

INSTITUTIONAL FACTORS INFLUENCING SMALL
DAM MANAGEMENT IN OKLAHOMA:
A CASE STUDY OF THE
LAKE FRANCES DAM

By

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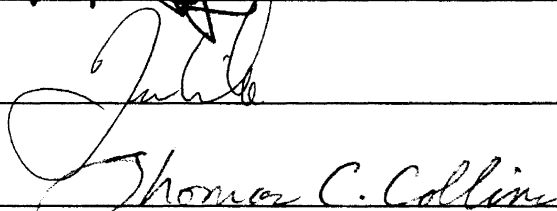
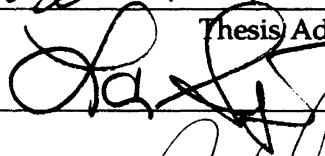
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CHAPTER I

INTRODUCTION AND LITERATURE REVIEW

How could a dam with a 4" high and 75' long horizontal crack exist for years in this time of environmental regulation and awareness? Some rudimentary research into the history of the Lake Frances Dam, located in Oklahoma, showed that not only had the crack existed for years, but that over 14 years ago, the U.S. Army Corps of Engineers had found the dam to be unsafe. Basic repairs were never made. On May 3, 1990 a 75' portion of the dam was swept away by floodwaters. Several water management entities in Oklahoma are responsible for small dams, such as the Lake Frances Dam. By using institutional arrangement analysis, an explanation of how this disrepair could continue will be offered.

Justification of the Study

The creation and jurisdiction of many entities within the water resource management institutions of Oklahoma are controlled by law. In Tobin, et al, the geographic approach to legal system analysis is recognized and encouraged. Understanding the way a water management institution functions is critical to understanding the way water is used, and those authors conclude that geographers need to do more research in the area of legal-system analysis (1989, 131).

Peter Taylor states in "Political Geography: Research Agendas for the 1980s,"

"It is important to develop methodologies that can integrate theories of the state with models of government action so that public policy decisions can be set within a broader theoretical framework (1982, 11)."

A genuine need exists for a detailed understanding of the processes of decision-making and the formulation of public policy. The values, attitudes, and perceptions of decision-makers, the relative importance of different actors such as professional experts and elected representatives, all warrant the attention of political geographers (Taylor 1982, 9). O'Riordan states that new institutional reforms should be regarded with top priority in resource management (1971).

The field of institutional arrangement studies is still a relatively young one. Individual case studies are still being used to test frameworks for analysis and criteria for evaluation in resource management. A variety of aspects exist to study, and as a result, not a large enough body of literature has accumulated yet to suggest one model or one panacea for every institutional crisis. For example, within water management, the existing institutions at the local, state, or federal level could be examined. The institutions at each scale could be studied to see how they function in relation to a particular interest, such as water quality, dam management, water consumption, or recreation. Multiple aspects of water management could also be studied for a specific entity. The scope of possibilities is wide. So, although analysis of a single case study will rarely be sufficient for a full inquiry, a large number of case studies can suggest fundamental relationships (Kennedy 1979; Yin 1981). This case study will add to the growing body of institutional research.

The scope of most institutional studies, thus far, has been large. In order to be of manageable size for a thesis, an analysis of a small-scale conflict was chosen

to test a previously developed framework and criteria. Lyle E. Craine's 1969 model was originally used to examine the institutional arrangements in England and Wales. Therefore, at the outset, some minor changes were needed to adjust this model to apply to the American system. Craine acknowledges this need in the introduction to his book.

Perhaps one of the most prevalent difficulties in comparing institutional arrangement studies is that most do not use the same definition of institution, or the same criteria for analysis. This view is shared by Mitchell (1979, 243). Several researchers have addressed the matter of varying definitions of institution (Wengert 1972 and 1973; Trock 1971; Mitchell 1979). Wengert found that the definition varied depending on the discipline using it. For example, lawyers applied the term to certain aspects of the legal system, sociologists generally could not agree on a definition, and federal agencies commonly used the word institution as a surrogate for organization (1973, 513). Trock states that institutions provide a framework or environment, at whatever level of social grouping, within which our lives are regulated. He further states that an institution would involve habits and cultural organizations, traditions, customs, laws and legal requirements (1971, 3). This definition is also used by Kaynor and Howards (1971).

