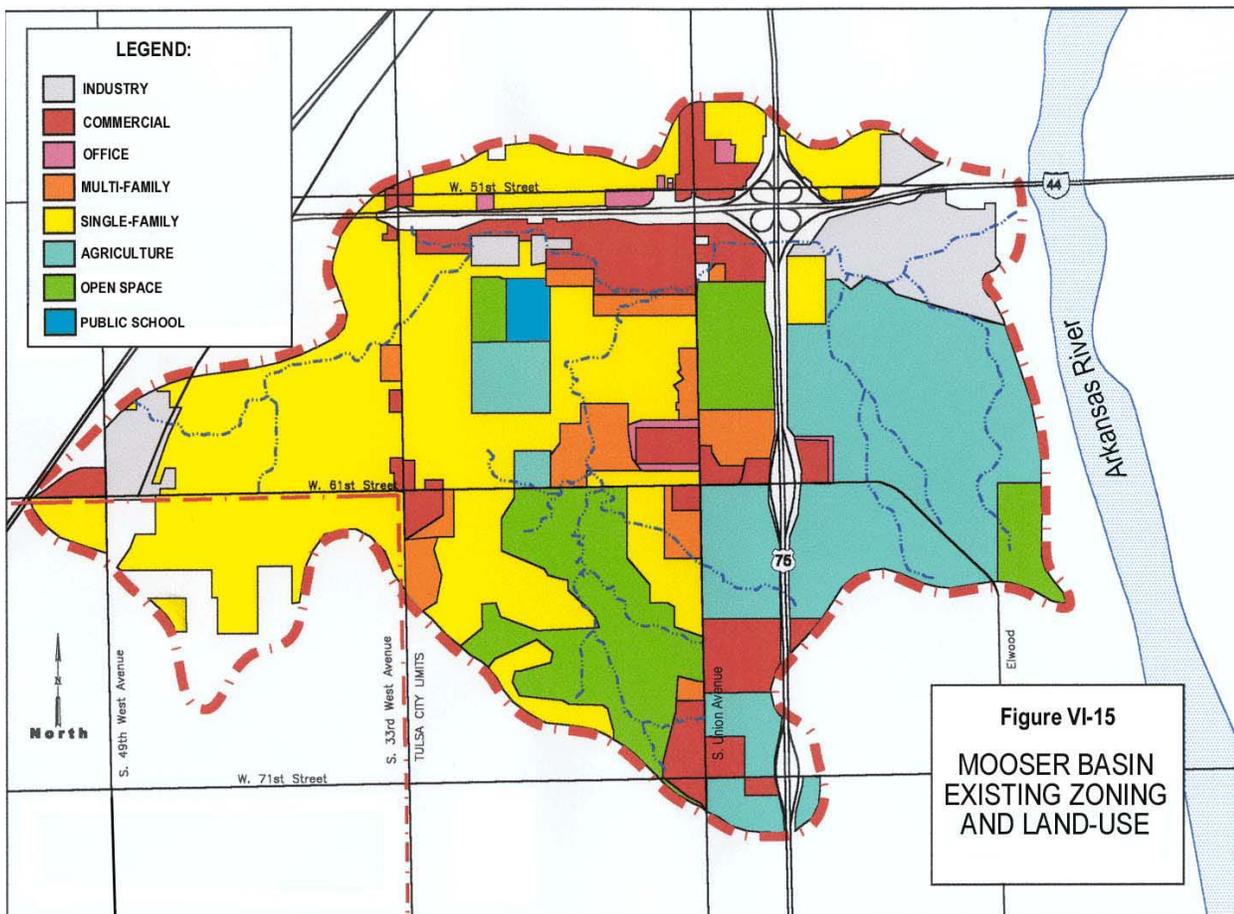


Tributary MM runs south from Mooser mainstem at about 56th Street and 35th West Avenue. There are no structures in the floodplain, but the culvert at 57th Street on Tributary MM would be overtopped during a 100-year flood. The SW Master Drainage Plan recommended its enlargement.

Tributary MN, which runs south at about 41st West Avenue between 57th and 61st Streets, has two residences and one mobile home in the floodplain. These would not be flooded during a 100-year storm, but culverts at 59th and 61st Streets would be overtopped. The SW Master Drainage Plan recommended enlarging these culverts.

Since much of the watershed is public or semi-public open space and will not develop, peak flows are projected to increase under full development from 9,059 cfs to

*Figure VI-15:
Mooser Basin Existing
Zoning and Land Use*



9,299 cfs, an increase of only 2.6%. By preserving existing floodplain storage, much of the potential increase in peak flows due to development will be alleviated.

The SW Master Drainage Plan proposed 15 miles of pedestrian-bicycle trails to link portions of Mooser Creek with the River Parks and Tulsa Trails Systems. Many of these trails would utilize the channel improvements, open channels and preserved floodplains recommended in the Plan. The Plan also suggested a joint detention area west of Union Avenue, which would be used for trails, playgrounds, ball fields, picnic areas and open space.

LAND USE

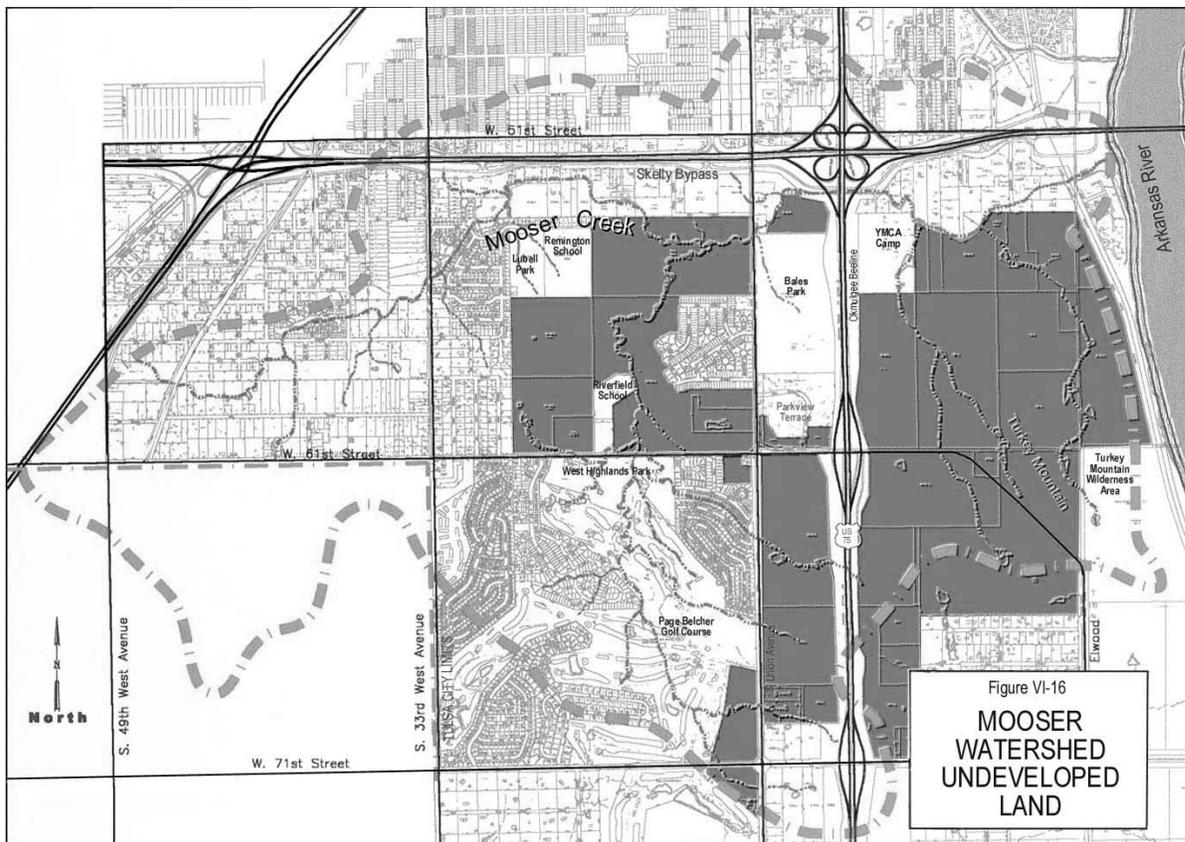
Existing Land Use

The 3,236-acre Mooser watershed is 65 percent developed (2103 acres) and 34 percent undeveloped (1133 acres). The largest land use is agricultural. As can be seen in Figure VI-16, most of this is located east of Union Avenue, although about 280 acres are on the west side of Union between 51st and 61st Street. The largest urban land use is paved streets and highways, which occupy about 28 percent of the basin, or 906 acres.

Single-family residential development, almost all of it west of Union Avenue, occupies 19.5 percent of the watershed, or 631 acres. Note that some of the land presently zoned SF (yellow on the map) is actually undeveloped—as can be seen by comparing Figures VI-15 and VI-16.

Parks and recreation make up 12 percent of the watershed, or 388 acres. Southwest Tulsa has more parkland per 1000 population than any other part of the city but one, and

Figure VI-16:
Mooser Watershed
Undeveloped Land



virtually all of it is in the Mooser basin. The largest park is Page Belcher Golf Course, followed by Bales Park, Turkey Mountain Wilderness Area, West Highlands Park, Lubell Park, Schlegel Park, and Carbondale Park. This land use is discussed more fully in the section entitled “Publicly-Owned Land,” p. VI-36.

Industrial land currently occupies 2.5 percent of the watershed, or 81 acres, most of it along the south side of I-44, at the extreme east and west ends of Mooser Creek. Pepsi Cola Bottling Company, just west of Elwood Avenue, is the basin’s largest industry.

Public or quasi-public land, such as the YMCA Camp and Remington Elementary School, occupies 2.4 percent of the basin, or 78 acres. This category includes, as well, such things as the Southwest Wastewater Treatment Plant, water storage facilities on Turkey Mountain, and fire stations

Multifamily residential occupies 1.8 percent of the land, or about 60 acres. This includes Parkview Terrace, South Haven Manor, Overlook Apartments, and a senior care facility on 33rd West Avenue.

Commercial/Office use takes up 1 percent of the watershed, or 32 acres. Most of this is on the south side of I-44, along 51st Street, and at commercial nodes such as Sunset Highlands Plaza at 61st Street and 33rd West Avenue.



I-44 (Skelly Bypass) Frontage Area, with the YMCA Camp in the lower right, and Pepsi Cola in the middle distance.

FUTURE LAND USE

Under full development, Mooser’s 3,236 acres will be 41.8 percent single-family (1353 acres), 27.9 percent paved streets and highways (903 acres), 11.7 percent parks and recreation (379 acres), 10.6 percent office and commercial (343 acres), 4 percent industrial (129 acres), 1.9 percent public or quasi-public (61 acres), and 1.9 percent multifamily residential (61 acres). These uses are shown in Figure VI-17, “Mooser Watershed Ultimate Projected Land-Use.”

These numbers assume the use of all land in the watershed. However, 254 acres, or 7.8 percent of the basin is floodplain and likely to remain sparsely developed, even if zoned single-family residential. There is also a considerable amount of land that qualifies as Development Sensitive due to the steepness of the terrain. INCOG’s Comprehensive Plan, recommends that much of this land remain undeveloped to preserve the natural beauty of the area.

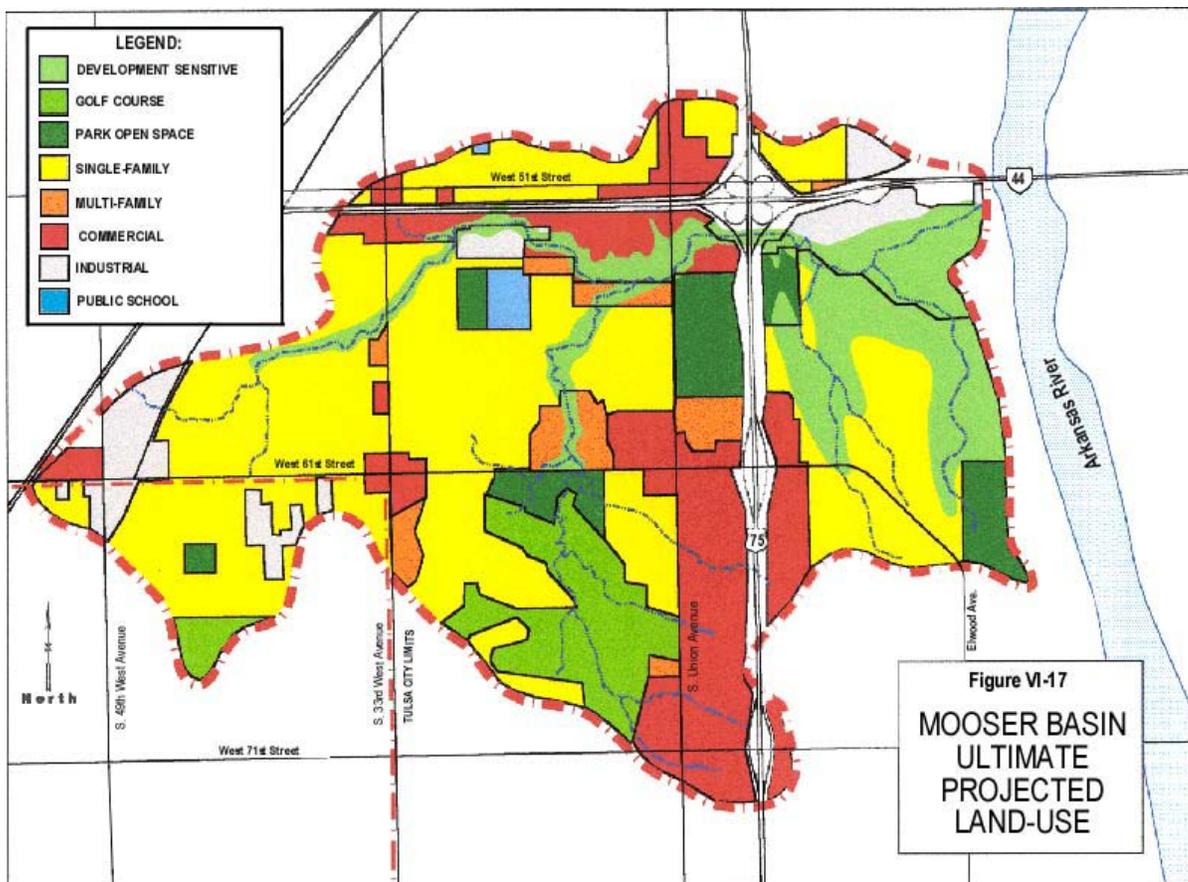
Mooser Creek in INCOG’s Comprehensive Plan

Most of the Mooser watershed lies within the boundaries of INCOG’s Comprehensive Plan for District 8. Those areas that are outside the Plan are Carbondale neighborhoods north of I-44, and the Mooser Creek reaches in Creek County.

