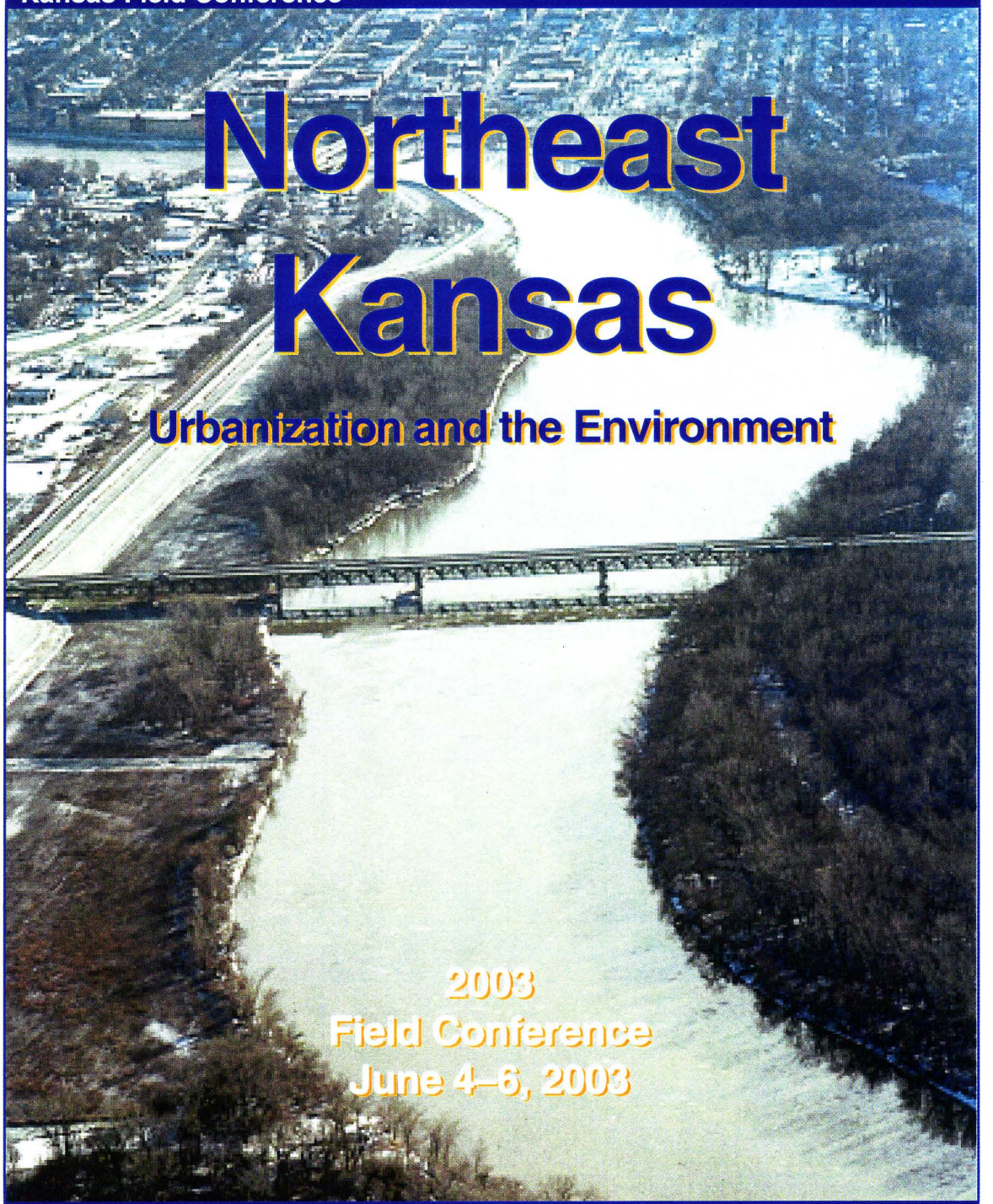
Kansas Field Conference

Northeast Kansas

Urbanization and the Environment



2003
Field Conference
June 4–6, 2003

Sponsored by
Kansas Geological Survey
Kansas Department of Wildlife and Parks
Kansas Water Office
Johnson County, Kansas

KANSAS FIELD CONFERENCE

FIELD GUIDE

2003 FIELD CONFERENCE

Northeast Kansas

Urbanization and the Environment

June 4-6, 2003

Edited by

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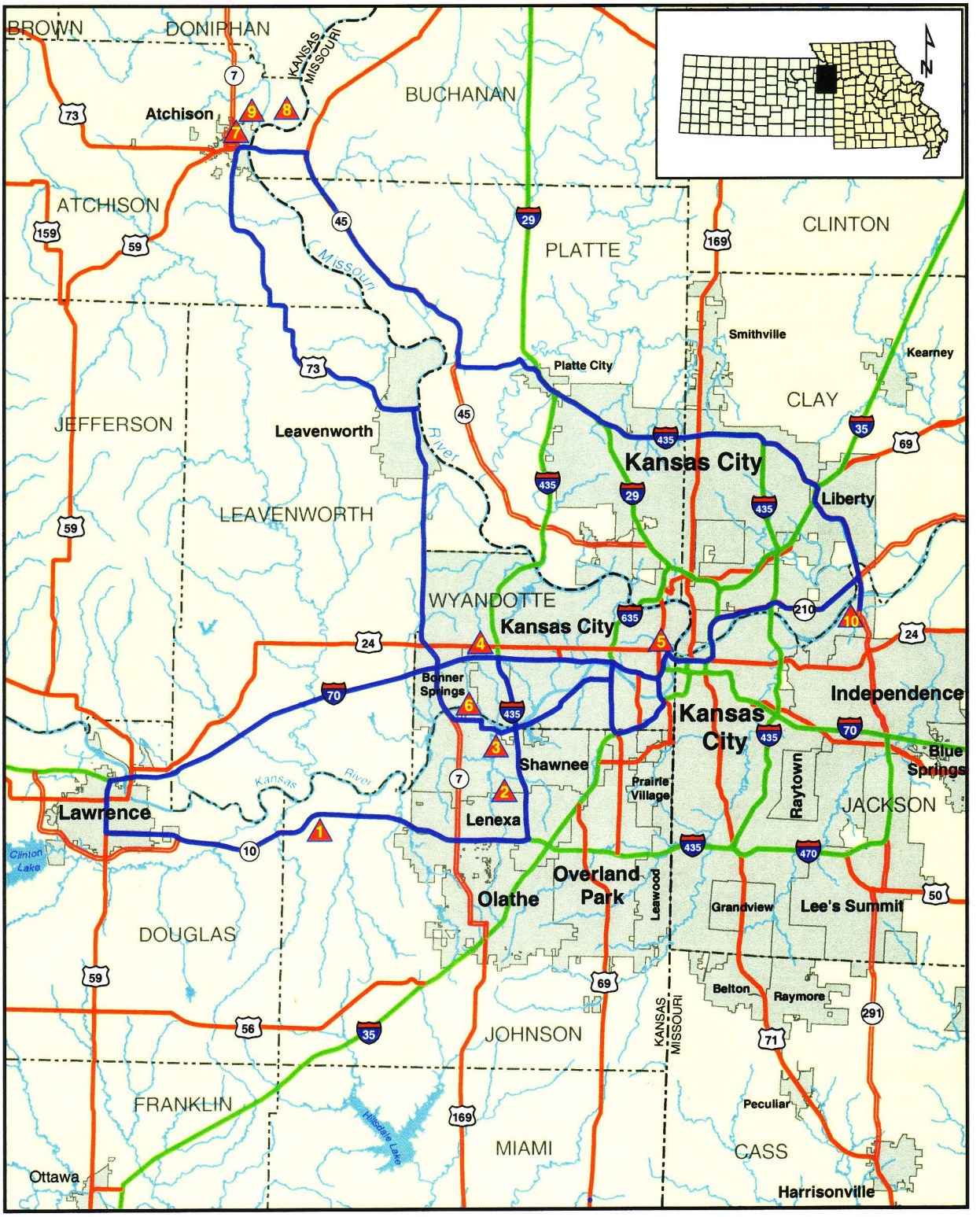
2003 Field Conference
Northeast Kansas



Legend

- Tour site
- Tour route
- Interstate highway
- U.S. highway
- State highway
- State boundary
- County boundary
- Water feature
- City (Selected cities labeled)

0 2.5 5 10 Miles

Map produced by the Kansas Geological Survey (KGS), 5/03. Data from the State of Kansas Data Access and Support Center (DASC) and Missouri Spatial Data Information Service (MSDIS).

Projection information:
Name: Universal Transverse Mercator (UTM)
Zone: 15 Datum: NAD83
Distance units: meters Spheroid: GRS1980

Northeast Kansas

Urbanization and the Environment

2003 FIELD CONFERENCE

June 4-6, 2003

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Acknowledgments

Many Survey staff members helped with the preparation of the 2003 Field Conference. In particular, we want to acknowledge graphic artist Jennifer Sims for the preparation of the brochure, the Field Guide cover, and many of the figures.

Northeast Kansas

Urbanization and the Environment

2003 FIELD CONFERENCE

June 4–6, 2003

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Education
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Administer statewide forestry programs including Forest Stewardship, Forest Product Utilization & Marketing, Urban & Community Foresty, Rural Fire Protection, and Conservation Tree Planting
Experience
Area Extension Forester, Kansas Forest Service (KFS), 1975–1986; Fire Control Specialist, KFS, 1987–1988; State Forester, KFS, 1988–present
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University of Missouri, Columbia – MS, 1975

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Experience
Retired Savings & Loan management; Kansas State Senator, 3rd District, 1997–2000
Education
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Kansas Water Authority: representative on environmental and conservation issues; Professor and Chair of Biology Department, Baker University; consultant/contractor with U.S. Army Corps of Engineers to monitor least tern and piping plover on Kansas River
Education
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Experience
Ninth year in Kansas Legislature; farmer; real estate construction & developer; Kansas Rural Center; Kansas Organic Producers
Education
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Experience
Kansas Senator; Lt. Governor; U.S. Senator
Education
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School teacher (secondary); farmland owner, manager
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Experience
Legislative Research, 20 years; previous committee assignments include Senate Ways & Means, Senate and House Federal & State Affairs, Senate and House Redistricting, Special Committee on Natural Resources

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Policy development and public information.

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Kansas Insurance Department, 1996–2003; Mennonite Housing, 1994–1996; Kansas Legislature, 1983–1994.

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State Representative, 27 years; General Counsel, KCC, 2 years; Executive Director, KCC, 2 years

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Chair, House Energy & Natural Resources Committee; President, Kansas League of Municipalities
Education
Colorado State University – BS, 1962

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Education
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Chair, House Agriculture Committee; Member, Environment, Commerce & Labor Committees; Member, Special Committee on Kansas Securities; Kansas Natural Resources Legacy Alliance
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Education
Fort Hays State University – BS, 1958
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Budget (including legislative actions), Engineering, Personnel, Administrative services (accounting, purchasing, licensing, revenue collections)
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17 years, Division of Budget, State of Kansas
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University of Kansas – BA, 1971
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Experience
Kansas Legislature, 7 years; Administrative Assistant to Kathleen Sebelius, 4 years; retail sales
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Education
Colorado School of Mines – Geol. Eng., 1949
Colorado School of Mines – Petrol. Geol., 1952
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State Senator; Ranking Minority Member, Natural Resources and Assessment & Taxation Committees; Member, Utilities, Agriculture, Education, Children's Issues (joint), and Reapportionment Committees
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Involved in family ranching and farming operation; USD #238 Board of Education
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Experience
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Education
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Experience
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Experience
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Education
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Oklahoma State University – BA, 1970
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Experience
City of Kansas City, KS; Kansas City, KS Public Housing Authority; Member, Kansas Legislature, 1995–2002

Education
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Experience
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Education
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Agency Head
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Education
Highland Community College – AA, 1983
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University of Kansas – MPA, 1993

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Experience
Former Executive Director, KACEE; Special Assistant for Environment and Natural Resources to Governor Mike Hayden, 2 years; Acting Secretary, Kansas Department of Wildlife and Parks, 1987 and 1995; Kansas State and Extension Forestry, KSU, 33 years; U.S. Forest Service, 4 years
Education
University of Missouri – BS, 1957
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Revisor of Statutes Office, 29 years
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Experience
Assistant Professor, PSU; Assistant Professor, Ohio State University, 5 years; Officer, U.S. Navy, 1968–1971
Education
Kansas State College of Pittsburg – BA, 1966
Kansas State College of Pittsburg – MS, 1968
University of Kansas – PhD, 1976

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Current Responsibilities
Oversight of various county departments, including wastewater, public works, stormwater, and environmental
Experience
Nearly 20 years of local government management experience, including 11 years as a city administrator
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Park College – BA
Park College – MPA

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City Manager, Hays, KS; City Administrator, Boonville, MO; Assistant to City Manager, Lawrence, KS; Assoc. Director and Chief Grants Officer, KS Arts Commission
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Wichita State University – BA, 1979
University of Kansas – MS, 1988

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Current Responsibilities
Director of administration and geologic research.
Experience
Kansas Geological Survey, 4 years; Director and State Geologist, Utah Geological Survey, 10 years; Western Earth Science Technologies, Inc., 6 years; University of Utah Research Institute, 3 years; SOHIO, 3 years
Education
University of California, Riverside – BA, 1970
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Current Responsibilities
Supervise publication and public outreach activities, media relations, and non-technical communications
Experience
Kansas Geological Survey, 25 years; University-Industry Research, University of Wisconsin, 3 years; Salina Journal, 4 years
Education
Kansas Wesleyan University – BA, 1975
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University of Wisconsin-Madison – MS, 1982

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Current Responsibilities
Editor, Current Research bulletin; Editor and Writer, Geology Extension; Manager, GeoKansas website; staff, State Energy Resources Coordination Council

Experience
Kansas Geological Survey, 9 years; Paleontological Institute, KU, 10 years

Education
University of Kansas – BA, 1980
University of Kansas – MA, 1985

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Current Responsibilities
Plan and initiate major research programs; Assess scientific quality of current programs

Experience
Kansas Geological Survey, 6 years; Lockheed Martin Idaho Technologies; EG&G Idaho, Inc.; ARCO Exploration & Technology; University of Oklahoma/ Oklahoma Geological Survey, Faculty/Staff Geologist

Education
Lamar State College of Technology - BS, 1966
University of Oklahoma – MS, 1968
Louisiana State University – PhD, 1976

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Current Responsibilities
Geologic mapping, remote sensing, public inquiries

Experience
Kansas Geological Survey, 27 years; KU Remote Sensing Laboratory, 6 years

Education
University of Kansas – BS, 1970
University of Kansas – MS, 1973
University of Kansas – PhD, 1977

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Current Responsibilities
Geology Extension, Kansas Field Conference, geologic mapping

Experience
Kansas Geological Survey, 11 years; Petroleum Geology, 15 years; Engineering Geology, 6 years

Education
Kansas State University – BS, 1972
Kansas State University – MS, 1977

KANSAS FIELD CONFERENCE

Northeast Kansas

Urbanization and the Environment

2003 FIELD CONFERENCE

June 4–6, 2003

Welcome to the 2003 Field Conference, co-sponsored by the Kansas Geological Survey, the Kansas Water Office, the Kansas Department of Wildlife and Parks, and Johnson County, Kansas. Previous field conferences have focused on specific natural-resource issues, such as water or energy, or specific regions. This year the Field Conference moves to northeastern Kansas, an area where a growing population has put increasing pressure on natural resources.

Nearly all of the trip will be spent in the glaciated region of northeastern Kansas, that part of the state that was covered by a sheet of ice about 600,000 years ago. That ice brought with it large red boulders of Sioux quartzite that are still scattered about the landscape. Melt-water streams from the glaciers carried silt that was later blown into thick deposits by the wind. This finely ground silt, called loess, makes up many of the hills and bluffs, such as those that line the Missouri River around Atchison. Loess has the ability to form a steep cliff face, and is also visible in many of the roadcuts in the Kansas City area. This glacial material is much more recent than the underlying bedrock, which is Pennsylvanian in age, or about 300 million years old. Pennsylvanian seas left behind layers of limestone and shale. Sandstone and coal were also sometimes deposited in the area.

A Preview

Day 1.—Much of our first day will be spent in Johnson County, the most populous county in the state. The increasing urbanization of this area, and the county's response to that urbanization, make for a good case study of the interaction between people, resources, and the environment. The county has 21 incorporated cities, including two of the largest cities in the state—Overland Park and Olathe, the county seat. Slightly over half of the 477 square miles of land in the county currently remains in farmland, a third is urbanized, and the remainder is predominantly woodland. The county's population increased from 270,000 in 1980 to 476,000 in 2002. In the 1990's alone it increased by 27%. From 2000 to 2030, the county's population is projected to grow to 655,000, another increase of 40%. If that holds true, nearly a quarter of the state's 2.7 million residents will live in this one county. Annual per capita income is about $43,000, the highest among the state's counties.