The primary consideration of this study was to choose a previous study whose definition and criteria are applicable. In this study,

"institutional arrangements" refers to a definable system of public decision making, one that includes specific organizational entities and governmental jurisdictions, but transcends conventional emphasis upon definition of agency structure, per se. In addition to being concerned with component organizational entities, the term "institutions" suggests special attention to

the configuration of various relationships:

- (1) established by law between individuals and government;
- (2) involved in economic transactions among individuals and groups;
- (3) developed to articulate legal, financial and administrative relationships among public agencies; and
- (4) motivated by social-psychological stimuli among groups and individuals.

Specific relationships falling in any or all of these four categories, constrained and shaped by the natural and social environment, weave a web which describes the institutional system for decision making. Thus, institutional studies focus on the linkages that tie authority and action centers together in a public decision making system, which is responsive to the environment within which it must operate (Craine 1971, 522).

Statement of the Problem

Recent political change and public awareness, in the realm of water management, has dealt with point source and nonpoint source pollution control, as well as preservation and protection of wetlands. However, the more fundamental concern is that there are laws in effect today already governing all phases of water management. Are they working effectively? The current institutional arrangements need to be examined and changes suggested to insure proper implementation of any new or existing legislation.

Wherever people develop a relationship with others, an institution evolved to manage and protect that relationship, thus minimizing the frictions or conflicts that might arise from it. Institutional problems arise primarily because some

guidance is looked for, or some change is proposed, that is contrary to the purpose of that institution. Such efforts cannot succeed until the framework within which that activity is to take place is changed (Trock 1971).

The institutional arrangements now in place within Oklahoma, concerning dam management, are not working. Dam disrepair for so many years is evidence of this. By using the case study of the Lake Frances Dam, and chronologically studying the institutional arrangements over the past 70 years, the point at which the breakdown in management occurred can be determined. There have been three controversies concerning Lake Frances over the years; water quality, water rights, and dam safety. Although these aspects have overlapped at times, this study will primarily explore the dam safety issue. Craine's model and criteria will be used to analyze the legal, administrative and financial aspects of the institutional arrangements pertaining to Lake Frances.

Description of the Study Area

In Oklahoma, there are two major river basins, the Red and the Arkansas. The Arkansas River Basin contains five of the state's six scenic rivers, one of which is the Illinois. The source of the Illinois River is in the Boston Mountains of Washington County, Arkansas. As shown in Figure 1, the river enters Oklahoma in Adair County, and after a slight northwestward turn into Delaware County, flows southwesterly through Cherokee and Sequoyah Counties before its confluence with the Arkansas River, completing its 109 mile stretch through eastern Oklahoma.

The Lake Frances Dam is located just inside Oklahoma on the Illinois River in Section 17, T19N, R25E (see Figure 2). The 1990 OWRB Water Atlas notes it to have a capacity of 2,280 acre feet with a surface area of 562 acres, 4 miles of