There are four Special Districts in the Mooser watershed: Skelly Drive (I-44) Frontage Areas, Turkey Mountain, the Arkansas River Corridor, and the Beeline (Okmulgee Expressway) Corridor. These are shown in Figure VI-18 on page VI-35.

The Skelly Drive Frontage Area is located along the south side of I-44 from Elwood Avenue west to I-244 and south to 61st Street. This district is divided into three sections. Elwood Avenue to the Okmulgee Expressway is reserved for light industrial uses, particularly those requiring highway transport. From the Expressway to Tulsa-Sapulpa Union Railway is reserved for commercial uses, especially those that are highway-oriented. The western section, from the Sapulpa Union Railway to I-244 and south to 61st Street, is for highway- and rail-oriented commercial and industrial uses. Residential land in this section is to be converted to commercial and light-industrial uses and substandard areas are to be improved.

Figure VI-17:
Mooser Basin Ultimate
Projected Land Use



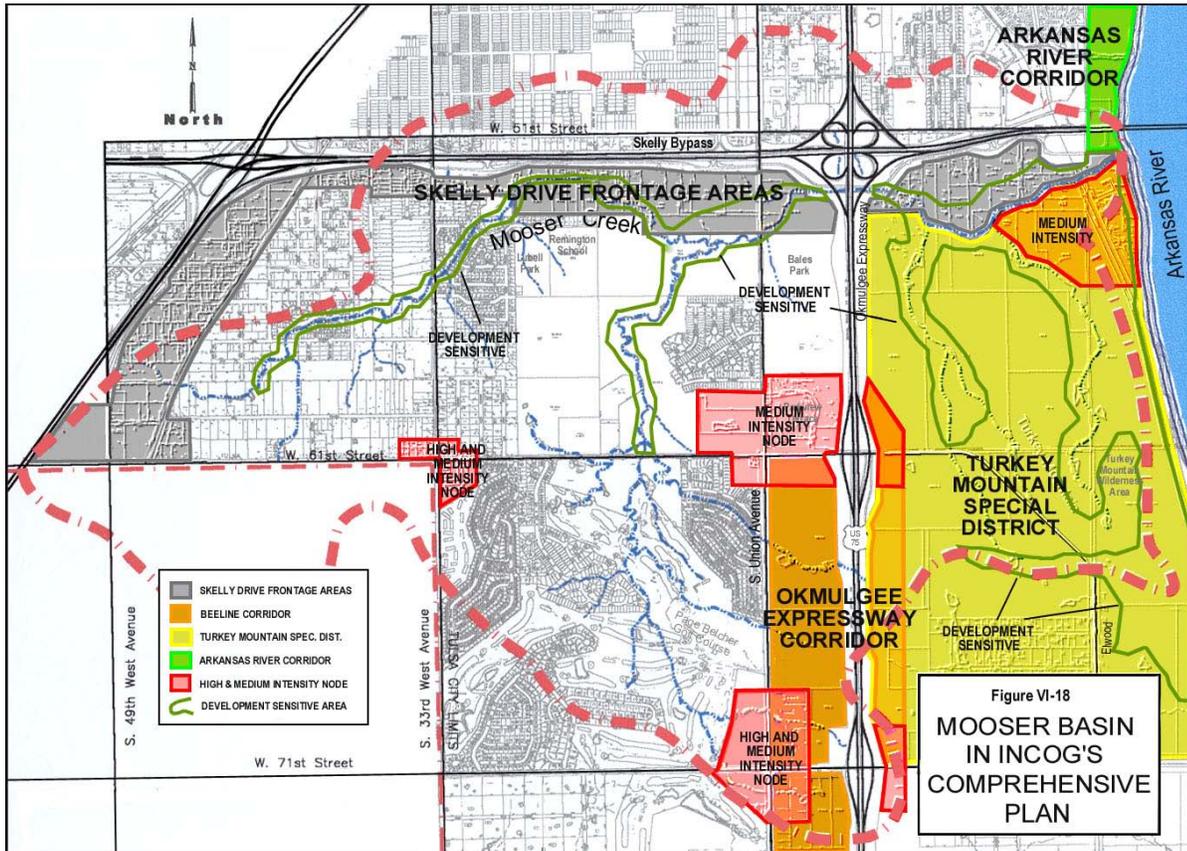
The Beeline Corridor lies between the Okmulgee Expressway and Union Avenue, and from 61st Street south to 91st Street. This district is reserved for low- and medium-intensity multifunctional uses, compatible with existing and potential low-intensity residential development within the corridor and on the west side of Union Avenue. Development in the Corridor is to be restricted to residential, multi-family, office or commercial uses, with appropriate transitions in intensity from one use to another, and strip commercial development avoided. Sign controls will be used to assure a uniform character to the area and guard against visual clutter. The Plan encourages developments and designs that make best use of the district’s natural beauty and rugged terrain.

The Turkey Mountain Special District reaches, generally, from Mooser Creek south to 71st Street, and from the Arkansas River west to the Okmulgee Expressway. The Plan recommends that the area’s unique physical and visual features be used to anchor (and buffer) River Parks, and that more park land be acquired. The river bluff areas should be

protected and development-sensitive land identified. Low intensity zoning (RS-1) is proposed for the district, except for a commercial corridor along the east side of the Okmulgee Expressway north and south of 61st Street.

The Arkansas River Corridor Special District, along the eastern boundary of Mooser basin, should develop compatibly with River Parks, achieve high environmental quality, and maintain the integrity of the area.

Figure VI-18:
Mooser Basin in
INCOG's
Comprehensive Plan



The Comprehensive Plan calls for containing all medium- and high-intensity development within the Okmulgee Expressway Corridor, the adjacent corners (or intersections) major arterial streets, and the Skelly Drive (I-44) Frontage Area, except for those tracts already zoned commercial. District shopping, services and light-intensity office should be in nodal areas, with region serving commercial, such as shopping centers, theaters, restaurants and light- and medium-intensity offices concentrated in the Expressway Corridor.

Substandard structures and grounds in the district are to be rehabilitated and brought up to reasonable standards by appropriate means, and existing high-quality areas kept in good repair. Rehabilitation should be through private enterprise, and public agencies employed only where market-based methods are not practicable.

Residential neighborhoods should be protected, maintained and enhanced; buffered from the adverse influences of other uses and transportation facilities; should retain their natural beauty; and have stable or rising values. The area is expected to provide its fair share of publicly subsidized housing.

Development Sensitive Areas are designated in the Plan to identify and preserve Southwest Tulsa’s natural features and ecology. These include floodplains, erodible soils on slopes exceeding 20 percent, and areas that possess unique wildlife habitat, forests, or natural beauty—such as Mooser Creek and Turkey Mountain.

The Plan also seeks to identify Developmental Concerns Areas—where there are problems in five or more of the following criteria:

- soils
- slopes
- old well/possible mines
- municipal water and sewer
- internal transportation network
- vegetation
- airport obstruction
- drainage
- existing development

Areas designated Development Sensitive and Developmental Concern are recommended for low-intensity zoning, unless accompanied by a PUD.

To eliminate roadside dumping, the Plan encourages neighborhood vigilance and prosecution of offenders; the establishment of City-subsidized free dumping locations; and perhaps the creation of a City-County system for collecting solid wastes from residences in unincorporated areas.

PUBLICLY-OWNED LAND

Approximately 40 percent (or 1400 acres) of the Mooser watershed’s 3236 acres is comprised of public or quasi-public land, as shown in Figure VI-19 on page VI-37. The bulk of this land is dedicated to streets and highways, which cover about 28 percent, or 903 acres. Parks and recreational open space make up 12 percent, or 388 acres, while public or quasi-public land (such as the YMCA Camp and Remington Elementary School) occupies 2.4 percent, or 78 acres. The public housing projects at Parkview Terrace and South Haven Manor take up an additional 1.4 percent of the watershed, or 46 acres.

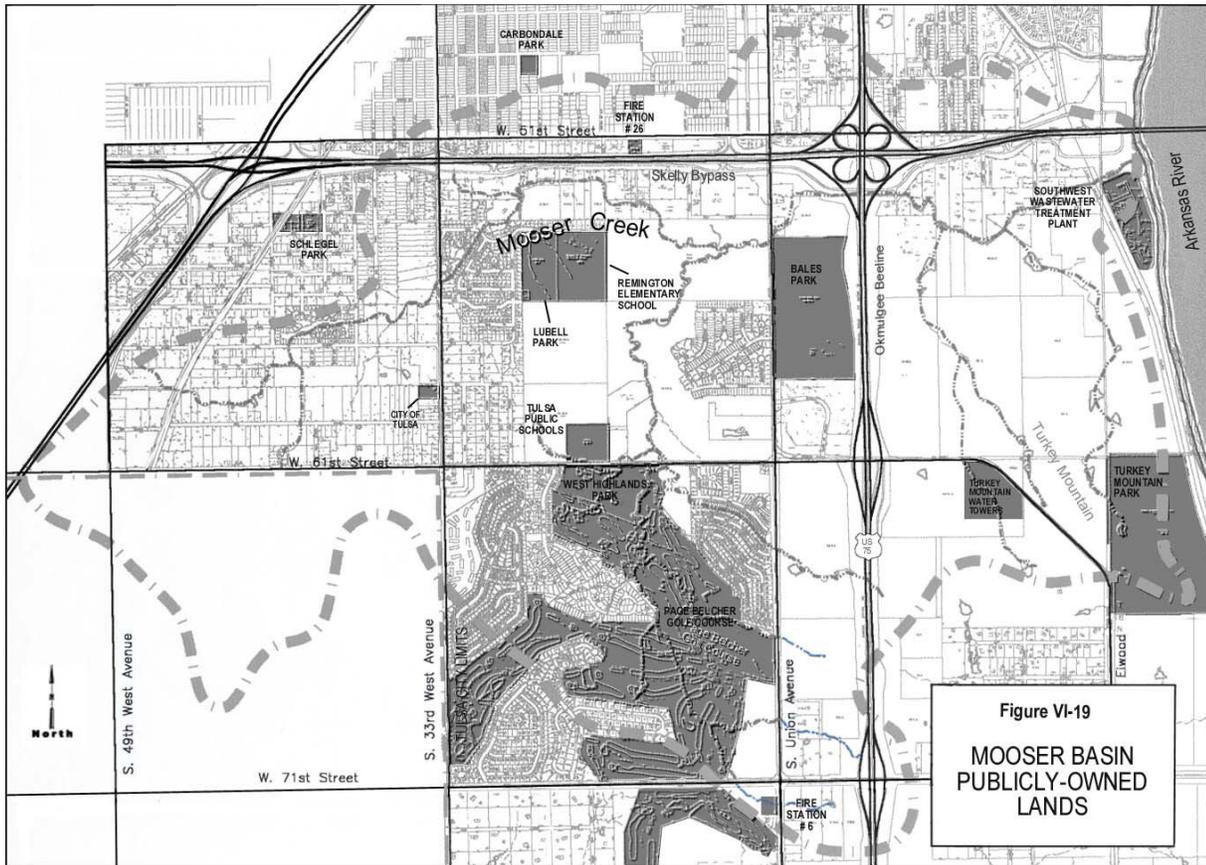
The clubhouse and putting green at Page Belcher Golf Course



At 326 acres, Page Belcher Golf Course is the largest of the watershed’s parks and recreational facilities. Located at 6600 South Union Avenue, the park contains two 18-hole golf courses (Page Belcher, completed in 1977, and Stone Creek, completed in 1987), a clubhouse and concession area, four restrooms, and 300 parking spaces. Approximately 195 acres of the park are within the basin. The Comprehensive Plan calls for development of Page Belcher into a metropolitan, family-centered recreational facility similar to LaFortune Park, with preference given to the needs and interests of teenagers.

River Parks' Turkey Mountain Wilderness Area is the basin's second largest publicly-owned property. It lies between 61st and 71st Street, and Elwood Avenue and the Arkansas River. Although the park occupies 140 acres (on land), only about 56 acres are within the Mooser watershed. The park contains the uppermost reach of Mooser tributary MB-1. There are 40 parking spaces and several miles of unimproved, unofficial pathways in the Wilderness Area. INCOG's Comprehensive Plan calls for the coordinated use of Turkey Mountain Park, other River Parks facilities and trails and the YMCA Camp.

Figure VI-19:
Mooser Basin Publicly-
Owned Lands



The 67-acre Bales Park, located at 5801 South Union Avenue, is the third largest park in the watershed. An unnamed Mooser Creek tributary runs from the center of the park down steeply falling ground to join the mainstem near the Union Avenue Bridge. At present, the park contains four lit baseball fields, a storage area, restrooms, and parking for 250 vehicles. Tulsa's Comprehensive Plan calls for the addition of a variety of community-type recreational facilities at Bales Park. Of special interest is the 17-acre mixed-grass prairie relict discovered by naturalists from the Oxley Nature Center during an inventory of the watershed's biological resources in 1997. The prairie is discussed in the Biological Survey section, pages VI-15 to 18.

West Highlands Park straddles Mooser Creek reach ME-2, just north of Page Belcher Golf Course, at 2626 West 61st Street. The 34-acre park contains a shelter with four tables and two grills, four tennis courts, a basketball court, an unlit baseball diamond with

CHURCH BRINGS NEW LIFE TO SOUTH HAVEN



Rev. Jones with the daughter of the new owner of Her House II built entirely by women.

Rev. Willard Jones is a man with a vision for South Haven.

The son of a Baptist minister, he was vice president of his senior class at Charles Page High School in Sand Springs and captain of the basketball team. A graduate of Northeastern, he has a masters degree in Education from Oklahoma State University. For the past four years he has been pastor of the Greater Cornerstone Baptist Church in historic South Haven, while working as recruiting manager for TCIM Services. He is on the board of Habitat for Humanity, a Christian charity whose goal is to eliminate poverty (substandard) housing worldwide.