Our first stop will be at the Sunflower Army Ammunition Plant, a deactivated facility in western Johnson County, adjacent to Kansas Highway 10. In this rapidly developing area, this land is obviously ripe for development, but any development faces a variety of issues related to environmental cleanup. From Sunflower we will move to more urban parts of the county and discuss the issues that accompany urbanization: planning, parks, storm-water runoff, urban wildlife, and floodplain development. We will then visit the Johnson County Landfill, operated by Deffenbaugh Industries, Inc.

We then move across the Kansas River into Wyandotte County, where Deffenbaugh operates a recycling center. Wyandotte County has a population of about 157,000, the fourth most populous county in the state. Although the county lost about 2.6 percent of its population during the last decade, some parts have recently undergone an economic resurgence. With the completion of the Kansas Speedway at the intersection of Interstates 70 and 435, other companies have moved into the area, including Nebraska Furniture Mart, Great Wolf Lodge and Waterpark, and the Kansas City T-Bones

baseball team. We will visit another new facility there, Cabela's, to discuss nature-based and outdoor tourism.

Day 2.—On the second day, we return to Wyandotte County, to Kaw Point at the confluence of the Kansas and Missouri rivers, where we will discuss plans for a new park and the Unified Government of Wyandotte County and Kansas City, Kansas. We will also hear from the Mid-America Regional Council, an organization that takes on issues that cut across state lines, which is particularly important in a metropolitan area that covers two states but shares many common problems, such as air pollution or water quality. This location is also appropriate for discussing the Lewis and Clark expedition, which camped here almost 200 years ago on its way west and is being commemorated in a park. From here we go to a location along the Kansas River in Bonner Springs to discuss sand dredging.

The next stop is to the north, in Atchison County. We will discuss a variety of issues related to the Missouri River, including management of the river for barge traffic and the impact of that management on wildlife and other reservoirs in the state. We will see a new access point on the Missouri that is also playing a role in area tourism. At Benedictine Bottoms, we will tour an area that is being restoredfor wildlife.

Day 3.—On the final day, we cross the state line into Missouri to visit an underground limestone mine and cement plant in Sugar Creek, just north of Independence. This mine is unique to the area because it has gone relatively deep, about 700 feet, to recover high-quality limestone and to minimize environmental issues that often arise in urban areas. We will also visit a state-of-the-art cement factory operated by Lafarge North America.

About the Kansas Field Conference

The 2003 Field Conference is the ninth in the Survey's annual field conferences. The purpose of the Field Conference is to provide first-hand, on-site experience on natural-resource issues to the state's policy makers. Local and regional experts in resources will describe each site and the resource issues related to it. When possible, participants will interact with county, state, and regional officials, environmental groups, and citizens' organizations. This information base will provide participants with new and broader perspectives useful in formulating policies. In addition, this comprehensive Field Guide provides background on the sites and the issues, serving as a handy reference long after the Field Conference is over.

During the Field Conference, participants are expected to be just that—participants. You are encouraged to make contributions to the discussions, ask questions, and otherwise participate in deliberations**. The bus microphone is open to everyone, and everyone is encouraged to contribute.**

In the course of this Field Conference, we do not seek to resolve policy or regulatory conflicts. Instead, we try to provide opportunities to familiarize policy makers with resource problems and issues. By bringing together experts who examine the unique technical, geographical, geological, environmental, social, and economic realities of the region, we hope to go beyond merely identifying issues. We want this combination of first-hand experience and interaction among participants to result in a new level of understanding of the state's natural-resource issues.

The Kansas Field Conference is an outreach program of the Kansas Geological Survey, administered through its Geology Extension program. Its mission is to provide educational opportunities to individuals who make and influence policy about natural resources and related social, economic, and environmental issues in Kansas. The Survey's Geology Extension program is designed to develop materials, projects, and services that communicate information about the geology of Kansas, the state's natural resources, and the products of the Kansas Geological Survey to the people of the state.

The Kansas Field Conference was begun in 1995 with the support of Lee Gerhard, who was then Survey director and state geologist. The Field Conference is modeled after a similar program of

national scope, the Energy and Minerals Field Institute, operated by the Colorado School of Mines. The Kansas Geological Survey appreciates the support of Dr. Erling Brostuen, Director of the Energy and Minerals Field Institute, in helping develop the Kansas project.

In 2001, the Kansas Geological Survey's Field Conference was recognized by the National Institute of Standards and Technology as among 50 Best Practices for Communication of Science and Technology to the Public. In 1998, the Field Conference received the Public Outreach Award from the Division of Environmental Geosciences of the American Association of Petroleum Geologists. Survey staff members appreciate the willingness of participants to attend the Field Conference and to share their insights for its improvement. Your input has helped make the Field Conference a model to be adopted by other state geological surveys.

Kansas Geological Survey

Since 1889, the Kansas Geological Survey has studied and reported on the state's geologic resources and hazards. Today the Survey's mission is to study and provide information about the state's geologic resources and hazards, particularly ground water, oil, natural gas, and other minerals. In many cases, the Survey's work coincides with the state's most pressing natural-resource issues.

By statutory charge, the Survey's role is strictly one of research and reporting. The KGS has no regulatory function. It is a division of the University of Kansas. The KGS employs about 70 full-time staff members and about 80 students and grant-funded staff. It is administratively divided into research and research-support sections. Survey programs can be divided by subject into water, energy, geology, and information dissemination.

Water.—Water issues directly affect the life of every Kansan. Water supplies are crucial for domestic and municipal use, and in much of the state's economic activity. Western Kansas agriculture and industry rely heavily on ground water; in eastern Kansas, growing populations and industry generally use surface water. The Survey's water research and service includes an annual water-level measurement program (in cooperation with the Kansas Department of Agriculture), studies of mineral intrusion in the Big Bend and Equus Beds areas, water quality in the Arkansas River, depletion of the Ogallala aquifer, the interaction between streams and aquifers, and a variety of other topics.

Energy.—Kansas produces more than $2 billion worth of oil and natural gas each year. Because much of the state has long been explored for oil and gas, maintaining that production takes research and information. The Survey studies the state's coal resources and one newly developed source of energy, coalbed methane. The Survey does research on the state's petroleum reservoirs, new methods of providing information (such as a digital petroleum atlas), and new methods of producing oil (such as the use of carbon dioxide flooding, a technique that was discussed during the 2001 Field Conference). The Survey is completing a multi-year study of the resources of the Hugoton Natural Gas Area and issues related to carbon dioxide sequestration. The Survey also has a branch office in Wichita, the Wichita Well Sample Library, that stores and loans rock samples collected during the drilling of oil and gas wells in the state. In 2002, the Survey played a leading role in the State's Energy Resources Coordinating Council.

Geology. —Much of the Survey's work is aimed at producing basic information about the state's geology, information that can be applied to a variety of resource and environmental issues. The Survey develops and applies methods to study the subsurface, such as high-resolution seismic reflection, undertakes mapping of the surficial geology of the state's counties, and studies specific resources, such as road and highway materials. The Survey reports on non-fuel minerals (such as salt, gypsum, aggregates, etc.) and is charged with studying geologic hazards, such as subsidence, earthquakes, and landslides.

Geologic Information.—To be useful, geologic information must be disseminated in a form that is most appropriate to the people who need it. The Survey provides information to the general public, to policy-makers, to oil and gas explorationists, water specialists, other governmental agencies, and academic specialists. Information is disseminated through a publication sales office, automated mapping, the state's Data Access and Support Center, a data library, electronic publication, and Geology Extension.

Kansas Geological Survey Staff participating in the 2003 Field Conference:

M. Lee Allison, Director and State Geologist
Bill Harrison, Deputy Director
Rex C. Buchanan, Associate Director, Public Outreach
James R. McCauley, Assistant Scientist, Geologic Investigations Section
Liz Brosius, Research Assistant, Geology Extension/Editing
Robert S. Sawin, Research Associate, Geology Extension

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Kansas Department Of Wildlife And Parks

The Kansas Department of Wildlife and Parks is responsible for management of the state's living natural resources. Its mission is to conserve and enhance the natural heritage of Kansas, its wildlife, and its habitats. The Department works to assure future generations of the benefits of the state's diverse living resources; provide the public with opportunities for the use and appreciation of the natural resources of Kansas, consistent with the conservation of those resources; and inform the public of the status of the natural resources of Kansas to promote understanding and gain assistance in achieving this mission.

The Department's responsibility includes protecting and conserving fish and wildlife and their associated habitats while providing for the wise use of these resources, and providing associated recreational opportunities. The Department is also responsible for providing public outdoor recreation opportunities through the system of state parks, state fishing lakes, wildlife management areas, and recreational boating on all public waters of the state.

In 1987, two state agencies, the Kansas Fish and Game Commission and the Kansas Park and Resources Authority, were combined into a single, cabinet-level agency operated under separate comprehensive planning systems. The Department operates from offices in Pratt, Topeka, five regional offices (including one in Lenexa), and a number of state park and wildlife area offices.

As a cabinet-level agency, the Department of Wildlife and Parks is administered by a Secretary of Wildlife and Parks and is advised by a seven-member Wildlife and Parks Commission. All positions are appointed by the Governor with the Commissioners serving staggered four-year terms. Serving as a regulatory body for the Department, the Commission is a non-partisan board, made up of no more than four members of any one political party, advising the Secretary on planning and policy issues regarding administration of the Department. Regulations approved by the Commission are adopted and administrated by the Secretary.

Kansas Dept. of Wildlife and Parks
Operations Office
512 SE 25th Ave.
Pratt, KS 67124-8174
316/672-5911
316/672-6020 (fax)

Secretary Mike Hayden
Landon State Office Building
1020 Kansas Ave.
Topeka, KS 66612
785/296-2281
785/296-6953 (fax)

Kansas City District Office
14639 W. 95th
Lenexa, KS 66215
Phone: 913/894-9113

http://www.ink.org/public/kdwp/

The Kansas Water Office

The mission of the Kansas Water Office (KWO) is to provide the leadership to ensure that water policies and programs address the needs of all Kansans for the present and into the 21st century. The KWO evaluates and develops public policies, coordinating the water-resource operations of

agencies at all levels of government. The KWO administers the Kansas Water Plan Storage Act, the Kansas Weather Modification Act, and the Water Assurance Act. It also reviews the plans of any state or local agency for the management of the water and related land resources of the state.

The KWO develops the Kansas Water Plan, which is revised annually and addresses the management, conservation, and development of the water resources of the state. Numerous water-related public and private entities, as well as the general public, are involved in its preparation and planning. The Kansas Water Plan is approved by the Kansas Water Authority, a thirteen-member board whose members are appointed to their positions, along with ten non-voting *ex officio* members who represent various state water-related agencies. In addition to approving the Water Plan, the Authority approves water storage sales, federal contracts, administrative regulations, and legislation proposed by the KWO. Much of the input for the Water Plan comes via twelve Basin Advisory committees. These committees are composed of volunteer members from each of the drainage basins in the state. During this year's Field Conference, we will be in the Kansas-Lower Republican and Missouri basins.

The Kansas Water Plan is directly linked with the State Water Plan Fund (SWPF). This fund, which takes in and expends about $18 million annually, provides funding for water-related projects that have been identified in the Kansas Water Plan. Every fall the KWA makes recommendations to the Governor and the Legislature on distributing the funds to implement the State Water Plan.

Key Responsibilities of the Kansas Water Office

1. Administer the State Water Resources Plan Act. (K.S.A. 82a-901 et seq.)
2. Conduct public water supply planning. (K.S.A. 74-2616)
3. Administer the State Water Plan Storage Act (Water Marketing Program) (K.S.A. 82a-1301 et seq.)
4. Administer the Water Assurance Program Act. (K.S.A. 82a-1345 et seq.)
5. Manage the State Water Plan Fund. (K.S.A. 82a-951)
6. Administer the Weather Modification Program. (K.S.A. 82a-1411)
7. Coordinate water related activities of state, local and federal government. (K.S.A. 82a-931)
8. Negotiate water-related agreements with the federal government. (K.S.A. 82a-915 & 82a-933)
9. Coordinate water-related research. (K.S.A. 82a-941)
10. Issue water-related revenue bonds. (K.S.A. 82a-1316)
11. Collect and compile information pertaining to the water resources of the state. (K.S.A. 74-2608 et seq.)
12. Work out a plan of water resources management, conservation and development for water planning areas in the state. (K.S.A. 74-2608 e t seq.)
13. Develop and maintain guidelines for water conservation plans and practices. (K.S.A. 74-2608 et seq.)
14. Establish guidelines for conditions indicative of drought. When such conditions are met, advise the Governor, and recommend that the Governor's Drought Response Team be assembled. (K.S.A. 74-2608 et seq.)

Kansas Water Office
901 S. Kansas Avenue
Topeka, KS 66612
785/296-3185
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http://www.kwo.org/

Johnson County, Kansas

Johnson County was originally part of the Shawnee Indian reservation and was opened to settlement with the passing of the Kansas-Nebraska Act of 1854. The area was crisscrossed by a number of major westward migration routes, including the Santa Fe and Oregon-California Trails. Johnson County was established in 1855. One of the first 33 counties in the state, it was named for the Reverend Thomas Johnson, founder of the Shawnee Methodist Mission.

The first city in Johnson County was Olathe Town company, incorporated in 1857. Soon thereafter, the towns of Spring Hill, Gardner, De Soto, and Gum Springs (present day Shawnee) also were incorporated. In 1870, 13,000 people resided in the county. The population remained relatively stable and the economy agriculturally based until the 1910's when the northeastern section of the county began to develop. Lured by J.C. Nichols' innovatively designed communities, Mission Hills in the early 1910's and the Country Club District in the early 1920's, the population began to grow.

In 1904, W. B. Strang began construction of an interurban electric railroad between Kansas City and Olathe. It passed through his newly planned community, Overland Park, and the town of Lenexa. A second interurban railroad, the Hocker Grove Line, was constructed south and west through Merriam and Shawnee. Today Johnson County is the most populous county in Kansas. Overland Park, with 150,000 residents, is the second-largest city in the state.

A seven-member Board of County Commissioners exercises general authority over the County's business and affairs to ensure the general health, safety, and welfare of the public. The Board of County Commissioners has exclusive power to enact, amend, and repeal local legislation, to levy taxes and to make appropriations, to adopt budgets, and to make appointments to certain offices, boards, and commissions.

The county manager serves as the chief administrative officer of the County Government and directs, supervises, and provides continuity for the proper and efficient administration of its business and affairs. The county manager implements the policy and priority decisions and programs of the County Commissioners through a strategic management system. The county manager develops and administers an annual operating budget, which serves as policy document, financial plan, operations guide, and communications device of County Government.

The county manager is responsible for a number of activities and agencies including Park and Recreation, Library, Airports, Mental Health, Public Health, Corrections, Museum, Emergency Management, Emergency Communications, Human Services and Aging, Nursing Center, Appraiser, Planning and Codes, Environmental Department, and Wastewater Department. The County Treasurer, County Clerk, Elections Commission, Sheriff, Register of Deeds, District Attorney, and courts are also part of Johnson County government.

Johnson County Commission
111 South Cherry, Suite 3300
Olathe, KS 66061-3441
Phone: 913/715-0430
Fax: 913/715-0440

http://bocc.jocoks.com/default.htm

SCHEDULE & ITINERARY

Wednesday ,June 4, 2002

7:00 am	Breakfast at the Holiday Inn, Lawrence
7:20 am	Conference Overview *Lee Allison*, Director, Kansas Geological Survey
8:00 am	**Bus Leaves Holiday Inn for Site 1**
8:30 am	**SITE 1**—Sunflower Army Ammunition Plant *Tony Sparr*, Sunflower Army Ammunition Plant *Dean Palos*, Johnson County Planning Dept.
10:30 am	Bus to Site 2
11:00 am	**SITE 2**—The Streamway Parks System and Johnson County *Hannes Zacharias*, Johnson County Manager's Office *Bill Maasen* and *Randy Knight*, Johnson County Park and Recreation *Chris Mammoliti*, Kansas Dept. of Wildlife and Parks
11:45 am	Lunch at Shawnee Mission Park
12:30 pm	Bus to Site 2a
12:40 pm	**SITE 2a**—Mill Creek Floodplain Buyout Area *Kent Lage*, Johnson County Stormwater Management Program
1:00 pm	Bus to Site 2b
1:20 pm	**SITE 2b**—Mill Creek Regional Sewer Plant
2:00 pm	Bus to Site 3
2:15 pm	**SITE 3**—Johnson County Landfill *Randy Alewine*, Deffenbaugh Industries, Inc. *Phil Askey*, Johnson County Environmental Dept.
4:15 pm	Bus to Site 4
4:30 pm	**SITE 4**—Cabela's and Nature-based Tourism *George Potts*, Kansas Nature-based Tourism Alliance *Jerry Hover*, Kansas Dept. of Wildlife and Parks *John Castillo*, Cabela's
6:15 pm	Dinner at Cabela's
7:45 pm	Bus to motel
8:00 pm	Holiday Inn, Mission/Overland Park

Glaciated Region

As the name suggests, the Glaciated Region is the part of Kansas that was glaciated—that is, it was covered by at least two of the eight or nine glaciers that encroached upon much of the northern United States during the Pleistocene Epoch, between 1.6 million and 10,000 years ago. The first of these covered just the northeastern corner of Kansas. The second, which encroached on Kansas about 600,000 years ago, extended almost to Manhattan and beyond Topeka and Lawrence in a line roughly parallel to the present-day Kansas River. In some places, this ice sheet was 500 feet thick.