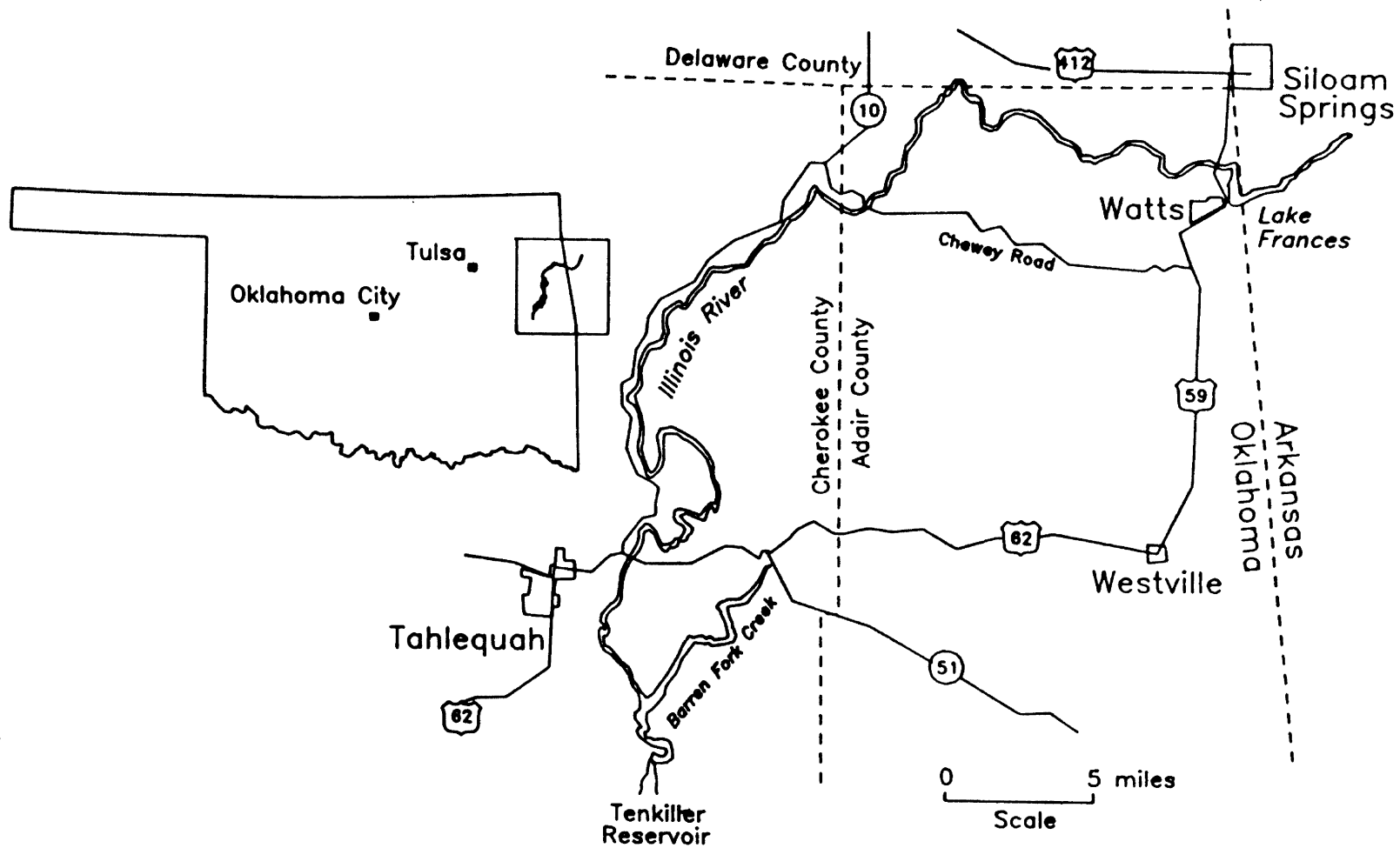


Figure 1. Study Area (Wikle 1992, 59)