A christening ceremony at the Greater Cornerstone Church welcomes new life into the community.

Rev. Jones' connections to South Haven go back 20 years, to when he and his brother played on Earl Chandler's championship Little League baseball team.

"I was shocked by what had happened to South Haven over the past 20 years," he said. "It was always a proud and close community with a great sports tradition and inspired coaches, like Earl Chandler and Aaron Scott. When I came back from California, where I had gone after finishing college, I found half the houses in South Haven had disappeared entirely, and many of the rest were empty. Yards were overgrown. Even



Like many black rural towns in the wake of integration, South Haven was largely depopulated during the 1970s and 1980s.

the Greater Cornerstone Church, which had been here for 70 years, was in disrepair."



Greater Cornerstone Baptist Church

At Rev. Jones' urging, Habitat for Humanity bought 76 lots in South Haven. It intends to build 48 houses there. Twenty have been completed—the first Habitat homes to be built on the west side. One of them, Her House II, was built entirely by women.

Rev. Jones considers South Haven and Habitat to be a perfect match. "I see neighborhoods full of children. I see families owning their own

homes. I see property values rising and the streets safe and clean. This community is going to live. Look around you. It's a beautiful area. It is a dream, a vision that's going to happen."

On a recent Sunday morning there were a hundred worshippers crowded into the Greater Cornerstone's small sanctuary. After the service, Rev. Jones christened two new members of the congregation. The joy and hope of the families gathered there were contagious. New life is indeed coming to South Haven.



A new Habitat for Humanity home built by Tulsa area Baptist churches.

There are two fire stations in the watershed. Station 6 is at 7212 South Union and Station 26 is at 2404 West 51st Street.

PRIVATELY-OWNED LAND

There are well over 1,000 privately owned parcels within the Mooser Creek watershed, most of which are residential lots west of Union Avenue and south of 51st Street. There are about a dozen large undeveloped tracts—most of them located south of Mooser Creek between Union Avenue and the Arkansas River. These are shown in Figure VI-20, Mooser Basin Property Ownership.

Major property owners in the Mooser watershed include Clyde and Sue Ferris (left) and Tom and Marty Clark (right).



The largest private landowners (holding more than 15 acres) are Ferris and Hunter, Dyer, Viersen, McGehee, Rego Enterprises, Lloyd's Investments, Okita Corporation, Ozark Commercial, Butler, Suppes, Woods, Martindale, Riverfield Country Day School, Kansas City Gas, and Pepsi Cola Bottling Company.

Owners of 5 to 15 acres include Johnson, Riverside Chevrolet, Buford, Hubbard, Karr, Rylander, New Life Pentecostal Church, Doenges, West Skelly Industrial, Monahan, and Kee.

There are approximately 49 properties which are within Mooser Creek's 100-year floodplain—20 on the east side of Union Avenue, and 29 on the west side. These properties contain 43 flood-prone structures. Eighteen of these are in South Haven Manor, four in Gantz Addition, six in Mountain Manor, four along I-44 between Mountain Manor and Union Avenue, four on Union Avenue, and seven on lower Mooser Creek between the Okmulgee Expressway and the Arkansas River.

There are 12 properties in the basin that have slopes in excess of 20 percent grade. These are owned by Ferris and Hunter, Dyer, Woods, Rego Enterprises, Lloyds Investments, Viersen, YMCA Camp, McGehee, Okita Corporation, Riverfield Country Day School, Johnson, and Suppes.

About 33 properties would be crossed by Mooser Creek Greenway trails (not including sidewalk trails). Of these, 16 are on the east side of Union Avenue and 17 on the west side.

VII ISSUES AND OPPORTUNITIES

ENVISIONING SOUTHWEST TULSA

The Mooser Creek Greenway project has given residents, stakeholders and City officials an opportunity to shape a consensual vision of the watershed's future. They want it to be a model of sustainable development: the creek maintained in a natural and stable condition, flooding reduced, the area's scenic beauty enhanced, and a network of trails and open space created.

Sustainability also means building with rather than against nature. Allowing nature a role in shaping development makes it possible for something unusual to happen on Turkey Mountain and along Mooser Creek, because whatever develops there will be shaped by the area's unique natural features and location.

*Mooser Creek
Greenway will
become the
gateway to
Southwest Tulsa.*

Defining a Turkey Mountain Style

In helping the watershed community develop its vision, Attila Bality of the National Park Service challenged citizens to dream big. High goals are important, he said, because of the divergent character of the basin's development and the quality of the resources at stake. The Greenway would help anchor their vision and give it substance. It would also give the City a yardstick to measure and encourage appropriate development elsewhere in the basin.



The idea of creating a suburban style in Southwest Tulsa that restores and preserves nature is not new, having already been sketched out in INCOG's Comprehensive Plan for District 8. The Plan called for open and spacious neighborhoods that retain existing trees and vistas; development that makes best use of the district's natural beauty and rugged terrain; preservation of floodplains and Arkansas River frontage; public acquisition of additional land on Turkey Mountain; and finding opportunities within the district for hobby farms and equestrian trails.

A Mooser Creek Greenway that preserves floodplains and riparian borders and restores water quality would be an essential component of this vision of a sustainable Southwest Tulsa with its own special Turkey Mountain style.

RESPECTING PROPERTY RIGHTS AND VALUES

To be funded and built, greenway projects require strong local support, particularly from landowners. Ultimately, a Mooser Creek Greenway will hinge upon property owners' support for greenways and trails. Some citizens expressed concerns about privacy, property rights, and real estate values. They want to be certain greenways would

not place their families and investments at risk. They would also like a clearer understanding of how the greenways will be managed.

The most difficult question has been whether to have creekside trails in residential neighborhoods. In the end, it was decided not to route Mooser Greenway trails through existing residential neighborhoods. A greenway whose trails stop at Mountain Manor might not be the Mayor's "blue sky vision," but it is buildable, has the support of residents and stakeholders, and leaves open the possibility that at some point in the future, when the City's trail network is more extensive and its benefits better understood, homeowners may choose to have trails completed through to 49th West Avenue.

A Trails Subcommittee meeting at Riverfield School



In the meantime, attractively-landscaped sidewalk trails will link residential neighborhoods to Greenway trails along tributaries MB, MC, and ME, as well as to Bales Park, the YMCA Camp, River Parks, and the Turkey Mountain Wilderness Area.

FLOOD MANAGEMENT USING A NATURAL CHANNEL

Bioengineering and geotextiles will be used to stabilize banks, slow stormwater runoff and preserve Mooser Creek's natural channel and floodplain. This "softer," more naturalistic approach is in line with INCOG's Comprehensive Plan for District 8.

The *Southwest Master Drainage Plan* recommended a grass-lined channel between 24th and 29th West Avenue, where the creek was straightened to make way for the I-44 service road. This area is subject to frequent flooding. The channel cannot remain in its present semi-natural, straightened condition because of risk to life and the safety of businesses on the south side of the expressway and to traffic on the service road. Upstream detention has been deemed ineffective. In keeping with Mooser Greenway concepts, the 100-year channel will be grass-lined and as natural appearing as possible, with 5:1+ slopes and curved banks. The low-flow (2-year) channel will accommodate bank-full flows and will meander like a natural stream.

To eliminate backup flooding and high outflow velocities, the bridges at Elwood Avenue, Olympia Avenue, Union Avenue and 53rd Street will be enlarged, as will a number of culverts in the basin.

Locations where erosion has been serious, such as behind Pepsi Cola and beneath the Okmulgee Expressway, will be stabilized using geoengineering techniques that simulate the stream's natural landform. Leaving floodplains and riparian borders intact will help prevent erosion.

Restoring Water Quality

The identification of “Long’s Spring” in the Carver addition, near the Sapulpa-Union Railroad, as the source of Mooser Creek gives the City’s flood control and Greenway project the popular objective of restoring and preserving an historic, pristine stream. Because it does not dry up in summer, but continues to flow from a spring-fed pool, Mooser Creek is more than just a drainageway for stormwater runoff. Making the stream a place where children can safely play and swim is a goal virtually everyone can support.

Mooser Creek cleanups and Blue Thumb water quality monitoring will be continued, and stream conditions reported in a proposed *Mooser Greenway* newsletter. The newsletter could also be used to keep the community informed about a range of environmental issues, such as the impact of non-point pollutants on water quality. Groundwater and stream contamination from aging septic systems will be significantly reduced as City sewer is extended to the rest of the basin.

GREENWAY DESIGN

The challenge of greenway design is finding a workable middle ground in the shifting balance between public needs and private interests. While achieving important public goals, like flood control and water quality improvement, the Greenway will also be tailored to increase property values and protect business and homeowner interests, particularly privacy and security.

Remington-Riverfield Demonstration Project

Many resident and stakeholder doubts about a greenway with public access trails will only be resolved by experience. For this reason, Attila Bality recommended the construction of a Model or Demonstration Greenway connecting Mooser Creek, Remington Elementary, Lubell Park, and Riverfield Country Day School.

Joint trail use between Riverfield and Remington is feasible because their properties adjoin and the schools share many of the same values and commitments. Caution will be exercised in planning entry points and trail routes in order to minimize access to these areas by unwanted visitors. Separating the public access areas of Lubell Park from the remainder of the complex is highly recommended.

Greenway safety and cleanliness, as here in River Parks, are major concerns for all users.



Trails

The Mooser Creek Greenway will serve as the backbone for a network of trails linking residential areas to schools, parks, employment and shopping. Three types of trails will be used: 10-12 feet wide hard surface, all-weather hiker-biker trails; 4-8-foot wide bark/chip nature trails for walkers, runners and equestrians; and landscaped sidewalk trails along the basin's arterial streets.

These trails will reach out westward from the Arkansas River along both sides of Mooser mainstem to Lubell Park, Remington Elementary School and 33rd West Avenue. A branch trail will follow Tributary ME south to Riverfield Country Day School, West Highlands Park and Page Belcher Golf Course, and other trails will lead from Mooser Creek into Bales Park, into the YMCA Camp and along Tributary MC, and over several routes into the Turkey Mountain Wilderness Area.

These trails are only one link in a growing network of Tulsa trails. Eventually, they will tie into the city-wide trail system through River Parks, the Sapulpa-Tulsa Trail, via sidewalk trails along Union Avenue and 33rd West Avenue, and across the Arkansas River at 32nd, 51st and 71st Streets.

GREENWAY MANAGEMENT

Good management is critical to the success of greenways and trails everywhere. The most common problems are noise, inconsiderate and irresponsible behavior, wildlife and habitat degradation, trash, and non-recreational uses of the greenway (i.e., transients, vandalism, crime, and drugs). New technologies and uses, such as skateboards and bikes, have also created stresses with property owners and other users.

Greenway design can do much to eliminate these problems. Trails can be routed past the fronts of homes, for example, and visitors' facilities located to provide the least amount of interference with residential neighborhoods and businesses. Trail design can also minimize potential conflicts by having separate trails for competing uses (e.g. bird watchers vs. mountain bikers), wider trails, longer views, and fewer surprises. Motorized vehicles, one of the most common sources of conflict, will not be allowed on any Greenway trails (except for trail maintenance and management).

Management is as critical to a greenway's success as design, and necessarily involves both a city and its local communities. Regular inspections of the Mooser Greenway by bicycle-mounted police and City employees will be supplemented by citizen hiker-biker patrols armed with cell phones to report unsafe trail conditions or suspicious behavior. Community support can make every evening walk an inspection.

To keep residents and stakeholders informed about the greenway and its impacts on public safety and property values, City and local support groups will compile greenway-related news and statistics and report them to the community via the proposed *Mooser Greenway* newsletter. Besides trail conditions and maintenance, data will be collected on vandalism, accidents, trespassing, property violations, crime, illicit behavior, vagrancy, and misuse of property. This will give residents and landowners an unvarnished view of what is happening along Mooser Creek and on other trails in Tulsa and around the country.

Safety

Safety is a major concern on all public trails. Safety involves the physical safety of users, safe trail conditions and safe use.

Physical safety includes the safety of trail users from crime, drug sales and solicitations, exposure to illicit sex and other nuisances like panhandlers and vagrants. Trail design will ensure physical safety by such things as providing adequate lighting, keeping trails open to public view, creating long vistas, and routing trails alongside well-traveled roadways. Greenway management can also institute regular patrols, issue and distribute safe trails rules and guidelines, enforce animal leash laws, and close trails after dark.

Unsafe greenway conditions, like trail hazards, undercut banks, and standing water, can be reduced by design and engineering measures, such as routing trails away from clayey soils and eroding stream banks. Most unsafe conditions can be eliminated by good management practices, such as regular inspections and maintenance, signage, prompt debris removal after storms, etc.

Safe use is primarily a management and education issue, and will be addressed through establishing, promoting and enforcing greenway regulations and trail etiquette. Of particular importance is eliminating reckless and destructive behavior, both to other users and to greenway resources.

Trail management will follow up on complaints, recruit citizen volunteers, and gather data on trail use. Citizens and the City will share responsibility for establishing appropriate use guidelines and developing and distributing safe trails literature.

Creek clean-ups have become a part of Southwest Tulsa civic life.

Dumping and Litter

Residents want the City more involved in cleaning up Mooser Creek and enforcing dumping regulations. To prevent creekside trails from becoming a source of litter and stream degradation, trash receptacles will be located throughout the Greenway and serviced by regular pickups. Litter patrols, sponsored by both the City and civic organizations, will be encouraged and annual creek cleanups continued.

The Greenway project has inspired a number of innovative environmental stewardship programs in the schools and housing projects. Getting young people involved in cleanups and litter patrols is a good way for them to learn about ecology. Creek clean-ups have become a regular part of Southwest Tulsa life. These initiatives should continue.

A Mooser Creek Model Greenway will do much to reassure businesses and residents that a greenway can be managed effectively.



WILDLIFE HABITAT

Retaining Mooser Creek's natural channel and floodplains will help preserve the basin's existing wildlife and habitat. By not routing public trails along the creek in residential neighborhoods, fencing will be minimized and wildlife given easier access to stream and forest. Restoring Mooser's water quality will help fish populations rebuild.