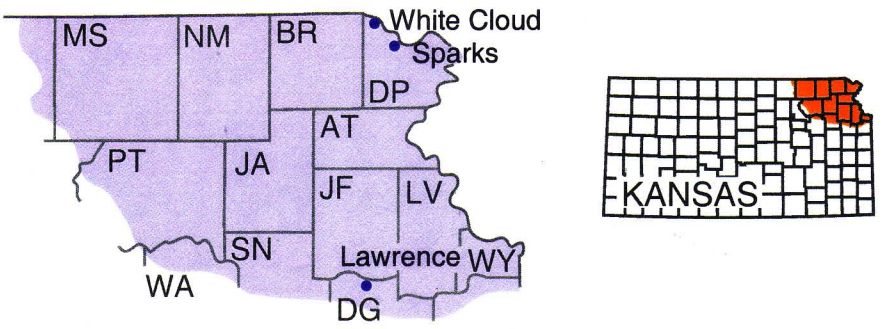
The underlying bedrock in the Glaciated Region, Pennsylvanian and Permian limestones and shales, was deposited about 320 to 250 million years ago. These rocks, however, have been covered by thick glacial deposits—silt, pebbles, and boulders—that were left behind when the ice melted. In some places, the thick deposits, which geologists call glacial drift, have formed deep soils.

Except for the glacial drift, erosion has erased most of the evidence of glaciation from the Kansas landscape. In other parts of North America, such as Wisconsin, the glaciation was more recent and the landscape still bears the marks of the advancing and retreating ice sheet.

During the Pre-Illinoian glaciation in Kansas, the force of the advancing ice was strong enough to break large boulders off outcrops in South Dakota, Iowa, and Minnesota and carry them into Kansas. Rocks that have been transported into an area from far away are called erratics. Among the glacial erratics in northeastern Kansas, quartzite is one of the most common. Quartzite, a metamorphic rock, is quartz sandstone that is so thoroughly cemented with silica (SiO_2) that the rock breaks through the grains as easily as around them. It is harder than sandstone and can not be scratched by a knife. The quartzite boulders in the Glaciated Region, known as Sioux quartzite, come from the area around Sioux Falls, South Dakota, where Sioux quartzite occurs naturally and crops out at the surface.

Source

Kansas Geological Survey, 2003, The Glaciated Region (GeoKansas—The Place to Learn About Kansas Geology): http://www.kgs.ku.edu/Extension/glacier/glacier.html (viewed May 2003).



Sunflower Army Ammunition Plant

History

Sunflower Ordnance Works, now Sunflower Army Ammunition Plant, was established in 1941 on 9,065 acres in Johnson County, Kansas, as the world's largest powder plant. On March 23, 1943, Hercules Powder Company (now known as Hercules, Inc.) began the production of smokeless powder. During World War II, over 200 million pounds of powder and propellants were produced with peak employment reaching 12,067. An additional 10,000 people were employed in construction jobs.

In June 1946, parts of the plant were designated as standby (inactive), meaning the facilities were inspected and maintained for future production. By June 1948, Hercules Powder Company had vacated the premises. The entire installation was placed in standby, and the government took over plant maintenance and surveillance.

In 1951, Sunflower was activated to support the Korean Conflict, producing over 166 million pounds of weapons propellants. It remained open until 1960 with a peak employment of 5,374. In June 1960, Sunflower was again in standby status, until August 20, 1965, when facilities were activated to support the Vietnam War, producing over 145 million pounds of propellants and with a peak employment of 4,065. Production ceased in June 1971, with delivery of final propellant the following month.

In 1984, the plant became the sole domestic source of nitroguanidine, an explosive component of propellants used in artillery and tank ammunition. The plant produced 63 million pounds of nitroguanidine from 1984 to 1992. In January 1994, a Corps of Engineers contractor completed construction of an Industrial Wastewater Treatment Facility that was designed to treat wastewater resulting from nitroguanidine production. Hercules, Inc. took over operation of that facility in February 1994, and in September 1994 they began treating wastewater that had been stored in six lagoons. In May 1995 all wastewater had been treated, and the lagoons were declared empty.

Current Use

In 1997, the Army began the process of closing the plant. SpecPro, Inc. took over as the maintenance contractor on October 1, 2001. The Army continues to investigate and clean up contaminated soil, sediment, and ground water. Excess equipment is being transferred to other governmental agencies. Explosive-decontamination work awaits funding. Disposal of inactive transformers and cleanup of PCB oil spills is underway. Abatement of asbestos that insulated above-ground steam lines is underway. Remaining improvements include 1,600 buildings, 110 explosive storage magazines, 126 miles of roads, and 51 miles of railroads.

Sunflower has been the subject of claims by the Shawnee Tribe of Miami, Oklahoma. In the 1990's and early 2000's, Sunflower was considered as a location for the World of Oz Theme Park. Those plans fell through, however, and now the General Services Administration and the Army are working with the State of Kansas on an agreement to transfer the entire installation to Johnson County. Johnson County's master plan for the county calls for a "community in the park" development at Sunflower (fig. 3-1), though other uses, such as a research park, have been proposed.

The 2003 session of the Kansas Legislature passed legislation allowing the creation of a seven-member redevelopment authority to oversee plans for the site. That authority has the power to issue development bonds and create sales tax and property-tax abatements in order to encourage development. All of these plans hinge, however, on the issue of the cleanup of toxic waste at the site. The Army, which continues to be responsible for cleanup, estimates that the cost of cleanup will range from $40 million to $130 million. If it is

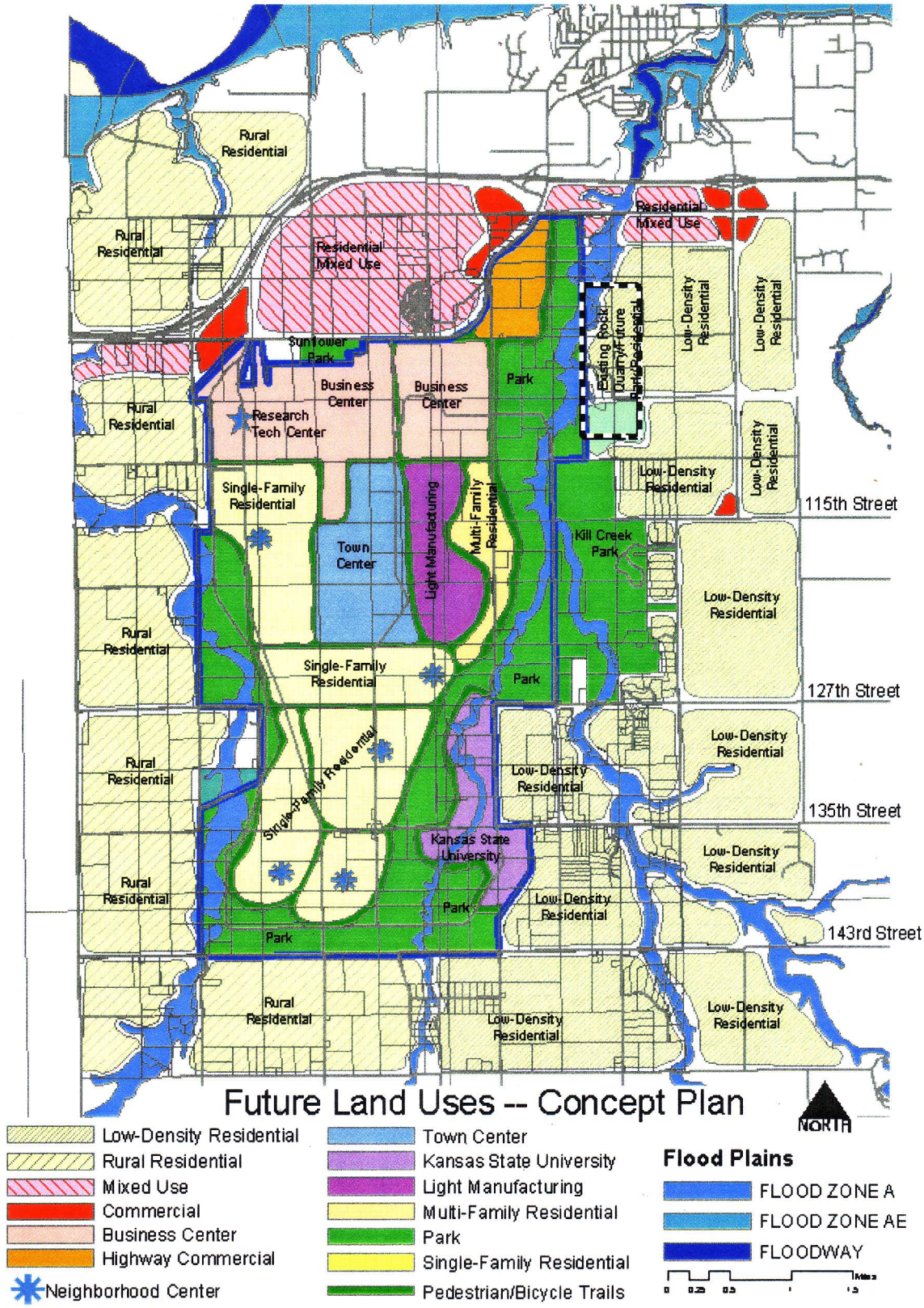


Fig. 3-1—Proposed plan for Sunflower site.

determined that the Army is making suitable progress on the cleanup, the land could be transferred before cleanup is complete.

Sources

Finn Bullers, 2003, County Pursues Sunflower Talks: Kansas City Star, 5 May 2003, p. B1–B2.

Department of Defense, 2003, DOE—Sunflower Army Ammunition web site: http://www.sfaap.net (viewed May 2003).

Resource Contacts

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Johnson County Park and Recreation District

Plan 2020

In September 1999, the Johnson County Park and Recreation District commissioned an analysis of existing District facilities and programs, and a guide for planning and financing the District into the 21st century. The resulting Master Action Plan, MAP 2020, is a comprehensive document designed to assist the District in building on its past while confronting the challenges of its future (see map on following page).

The District covers all of Johnson County, encompassing 477 square miles and a population of over 450,000 people. With the population expected to grow by 40% to more than 650,000 over the next two decades, the District is faced with several challenges in meeting the park and recreation needs of County residents. One of the District's primary challenges is to provide facilities in the growth areas of the County where existing facilities are few. Another is the competition for available land as developers strive to meet the housing and commercial needs of the forecasted growth.

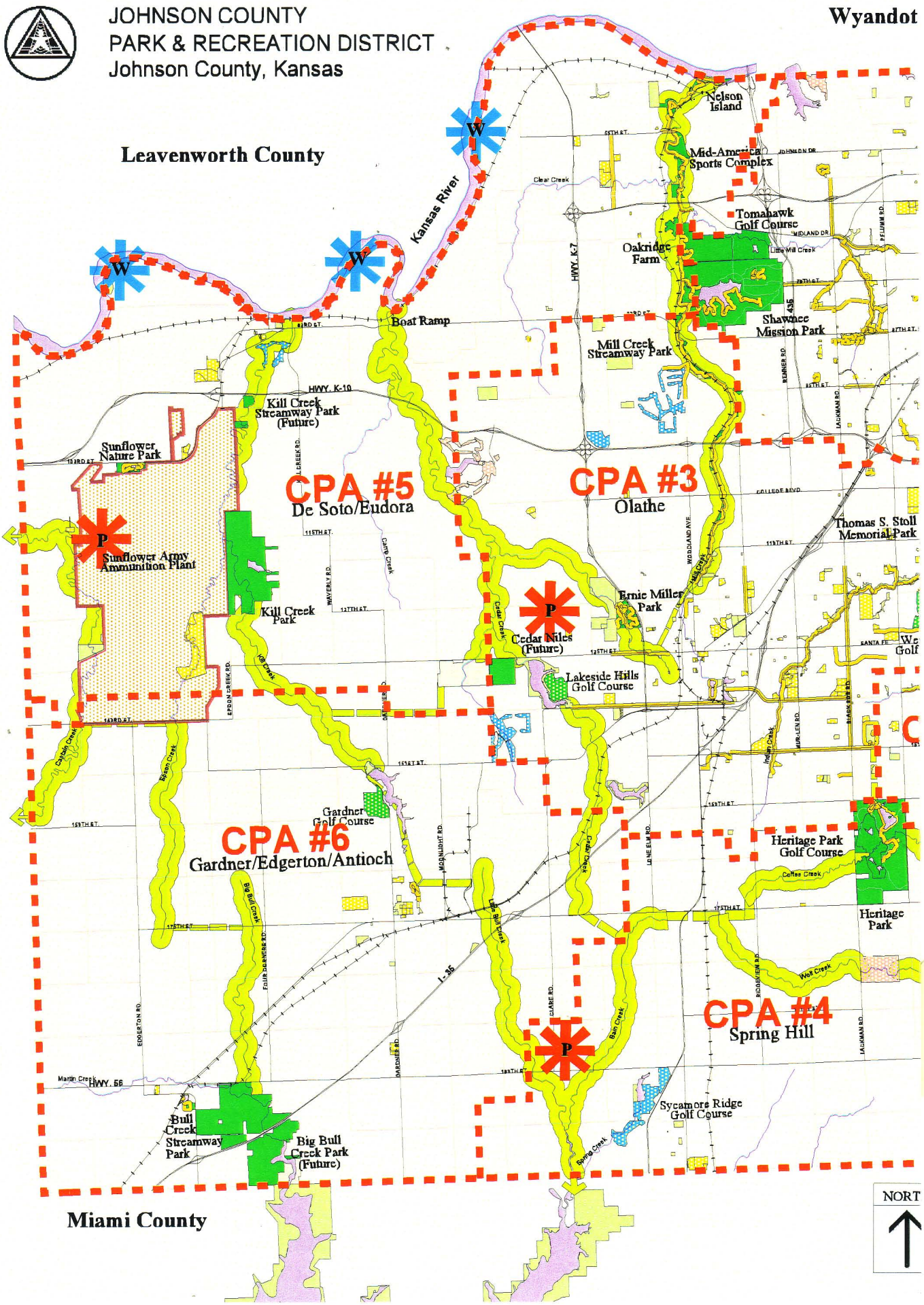
The District offers a variety of active and passive recreation opportunities. With facilities that include golf courses, athletic fields, aquatic facilities, marinas, a beach, and a nature center, the District provides over 4,000 recreation and interpretive programs annually. Due to space limitations, the District offers the majority of those programs at sites it operates but does not own. Of the District's 6,396 acres of parkland, only 20% have been developed for active recreation endeavors.

Based on a nationally recognized standard of 40 acres of parkland per thousand residents, the District has adopted a standard of 22 acres per thousand as its contribution to the overall system to be provided in Johnson County. Municipalities, the State of Kansas, the federal government, and others will be challenged to supplement the standard in order to achieve the 40-acre minimum. The District currently provides 14.1 acres of parkland per thousand residents. The existing parkland ratio, coupled with population projections, make it necessary for the District to acquire more than 7,500 acres of additional land over the next 20 years. The acreage will be acquired in a manner that best provides regional access to park and recreation facilities for the growing population. To provide open space linkages throughout Johnson County, over 2,000 acres of the 7,500 acquired will be dedicated to the parks along streams.

Some areas of Johnson County offer limited opportunity for acquisition of additional land. In those areas, a high priority will be placed on improving existing facilities. System-wide, the District will endeavor to purchase all properties adjacent to existing park sites that are suitable for park use. A major focus in facility planning is the construction of four new multi-use centers and an extreme sports facility.