Bales Park's mixed-grass prairie is an excellent wildlife habitat. White-tailed deer are a common presence there, feeding on its rich grasses. The prairie should be exempted from the City's mowing regulations.

The historic South Haven community should be considered for some sort of commemoration, and a number of other sites investigated for their historical value.

The preservation of steep slopes within the watershed is in line with the Comprehensive Plan’s recommendations concerning Development Sensitive Areas (see page VI-36). These include lands that flood frequently, have erodible soils on slopes over 20 percent, or possess unique qualities, such as wildlife habitat, forest potential and aesthetic value. The protection of these slopes, whether or not acquired by the City, will significantly extend the reach of Turkey Mountain Wilderness Area’s wildlife habitat.

Planning commissions and zoning boards should be encouraged to give preference to development proposals that leave as much native timber standing as possible. The forests of Mooser Creek and Turkey Mountain are excellent songbird habitat and appear to be in exceptional health, considering their proximity to highways and industrial areas. Efforts will be made to retain some of them as completely as possible. While not all these areas can be saved, developers and builders can use “green” construction methods, and be given assistance in identifying the most productive trees and shrubs to preserve.

CULTURAL PRESERVATION

Mooser basin’s rich natural and cultural history will be available to visitors by means of brochures, maps, guides, signs and markers. These might include pamphlets on Moses Naharkey and the Mooser name, Indian artifacts discovered near Remington Elementary School, and the colorful history of “Clarence’s Back Door”. Trail maps showing historical sites in the watershed and nearby parts of west and Southwest Tulsa, such as the site of Sue Bland #1, the first oil strike in Tulsa, can be made available at Greenway information kiosks, schools, public and civic offices, and the West Regional Library.

Residents and educators discuss Mooser Greenway outreach strategy.



The historic South Haven community should be considered for some sort of commemoration, and a number of other sites assessed for their historical value, such as the carvings and graffiti on the bluffs along the Arkansas River, Indian pictographs on the Dyer property, and the unidentified graves near the YMCA Camp. Generally, more needs to be done to preserve the archaeology of the Mooser basin.

Natural history markers can focus on the vegetation, soils and geology of the basin, such as the Checkerboard limestone and Quaternary deposits.

PUBLIC EDUCATION AND OUTREACH

Greenways and trails depend upon public support and funding. Continuing efforts will be made to increase public awareness of the Mooser project. The proposed *Mooser*

Greenway newsletter can be expanded to include research into public safety issues, property values and other relevant information from greenway conferences and journals.

Brochures and pamphlets can explain the Greenway Plan, the Remington-Riverfield demonstration project, and specific basin resources, like Bales Park prairie. An artistically rendered map of the creek could show the location of points of interest, such as trails, playing fields, parks, historic structures, archaeological sites, significant trees, and geological features.

The West Regional Library can be an excellent point of contact and outlet for public information materials. For example, a series of seminars could be presented there on greenway-related subjects, like basin geology and history, environment-friendly development practices, easements and rights-of-way, and local flora and fauna.

Creating a greenway is an ongoing public education process. Although public greenways and trails are increasingly common, many citizens do not know what to expect of them—or what will be demanded of them as users and neighbors. Teaching people about greenway rules and behaviors can be done through citizen patrols, guidebooks, signs and posters, fliers and brochures, newspaper articles, and presentations before clubs, civic groups, and schools.

Local citizens can be a greenway’s most effective advocate. New ways should be found to recognize and reward project sponsors and volunteers. The generosity of landowners in granting easements for public use must be met with a corresponding willingness by the public to honor their gift and respect their property and privacy. This is above all a public education task.

The Mooser Creek Greenway will provide students at Remington Elementary and Riverfield Country Day School with safe and easily accessible outdoor nature classrooms and the raw material for a variety of educational projects. The schools have already created nature trails and adopted sections of the stream as their own. While caring for the stream, children can also learn about animal life, ecology and safety.

TURKEY MOUNTAIN PRESERVATION

Turkey Mountain is one of Tulsa’s last wildernesses. Its river frontage is of great value—to its owners, the City, and Southwest Tulsans. Concern for its fate has been a major driver of the Greenway project.

Tulsa’s Comprehensive Plan recommends low intensity zoning (RS-1) for Turkey Mountain, the extension of River Parks’ trail system into and through the Special District, the protection of the river bluff areas, and the acquisition of additional park land by the City. It also calls for the identification of Development Sensitive Areas, such as floodplains, steep slopes, forests and wildlife habitat. In addition, it recommends equestrian trails and opportunities for keeping horses on residential lots.

What is suggested by these recommendations is a section of the city with its own unique ambience—a “Turkey

Turkey Mountain preservation has been a driving force behind the Mooser Creek Greenway project for citizens and City alike.

Turkey Mountain from the mouth of Mooser Creek on the Arkansas River



Mountain style”. Cloistered above the city by forests and bluffs, the Turkey Mountain district could become a suburban paradise of substantial homes and hobby farms, laced with equestrian trails and pristine streams, and ringed round with woods containing deer and foxes—all less than 10 minutes from downtown Tulsa.

The Mooser Creek Greenway provides a vision and rationale for achieving these and other Comprehensive Plan objectives. Development Sensitive Areas—primarily floodplains and steep slopes—have been identified and mapped and incorporated into the Greenway Final Plan. The result is a spectacular network of parks, trails and open space unmatched in the city.

VIII GREENWAY PLAN

FLOOD CONTROL MEASURES

Flooding on Mooser Creek has been exacerbated by development within the floodplain, high water on the Arkansas River, backup from undersized bridges and culverts, and by low banks in areas disturbed by prior road construction. One of the most important results of the public planning process was the decision to retain Mooser Creek's natural channel and preserve its 100-year floodplain. Flooding will be controlled by these measures, and by bridge and culvert enlargement, floodproofing, voluntary acquisition and removal, the preservation of native vegetation and steep slopes, and by creating a naturalistic, meandering channel in one location and channel improvements in another. Besides reducing runoff, preserving the stream's natural channel and riparian border, and improving its water quality, these multi-purpose flood control measures will create opportunities for open space, parks, playing fields, trails, educational uses and wildlife corridors.

Arkansas River to Union Avenue

Flooding on Mooser Creek's lowest reach, between Union Avenue and the Arkansas River, has been caused largely by construction within the 100-year floodplain, river backup, and channel constrictions from undersized bridges at Elwood and Olympia Avenues.

Floodplain and steep slope preservation in the basin will reduce runoff and slow water velocities. The bridges at Elwood and Olympia Avenues will be enlarged and a new crossing structure added near the confluence of Tributary MB and Mooser mainstem. Floodproofing of 15 buildings will be recommended, along with the voluntary acquisition of floodplain structures just east of Union Avenue.

There are several locations where erosion has been severe—for example, behind Pepsi Cola and Transa-Kool, and beneath the Okmulgee Expressway. These banks will be stabilized using naturalistic “soft” techniques like bioengineering and geotextiles

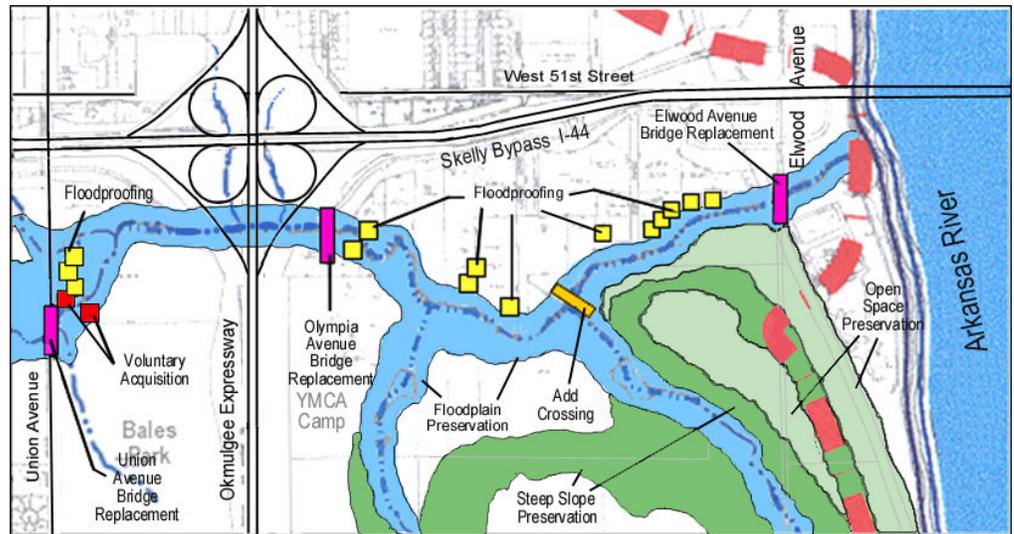
Union Avenue to 33rd West Avenue

From Union Avenue to 33rd West Avenue, there are nine commercial buildings and eight residences within the floodplain. Of these, five commercial buildings and five residences would have water above their first finished floor elevations during a 100-year flood. In addition, bridges at 26th West Avenue and 53rd Street would be overtopped, and the banks overrun between 26th and 28th West Avenues.

Although the *Southwest Master Drainage Plan* recommended a stormwater detention facility west of Union Avenue to reduce downstream flooding during peak flows and serve local residents as a park and recreation area at other times, the high price of acquisition has made this option infeasible. Consequently, Union Avenue Bridge will be widened and strengthened, and fitted for sub-grade hiker-biker and nature trails. A naturalistic 1,300-foot grass-lined channel will be created between 25th and 29th West Avenues, where the creek was straightened during construction of I-44 and where the banks are not high enough to contain 100-year floodwaters. Artificial meanders will be created using bio- and geo-engineering techniques. An existing bridge and low-water

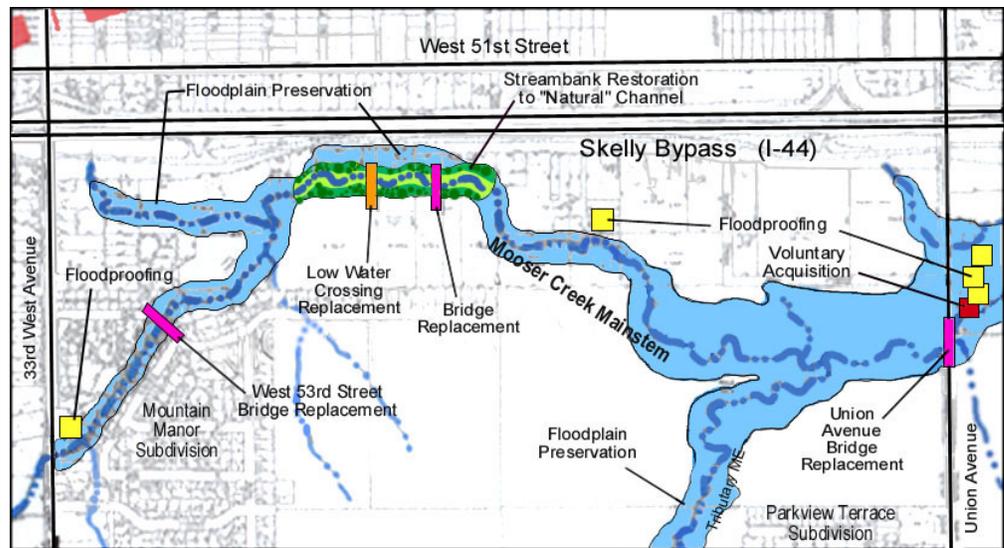
crossing at about 26th and 28th West Avenues will be replaced with larger structures. One commercial building in the floodplain, at about 24th West Avenue, is recommended for floodproofing.

Figure VIII-1:
Flood control measures
from Union Avenue to
33rd West Avenue



Five residences in Mountain Manor are currently subject to flooding during peak flows, most from backup created by the undersized bridge at West 53rd Street. This bridge will be replaced by a larger structure, and one residence, near 33rd West Avenue is recommended for floodproofing.

Figure VIII-2:
Flood control measures
from the Arkansas River
to Union Avenue



33rd West Avenue to 49th West Avenue

There are 35 residences in the floodplain between 33rd West Avenue and the Sapulpa-Union Railroad Bridge. Of these, 23 would be flooded during a 100-year storm, almost all of them in South Haven Manor. In addition, four road crossings would be overtopped: 33rd West Avenue, 35th West Avenue, 37th West Avenue, and 57th Street. On Tributary MM, the culvert at 57th Street would be flooded, as would culverts at 57th and 61st Street on Tributary MN.

This Plan recommends channel improvements to the creek where it passes through South Haven Manor, between 37th West Avenue and 57th Street. The culverts on Mooser mainstem at 37th West Avenue and 57th Street will be replaced with larger structures. In addition, the culverts on Tributaries MM and MN will be enlarged, and a stretch of 57th Street between 38th and 41st West Avenue will be improved.

Tributaries MB, MC, MD and ME

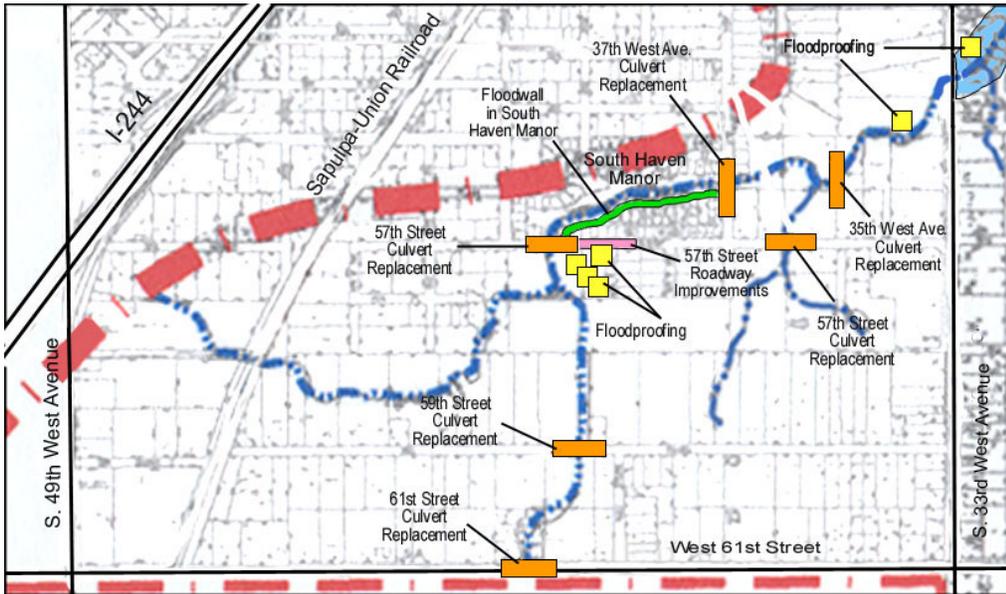


Figure VIII-3:
Flood control measures
from 33rd West Avenue to
49th West Avenue

There are no structures in the floodplains of Tributaries MB, MC, MD or ME. The culvert on Tributary MC at 61st Street would be overtopped during a 100-year event, as well as the following structures on Tributary ME and its sources: 61st and 71st Street culverts on ME; 61st Street culvert on MI; and the Union Avenue culvert on MJ. The *Southwest Master Drainage Plan* recommends enlarging all these culverts.

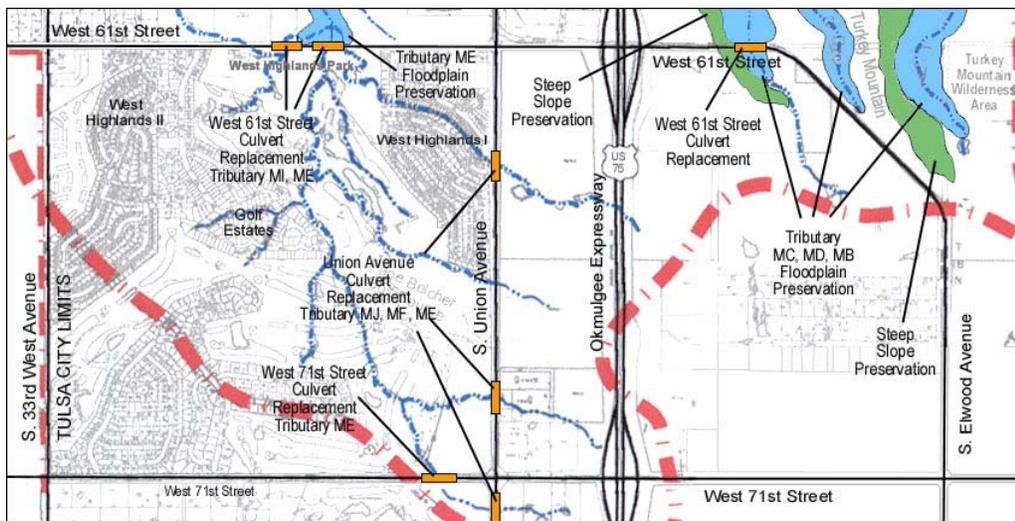


Figure VIII-4:
Flood control measures
on Tributaries MB, MC,
MD and ME

RESTORING AND PRESERVING A PRISTINE STREAM

Development will increase runoff and erosion in the watershed, particularly in Tributaries MB, MC and ME. Preserving as much native vegetation as possible and leaving Mooser's floodplain and riparian borders intact will substantially reduce erosion, water quality degradation and loss of fish habitat. Bank erosion has already been severe in several locations. These banks will be stabilized using bioengineering techniques and "soft" technologies, like geotextiles.

PARKS, RECREATION AND OPEN SPACE

The Mooser Creek Greenway reaches from the Arkansas River to 33rd West Avenue, and south from the mainstem to 61st Street along Tributaries MB, MC, MD and ME. The Greenway's width is generally defined by the 100-year floodplain, although on Turkey Mountain it also includes some steep slopes (over 20 percent grade). Except for where the mainstem passes through the Mountain Manor Subdivision, the Greenway will be laced with a network of hiker-biker, nature and equestrian trails that will comprise an alternative transportation system linking neighborhoods, schools, shopping, parks and recreational facilities.

The 60-acre YMCA Camp is one of the watershed's prime recreational facilities.



The Greenway will connect the watershed's major recreation areas and facilities, as recommended in INCOG's Comprehensive Plan. A paved, all-weather multi-purpose/maintenance trail along the north side of Mooser mainstem will tie into the River Parks' all-purpose, paved and lighted trail network on the west bank of the Arkansas River. Nature trails will connect Page Belcher Golf Course and West Highlands Park with Lubell Park, Bales Park, and the YMCA Camp via Riverfield Country Day School and Remington Elementary School. An interlinked series of nature/equestrian trails will follow the west bank of the Arkansas River, loop up the south side of Mooser Creek to Bales Park, and ascend Tributaries MB and MD to parking facilities on Elwood Avenue at South 63rd and 68th Streets.

Mooser Creek and Turkey Mountain comprise a rich and diversified wildlife habitat. By keeping the creek and its floodplains natural, and preserving the steep slopes of Turkey Mountain, the Greenway will create a crescent-shaped wildlife habitat reaching from South 71st Street and the Arkansas River north to I-44, west to 33rd West Avenue, and south along Tributary ME to Page Belcher Golf Course.

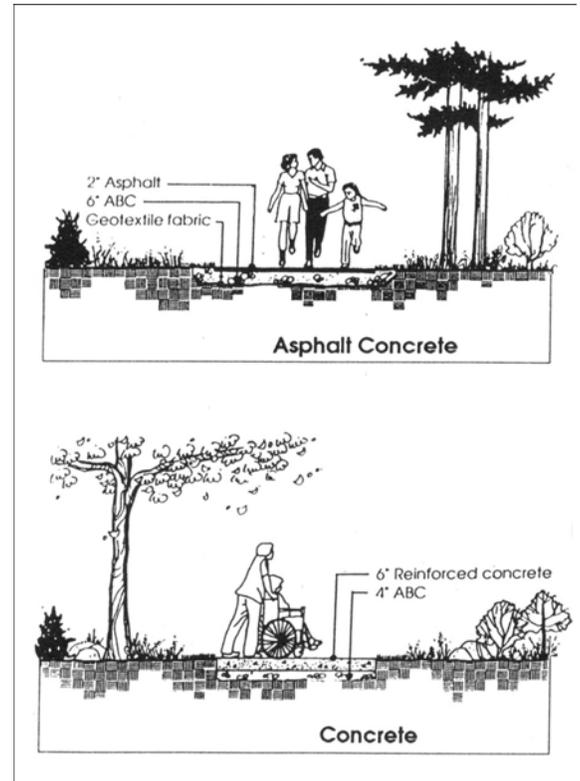
MOOSER GREENWAY TRAILS

Mooser Greenway's network of sidewalk, hiker-biker, nature, and equestrian trails will make up an alternative transportation system linking neighborhoods and housing projects with schools, parks, shopping, employment, recreation, and entertainment opportunities. Children will be able, for example, to bicycle on Greenway all-weather trails from 33rd West Avenue to the Arkansas River Bridge at 71st Street, a distance of more than five miles, without having to cross a major street or highway. Trails will also connect the watershed to Tulsa's expanding citywide trail system via River Parks trails, sidewalk trails along Elwood Avenue, Union Avenue, and 33rd West Avenue, and by way of the proposed Tulsa-Sapulpa Trail.

Asphalt and concrete are the most common multi-purpose, all-weather trails.

Mooser Mainstem Paved, All-weather Trail

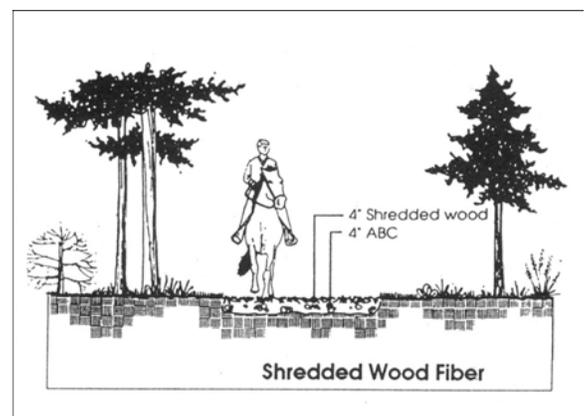
A paved, all-weather, multiple-use trail will run from 33rd West Avenue along the north side of Mooser mainstem to the Arkansas River, where it will connect with the paved, all-weather River Parks west side trail. The Mooser trail will be a major link in Tulsa's expanding network of citywide hiker-biker trails. Oriented to I-44, it will pass beneath Union Avenue and the Okmulgee Expressway, allowing children and other users to travel safely throughout the watershed—and eventually, when the River Parks Trail is completed, throughout the entire city. This trail will accommodate all types of users, such as pedestrians, runners, bicyclists, and in-line skaters. It will be 10 feet wide and have a 4-inch-thick concrete surface, reinforced with rebar or welded wire mesh, and a 6-inch sub-base of course gravel set on compacted or undisturbed subgrade. The trail will have benches, lighting, information kiosks, trash receptacles, drinking fountains, and bicycle loops. Signage, striping, pavement markers, screening, and buffers will be incorporated into the design.



With its miles of proposed nature trails, Turkey Mountain could become the most sought after residential area for equestrians.

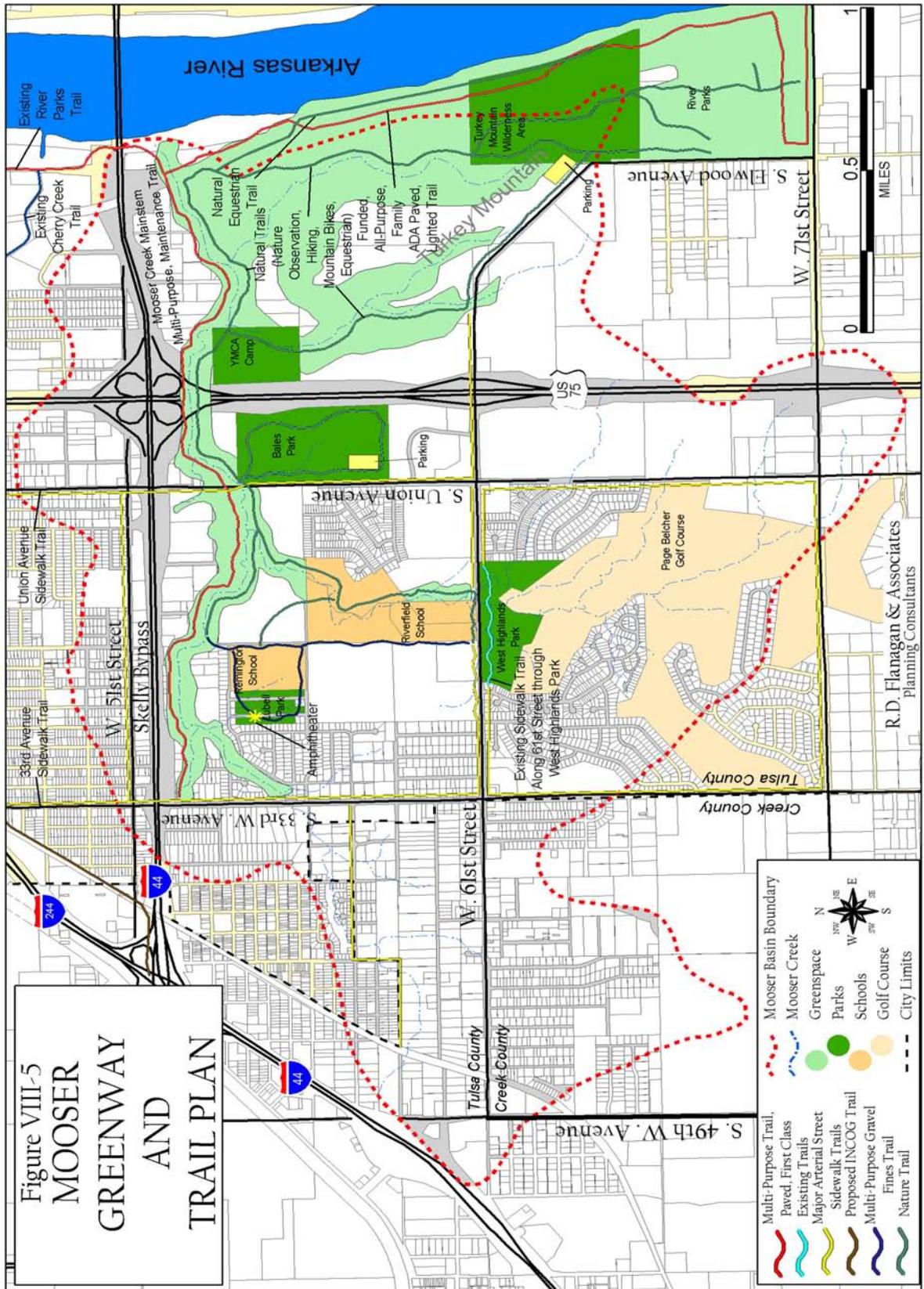
Nature and Equestrian Trails

As planned, the Greenway will have almost 10 miles of nature/equestrian trails. These trails, shown in green in Figure VIII-6 (on page VIII-9), will branch off along Tributaries MB, MC and ME. A fourth trail will make a circuit of Bales Park, where trailhead parking and visitors' facilities will be located. There will also be trailhead parking adequate for horse trailers at the entrance to the Turkey Mountain Wilderness Area at 63rd and Elwood Avenue. Nature trails will be 10 feet wide, with no less than 4 inches of compacted shredded wood or bark chips, set on a 4-inch sub-base of compacted course gravel over compacted or undisturbed subgrade, and crowned with a maximum of 2 percent for side slopes. Longitudinal slopes will be limited to less than 5 percent. These trails will also have signage and screening or planting buffers where necessary.



Images adapted from INCOG *Trails Master Plan*

Figure VIII-5:
Mooser Creek Greenway
and Trail Plan



Several equestrian trails are also proposed for the Turkey Mountain Wilderness Area and Arkansas River frontage. These will join the Mooser mainstem nature trail at 52nd and Elwood. If the Turkey Mountain Special District is zoned for hobby farms and horses in residential areas, as INCOG's Comprehensive Plan suggests, these trails could make Southwest Tulsa attractive for equestrians.

Remington-Riverfield Gravel Fines Trail

The gravel fines trail linking Riverfield and Remington schools is suitable for relatively flat trail corridors. It will be stabilized with steel edging on both sides of the trail and crowned in the middle with side slopes of no more than 2 percent. It will be allowed to sheet drain with a maximum cross slope of 2 percent. One shortcoming of a gravel fines trail is its inability to suit in-line skaters. However, it is very cost efficient. Another advantage is that water can percolate through its surface and more efficiently reach the water table.