A $191.9 million Capital Improvement Plan is required to meet the County's land acquisition and development needs. With an emphasis on acquiring additional parkland early in the implementation process, $133.2 million of the total will be required in the first ten years. Over the 20-year planning period, $88 million is to be utilized for land acquisition and $103.9 million for park development. Included in the development costs are $16.7 million for expansion of streamway parks and $24 million for construction of major facilities.

The major portion of land acquisition and capital improvement costs, $157.3 million, could be financed through a voter-approved 1/10 cent sales tax and a temporary mill levy increase. The remaining $34.6 million needed to implement MAP 2020 would be funded through a variety of other mechanisms. Grant funding for some improvements would be available from state and federal sources. Additional implementation tools would include funding through foundations and gifts, developer donations, the granting of easements or conservation easements, joint use of

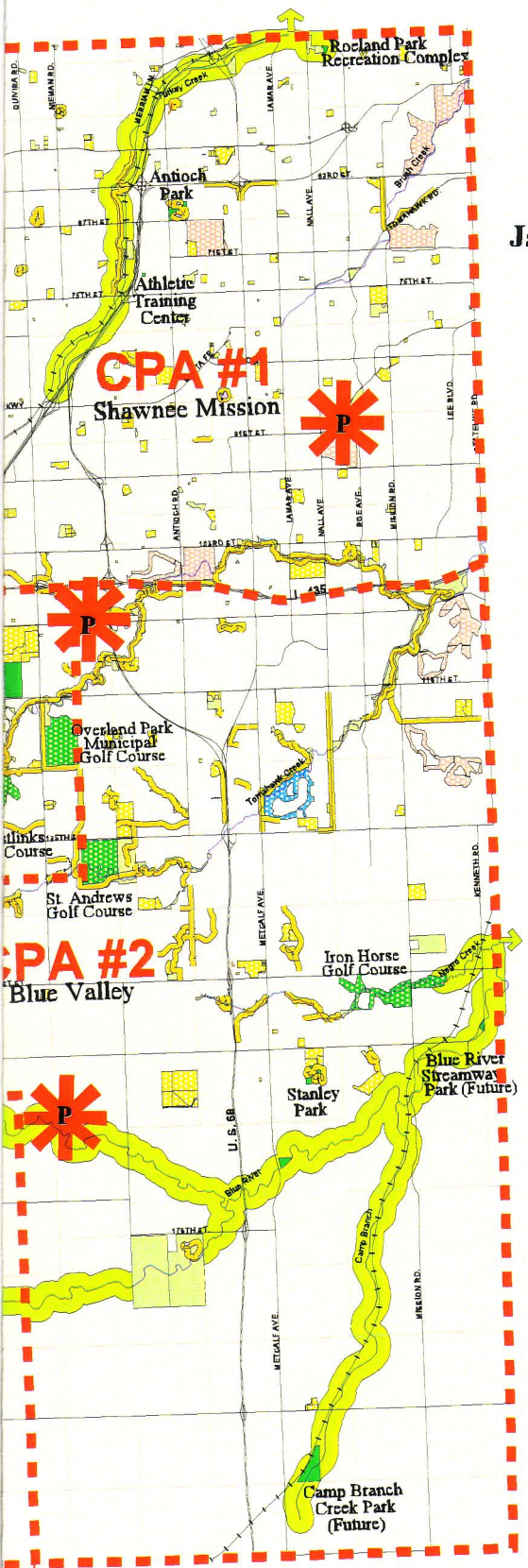

JOHNSON COUNTY
PARK & RECREATION DISTRICT
Johnson County, Kansas
Wyandot
Leavenworth County
Douglas County
Miami County
Kansas River
Boat Ramp
Nelson Island
Mid-America Sports Complex
Tomahawk Golf Course
Oakridge Farm
Shawnee Mission Park
Mill Creek Streamway Park
Kill Creek Streamway Park (Future)
Sunflower Nature Park
Sunflower Army Ammunition Plant
Kill Creek Park
CPA #5
De Soto/Eudora
CPA #3
Olathe
Thomas S. Stoll Memorial Park
Ernie Miller Park
Cedar Niles (Future)
Lakeside Hills Golf Course
Gardner Golf Course
CPA #6
Gardner/Edgerton/Antioch
Heritage Park Golf Course
Heritage Park
CPA #4
Spring Hill
Sycamore Ridge Golf Course
Bull Creek Streamway Park
Big Bull Creek Park (Future)
HWY. K-7
HWY. K-10
HWY. 56
I-35
NORT

te County

Map 8

Plan for Parks

Master Action Plan 2020



Legend

Existing

- JCPRD Parks
- Other Municipal Parks
- State of Kansas Wildlife & Park
- Public Golf Course
- Semi - Public Golf Course
- Private Golf Course
- School Property
- County Planning Area (CPA)
- JCPRD & Municipal Trailway
- Major Road
- Lake / River
- Railroad
- Stream

Proposed

- Potential Streamway Park Addition W/ Proposed Trail
- Streamway Trail Linkage
- P — Potential Park Site
- W — Proposed Wetland Bank & Restoration Site

H SCALE IN MILES

0 1 2 5

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facilities, and other alternatives that reduce the need to purchase land. Site development costs would also be reduced through partnerships with public entities and cooperative agreements with the private sector.

Wildlife and Parks, Lenexa

The Kansas Department of Wildlife and Parks operates a regional office in Lenexa, a Johnson County suburb immediately north of Olathe. Because of the urban location of this office, it deals with issues that differ substantially from those in much of the rest of the state. The deer population in Johnson County, for example, is an important issue here because control by hunting is difficult in this heavily populated area; at the same time, car/deer accidents are common because of the heavy traffic in this area. Wildlife educational activities for an urban population and water-quality in local watersheds are also important issues here.

Source

Johnson County Park and Recreation District, 2001, MAP 2020 Master Action Plan, Johnson County, Kansas, 139 p.

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Johnson County Stormwater Management Program

As Johnson County and cities have grown, so too have expectations for stormwater management systems. At the same time, flood-damage mitigation has become increasingly important. Consequently, the County, in partnership with the cities, has developed and implemented a practical and workable stormwater management plan to reduce or eliminate stormwater-related damage, inconvenience, and threat to life.

In 1988, the Kansas Legislature authorized Kansas counties to adopt a 0.10-cent sales tax for the purpose of funding stormwater management projects. Johnson County was the only county to implement the tax. Subsequent to the sales tax collection, the Board of County Commissioners created the Stormwater Management Advisory Council (SMAC) to help plan a program for the County. The Johnson County cities signed interlocal agreements that gave each city one voting member on the council. To ensure true "regional" coordination, the commissioners also requested that SMAC contain non-voting members such as the U.S. Army Corps of Engineers, the Federal Emergency Management Agency, and several of the cities and counties surrounding Johnson County. SMAC makes recommendations to the County Commissioners, who have the authority to approve recommendations. Additionally, the Commissioners created the Stormwater Management Program to manage and direct program funds and to work with the staff from the cities to implement Program policies and procedures.

In the first few years of the Program, $5 million in sales tax monies were collected annually. The County now is collecting approximately $10 million annually. To date, nearly $100 million of stormwater design and construction projects have been or are being completed through this Program. About $80 million of these projects have been paid for by the 0.10 cent sales tax, with the remainder funded by the cities.

Today, Johnson County and the cities are solving some problems by improving open channels and replacing inadequate culverts and bridges. Other problems are solved cost effectively by purchasing buildings that have a history of repetitive flooding. More importantly, and in an effort to minimize future flooding, countywide watershed studies are being completed to better define outdated Federal Emergency Management Agency (FEMA) floodplains and to estimate floodplain limits based on the continued growth and development in Johnson County. One of the primary goals of these studies is to limit development in areas that are likely to flood, and therefore limit the creation of future flooding problems that require taxpayer dollars to solve.

Two other significant and recent efforts include more proactive regional coordination and a focus on the environment. The Stormwater Management Program is a major player in the Kansas City metropolitan area's efforts towards consistent and appropriate stormwater management. Program staff are key steering team members on regional projects and efforts and the Program is one of the sources for cost-sharing of efforts that benefit the County, cities, and the region. The environmental focus is a result of the changing face of stormwater management –it is no longer acceptable to be concerned only with water quantity. There is also a need to consider environmental impacts of stormwater runoff as it relates to urban runoff, non-point source pollution, and development. The goal is to provide a holistic approach to stormwater management. This goal has been encapsulated in recently developed mission and vision statements. The Program's vision is safe, healthy, and sustainable Johnson County waterways that can be enjoyed by everyone. The Program's mission is to provide financial, technical, and other stormwater assistance services to encourage regional solutions for protecting human lives and property, conserving natural resources, and promoting appropriate public use of Johnson County stream corridors.

Source

Johnson County Park and Recreation District, 2001, MAP 2020 Master Action Plan, Johnson County, Kansas, 139 p.

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Johnson County Landfill

Located at the intersection of Interstate 435 and Holliday Drive in the town of Shawnee, the Johnson County Landfill receives solid waste from much of the greater metropolitan area of Kansas City. The landfill, operated by Deffenbaugh Industries, Inc., handles about 4,500 tons of trash a day from 12 counties in Kansas and Missouri and is one of the 25 largest public landfills in the country. The landfill currently covers about 600 acres, and recently received approval to expand by another 170 acres. As part of the agreement for that expansion, Deffenbaugh will pay the city of Shawnee a one-time fee of $1 million, as well as annual fees that escalate over the life of the landfill, which is scheduled to close in the year 2027.

Landfill Construction

The landfill is located in a quarry that is being excavated into limestones of Pennsylvanian age, including the Iola Limestone, Lane Shale, and Wyandotte Limestone (these same units are nicely exposed in the roadcut at the on-ramp from Holliday Drive to southbound I-435). Cells for the disposal of waste are lined with clay and a synthetic plastic liner that is 60 mils (or about 0.06 inches) thick (fig. 3-2). The water that seeps through the landfill (or leachate) is captured in a leachate collection system. Decomposition in landfills leads to the creation of landfill gas, which is about 45 percent methane. At the Johnson County Landfill, landfill gas is collected through a series of wells that have been drilled into the waste-filled cells. Gas from these wells is carried through pipes and collected at a compressor station where it is processed and pumped into a local pipeline, thus turning a pollutant into a resource.

Landfill Regulaton

The Johnson County Landfill has an operational permit from the Johnson County Environmental Department (JCED) and the Kansas Department of Health and Environment (KDHE). The county permit is issued annually and contains both general and specific operating requirements. The first county permit was issued to the landfill on January 29, 1982. Starting in 1982, JCED has inspected the landfill quarterly. Currently, JCED and KDHE co-inspect the landfill twice a year.

Fig. 3-2—New cell at Johnson County Landfill.

Inspections are based on KDHE solid waste regulations and include visual inspection of landfill waste-disposal operations, such as working-face area, asbestos disposal, special waste disposal, tire shredding, white goods area with freon collection, composting site, medical-waste transfer station, the construction/demolition landfill, and the random-waste screening program. A review of records is also performed. An inspection letter is prepared by JCED specifying those areas needing attention or correction.

The leachate is sampled quarterly from collection tanks in the landfill. Hayes Creek flows through the landfill and is sampled quarterly at three locations: upstream of landfill activities, center of the landfill, and downstream of the landfill. A series of observation wells have been drilled around the property and are analyzed twice a year to monitor water-quality. The landfill gases are subject to regulation under the federal Clean Air Act, and the landfill is monitored quarterly to assure that it complies with these regulations.

Deffenbaugh Industries

Deffenbaugh Industries, Inc., was founded in 1957 and is headquartered in Shawnee Mission. Deffenbaugh is the largest privately owned refuse firm in the midwest, employing more than 1,500 people. Deffenbaugh operates from 14 locations in Kansas, Missouri, and Nebraska, operating 24 hours a day, seven days a week. In addition to collecting, transporting, and disposing of commercial and residential waste, the company handles commercial and residential recycling; portable toilets; quarrying; industrial waste services; and medical waste services. Deffenbaugh's recycling program was created in 1989, and is now the area's largest recycler of its type. The company owns and operates a recycling center in Wyandotte County that processes about 9,000 tons a month of recyclables. Deffenbaugh Recycling offers curbside collection service in most municipalities across the metropolitan area and operates the residential recycling program in Omaha, Nebraska. The company complements its curbside activities with an extensive network of drop-off recycling centers in and around Kansas City.

Sources

Betsy Betros and Mike Booth, 2003, The Clean Air Act and the Johnson County Landfill, Inc.: Fact Sheet, Johnson County Environmental Department, 4 p.

Deffenbaugh Industries, 2003, Deffenbaugh Industries: www.deffenbaughindustries.com (viewed May 2003).

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Watney, W. L., French, John, and Franseen, E. K., eds., 1989, Sequence stratigraphic interpretations and modeling of cyclothems in the Upper Pennsylvanian (Missourian) Lansing and Kansas City groups in eastern Kansas, Kansas Geological Society, Forty-first Annual Field Conference: Kansas Geological Survey, Open-file Report 89-44, 211 p.

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Nature-Based Tourism

Kansas is one of the best places in the world to see the flowers and grasses of the tallgrass prairie, to see the shorebirds that migrate through North America each spring, or to get a clear view of the stars in the night-time sky. Over 450 species of birds and 800 species of wildflowers have been recorded in the state. The landscape is as varied as the Ozark Pleateau of southeastern Kansas to the High Plains of western Kansas.

Some of the most-visited locations in Kansas are those that involve the natural world. According to the Kansas Travel and Tourism Division, Cabela's (in Kansas City, Kansas) was the most popular tourist attraction in the state in 2002, with 2.4 million visitors. Hillsdale State Park, near Paola, was the most popular state park, with 1.6 million visitors, and Clinton Lake and State Park drew 1.5 million visitors. The Sedgwick County Zoo drew 429,000.

Based on the growing interest in the natural world, the Division of Travel and Tourism of the Kansas Department of Commerce and Housing helped bring together an alliance of groups and individuals with an interest in nature-based tourism. The alliance includes bed and breakfast operators, convention and visitors bureau staff, the state's nature centers, state agencies, environmental organizations, and interested individuals.

With support from the Kansas Department of Wildlife and Parks, this Nature-based Tourism Alliance has created a web site that is an excellent source of information about the natural landscape in Kansas, along with information about opportunities and locations to view that landscape. That web site is hosted by the Great Plains Nature Center in Wichita and includes sections on wildlife viewing, upcoming nature-based events, scenic roads and hiking and biking trails, and books and other resources for learning about the natural world in Kansas. The Alliance meets quarterly and is developing plans for other ways to showcase nature-based tourism opportunities in the state.

Cabela's

Cabela's has labeled itself as the world's foremost outfitter of hunting, fishing, and outdoor gear. In the fall of 2002, Cabela's opened its most recent retail store in Kansas City, Kansas, near the intersection of Interstates 70 and 435. The Cabela's site covers 83 acres, of which 46 are dedicated to the retail store. The store covers 188,000 feet of floor space, or about four acres. The store features a 65,000-gallon aquarium with fish native to the midwest and Kansas; a mule-deer museum that consists of the world's largest collection of life-size trophy deer in their natural surroundings, including two world records and numerous state and provincial record deer; an outdoor bronze sculpture of three world-class mule deer, each standing 19 feet tall; and an archery range. Other highlights are a full-service marine department, laser arcade, archery range, art gallery, furniture department, gun library, restaurant, general store, fly fishing store, bargain cave, and gift shop. In the five months after opening, the store drew 2.4 million visitors.

Cabela's started in 1961 when Dick Cabela began selling fishing flies through mail order from his home in Chappell, Nebraska. In 1969 the business was moved to Sidney, Nebraska. The company is perhaps best known for its catalog, which offers more than 500 pages of outdoor equipment and is shipped twice a year to customers in all 50 states and 125 countries. More than 90 million catalogs are mailed each year. The Cabela's in Kansas City is one of seven retail outlets. The others are in Sidney, Nebraska; Kearney, Nebraska; Owatonna, Minnesota; Prairie du Chien, Wisconsin; East Grand Forks, Minnesota; and Mitchell, South Dakota. Plans call for the addition of two more stores: Hamburg, Pennsylvania, in late 2003, and Wheeling, West Virginia, in 2004.

In addition to catalog and retail operations, Cabela's offers programs in corporate outfitting, government outfitting, an electronic newsletter, and a magazine and television program.

Sources

Cabela's, 2003, Cabela's—World's Foremost Outfitter: www.cabelas.com (viewed May 2003).

Kansas Dept. of Wildlife and Parks, 2003, Natural Kansas: www.naturalkansas.org (viewed May 2003).