Neighborhood Sidewalk Trails

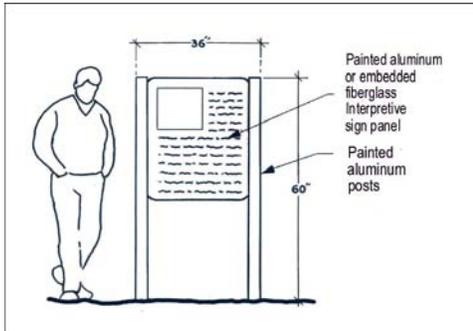
Mooser Creek Greenway's trail network will not extend into existing residential areas in Mountain Manor or beyond 33rd West Avenue. Instead, sidewalk trails will connect these neighborhoods to the Greenway at South 52nd Street and 33rd West Avenue, at South 61st Street across from West Highlands Park, and at Union Avenue. Properly designed, sidewalk trails can be as attractive as greenway trails, and are essentially the same. They will be paved, all-weather, multiple-use trails, 8 to 10 feet wide, made of 4-inch-thick concrete reinforced with rebar or welded wire mesh over a 6-inch sub-base of course gravel on compacted or undisturbed subgrade. These trails, similar to normal city sidewalks, can be landscaped and gently curved for aesthetic quality.

A sidewalk trail and bridge over Mooser Tributary ME in West Highlands Park



Greenway and Trail Signage

Mooser Greenway trails will have a wealth of educational and interpretive signs.

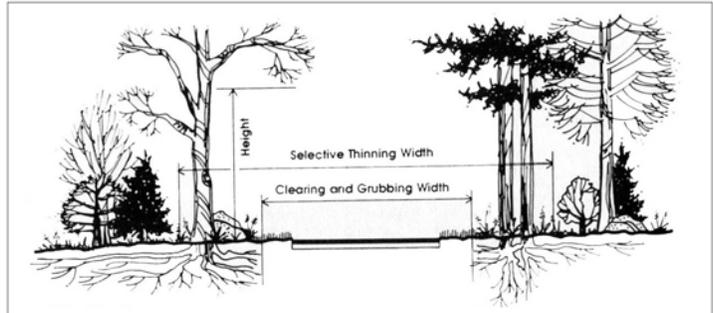


Trail signage will give the public the information it needs to use the Greenway and avoid confusion and conflict with other users. All signage will conform to the guidelines set forth in Tulsa's *Trails Master Plan*. Directional and informational signs will provide maps, trail rules and regulations, trail etiquette, mileage to destinations, and directions to destinations and amenities. Regulatory and warning signs will display rules, regulations and warnings regarding trail use, such as Yield, Stop, RR Crossing and Low Water Bridge. Distance markers will display the mileage from the beginning of the trail. Educational/Cultural signage will inform users about natural and cultural features within the watershed and within view of a trail. Special signs with a Mooser Creek Greenway logo might also be used to convey a sense of locale and community pride. As a rule, signage will be 5 feet high from the finished grade to the base of the sign, and placed no less than 2.5 feet from the edge of the trail pavement. Swales, drainage ways, planting, and fences will continue on the outside of a trail sign.

Vegetative Clearances

The amount of vegetative clearing will depend on the type of trail being developed. As a rule, natural footpaths or hiking trails require little or no clearing. Vegetative clearances for paved, lighted all-weather trails will be at least 10 feet above the ground and 28 feet on each side of the trail. In sensitive areas, existing vegetation will be preserved and all groundcover within the drip lines of trees protected and integrated within the trail corridor.

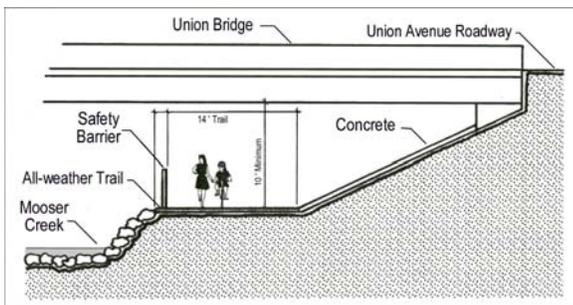
Good trails balance aesthetics and safety in vegetative clearing.



Union Avenue bridge will be widened and enlarged for traffic, stormwater runoff, and Greenway trails.

Union Bridge Underpass

Union Bridge is being enlarged and widened as part of Tulsa's transportation and drainage improvement programs. The bridge has often been a bottleneck for both traffic and stormwater runoff. Mooser mainstem's nature and paved, all-weather trails will pass underneath Union Avenue on the south and north side of the creek, respectively. The underpass will give users access to the watershed's other trails and to River Parks' network. Children, for example, will be able to ride from Riverfield or Remington schools to Turkey Mountain Park, or even to downtown Tulsa, without having to cross over a major highway or arterial street. The Union bridge underpass will be lighted for safety and separated from the stream by a guardrail. The nature trail will be paved where it passes beneath the bridge.



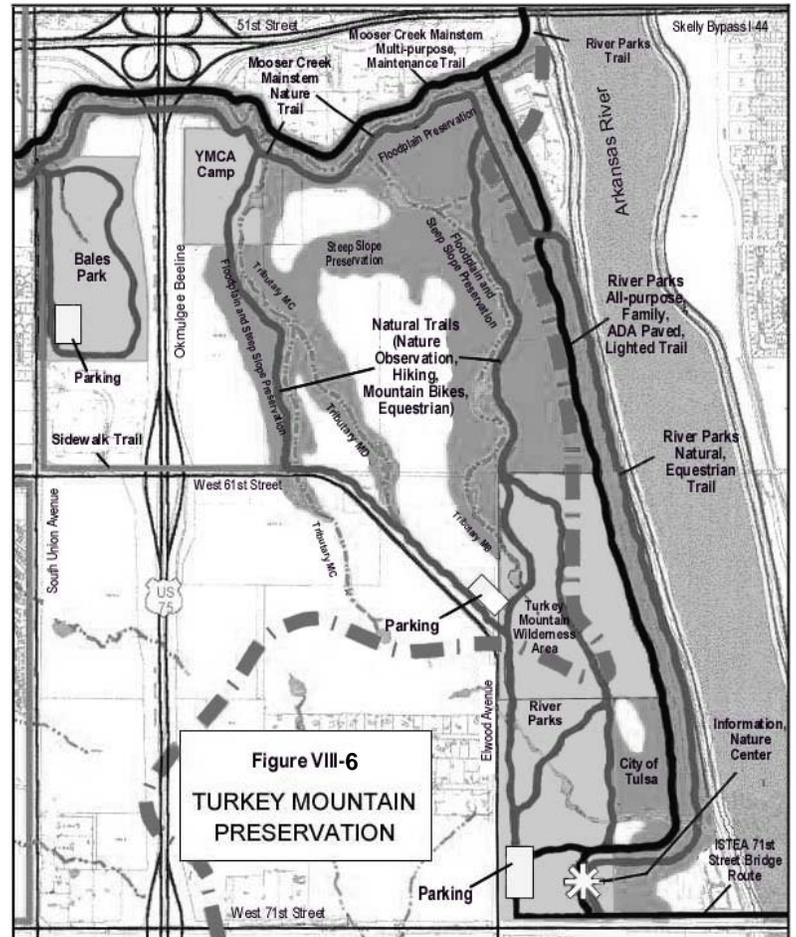
Images adapted from INCOG *Trails Master Plan*

TURKEY MOUNTAIN PRESERVATION

INCOG's Comprehensive Plan specifies low intensity zoning (RS-1) for Turkey Mountain, the extension of River Parks' trail system into and through the Special District, the protection of the river bluff areas, and the acquisition of additional park land by the City. It also calls for the identification of Development Sensitive Areas in the district which should be least disturbed by development, including floodplains, steep slopes, forests, and wildlife habitat. It also recommends equestrian trails on Turkey Mountain and opportunities for keeping horses on residential lots.

The Mooser Creek Greenway provides a vision and rationale for achieving these and many other Comprehensive Plan objectives for Southwest Tulsa.

Figure VIII-6:
Turkey Mountain Preservation



REMINGTON-RIVERFIELD DEMONSTRATION GREENWAY

Many watershed residents will only be reassured about the benefits and costs of a greenway by having lived with one. For this reason, the Recreation Subcommittee made a model Demonstration Greenway along a portion of the creek one of its high priority strategies. The proposed model greenway will link Remington Elementary and Riverfield Country Day School, two strong supporters of the Mooser project. Their properties adjoin, and both schools share a commitment to education, to the creek, to ecology and community.

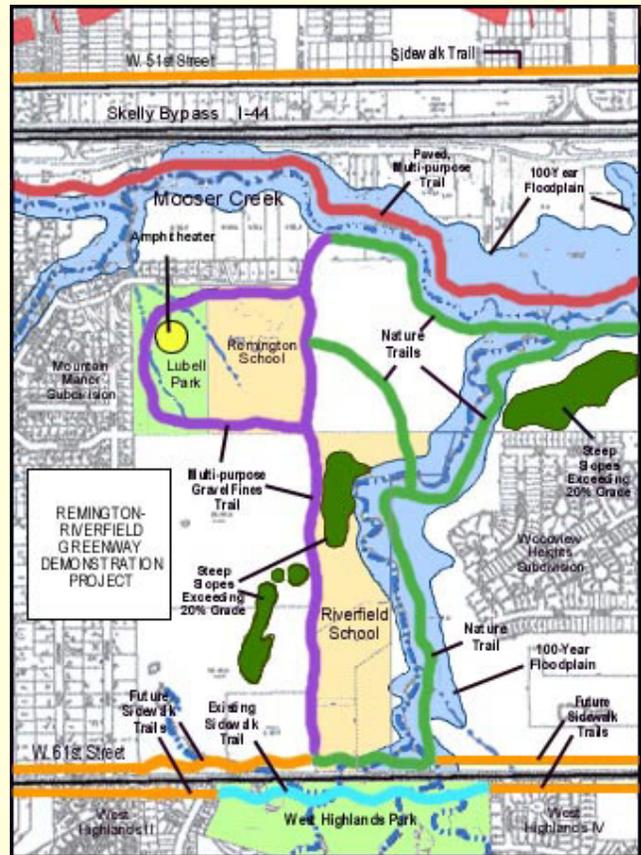
*A dream in the making:
Neighborhood school
children on the future gravel
fines trail between Mooser
Creek and 61st Street.*



Riverfield School's 88-acre campus is situated astride Tributary ME north of 61st Street. It is one of Mooser Creek's loveliest reaches and has, perhaps, its best water quality and aquatic environment. Because Riverfield is a private school, its property, beyond trail easements, will be closed to the general public except by arrangement with the school or Camp Raven.

For its part, Remington Elementary School offers an environmental center, which specializes in nature education and Mooser Creek ecology, excellent public facilities for recreation and meetings, and 16-acre Lubell Park directly to the west.

A multi-purpose gravel fines trail between Mooser Creek and 61st Street will connect Remington and Riverfield schools and loop through Lubell Park, where an amphitheater is planned. At Mooser mainstem, this gravel trail will tie into the nature trail on the creek's south bank, and with the paved, multi-purpose trail on the north bank. A second nature trail will run down Tributary ME, along the east side of Riverfield Elementary School, and link the 61st Street sidewalk trail with the school and the other trails on Mooser's mainstem. Besides joining the two schools, the trail network will allow safe and direct access to Remington from homes in Woodview Heights, West Highlands, and Parkview Terrace.



The Demonstration Greenway will have a gravel fines trail (purple) linking 61st Street sidewalk trails to Remington Elementary School, and nature trails (green) along Tributary ME to Remington and Mooser Creek.

The Remington-Riverfield Demonstration Greenway will provide opportunities for nature education and recreation, but its biggest user group will undoubtedly be neighborhood children traveling to and from home and Remington and Riverfield schools.



Selected photographs courtesy of Remington Elementary and Riverfield Country Day School

IX ACTION PLAN

ACTIONS

Solve Flooding and Drainage Problems

Replace Union Avenue Bridge. Public Works. Funded with 1996 Sales Tax. Cost estimate: \$830,000. Design, right-of-way acquisition, and utility relocation complete. Advertised 06/02. Construction to begin Feb., 2003. Estimated completion: April, 2003.

Replace 53rd Street Bridge. Public Works. Funded 2001 Sales Tax Extension. Cost estimate: \$1,365,000. Final design 84% complete; ROW acquisition 60% complete. Construction scheduled for July 2003. Estimated completion: Oct. 2003.

Improve stormwater drainage north of I-44. Public Works. Funded 1999 Bond Issue. Maintenance zone project final design being reviewed. Advertise for bids in Feb. 2003. Estimated completion: Feb., 2004.

Floodproof selected structures. Individual owners, with technical assistance provided by Public Works and the Corps of Engineers. Funding: private. Estimated time of completion: On-going, based on owners participation and time schedule.

Channel improvements in South Haven Manor. Public Works, Public Housing Authority. Funding: In current 2004-2008 CIP inventory; future Sales Tax or Bond Issue. Investigate feasibility of channel improvements, and acquisition and removal of buildings from the floodplain.

Replace undersize culverts in watershed. Public Works. Funding: In current 2004-2008 CIP inventory; future Sales Tax or Bond Issue.

Improve 57th Street between 35th and 41st West Avenue. Public Works. Project is not scheduled.

Residual floodplain acquisition. Public Works. Funding: Federal HMGP and local funding share. Voluntary participation on the part of property owners. Completion: On-going, as opportunities and funding permit. Some properties are included in a current Hazard Mitigation Grant Program (HMGP) acquisition application

Preserve and Improve Stream Channel

Clean up and preserve "Long's Spring" as the pristine source of Mooser Creek. Watershed Council, and Blue Thumb. Status: Awaiting formation and action of the proposed Watershed Council.

Rehabilitate Mooser mainstem channel alongside I-44 between 24th and 29th West Avenue. Public Works. Funding: In current 2004-2008 CIP inventory; future Sales Tax or Bond Issue.

Stabilize banks and minimize erosion on Mooser mainstem between the Missouri-Pacific Railroad Bridge and Olympia Ave. Bridge. Public Works. Funding: In current 2004-2008 CIP inventory; future Sales Tax or Bond Issue.

Stabilize banks and minimize erosion on Tributary ME between Mooser mainstem and South 61st Street. Public Works, Blue Thumb. Funding: In current 2004-2008 CIP inventory; future Sales Tax or Bond Issue.

Create Trail System

Complete River Parks West Bank Extension Trail. River Parks Authority. Funding: Funded by 2001 Sales Tax and TEA 21 Federal enhancement funds. Plans are approved for Phase 2 of trail from I-44 south to 67th Street. ROW acquisition to begin in spring, 2003.

Build Remington-Riverfield Demonstration Greenway gravel fines and nature trails. Remington-Riverfield Greenway Committee, Watershed Council, Public Works. Funding: Private. Current status: Easements on private property needed to connect Remington School and Riverfield Country Day School.

Contact landowners about trail easements. Watershed Council, Public Works, Tulsa Parks, Tulsa Trails. Trails on private property on temporary hold.

Build Mooser Creek all-weather trail on north side of Mooser mainstem. (Arkansas River to Remington School and 33rd West Avenue). Watershed Council, Public Works. Funding: In current 2004-2008 CIP inventory; future Sales Tax or Bond Issue.

Build nature trail on south side of Mooser mainstem (from River Parks trail to YMCA Camp and to Remington School). Watershed Council, Public Works. Funding: In current 2004-2008 CIP inventory; future Sales Tax or Bond Issue.

Develop watershed sidewalk trails. Public Works. Not in current CIP. Sidewalks to be improved in conjunction with major arterial street improvements.

Build amphitheater in Lubell Park. Tulsa Parks, Watershed Council. Funding: Future Park Department CIP request. Status: Awaiting Watershed Council action.

Create equestrian trail network in Turkey Mountain Park. River Parks, Tulsa Parks. Completed.

Increase Interest in Mooser Creek and Greenway

Establish Watershed Council. Southwest Tulsa Chamber of Commerce, West Tulsa Historical Society, Mooser Creek watershed citizens, Public Works, should work together to form watershed council. Public Works can provide technical support and assistance.

Create educational and interpretive signage. Watershed Council, Public Works, Tulsa Parks, West Tulsa Historical Society, Tulsa Archaeological Society, Oxley Nature Center. Funding: to be identified. Watershed Council, when formed, to take lead to identify signage needs and placements.

Reestablish West Regional Library Information Center. Tulsa County Library, Public Works, Watershed Council. Contact Library to assess needs and resources.

Publish Mooser Greenway newsletter. Public Works, Watershed Council, Blue Thumb. Funding: to be identified. Status: Currently not being printed. To be printed as needed by area interest groups.

Maintain and Preserve Waterway and Wildlife Habitat

Identify and preserve Bales Park prairie. Tulsa Parks and Oxley Nature Center. Status: Investigate feasibility with Park Department.

Monitor and report Mooser Creek water quality. Public Works, Blue Thumb, Funding: Public Works and Blue Thumb. Status: On-going continued water quality monitoring.

Reduce or eliminate dumping and pollution. Watershed Council, Public Works, Blue Thumb. Funding: Public Works and Blue Thumb. Status: Public Works and Blue Thumb have on-going public information and education programs to reduce and eliminate dumping in, and pollution of area streams.

Encourage Mooser Creek clean-ups as a regular (or annual) civic activity. Watershed Council, Public Works, Southwest Tulsa Chamber of Commerce, Blue Thumb. Watershed Council should organize and coordinate the efforts.

Identify and preserve Turkey Mountain steep slopes. Tulsa Parks, River Parks, West Tulsa Chamber of Commerce, Watershed Council. Status: The District Comprehensive Plan and the Mooser Creek Greenway Plan have identified steep and environmentally sensitive slopes that should remain in open-space. Status: Watershed Council and private property owners should work together to preserve the steep slopes through creative planning.

Acquire and distribute information on green construction and development practices. Tulsa Parks, Oxley Nature Center, Watershed Council, INCOG, TMAPC, Public Works. Funding: Operating budgets of various agencies. Status: On-going. Annual Resource Management Conference and continued public information and education programs is recommended.

Identify and Preserve Cultural Resources

Identify, evaluate and preserve archaeological and historical sites (petroglyphs, rock carvings, grave sites near the YMCA Camp, archaeological sites and artifacts). Watershed Council, Southwest Tulsa Historical Society, Tulsa Archaeological Society. Funding: Operating budgets. Status: On-going. Continue agency projects.

COSTS

Trail Costs. Tulsa Trails Master Plan estimated the cost of the 3.55 Mooser Creek Trail at between \$798,750 and \$923,000. A 10-foot-wide aggregate/stone trail is about \$15 per linear foot, or \$79,200 per mile. An 8-foot-wide wood chip pedestrian trail costs about \$10 per foot, or \$52,800 per mile, while a 6-foot-wide bare earth trail cost \$5 per linear foot, or about \$26,400 per mile. A six-foot-wide sidewalk trail costs about \$12 per foot, or \$65,000 per mile. Typical trail maintenance costs run about \$8,600 per mile per year.

Signage. Information signs cost about \$1000 each, while direction, warning and mile signs run in the neighborhood of \$200.

Trail/Greenway Furnishings. Benches cost about \$600, trash receptacles \$400, bicycle racks \$500, emergency phones \$1000, and drinking fountains about \$2500.

FUNDING OPPORTUNITIES

Funding Sources. There are a variety of funding sources for greenways and trails from both public and private sources.

Federal sources include the Transportation Equity Act for the 21st Century (TEA21) (for bicycle and pedestrian transportation projects), Surface Transportation Program (STP) funds (for bicycle and pedestrian facility construction, brochures and maps), National Highway System (NHS) (for bicycle transportation facilities adjacent to national highways), Transportation Enhancements Program (trails, greenways, sidewalks, signage, wildlife under-crossings), National Recreational Trails Fund Act (NRTFA) (property or easement acquisition, trail development or construction), Community Development Block Grant Program (low-income neighborhood revitalization, economic development, and community improvements), USDA NRCS Watershed Protection and Flood Prevention (Small Watershed) Grants (watershed improvements involving less than 250,000 acres).

State of Oklahoma sources include the Oklahoma Department of Transportation (TEA21 funds), and Oklahoma Recreational Trails Fund Program.

Local public funding is available from sales taxes, stormwater management fees, impact fees, bond referendums, and local capital improvements programs.

Private sources include local businesses, trail sponsors, volunteer work, and “Buy-a-Foot” programs.

Private foundations are a good potential source of funding. These include the Kerr Foundation (youth focus, especially for education, health, cultural development and community service), Sarkeys Foundation (for non-profit conservation and environmental projects), Samuel Roberts Nobel Foundation, Inc. (quality of life, community affairs, and public affairs), The Helmerich Foundation (large capital projects, such as trails), The Helmerich Trust (community service projects), Founders and Associates (trails), The Tree Bank Foundation of Oklahoma (trees for planting on public and non-profit land), Kaiser Foundation (social services, education and the arts), Zink Foundation (arts, education and community services), Nelson Family Foundation (community services, education), Chapman Charitable Trust (education, health, community services, and arts and science), The Oxley Foundation (education and community service), Tulsa Community Foundation (social service, education, arts and civic organizations), and the Bank of Oklahoma Foundation (health and human services, education, culture and the arts, and civic and community needs).

National foundations include the American Greenways DuPont Awards (small grants for the planning, design and development of greenways), REI Environmental Grants (protecting and enhancing natural resources for outdoor recreation), and the Trust for Public Land (protection of land for public use).

X INDEX

- Acidity VI-19
 Action Plan IX-1
 Alice Robertson Elementary School II-4
 Ammonia nitrogen VI-19
 Archaeological and historical sites VI-21 (map)
 Archaeological resources V-7, VI-20
 Archaeological sites V-7
 Archaeological survey areas VI-21 (map)
 Arkansas River bluff areas VII-7
 Arkansas River Special District VI-35
 Arterial streets VI-25
 Ashley, Tim IV-11
 Audubon Society VI-16
- Bales Park Prairie I-4, IV-12, VI-15, VI-18, VI-37, VII-5
 Bales Park VI-33, VI-37
 Bality, Attila I-3, IV-1, IV-2, IV-3, IV-4, IV-5, IV-7, IV-15, IV-16, V-1, VII-1, VII-3
 Beaver Branch V-12
 Beaver V-6
 Beeline Corridor (see Okmulgee Expressway Corridor)
 Bell, John II-1
 Bicycle lanes and paths VI-27
 Bioengineering V-4, VII-2
 Biological inventory sites VI-16
 Biological inventory VI-14
 Birds VI-16
 Blackburn Building II-4
 Blue Thumb VI-19
 Blue Thumb water quality monitoring IV-9, VII-3
 Boone, Nathan II-1
 Breed, David IV-11, V-7, VI-24
 Brooks, Dr. Robert IV-12, VI-22
 Bubenik, Jackie IV-4
 Buchert, Mike IV-4, IV-6
 Buford property VI-40
 Butler property I-4, VI-40
 Butler, Buford and Brown VI-23
- Caddoan Period II-1, VI-21
 Camp Raven V-12, VIII-10
 Campbell, Mabel II-5
 Carbondale II-4
 Carbondale Park VI-33, VI-39
- Caving Banks (battle of) II-1
 Central hardwood forest VI-15
 Chandler, Earl VI-38
 Cheadle, Forrest IV-9
 Checkerboard limestone VI-1, VI-2, VI-3, VI-4
 Cherry, J. W. II-2
Chinese lespedeza VI-15
 Chlorpyrifos VI-19
 Choska-Severn urban complex VI-5
 Choteau, Rene II-1
 Chustenalah II-2
 Citizen concerns V-1
 Citizen patrols VII-4
 Clarence's Back Door IV-11, V-7, VI-23, VII-6
 Clark, Marty V-12, VI-40
 Clark, Tom IV-11, V-12, VI-40, VII-2
 Clovis people VI-6
 Coffeerville formation VI-1, VI-2
 Coly, Daryl VI-22
 Commercial uses VI-33
 Costs IX-1
 Covey Cemetery III-10
 Covey family homesteads III-10
 Coweta-Bates complex VI-5
 Coweta-Eram urban complex VI-7
 Creek Cleanups South Haven Manor IV-9 Webster High School IV-10
 Creek County Rural Water District VI-28
 Crime concerns V-1
 Crinoid VI-4
 Crow Creek VI-16
 Cultural preservation VII-6
 Cultural resources V-7
 Curtis, Idella II-5
- Davis, Sharon IV-10
 Demonstration Greenway VIII-10
 Dennis silt loam VI-7
 Dennis urban complex VI-8
 Dennis-Radley complex VI-8
 Design of greenway VII-3
 Development Sensitive Areas VI-36
 Developmental Concerns Areas VI-36
 Dickson, Clarence II-5
 Dissolved oxygen VI-19
 Doenges property VI-40
 Dr. Carver addition II-4
 Dumping concerns V-2
 Dumping VII-5
- Dyer property I-4, VI-40, V-7
- E. coli VI-19
 Easterling, Grant IV-6
 Easterling, Jeanette IV-6, V-9, V-12, VII-6
 Education and outreach strategies V-11
 Education issues V-9
 Educational opportunities I-6
 Elliott, Johnny Bruce II-5
 Epps, Cleo VI-23, VI-24
 Equestrian trails V-7
 Eram-Coweta complex VI-8
 Erosion V-5
- Fecal coliform VI-19
 Ferris and Hunter property I-4, VI-40
 Ferris, Craig IV-11, VI-40
 Ferris, Sue VI-40
 Fessenden, Judy IV-12, IV-13
 Fire Station 26 VI-40
 Fire Station 6 VI-40
 Fish VI-16
 Flanagan, R. D. V-3
 Flood control I-5
 Flood control measures Arkansas River to Union Ave. VIII-1 Union Ave. to 33rd West Ave. VIII-1 33rd West Ave. to 49th West Ave. VIII-2 Tributaries MB, MC, MD and ME VIII-3
 Flood management VII-2
 Flooding concerns V-3
 Flooding problems, roads and bridges VI-26
 Flooding, history III-1
 Floodplain management Tulsa's approach III-5 Strategies V-10
 Floodproofing VI-29-30
 Fred Creek VI-16
 Frisco Railroad II-3
 Fritts, Lynda VI-18
 Fritz, Herb VI-22
 Fry, Robert II-2
 Funding opportunities IX-1
- Ganz addition VI-40
 Gay, Stephen IV-11
 Geoengineering VII-2
 Geology VI-1, VI-2 (map)
 Geotextiles V-4, VII-2
 Gifford, Charlie VI-22
 Gill, John II-5
 Gill, Laverne II-5
 Gilroy, Lauren Gibson
- IV-8, IV-9, IV-10
 Glenn Pool II-3
 Goals and Strategies I-3
 Graham, Vonzel Washington II-5
 Gravel fines trail VIII-7, VIII-10
 Greater Cornerstone Baptist Church VI-38
 Greenway design I-6, VII-3
 Greenway Issues and Opportunities I-4
 Greenway maintenance V-7
 Greenway management I-6, VII-4
 Greenway trails I-6, VIII-5
 Greenways Characteristics III-7 Benefits III-7
- Habitat for Humanity II-5, VI-38
 Hall, Darla Covey (City Councilor) I-2, III-9, III-10, III-11, IV-7, IV-11, VI-24
 Hardison, John IV-11, V-2
 Hardt, Charles L. (Public Works Director) I-2, III-1, III-11, IV-7, IV-8, IV-12, IV-15, V-2, V-7
 Heim, Roy IV-6, IV-11, VI-24
 Heim, Sherry V-4, VI-24
 Her House II VI-38
 Hernandez, Jodi IV-1, IV-4
 Herron, Mary Sue IV-9, IV-12, IV-13, VII-6
 Highway 66 II-4
 Hiker-biker trails VII-4
 Historical resources V-7, VI-23
 Horton, Donna VI-18
 Hubbard property VI-40
 Hushbeck, Walter II-8
- INCOG Comprehensive Plan V-5, VI-33
 Indian artifacts VII-6
 Indian pictographs VII-6
 Industrial land VI-33
 Institute for City Design III-8
 Interstate-244 VI-25
 Interstate-44 II-6, VI-25
 Irving, Washington II-1
- James, Steven IV-11
 Jennings, Bob VI-18
 Johnson property VI-40
 Jones, Rev. Willard VI-38
 Jordan, Leroy K. II-5
 Kamie urban complex VI-8