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SCHEDULE & ITINERARY

Thursday June 5, 2003

7:00 am	Breakfast at the Holiday Inn, Mission/Overland Park
8:00 am	**Bus Leaves Holiday Inn for Site 5**
8:30 am	**SITE 5**—Kaw Point and Wyandotte County *Shari Wilson*, Wyandotte County Lewis and Clark Task Force *Bob Roddy*, Unified Government of Wyandotte County and Kansas City, Kansas *David Warm*, Mid-America Regional Council
9:20 am	Bus to Site 6
10:00 am	**SITE 6**—Holliday Sand and Gravel Company, Plant #7 *Mike Odell* and *Mark Mitchener*, Holliday Sand and Gravel Company *Robert Smith*, U.S. Army Corps of Engineers *Woody Moses*, Kansas Aggregate Producers Association
12:00 pm	Bus to Lunch
12:15 pm	Lunch at Wyandotte County Park
1:15 pm	Bus to Site 7
2:15 pm	**SITE 7**—Missouri River Issues (Overlook at Benedictine College) *Steve Adams*, Kansas Dept. of Wildlife and Parks *David Pope*, Kansas Dept. of Agriculture, Division of Water Resources U.S. Army Corps of Engineers
3:00 pm	Bus to Site 8
3:15 pm	**SITE 8**—Benedictine Bottoms Fish and Wildlife Mitigation Site *Kirk Thompson*, Kansas Dept. of Wildlife and Parks *Glen Covington* and *Kelly Ryan*, U.S. Army Corps of Engineers
4:45 pm	Bus to Site 9
5:00 pm	**SITE 9**—Missouri River Access Site and Lewis and Clark Celebration *Steve Adams*, Kansas Dept. of Wildlife and Parks *Karen Seaberg*, Kansas Lewis and Clark Commission *Greg Miller*, U.S. Army Corps of Engineers
5:30 pm	Refreshments and Dinner at the River House Restaurant
8:00 pm	Bus to AmericInn, Atchison

Flooding in Kansas City

Kansas City is located at the juncture of two large rivers—the Kansas and the Missouri—and over the years has experienced numerous episodes of flooding. In 1821 Francois Chouteau established a fur-trading post near the mouth of the Kansas River called, appropriately, Kawsmouth. This was one of the first settlements in the area. Five years later, a major flood forced Chouteau to move his trading post to higher ground.

In 1844 a major flood occurred in the Kansas and Missouri rivers. Sparse settlement in the area resulted in few accurate appraisals of this flood's magnitude; however, Indians living in what would become Kansas referred to this flood as "the big water." Very high flood stages were recorded downstream on the Missouri and Mississippi. This is considered the largest flood on the Kansas River during historical times.

A major flood occurred on the Kansas River in 1903 destroying 12 bridges over the Kaw and cutting off the water supply to Kansas City for 12 days. A wet spring and early summer in 1951 set the stage for a major flood in much of eastern Kansas. Up to 16 inches of rain in the second week of July sent the Kansas River and many other streams in eastern Kansas out of their banks. Destruction in the large cities along the Kaw was particularly extensive. The Argentine, Armourdale, and Rosedale areas of Kansas City, Kansas, were inundated with up to 30 feet of water (fig. 4-1). The meat packing plants in the Kaw bottoms and the vast Kansas City stockyards were all flooded. Nineteen people died and 1,100 were injured in the 1951 flood. Property damage was estimated as high as $2.5 billion, making it the most destructive flood in the nation's history up to that time. Flooding extended down the Missouri River to near St. Louis, covering up to 2 million acres.

In the years following the 1951 flood, new levees were built, existing ones were raised, and reservoirs were added in the Kansas basin. Today 18 federal reservoirs exist on Kansas River tributaries. These efforts paid off in 1993 when flooding occurred throughout the lower Missouri River basin. Kansas City was largely spared the

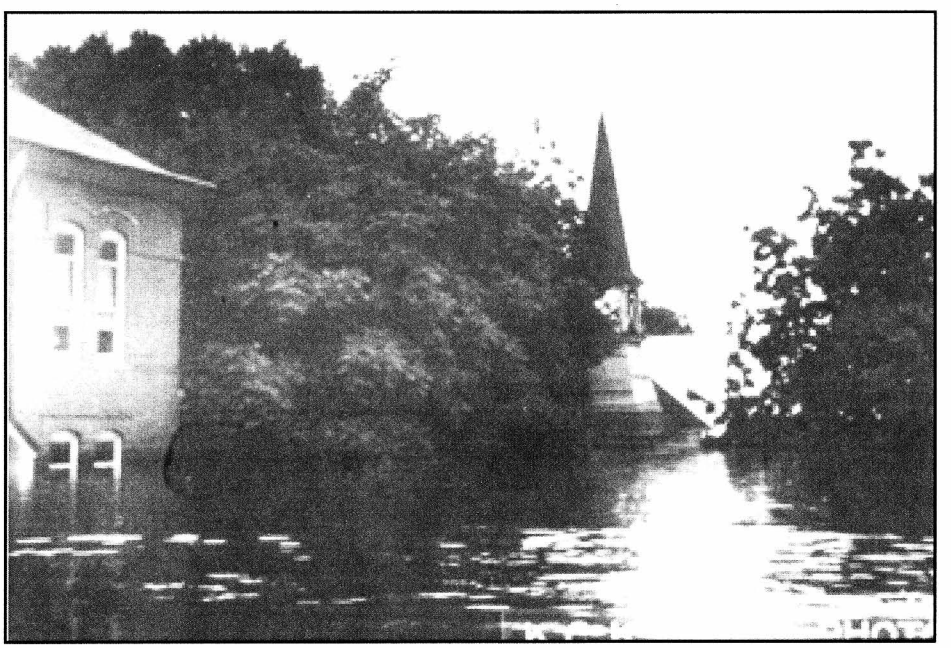

Fig. 4-1—Argentine Baptist Church, July 14, 1951 (Kansas State Historical Society photo).

extensive flooding that occurred in 1951, but flooding did occur upstream and downstream of Kansas City where levees were lower or non-existent. The small town of Wolcott along the Missouri River in northern Wyandotte County was flooded. This was the last in the series of floods to affect Wolcott because all the homes in the town were bought out by FEMA after the 1993 flood and today Wolcott no longer exists. Flooding across the river in the Riverside area of Missouri has resulted in a levee expansion project that is in progress now.

The area around Kansas City can best be described topographically as a dissected plateau. The flat-lying resistant limestones of Pennsylvanian age that crop out in the area cap the level uplands. Elevations range from 1,080 feet in Overland Park down to 720 feet along the Missouri River, producing over 360 feet of topographic relief. Tributaries of the Kansas and Missouri rivers have carved a number of narrow valleys into the uplands. Streams in these valleys have steep gradients falling as much as 40 feet per mile in some stretches, which is comparable to the gradient of the Arkansas River in the Colorado Rockies. Urbanization has replaced much of the natural vegetation in the watersheds with impervious pavement and roofs. This has forever changed the dynamics of these streams when heavy precipitation occurs. These factors make the Kansas City area susceptible to flash flooding, and numerous floods have occurred in the last few decades with deadly results.

On September 12 and 13, 1977, two 100-year, 24-hour rain accumulations occurred 10 hours apart. The second rain fell on saturated ground and caused widespread flash flooding in the Kansas City area. Whereas the 1951 flood lasted several days and claimed 19 lives over a large area, the 1977 flash flood claimed 25 lives in a limited area in the matter of hours. Damage was extensive along Turkey Creek and Brush Creek as well as other streams. Brush Creek drew much national attention when it flooded the Country Club Plaza shopping area. Steps taken to prevent a repeat of this type of flooding include the widening and deepening of stream channels, the raising of bridges over streams to prevent impounding of flood waters, and, in the case of Brush Creek, the construction of retention basins to contain some of the excess runoff. These efforts continue today.

However, these corrections did not come soon enough. On Monday evening, October 4, 1998, millions of sports fans tuned in to watch the Monday night football game between the Kansas City Chiefs and Seattle Seahawks played at Arrowhead Stadium. Instead, they saw the rare sight of a football game delayed by torrential rain. What they didn't see was another disastrous flash flood that claimed 11 lives.

Flash flooding will continue to be a problem in the Kansas City area. Attempts at solutions are difficult because of both the physical and the political geography. Turkey Creek, for instance, which has repeatedly flooded parts of Merriam and the Southwest Boulevard area near the State line drains parts of two states, three counties, and eight municipalities in the course of about 11 miles.

Rapid urbanization that began in northeast Johnson County after World War II continues today, expanding into the western and southern parts of the county, drastically changing the runoff characteristics of a large area in the last 50 years. The watersheds of a number of flood-prone streams such as Turkey Creek, Brush Creek, Indian Creek, Tomahawk Creek, and the Blue River begin in the high ground of Johnson County and extend downstream into Kansas City, Missouri, where much of the death and destruction of flash flooding is concentrated. Thus, with each damaging flood, fingers of blame often point in the direction of Kansas

Source

Juracek, K.,E., Perry C.,A., and Putnam, J.,E., 2001, The 1951 Floods in Kansas Revisited: U.S. Geological Survey, Fact Sheet 041-01.

Kaw Point and Wyandotte County

Kaw Point is the name given to the confluence of the Kansas and Missouri rivers in eastern Kansas City, Kansas (fig. 4-2). It is also the place where, nearly 200 years ago, the members of the Lewis and Clark expedition camped for three days in June 1804 on their way up the Missouri.

To commemorate that campsite, the Wyandotte County Lewis and Clark Task Force wants to build a park at Kaw Point (fig. 4-3). The park will be built on land owned by the Unified Government of Wyandotte County and Kansas City, Kansas. The site is located in the Fairfax Industrial District in Kansas City, Kansas.

The task force, in partnership with the State of Kansas, the Unified Government, local Convention and Visitors Bureau, various community organizations, and private funders, is planning a threefold approach to the Lewis and Clark Bicentennial:

- legacy projects that will enhance the commemorative event and remain after the bicentennial activities are completed;
- site preparation and enhancement/restoration of infrastructure to ready the Kaw Point area for large numbers of visitors; and
- education and marketing efforts to involve students and the community, including Native American students at Haskell Indian Nations University in Lawrence, Kansas.

Together, these efforts and activities will preserve and interpret a portion of the Lewis and Clark Trail for the public.

Plans for the park at Kaw Point include an open-air education center that will tell the story of the encampment, a boat ramp with river access, trails, and a replica of the temporary fort the expedition built at the site. A plaza will honor people who lived in the area or passed through on their way west.

So far, the task force has raised roughly half of the $1 million needed to complete the first phase of the project. This first phase is to be completed by June 26, 2004, in time to mark the bicentennial of Lewis and Clark's arrival there. The second phase of the plan, which is also estimated to cost about $1 million, includes more landscaping, the construction of an overlook, and the creation of an endowment for ongoing maintenance.

While camped at Kaw Point, the men in the Lewis and Clark expedition hunted and repaired

Fig. 4-2—The confluence of the Kansas and Missouri rivers at Kaw Point.

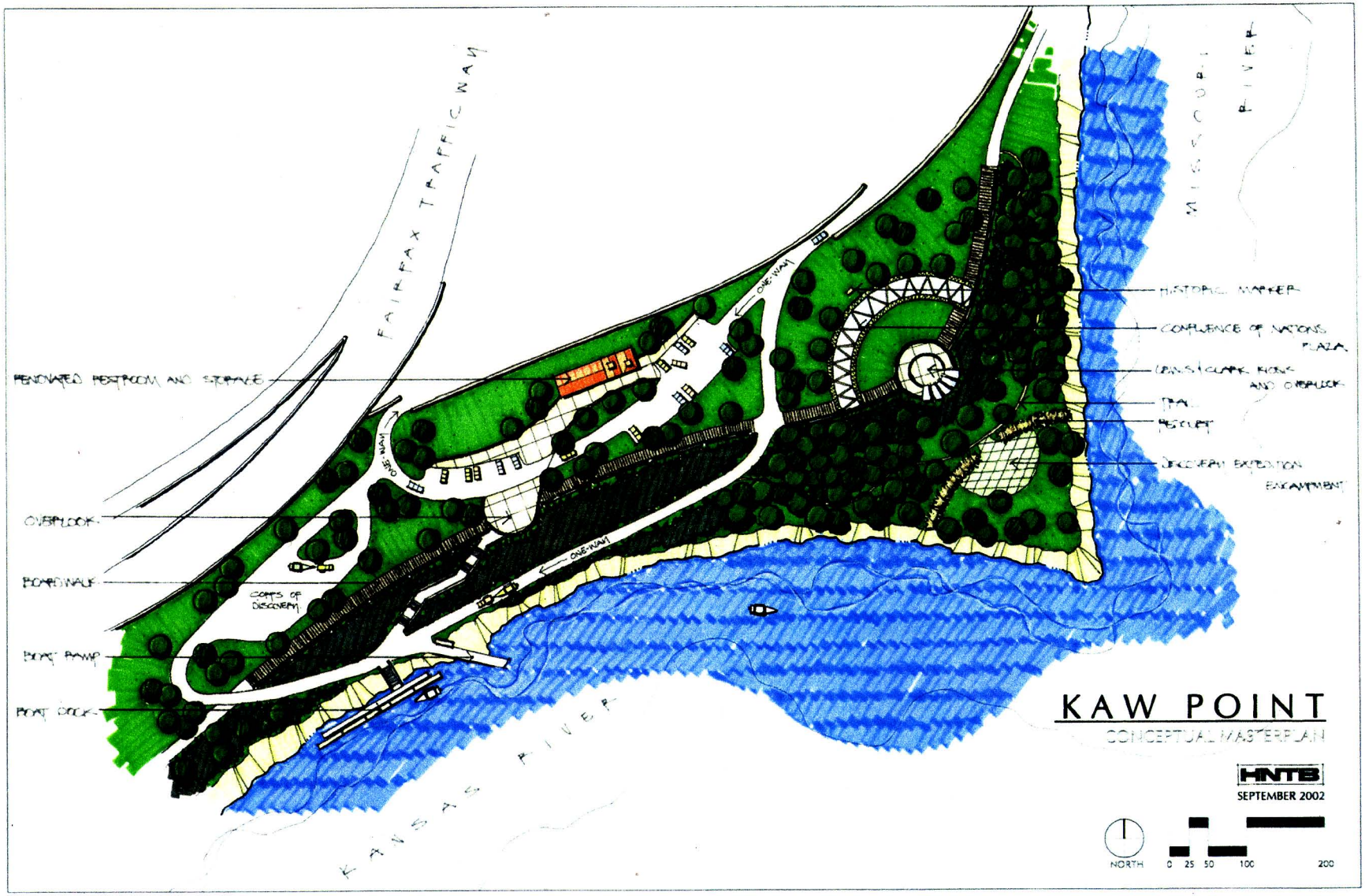

Fig. 4-3—Conceptual plan for proposed park at Kaw Point, Wyandotte County.

their boats—flat-bottomed wooden boats called pirogues that were shaped like canoes. They also built a temporary fort from logs and brush. In his journal, Clark reported the sighting of some now-extinct Carolina parakeets and noted that "the waters of the Kansas is verry disigreeably tasted to me."

Unified Government of Wyandotte County and Kansas City, Kansas

In 1997, voters approved a city-county government consolidation, now known as the Unified Government of Wyandotte County and Kansas City, Kansas. The Unified Government consists of a Mayor/CEO, currently Carol S. Marinovich, and an elected Board of Commissioners, consisting of eight district and two at-large commissioners.

Wyandotte County is the smallest county in Kansas but has the third largest population in the state. The Unified Government of Wyandotte County and Kansas City, Kansas is the only unified city-county government in Kansas or Missouri.

The Mayor/CEO and the Board comprise the Executive and Legislative Branches of the Unified Government respectively. The Mayor/CEO presides over the Board of Commissioners, has veto power, and serves as the eleventh member of the Commission, casting a vote only in the case of a tie or as otherwise required. The Board of Commissioners has policy-making authority for the Unified Government, and is committed to fulfill its mission to provide policy guidance and direction in providing quality services to citizens. Through strategic planning, the Board sets goals and objectives that address issues within the organization and throughout the community.

Mid-American Regional Council (MARC)

The Mid-American Regional Council (MARC) serves as the association of city and county governments and the metropolitan planning organization for the bi-state Kansas City region. MARC is a voluntary association that strives to foster better understanding and cooperation on issues that extend beyond the jurisdiction

Fig. 4-4—Wyandotte County, Kansas.

of a single city, county, or state. These issues include transportation, child care, aging, emergency services, environmental issues, and many others.

MARC seeks to build a stronger regional community by providing:

- a forum for addressing regional objectives and diverse community issues,
- long-range planning and public policy coordination, and
- technical assistance and services to enhance the effectiveness of local government.

The 30 members of MARC's Board of Directors are locally elected leaders, representing the eight counties and 114 cities in the bi-state metropolitan Kansas City region (fig. 4-4). Currently, Dr. Charles A. Eddy, Councilmember, Kansas City, Missouri, is the MARC Board Chair. The work of the Board is assisted by MARC's department directors and staff of approximately 90 professionals and support personnel.

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Kansas River Sand Dredging

Aggregate

At this site Holliday Sand and Gravel Company operates both a river dredge and a pit or floodplain dredge to mine sand and gravel for use as aggregate (fig. 4-5). An aggregate is any hard, inert material used for mixing with a cementing or bituminous material to form concrete, mortar, asphalt or similar product, or used alone as in railroad ballast, road covering, or fill. Although aggregates are inexpensive and an abundant natural resource in places, they are like most of the earth's resources and are not distributed in a uniform or equitable manner.

The two main types of aggregates used in Kansas are sand and gravel and crushed stone. Most of the crushed stone in Kansas is produced from the limestones that crop out from the Flint Hills eastward. In the Kansas River valley there are roughly 75 named limestone units. However, only a few of these meet the rigid specifications of the Kansas Department of Transportation (KDOT) and other aggregate users for purity and physical character for use in concrete construction. Recent problems with crumbling concrete in the Kansas City area have been blamed on the use of crushed limestone from eastern Kansas. Today, more sand and gravel is being substituted for crushed stone. The average mixture in highway concrete is 65% sand and gravel to 35% crushed limestone. KDOT estimates that one mile of two-lane concrete highway, nine inches thick, uses 3,400 tons of sand and gravel. Twenty-five percent of the sand and gravel produced in the Kansas River corridor is used by KDOT.

Primary Sources of Sand and Gravel

The primary sources of sand and gravel in eastern Kansas are the Kansas River (and also the lower tributaries of the Kansas River such as the Republican, Big Blue, and Smoky Hill); the Arkansas River, which is extensively mined in the Wichita area and other places; and the Missouri River, which has a drawback in that much of its sand contains lignite, a form of brown coal that causes dark spots in the concrete that can lead to

Fig. 4-5—River dredge in Kansas River, near Bonner Springs, operated by Holliday Sand and Gravel Company.

cavities and make it susceptible to attack by the elements. The Neosho River is mined for cherty gravels that are found along its course.

Kansas River Alluvium

The Kansas River has formed a deep bedrock trench that is partially filled with silt, sand, and gravel—material collectively known as alluvium. In places, this alluvium is as much as 95 feet thick. The upper surface of this alluvial fill is known to geologists as the floodplain. The average width of the Kansas River floodplain is 2.6 miles. However, it is 3 miles or wider in numerous places above Eudora. The widest stretch of the flood plain is in the Wamego to Rossville area where it is 4 miles or slightly more in width. The narrowest stretch of the Kansas River is from Eudora to its mouth at Kaw Point where it is less than a mile and a half in width and in some places less than a mile. At this Bonner Springs location, the floodplain is 1.1 miles wide.

Types of Dredging

The Kansas River is a major source of sand and gravel in northeastern Kansas. Sand and gravel is produced by two dredging processes: river dredges and floodplain or pit dredges. Numerous exclusion zones—mostly built structures, such as bridges and water intakes, that the U.S. Army Corps of Engineers wants to protect—in the lower portion of the river significantly limit the amount of sand-and-gravel resources.

River dredges are the main method of dredging in the Kansas City area, particularly with respect to tonnage. They mine the bed material of the river, which is generally sand and small gravel. In general, the Kansas River contains very little mud or clay; therefore, there is very little waste. Nearly all the material taken from the river can be used as a commercial product. This results in some of the best-quality, least-expensive sand in the United States.

Floodplain dredges or pit dredges operate on the floodplain of the river at some distance from the river and mine the alluvial fill of the river valley. The uppermost part of the floodplain and much of the terrace deposits are composed of over-bank deposits, generally consisting of fine-grained materials such as clays and silts that were deposited at times of flood at some distance from the river channel itself. The soil and these fine-grained materials represent overburden that must be removed and can be used as fill or possibly as topsoil. There is a limited market for this material. The next material commonly encountered is a fine-grained sand. Much of that is also unusable; however, a small amount can be used and sold as masonry sand. The deeper layers on down to bedrock commonly contain large amounts of medium- to coarse-grained sand and gravel, and this is the desired material. However, within this sand and gravel sequence may be lenses of clay or silt that again have very little market value. The overburden must be removed down to the water table in order to float the dredge that will then dig up the sand and gravel.

Pit Dredging Versus River Dredging

Pit dredges are permitted by the State Conservation Commission and the Division of Water Resources (DWR) of the Kansas Department of Agriculture with approval from the appropriate county commission. In some cases, pit-dredge operations may need a water right because of the evaporation created by exposing the aquifer. River dredges are permitted by the U.S. Army Corps of Engineers with approval of plans by the DWR. In addition, county commissioners approve areas where the plant and handling facilities are located.

A pit dredge requires much more land. At a minimum, about 100 acres are required for a successful pit-dredge operation, and this land is commonly expensive bottom land. A river dredge requires only about 10 acres of land necessary for the screening and storage of material, and this is generally located along the river bank. A pit-dredge operation generally requires drilling or some sort of exploration program to ensure that adequate supplies of sand and gravel are available for mining. This generally is not necessary for the river dredge. With a pit dredge, overburden must be removed at some cost and the pit must be excavated down to the water table, which may be at a considerable depth below the surface. On a river dredge, there is no overburden, and no unnecessary excavation is needed. Unused material produced by pit dredging incurs some

cost for removal or disposal. With a river dredge, there is very little in the way of unusable material. Pits also require reclamation. There are no reclamation expenses involved in river dredging. In addition, when a pit dredge is shut down, a large hole is left in the floodplain in which the water table is exposed, creating a potential avenue of pollution and also loss of water resources through evaporation. In general, in the lower Kansas River area, sand produced by pit dredging is 50% more expensive than sand produced by river dredges.

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Missouri River

The Missouri River is the nation's longest river, and its watershed includes one-sixth of the continental United States. The Missouri River basin has an area of 529,000 square miles, including about 9,700 square miles in Canada. The basin spans 10 states, including all of Nebraska; most of Montana, Wyoming, North Dakota, and South Dakota; about half of Kansas and Missouri; and smaller parts of Iowa, Colorado, and Minnesota (fig. 4-6).

Basin topography varies from the Rocky Mountain area in the West, to the Great Plains area in the middle of the basin, to the Central Lowlands of the lower basin. Elevations in the basin range from over 14,000 feet in the Rocky Mountains to 450 feet above sea level near the river's mouth at St. Louis, Missouri. Major tributaries of the Missouri River include the Yellowstone River, which drains over 70,000 square miles; the Platte River, with a 90,000-square-mile drainage area; and the Kansas River, which drains approximately 60,000 square miles. Three reservoirs on tributaries of the Kansas River—Tuttle Creek, Perry, and Milford—are operated by the U.S. Army Corps of Engineers.

Average annual precipitation ranges from 8 inches just east of the Rocky Mountains to about 40 inches in the southeastern part of the basin and the higher elevations of the Rocky Mountains. Normal seasonal maximum precipitation occurs during the spring and early summer months throughout the basin. Roughly 48 percent of the

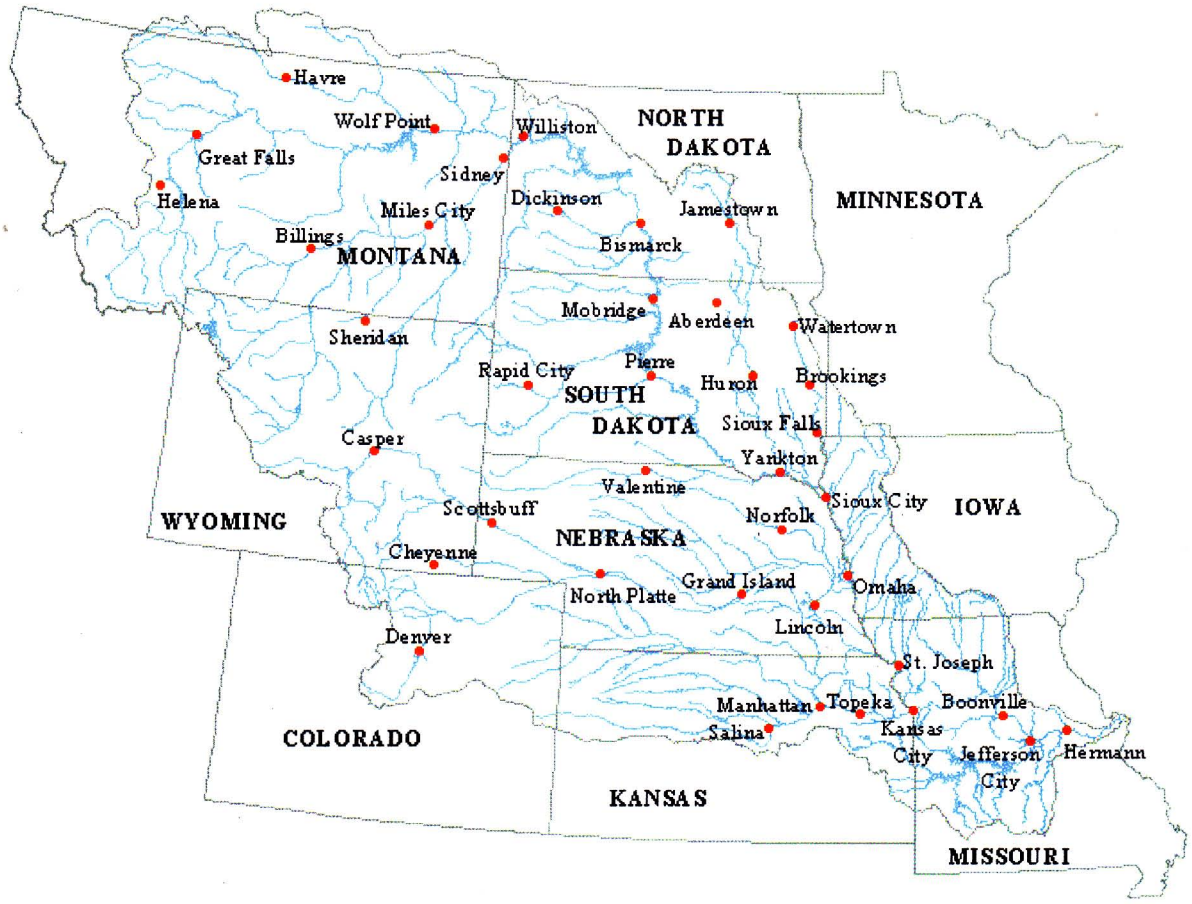

Fig. 4-6—The Missouri River basin.

annual runoff comes in the months of May, June, and July as a result of snow melt and spring and summer rains. Runoff averages 25.2 million acre-feet (MAF) annually above Sioux City, Iowa. Records dating back to 1898 indicate runoff has varied from a high of 49.0 MAF in 1997 to a low of 10.6 MAF in 1931.

The six large dams that span the Missouri River control runoff for approximately half of the basin. Those six dams—Fort Peck in Montana; Garrison in North Dakota; Oahe, Big Bend, and Fort Randall in South Dakota; and Gavins Point along the Nebraska-South Dakota border—make up the largest system of reservoirs in the United States. The combined storage capacity of all six reservoirs is 73.4 MAF, about three times the annual runoff. The system became fully operational in 1967.

The U.S. Army Corps of Engineers releases water from the dams to allow navigation for barges from Sioux City, Iowa, to St. Louis, Missouri; however, barge traffic has decreased steadily since 1977. Management of the system for navigation has put the Corps in the middle of controversy between those who want to maintain the current system and those who want greater amounts of natural flow. Environmentalists generally want the Corps to allow greater natural flow to restore the river's ecosystem and more nearly mimic flow conditions before the dams existed; recreational users and the tourist industry say low water levels affect fishing, swimming, and boating; farmers say more water will cause flooding of their crops.

Master Manual

Congress authorized the operation of the six dams on the Missouri River for flood control, recreation, irrigation, water supply and water quality, navigation, hydropower generation, and fish and wildlife. The system is operated by the U.S. Army Corps of Engineers using guidelines published in the Missouri River Main Stem Reservoir System Master Manual (or Master Manual), which describes the regulation of the six Missouri River main stem dams as a system. The Master Manual presents a highly technical description of the guidelines that govern long-term water management of the system. A review of the guidelines presented in the Master Manual is currently underway. The purpose of the review, which began in 1989, is to identify a water control plan that serves the contemporary needs of the basin, complies with current environmental laws, and serves Congressionally authorized project purposes.

Flood Control.—Flood control is the only authorized project function that requires the availability of empty storage space rather than impounded water. Flood events are generally unpredictable; therefore, detailed routing of specific major flood flows is accomplished when floods occur. The high risk flood season begins about March 1 and extends through the summer. Storage levels are gradually lowered throughout the fall and winter months to levels at or below the base of the annual flood control zone by March 1. During all but excessively dry years, water stored in the reservoirs will increase during the March-July season.

Navigation.—The Missouri River navigation channel extends for 735 miles from its mouth at St. Louis, Missouri, to Sioux City, Iowa. Navigation on the river is limited to the normal ice-free season with a full length season normally extending from April 1 to December 1 at its mouth. To permit a viable navigation industry, it is desirable to maintain navigable flows throughout this 8-month period. System reservoir releases are scheduled to provide adequate flows for navigation according to established minimum and full-service flow targets at Sioux City, Omaha, Nebraska City, and Kansas City. The target flows increase downstream because of the increased flow requirements needed to maintain similar flow depths with naturally increasing channel dimensions. Target flows are evaluated and adjusted periodically to ensure compatibility between available water supply and current navigation channel conditions. The three Kansas River Corps reservoirs are authorized to provide additional water to meet the Kansas City flow target, but at times, the State wants to keep that water in the reservoirs.

Water Quality Control.—Downstream water requirements for water quality were established by

the Federal Water Pollution Control Administration in 1969 and reaffirmed by the Environmental Protection Agency in 1974. Minimum daily flow requirements are established to maintain water quality.

Water Supply.—Numerous water intakes are located along the Missouri River. These intakes are primarily for municipal water supplies, nuclear and thermal electric powerplant cooling, and for irrigation supplies withdrawn directly for the river. Operation guidelines call for a minimum daily average release that is satisfactory for municipal water supply. These rates also supply ample water to meet most irrigation demands.

Power Production.—Western Area Power Administration markets hydroelectric energy and capacity from the system. Energy is marketed on both an annual and seasonal basis, recognizing the seasonal pattern of releases made for navigation and required for flood control. The hydroelectric powerplants provide power in parts of Montana east of the Continental Divide, North and South Dakota, eastern Nebraska, western Minnesota, and western Iowa.

Fish and Wildlife.—Construction of large reservoirs on the Missouri River system has increased sport fishing in the basin. Because of extensive management, the big reservoirs produce more sport fish than the Missouri River did before impoundment. However, the construction and operation of the system has altered the natural streamflow of the river. An early spring rise and a late spring-summer rise characterized the natural flow. High flows resulted from the plains snowmelt, from March and April rains, and from the mountain snowmelt and rains in May, June, and July. Low flows typically occurred in late summer and fall. Regulation of flows has reduced spring flows and increased fall and winter flows, thus altering the habitat of native riverine fish species and some nesting birds. Currently, five species are listed or are candidates for listing as Federal threatened or endangered species: interior least tern (endangered); piping plover (threatened); pallid sturgeon (endangered); sturgeon chum and sicklefin chub (candidates). Waterfowl management takes place on the Charles M. Russel, Audubon, and Pocasse National Wildlife Refuges. Under intense management, wildlife production on the refuges has been substantial. Large numbers of migrating waterfowl use the reservoirs, open water reaches on the river, and nearby refuge areas.

National Research Council Study

A two-year study that examined how the Missouri River system is managed, sponsored by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency, was released in January, 2002. The study was conducted by the National Research Council, an operating arm of the National Academy of Sciences, and the National Academy of Engineering, a private, nonprofit institution that provides science and technology advice under a congressional charter. The report (*The Missouri River Ecosystem: Exploring the Prospects for Recovery*) says the Missouri River and its floodplain ecosystem experienced significant environmental and hydrologic changes (construction of dams and levees, channelization, and other human activities) over the last century and is clearly in a serious state of decline, and degradation will continue unless the river's natural water flow is substancially restored.