Kansas City Gas property VI-40
 Karr property VI-40
 Kee property VI-40
 Killman, Curtis IV-11

 Lagorin, Lorri IV-11
 Land use, existing VI-31 (map) VI-32, VI-33
 Land use, future VI-33, VI-34 (map), VI-35
 Lawton Industrial Park III-9, III-10
 Layton Sand VI-1
 Least tern VI-17
 Leslie, Leland VI-22
 Lewis, Laura Dickson II-5
 Liability concerns V-1
 Litter concerns V-2
 Litter VII-5
 Lloyd's Investments property I-4, VI-40
 Lochapoka Creeks II-1
 Lockett, J. W. II-5
 Long, Sen. Lewis I-3, IV-11, V-6, V-8
 "Long's Spring" V-8, VII-3
 Lubell Park amphitheater VIII-10
 Lubell Park VI-33, VI-39
 MacLeod, Kimberly IV-10
 Mammals VI-16
 Management of greenway VII-4
 Martindale property VI-40
 Master Drainage Plan III-2
 Mooser Creek in VI-29-32
 Maxwell, Gwen IV-12, IV-13
 McCondieche, Carolyn
 Campbell II-5
 McCondieche, Richard II-5
 McCright, Rick VI-5
 McGehee property VI-40
 McHarg, Ian III-6
 Memo of Understanding with NPS and Tulsa IV-2
 Memorial Day flood 1976 III-2
 Miller, Randi IV-11
 Mingo Creek flood 1984 III-2
 Mingo Creek project I-2, III-6
 Mixed-grass prairie VI-18
 Monahan property VI-40
 Mooser basin biological inventory VI-14
 Mooser basin existing zoning and land use VI-31 (map)
 Mooser basin future land use VI-33, VI-34 (map)
 Mooser basin geological strata VI-3
 Mooser basin geology VI-1, VI-2 (map)
 Mooser basin hydrology VI-11 (map)
 Mooser basin in INCOG's Comprehensive Plan VI-33, VI-34, VI-35 (map)

 Mooser basin oil and gas wells VI-13, VI-14 (map)
 Mooser basin property ownership VI-39 (map), VI-40
 Mooser basin steep slopes VI-11
 Mooser basin streamflows VI-11
 Mooser basin topography VI-9, VI-10 (map)
 Mooser basin transportation VI-25
 Mooser basin undeveloped land VI-32 (map)
 Mooser basin water and sewer lines VI-30 (map)
 Mooser Creek cleanups VII-3
 Mooser Creek Environmental Center IV-12, IV-13
 Mooser Creek interceptor sewer VI-29
 Mooser Creek Issues V-1
 Mooser Creek preservation I-5
 Mooser Creek Project
 Goals V-9
 Strategies V-10
 Interdisciplinary team IV-4-5
 Management committee IV-5
 Technical committee IV-5
 Citizens' committee IV-5
 Vision Statement IV-5, IV-6
 Mooser Creek reaches VI-12 (map)
 Mooser Creek restoration I-5
 Mooser Creek streamflows VI-13 (map)
 Mooser Creek vertical drop VI-12
 Mooser Creek watershed Location I-1 (map)
 Development I-2
 Mooser Creek Infrastructure development III-8
 Mooser Greenway Action Plan I-9, IX-1
 Mooser Greenway costs IX-1
 Mooser Greenway Final Plan I-5
 Mooser Greenway funding opportunities IX-1
Mooser Greenway newsletter IV-10, VII-6
 Mooser Greenway Trail Plan VIII-6 (map)
 Mooser Greenway Issues, Goals, Strategies V-1 to V-11
 Mooser mainstem paved, all-weather trail VIII-5
 Mooser Naharkey II-2
 Mooser Project
 Public Meetings January 28, 1997

 Mooser Project Subcommittees
 Homeowner Rights IV-7
 Resource Inventory IV-7
 Recreation IV-7
 Creek Design and Stability IV-7
 Education IV-8
 Publicity IV-8
 Mooser watershed
 Development II-1
 Location II-1 (map)
 Mooser watershed
 Neighborhoods II-7
 historical development II-1
 Infrastructure improvements II-8
 Mountain Manor subdivision II-6, VI-40
 Multi-objective planning III-4
 Multi-purpose greenways III-7
 Multi-use hiker-biker trails VI-27

 Naharkey, Millie II-2
 Naharkey, Mooser II-2, VII-6
 Naharkey, Sammie II-2, II-4
 National Park Service IV-1
 Rivers and Trails I-3
 National Society of Professional Engineers
 Top 10 Design Award for Mingo Creek Project III-8
 Native Plant Society VI-18
 Natural history markers VI-5
 Nature and equestrian trails VIII-5
 Nature trails VII-4
 Neighborhoods, Mooser watershed II-7 (map)
 Nelson, Fred (Judge) VI-24
 New Life Pentecostal Church property VI-40
 Newblock terrace deposits VI-6
 New Mannford II-1
 Niotaze-Darnell complex VI-9
 Nitrate nitrogen VI-19

 O'Brien, Bill VI-22, VI-24
 Odell, Frida VI-22, VI-23
 Odell, George VI-22, VI-23
 Oil and gas wells VI-13, VI-14 (map)
 Okemah silt loam VI-9
 Okemah-Parsons-Carytown complex VI-9
 Okita Corp. property I-4, VI-40
 Oklahoma Archaeological Survey VI-22
 Oklahoma State University teleconference IV-12
 Savage, Mayor Susan IV-12

 Hardt, Charles L. IV-15
 Okmulgee Expressway Corridor V-6, VI-34
 Okmulgee Expressway VI-25
 Olympia Ave. bridge VI-29
 Open space opportunities VIII-4
 Orthophosphate phosphorous VI-19
 Ouachita physiographic province VI-10
 Overlook apartments VI-33
 Oxley Nature Center IV-12, V-6, VI-14, VI-18
 Ozark Commercial property I-4, VI-40
 Ozark physiographic province VI-10

 Packard, Bill IV-6
 Page Belcher Golf Course III-8, VI-24, VI-33, VI-36
 Parks opportunities VIII-4
 Parks VI-36
 Parkview Terrace apartments II-6, VI-33
 Patton, Ann IV-1, IV-4, IV-5, IV-10, IV-11, IV-15
 Pearson, Janet IV-11
 Pennsylvanian Epoch VI-1
 Pepsi Cola Bottling Co. IV-15, VI-33
 Pepsi Cola property I-4, VI-40, VIII-1
 Perkins, Mike IV-9
 Petroglyphs V-7
 Physical safety, trails VII-5
 Pike, Zebulon II-1
 Plant species VI-15
 Pleistocene Epoch VI-6
 Pope, Karen IV-11, IV-12
 Porter, Pleasant II-2
 Posey Creek VI-16
 Prairie regions in U.S. VI-18
 Prehistoric occupation site VI-22
 President's Commission on Sustainable Development IV-1
 Price, Lali IV-9
 Privacy concerns V-1
 Property owner issues V-1
 Property owner strategies V-10
 Property ownership VI-39 (map)
 Property rights VII-1
 Property value concerns V-2
 Property values VII-1
 Public education and outreach VII-6
 Public housing projects VI-36
 Public Involvement IV-8
 Creek Cleanups IV-8, IV-14
 Library Greenway Information Center IV-14

Mainstream media coverage IV-10, IV-14
Mooser Greenway newsletter IV-8, IV-10, IV-14
 Newsletters and flyers IV-14
 OSU Teleconference IV-12, IV-15
 Public meetings IV-14
 Remington Elementary IV-8, IV-14
 Stream monitoring IV-14
 Public transportation VI-27
 Publicly owned land VI-36, VI-37 (map), VI-39

Quaternary deposits VI-3, VI-6

R.D. Flanagan & Associates III-5, III-6, IV-3, V-3
 Race riot II-4
 Radley floodplains VI-9
 Recreation management issues V-7
 Recreational facilities I-6
 Reed, Paul II-5
 Reese, Eddie VI-18
 Rego Enterprises property I-4, VI-40
 Reid, David IV-11
 Remington Elementary School I-6, IV-12, IV-13, V-9, VI-39, VIII-10
 Remington Environmental Center II-1, IV-13, V-9
 Remington Stone V-7, VI-22
 Remington-Riverfield Demonstration Greenway V-12, VII-3, VIII-10 (map) VIII-10
 Remington-Riverfield gravel fines trail VIII-7
 Residential neighborhoods II-7 (map), VI-35
 Restoration (see Stream restoration)
 Resource Inventories I-4
 River Parks VI-27
 Riverfield Country Day School I-4, I-6, III-8, V-9, V-12, VI-40, VIII-10
 Rivers and Trails IV-1, IV-2
 Three-Stage Planning Process IV-2
 Conservation Assistance Program IV-1
 Riverside Chevrolet property VI-40
 Roberts, Paul VI-22
 Robertson Elementary School II-4
 Ross, Eleanor Walker II-5
 Ross, Jerry II-5
 Rylander property VI-40

Safe use, trails VII-5
 Safety VII-5
 Sand Springs terrace deposits VI-6
 Savage, Mayor Susan I-2, III-8, III-9, III-11, IV-1, IV-7, IV-8, IV-12
 Vision for Mooser Creek III-8
 Schlegel Park VI-33, VI-39
 Schlegel, Oscar II-3
 Schumacher, David VI-24
 Scott, Aaron VI-38
 Sediment control V-5
 Seminole formation VI-1, VI-3
 Sewer VI-29, VI-30 (map)
 Sidewalk trails VI-27, VII-2, VII-4, VIII-7
 Signage, trails VIII-8
 Sinclair, Jean IV-12, VI-20, VI-22
 Skelly Bypass II-6, VI-25
 Skelly Drive Frontage Area VI-34
 Smith, Leon II-4
 Smith property V-7, VI-23
Soil Survey of Tulsa County VI-5
 Soils VI-5 to VI-9, VI-7 (map)
 South Haven VII-6
 South Haven development II-4
 South Haven Manor II-6, VI-33
 South Haven School V-7, VI-25
 Southside Wastewater Treatment Plant II-6, VI-29
 Southwest Gardens addition II-4
 Southwest Master Drainage Plan V-4
 Revision of V-4
 Southwest Tulsa Chamber of Commerce II-6, IV-8, V-3
 Southwest Tulsa Historical Society IV-11, V-7
 Southwest Tulsa News IV-11
 Southwest Tulsa Infrastructure development III-8
 Southwest Wastewater Treatment Plant VI-33, VI-39
 Steep slopes (above 20 percent) VI-40
 Stone Creek Golf Course VI-36
 Stormwater facilities VI-29
 Stormwater Management Department III-2
 Stormwater management I-2, III-3
 Plan III-2
 Principles III-3
 Corrective policies III-3
 Preventive policies III-3
 Stream restoration VIII-4
 Streamflows VI-11, V-13 (map)
 Streets and highways VI-36
 Stringer, Jody IV-9
 Substandard structures VI-35
 Sue Bland #1 II-3, VII-6
 Summit Park addition II-4, II-6
 Sunlight Carbon Co. II-4
 Sunset Highlands Plaza VI-33
 Suppes property I-4, VI-40
 Surber, Charles VI-22
 Sustainability VII-1

Ten-Step Planning Process for Mooser Creek IV-3
 Thomas, James II-1
 Topography VI-9, VI-10 (map), VI-11
 Toxicity VI-19
 Trail design VII-4
 Access strategies V-11
 Trails in residential neighborhoods VII-2
 Trails VI-27, VI-28, VII-4, VIII-5, VIII-6 (map)
 Transa-Cool VIII-1
 Transportation VI-25
 Transportation, public VI-27
 Trash concerns V-2
 Trespass concerns V-1
 Tulsa Archaeological Society IV-12, VI-20
 Tulsa Bicycle, Pedestrian and Transit Linkages Study VI-27
 Tulsa County Blue Thumb IV-8, IV-9, VI-19, VI-20, VII-3
 Tulsa flooding history III-1
 Tulsa Transit bus 17 VI-27
Tulsa World IV-11
 Tulsa Memorandum of Understanding with NPS IV-2
 Tulsa-Sapulpa Union Railroad II-3
 Turkey Mountain archaeological site VI-21 (map)
 Turkey Mountain II-8
 Turkey Mountain preservation I-6, VII-7, VIII-9 (map)
 Turkey Mountain Special District VI-34 (map), VIII-9

Turkey Mountain storage tank VI-28
 Turkey Mountain style VII-1
 Turkey Mountain water storage VI-39
 Turkey Mountain Wilderness Area VI-37
 Turner Turnpike II-4

U.S. Highway 75 (Okmulgee Expressway) VI-25
 Union Avenue Bridge II-4
 Underpass VIII-8
 Unsafe conditions, trails VII-5
Urban Tulsa IV-11

Valley Homes addition II-4
 Vegetation VI-15
 Vegetative clearances, trails VIII-8
 Viersen property I-4, VI-40
 Vision Statement IV-6
 Main themes IV-6
 Wallis, Charles S. VI-20, VI-21
 Water and sewer VI-28
 Water quality IV-10, VI-16, VI-19
 Monitoring sites VI-20
 Restoration VII-3
 Water VI-28
 Watershed ecosystem strategies V-11
 Webster High School II-4
 West Regional Library I-5, IV-8, IV-11, V-9, VII-7
 West Skelly Industrial property VI-40
 Westside YMCA VI-33
 Wilbur Smith and Associates, Inc. VI-11
 Wildlife VI-15
 Wildlife habitat I-5, VII-5
 Issues V-6
 Strategies V-10-11
 Wilkinson, J. B. II-1
 Williams, Corey IV-9, VII-5
 Wood, Dorothy Jefferies II-5
 Wood, Maxine Pegues II-5
 Woodland Period II-1, VI-21
 Woods property VI-40
 Wright-McLoughlin Engineers III-5

Yale Avenue terrace deposits VI-6
 YMCA Camp V-5, VI-33
 YMCA Nature Center V-9, VIII-4
 YMCA, Westside II-6

Zachary, Alex II-5
 Zachary, Tommy II-5