The Research Council report calls for a moratorium on further revisions of the Master Manual until such changes reflect a science-based approach known as adaptive management. The adaptive-management strategy considers environmental and economic goals equally, and enables natural resources managers to adapt decisions to changing social and economic situations and the latest scientific information. The study says this effort should be directed by a formal group of stakeholders that should include the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Department of Energy, the U.S. Bureau of Reclamation, the U.S. Fish and Wildlife Service, the National Park Service, American Indian tribes, state governments, local municipalities, farmers, envronmental and recreational groups, and the barge industry. The stakeholder group should receive input from an independent panel of scientists to help resolve questions and ensure that the group is adhering to adaptive-management principles.

In addition, the Research Council report recommends that Congress enact legislation to ensure that federal officials manage the Missouri River in a way that improves ecological conditions.

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Missouri River Mitigation Project—Benedictine Bottoms

Introduction

The Missouri River Mitigation Project is designed to mitigate, or compensate, for fish and wildlife habitat losses that resulted from past channelization efforts on the Missouri River. The project extends from Sioux City, Iowa, to the mouth of the Missouri River near St. Louis, a length of 735 river miles.

The purpose of this mitigation effort is to acquire, restore, and preserve aquatic and terrestrial habitat on individual sites found along the project length. New wildlife areas will be created, existing areas improved, and other river features may be returned to historic conditions. The project will develop approximately 166,750 acres of land in separate locations along the river in Nebraska, Iowa, Kansas, and Missouri.

Preservation or restoration will be accomplished by means of land acquisition from willing sellers, dredging filled-in areas, reopening historic chutes, bank stabilization, dike notching, pumping, dike/levee construction, vegetative plantings, and vegetation and land management.

The Corps is working with a coordination team, composed of state and federal fish and wildlife agencies, to construct this mitigation project. In addition, the Corps also works with interested State and local groups on a site-by-site basis for successful project implementation.

Project History

Prior to 1900, the Missouri River channel was uncontrolled. It was free to meander back and forth across the river valley. The river continually eroded the banks and deposited the eroded material in new locations to form bars, shoals, and new banks downstream.

At all times, the channel occupied roughly 300,000 acres and consisted of numerous islands, channels, chutes, sandbars, and slack water supporting vegetation in various stages of succession. This vegetation reflected the natural processes of erosion deposition and consisted primarily of willow and cottonwood.

Efforts to stabilize the Missouri River and provide a navigation channel started in the early 1900's. Since 1912, seven separate acts of Congress provided for the construction and maintenance of a navigation channel and bank stabilization works. The collection of projects, constructed and maintained by the U.S. Army Corps of Engineers, is known as the Missouri River Bank Stabilization and Navigation Project (BSNP).

The BSNP projects included placing revetments on the riverbanks, closing off sloughs and side channels, and constructing pile dikes. Later work included dredging and rock dike construction. Construction and long-term operation and maintenance of the BSNP created an inland navigation system and provided many benefits such as protecting utilities, transportation networks, bridges, and adjacent landowners and farms.

However, the highly controlled, narrow channel has reduced the amount of fish and wildlife habitat that used to be supported from the natural channel and meander belt. Consequently, the fish and wildlife populations have seen a significant reduction along with the loss of recreational opportunities that they provided.

In the early 1980's, the Kansas City District of the U.S. Army Corps of Engineers completed a study of the feasibility of Missouri River Mitigation Project. The study determined that it was economically feasible to mitigate fish and wildlife resources lost to the construction of the BSNP project and enhancing fish and wildlife resources.

Implementation

In 1986, Congress authorized construction of the Mitigation project, and passed another bill in 1999 that brought the total amount of land autho-

rized for purchase from willing sellers and/or public interests to 166,750 acres. The U.S. Army Corps of Engineers began implementation of the Mitigation project in 1991. Since that time, approximately 24,900 acres of land have been purchased from private and willing sellers and set aside for fish and wildlife. Easements have also been obtained on another 5,800 acres of existing public lands in which mitigation efforts have taken place. To date, 28 different mitigation sites are in various stages of acquisition and development.

Benedictine Bottoms

The Benedictine Bottoms mitigation site, located two miles northeast of Atchison, Kansas, is 2,111 acres in size (fig. 4-6). The site was purchased from willing sellers in 1996. Design of the mitigation features at this site were coordinated with the Kansas Department of Wildlife and Parks, the Kansas Forest Service, and the U.S. Fish and Wildlife Service. The project features 550 acres of native upland habitat, 750 acres of native grassland habitat, and 450 acres of wetland habitat.

Construction of the project was completed in 1998. The native upland habitat was created by planting more than 175,000 tree and shrub seedlings. Shrubs were planted at the edges of the trees to provide a transition zone between the woodland and wetland prairie habitats. The combination of bottomland hardwoods and shrubs will provide food as well as escape and winter cover. The grasslands were created from a

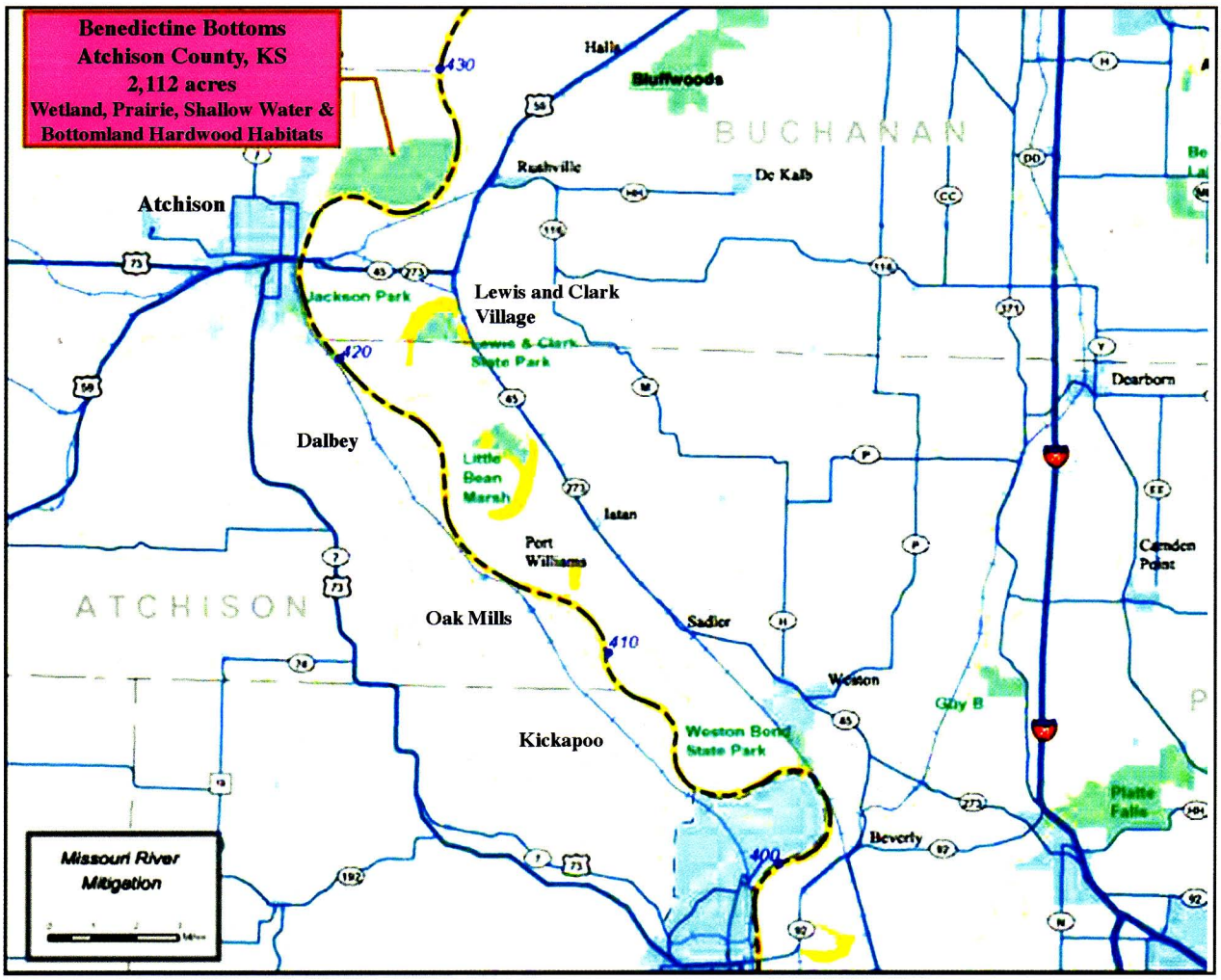

Fig. 4-6—Benedictine Bottoms mitigation site, Atchison County.

mixture of big bluestem, Indian, eastern gama, and switch grasses along with wildflowers and legumes. The wetland prairie habitat will provide valuable nesting and escape cover as well as a source of food. The wetlands were built using low-profile earthen fill levees, three wells and distribution piping, and water-level control structures. Some wetland cells will be operated as permanent marshes which will contain shallow water habitat year-round. Others will be managed as seasonal wetlands for migratory waterfowl.

The Benedictine Bottoms mitigation site is currently managed by the Kansas Department of Wildlife and Parks. The site is available to the public for a variety of outdoor activities including bird watching and hunting when in season.

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Lewis and Clark in Kansas

The Expedition

Early in 1803, at the request of President Thomas Jefferson, Congress authorized funds for an expedition from the Missouri River to the Pacific Northwest, the primary objective of which was to discover an all-water route to the Pacific Ocean (the so-called Northwest Passage). Jefferson also wanted the expedition to collect plant, animal, and mineral specimens; record weather data; study native cultures; and create a permanent map of the route. He appointed his secretary, Meriwether Lewis, to lead the expedition. Lewis, in turn, chose his friend William Clark to be co-commander of what soon became known as the Corps of Discovery.

That spring, on April 30, 1803, representatives of the United States and France completed arrangements for the sale of Louisiana to the U.S. The Louisiana Purchase doubled the nation's size (adding 838,000 square miles). Most of this new territory was unknown (except of course to the Native Americans who had lived there for centuries and fur traders who had traveled up the Missouri into what is now North Dakota).

In Kansas

From June 26 until July 10, 1804, the Lewis and Clark expedition followed the Missouri River along the northeastern edge of today's Kansas. Of all the states (or, rather, of all the Louisiana Purchase that eventually became states) that they saw, they spent less time in Kansas than any other place. Nonetheless, it was an eventful time—one member of the crew was bitten by a snake, two men were court-martialed and punished, and the company celebrated the 4th of July. Though Lewis and Clark were in Kansas only slightly more than two weeks, their records provide a sense of the land's appearance, prior to white settlement.

Lewis and Clark left St. Charles, Missouri, on May 21, 1804. Slightly more than a month later, they camped at the mouth of the Kansas River, in present-day Wyandotte County, Kansas. They stayed here for three nights. While the courses of both rivers have changed considerably since 1804, the camp was probably very near the present confluence of the two rivers, an area that is now known as Kaw Point and part of Kansas City, Kansas, and lies just across the Missouri River from Kansas City, Missouri. "Came to ... Camped in the Point above the Kansas River," wrote William Clark (Moulton, vol. 2, 1986, p. 324). The next day, Clark described the country around them. "A high Clift, on the upper Side of the Kansis 1/2 a mile up," he wrote (Moulton, vol. 2, p. 325). This is probably the first reference to the loess hills of northeastern Kansas. These loess bluffs, which line both sides of the Missouri above the mouth of the Kansas River, are thick deposits of brown, tan, and buff-colored silt generally thought to have been the result of wind deposition during various glaciations in the midcontinent. Lewis and Clark made repeated references to the loess bluffs, though they only identified them by color and not by rock (or soil) type.

Also on that first day in Kansas, Clark measured the mouth of the Kansas River as "230 yds 1/4 wide" (Moulton, vol. 2, 1986, p. 325). The following day, Meriwether Lewis compared the weight of the water from the two rivers, and found that the Missouri was the siltier of the two. Clark, however, reported that "the waters of the Kansas is verry disigreeably tasted to me" (Moulton, vol. 2, 1986, p. 327). Lewis and Clark were only vaguely aware of the headwaters of the Kansas, believing that it began in the Black Hills.

Lewis and Clark were more accurate, however, in associating the Kansas River with the Indian tribe that gave the river its name. Though they saw no Kansa Indians during their time in Kansas—"This nation is now out in the plains hunting the Buffalow" (Moulton, vol. 2, 1986, p. 327) —they knew that two Kansa villages were nearby, and later noted the location of former Kansa villages as the expedition moved farther north. They knew that the Kansa had abandoned their villages in Doniphan County, Kansas, to move out onto the plains to the west (Unrau, 1971).

On the afternoon of June 29, 1804, after drying out their boats and provisions, and allowing their hunters to return with meat, the expedition headed upriver. Their departure had been delayed by the court martial of John Collins and Hugh Hall, the first for drinking while on sentinel duty, the second for drinking whiskey without permission. The men were punished with lashes, then the expedition broke camp and moved back into the river. Today, the proposed park at Kaw Point will commemorate the location where Lewis and Clark camped.

By July 1, Lewis and Clark were near today's Leavenworth, and on July 3 the expedition was in Atchison County. On the 4th, one of the men was bitten by a snake, and Lewis treated the wound. That night they camped on a previously unnamed stream and christened it Independence Creek; they also named another stream "4th of July 1804 Creek," now known as White Clay Creek. On the night of July 4, 1804, the men fired off a cannon, undoubtedly the first 4th of July celebration in today's Kansas.

During their 16 days in Kansas, Lewis and Clark commented about the large numbers of deer they saw, along with elk, ducks, geese, whip-poor-wills, Carolina parakeets, pelicans, wood rats, pike, swans, buzzards, crows, hawks, and a great horned owl. They saw grapes, wild roses, wild rye, Indian potatoes, paw-paws, cottonwoods, sycamores, ashes, mulberries, elms, walnuts, hickories, willows, and even a native pecan tree (at the far northern edge of its range).

Bicentennial Commemorations

From 2003 through 2006, communities throughout the U.S. will observe the bicentennial of Lewis and Clark's journey (fig. 4-7). In June and July of 2004, Kansas communities along the Missouri River will participate in "A Journey Fourth," designated by the National Council of the Lewis and Clark Bicentennial as a Signature Heritage event. This event will commemorate the

Fig. 4-7—The route of the Corps of Discovery (outbound route shown in red, inbound in blue).

first Independence Day celebration in the American West.

The principal events will take place on the weekend of July 3–4 in the cities of Kansas City, Missouri, and Leavenworth and Atchison, Kansas. From June 22 to July 11, a wide range of activities tied to the Lewis and Clark bicentennial are planned throughout the region.

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SCHEDULE & ITINERARY

Friday ,June 6, 2003

7:00 am	Breakfast at the AmericInn, Atchison
8:00 am	**Bus Leaves AmericInn for Site 10**
9:15 am	**SITE 10**—Sugar Creek Underground Limestone Mine and Cement Plant *Bob Elliott*, Lafarge North America *Woody Moses*, Kansas Aggregate Producers Association
12:00 pm	Bus to Motel
1:00 pm	**Arrive Holiday Inn, Lawrence**

Sugar Creek Underground Limestone Mine and Cement Plant

In Kansas, limestone is as an ingredient in asphalt, as gravel on roads, in building construction, and in making cement (which is mixed with sand, stone, and water to make concrete). In Kansas, limestone is generally mined from quarries at the surface. In the Kansas City area, it is mined from shallow quarries and from shallow underground mines (generally less than 100 feet deep). Open space from these shallow underground mines is then used for storage, for office space, and for a variety of other uses throughout the metropolitan area.

The cement plant in Sugar Creek, Missouri, is unusual because the limestone used in making cement comes from a relatively deep mine, about 700 feet underground. Even though this mine produces limestone, in some ways it has more in common with underground salt mines (such as the one in Hutchison that we visited during the 2002 Field Conference) than the surface quarries that produce limestone in Kansas. By going deep underground here, Lafarge North America is able to reach a rock unit that produces high-quality limestone that is desirable in making cement. The company also avoids some of the environmental issues that arise from operating a surface quarry in an urban area.

Mining

The Kansas City Portland Cement Company began operation in this location in 1905, quarrying a rock layer of Pennsylvanian age called the Iola Limestone as the raw material for making cement. From the 1930s until the 1960's, the plant also used the slightly lower Bethany Falls Limestone as a raw material, quarrying it from shallow underground mines. In 1991, Lafarge North America acquired this plant and in 1998 began construction on a new cement plant that was completed last year at a cost of roughly $200 million.

The production process begins in the underground mine, where explosive charges are used to break up huge chunks of limestone (fig. 5-1). Those pieces of limestone are then taken to a crusher (also underground) where they are broken into pieces of five inches or smaller. The rock is then hauled up a vertical shaft in 10-ton loads (about 500 tons per hour), then to a covered storage shed. From there the limestone is mixed with other ingredients and fed into a roller mill, where the rock is ground into a fine powder, known as kiln feed.

Cement Plant

The limestone mixture is moved to the preheater/precalciner tower, about 415 feet high. Inside this structure the kiln feed is heated to 2,000 degrees Fahrenheit. Here the heat drives off about 95 percent of the carbon dioxide in the raw materials, a process known as calcination. The kiln feed then enters the kiln, a 164-foot long, 14 foot-diameter rotating tube that is heated with coal. The kiln heats the feed to 2,700 degrees, until it becomes nearly molten. This material is then cooled and forms "clinker," small black cement rocks.

From here the clinker moves to a finish mill where it is mixed with gypsum and ground into the finished product—portland cement ("portland" is not a brand name, but instead comes from the Isle of Portland off the English coast, which produces a type of building stone that resembles finished concrete). The finish mill is a steel cylinder that is 13 feet in diameter and 39 feet long. Inside, 220 tons of steel balls crush the clinker into a fine powder at the rate of 80 tons per hour. The cement is then pumped to storage silos, from which it can be loaded onto river barges or trucks. Up to 150 30-ton tanker trucks and one 3,600-ton barge can be loaded per day at this facility.

This plant can produce 1 million tons of cement per year. It employs about 100 people with an annual payroll of more than $9 million.

Lafarge North America

Lafarge North America is the largest supplier of cement and concrete in the United States and Canada. It is also a major producer of construction aggregate (crushed stone and sand and

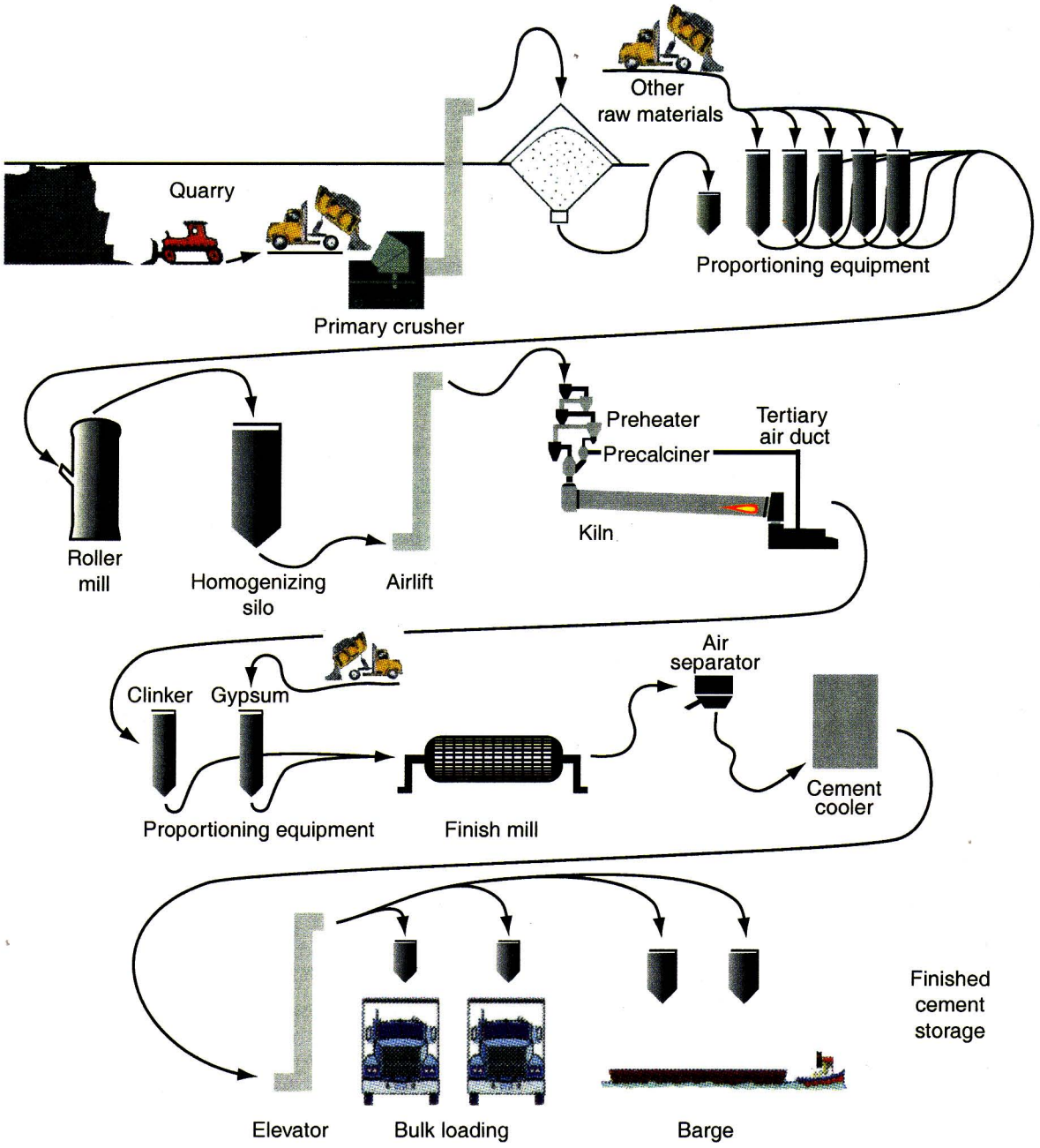

Fig. 5-1—The cement manufacturing process.

gravel), and gypsum drywall. In 2002, Lafarge sold more than 19 million tons of cement and cement-related products. The company has 20 cement manufacturing plants and 90 distribution facilities. In Kansas, it operates a cement plant and terminal in Fredonia. Lafarge North America, headquartered in Herndon, Virginia, has about 1,000 operations in 46 states and all Canadian provinces, employing more than 15,000 people. Its net sales in 2001 were $3.32 billion.

Lafarge North America is part of the Lafarge Group, a $12.3 billion company that operates in 75 countries and has 83,000 employees. The Lafarge Group has four divisions—Cement, Aggregates and Concrete, Roofing, and Gypsum. The Lafarge Group is headquartered in Paris.

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Kansas Geological Survey
Public Information Circular 19
December 2001

Natural Gas from Coal in Eastern Kansas

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Coalbed methane now accounts for about 7 percent of the total annual gas production in the United States

Introduction

Methane, the main component of natural gas, has been a product of the petroleum industry for years. Many of us use natural gas in our homes—in our furnaces, water heaters, and stoves. Now, a relatively new and unconventional source of natural gas—methane from coal beds—has generated interest in eastern Kansas.

Coalbed methane is natural gas that occurs in coal beds. The geological process that turns plant material into coal generates methane gas. This gas was a deadly nuisance that produced explosions in underground coal mines, so the mines had to be ventilated to remove the gas. In the early 1980's, the mining industry began to capture and sell this gas rather than release it to the atmosphere. Thus, a new industry was created—the commercial production of methane from subsurface coal beds.

Coalbed methane now accounts for about 7 percent of the total annual gas production in the United States. In areas of the San Juan basin in New Mexico and Colorado, parts of the Black Warrior basin in Alabama, and basins in the central Appalachians, large quantities of methane are being developed from coal beds. This gas is now being exploited in other areas of thick, coal-bearing rocks such as the Powder River basin in Wyoming and Montana.

In Kansas, most of the activity has been in the southeastern part of the state, primarily Montgomery, Wilson, western Labette, and eastern Chautauqua counties; however, other parts of eastern Kansas that are underlain by coal beds also have potential for coalbed methane production (fig. 1). Coal beds that have potential to produce methane occur in eastern Kansas east of the Nemaha uplift, a subsurface geologic structure that runs from Oklahoma City, Oklahoma, north through El Dorado, Kansas, and just east of Manhattan, Kansas.

This circular describes coal and coalbed methane, gas production from coal, leasing and landowner mineral rights, and the potential for coalbed methane production in Kansas.

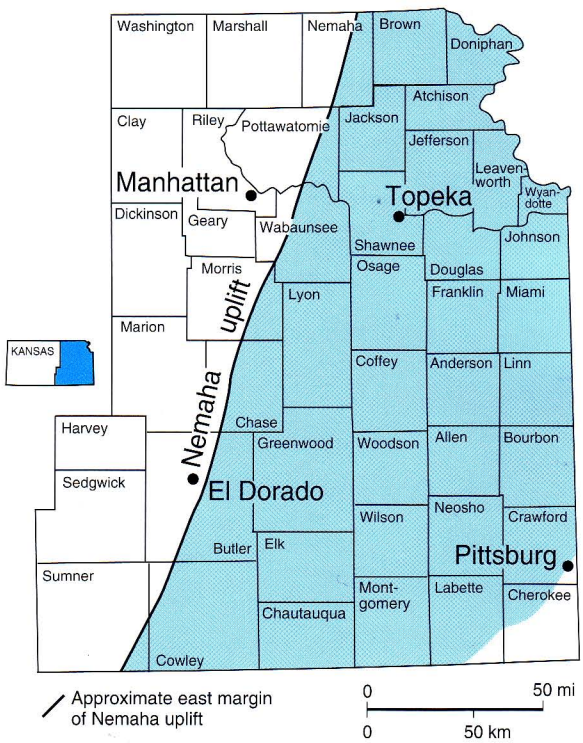

Figure 1—*Portion of Kansas with potential for coalbed methane development.*

Coal and Coal Gas

Coal is the most abundant energy source in the world. Coal deposits have been mined in Kansas for nearly 150 years, mostly in southeastern Kansas, where surface and subsurface mines have produced over 300 million tons of coal. Bituminous (soft grade) coal resources of Pennsylvanian age, deposited about 300 million years ago, are widespread in eastern Kansas and constitute nearly all the coal resources in the state. Coal production in Kansas peaked during World Wars I and II. Today, however, only one small mine operates in Kansas, near Prescott, in Linn County.

An increasing level of interest in coalbed methane has spurred activity in eastern Kansas

Coal forms from plant material that was accumulated in ancient swamps and bogs at rates fast enough to prevent decay. Upon burial, the material is first converted to peat. Through time, as temperature and pressure increase with further burial, peat is converted to coal (it takes about 10 feet of peat to make 1 foot of coal). During this process, large quantities of methane-rich gas are generated and stored within the coal. Coal can store surprisingly large volumes of gas, up to six or seven times as much gas as a conventional gas reservoir (typically sandstone or limestone) of equal rock volume. The amount of gas in coal depends on the degree of alteration the coal has undergone in the burial process, the depth below the surface, and the pressure of the reservoir.

Coalbed gas is mainly composed of methane (CH_4), the principal constituent of natural gas. Coalbed methane is what geologists call a sweet gas because it typically contains very few impurities such as hydrogen sulfide, nitrogen, or carbon dioxide, all normally found in natural gas. Coalbed methane, when burned, generates as much heat as petroleum-based natural gas.

Producing Gas from Coal

Coal contains gas and large amounts of water. Once the confining pressure on the coal is relieved (for example, by drilling and pumping), the gas is slowly released from the coal. Naturally occurring fractures, called cleats, provide the plumbing system within the coal that allows water and gas to travel through the coal to the well. For gas to be released from the coal, the pressure must be reduced by removing water from the coalbed, a process called dewatering. Dewatering brings large quantities of water (usually saltwater in Kansas) to the surface, which is reinjected deep underground.

Initial development of coalbed methane wells can take several months because of the large quantities of water that need to be pumped from the coal bed. In general, coalbed methane wells go through three stages during their production history (fig. 2). During the dewatering stage, water production initially exceeds that of methane, but as production continues, the volume of water decreases as the volume of methane increases. A stable production stage is reached when methane production reaches its maximum and water production levels off. During the decline stage, water production remains low and the amount of methane declines until methane becomes uneconomical to produce.

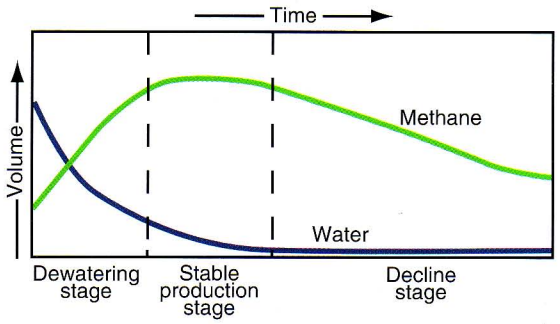

Figure 2—*Production stages of a coalbed methane well (adapted from Rice, 1997).*

Mineral Rights and Leases

An increasing level of interest in coalbed methane has spurred activity in eastern Kansas. Local landowners may benefit economically if they own the mineral rights beneath their property. Mineral rights are defined as the right of ownership of the mineral resources that underlie a tract of land.

Both the land surface and the resources below the surface can be owned and are considered property. The mineral rights can be owned in total or can be owned by the specific mineral commodity; for example, one company can own the mineral rights to the coal, while another company owns the oil and gas rights. Coalbed methane is natural gas and is considered part of the oil and gas minerals.

The owner of the mineral rights can be different than the surface owner. In Kansas, the landowner usually owns the subsurface rights, but sometimes these rights have been severed, or separated from the surface ownership. Severance of mineral rights occurs when the owner of both the surface and mineral rights sells or grants by deed the mineral rights underlying their property. The landowner may also reserve, or retain, all or a portion of the mineral rights upon sale of the property. Mineral deeds and mineral reservations are recorded with the county register of deeds and are included in any abstract of title to the land involved.

Mineral owners have the right to access and develop their minerals. Landowner rights are preserved, whether or not they participate in development of the mineral rights. Regulations are in place to stop operators if their activities are irresponsible or damaging to the surface. Landowners are entitled to compensation for loss of use or damage to their land. Most operators are willing to work with the landowner to reach a fair settlement for damages, but if this fails, state and federal regulations protect the landowner.

Before companies can begin an exploration and development program, they must obtain a lease to the mineral rights (in the case of coalbed methane, an oil and gas lease). An oil and gas lease is a legal agreement between the mineral-rights owner (the lessor) and the oil and gas operator (the lessee) that grants the operator the right to explore and develop the oil and gas resources which may underlie the area described in the lease. Some general stipulations that are usually part of a lease agreement are lisited below:

- A legal description of the area and the number of acres.
- The primary term of the lease. This can be for any period of time, but is usually five or ten years.
- A provision for lease rental payments (usually annual) by the operator to the mineral-rights owner. Rental payments maintain the lease in effect throughout the primary term. If oil or gas is found, the lease will remain in effect as long as production continues, even beyond the primary term of the lease.
- A royalty clause that stipulates the mineral-rights owner's share of the oil or gas production. The royalty may be any amount mutually agreed to by the operator and the mineral rights owner, but is usually one-eighth (12.5 percent) of the oil or gas produced from the lease. Usually the operator sells the oil or gas to a refiner and the mineral-rights owners receive payment for their share from the operator.

The bituminous coals of eastern Kansas have great potential for large quantities of methane

Coalbed Methane Potential in Kansas

The bituminous coals of eastern Kansas have great potential for large quantities of methane. In areas where the coals are deeper than 500 feet, and the gas has been trapped in the coals by thick overlying shales, economic quantities of methane gas may exist. Many other factors, such as the market price for natural gas, also determine the economic feasibility of exploring for coalbed methane in eastern Kansas.

Although the coal beds in eastern Kansas tend to be widely distributed, and several beds (up to 14) could be encountered in a well, the primary concern is the thinness of most of the coal beds and the correspondingly smaller volumes of gas. Evaluation of approximately 600 geophysical logs in eastern Kansas indicates that about 96 percent of the coal occurs in beds 14 to 42 inches thick (fig. 3) and only about 4 percent occurs in beds greater than 42 inches. The main strategy for exploring for coalbed methane in eastern Kansas will be to locate thicker coals or multiple coal beds to warrant viable economic development (fig. 4).

Most of the coals in eastern Kansas are less than 2,500 feet deep, so drilling costs should be relatively low. Many gas pipeline networks already exist, and Kansas has recognized disposal zones for the water that is produced with the methane. All these factors suggest that eastern Kansas is an important area for potential development of coalbed methane.

Photo: Robert S. Sawin

Figure 3—*Outcrop of a thin coal bed in Cherokee County.*

Agencies to Contact About Coalbed Methane

Kansas Corporation Commission
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Photo: Robert S. Sawin

Figure 4—*Coalbed methane well in Montgomery County, Kansas.*

The mission of the Kansas Geological Survey, operated by the University of Kansas in connection with its research and service program, is to conduct geological studies and research and to collect, correlate, preserve, and disseminate information leading to a better understanding of the geology of Kansas, with special emphasis on natural resources of economic value, water quality and quantity, and geologic hazards.

The Geology Extension program furthers the mission of the KGS by developing materials, projects, and services that communicate information about the geology of Kansas, the state's earth resources, and the products of the Kansas Geological Survey to the people of the state.

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