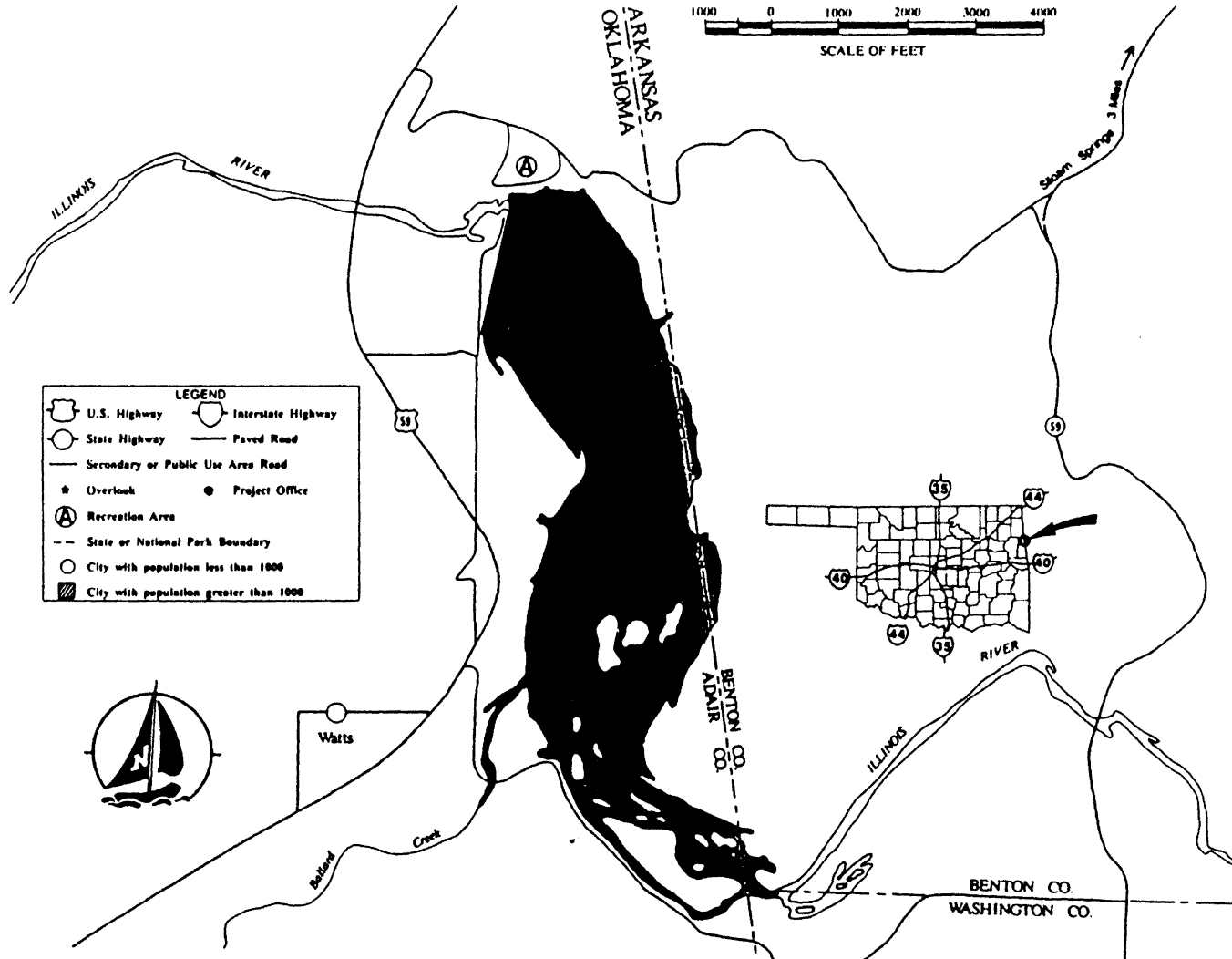


Figure 2. Lake Frances (OWRB 1990, 212)

shoreline, and lists the primary use as water supply and recreation for the town of Siloam Springs, AR (15).

The history of the lake began in the 1920s when James W. Sloan bought 800 acres of land, then known as Forest Park, along the Illinois River. A 70-acre lake existed on the property. Sloan decided to expand the lake for recreational purposes in 1931. The newly created lake was christened on Memorial Day, May 30, 1931, and was named after Sloan's daughter Frances. The original planning and design of the Lake Frances Dam, which included a small hydroelectric plant, was by Victor H. Cochrane, a consulting engineer from Tulsa, Oklahoma.

The lake's peak years of popularity were between 1931 and 1941, when motorboat races, canoeing, fishing, and parties at the resort were commonplace. The resort was impressive with swank cabins and cottages nearby, and drew in vacationers from Tulsa, Dallas, Kansas City, and New Orleans. Its success can be attributed to the lack of other large reservoirs in eastern Oklahoma. Lakes Tenkiller, Grand, or Texoma were yet to be built.

Today, the resort is in a serious state of disrepair, although it is still being operated. Fishing activities still go on, even though the Lake level has fallen to less than two feet in most places. Lake Frances will not likely enjoy the prosperity of those early years again.

General Nature of Dams

As a prelude to the actual case, a brief history of dams and their general nature would serve to place the scope of this study in perspective.

Early Dam Development

The Sadd el-Kafara the oldest known dam, whose ruins may still be seen today, is located near Helwan, approximately 20 miles south of Cairo, Egypt. It was built during the Third or Fourth Dynasty, had a crest length of 348', a base length of 265', and a maximum height of 37' above the bed of the valley (Smith 1972, 1). As civilization progressed to the point that a ruler had sizable labor forces available, more dams and irrigation works could be built (Smith 1972, 15). Early projects of this size were obviously only undertaken by rulers with substantial power.

Dams were used in warfare as early as 689 B.C., when Babylon was attacked and destroyed by the Assyrian King Sennacherib. After sacking the city, he dammed the Euphrates River, built up a large reservoir and then destroyed the dam. The resulting flood completed the destruction of Babylon (Smith 1972, 9).

Strabo, a well-known Greek geographer of the first century B.C., believed the Persians used dams on the Tigris and Euphrates Rivers as defense against Alexander. Dam-based irrigation was used on the same rivers as early as the fourth century B.C. (Smith 1972, 14).

Construction materials of those ancient dams were earth, wood, and masonry. Primary purposes were for agriculture, a potable water supply, canal systems, and hydraulic power for mining or mills. Causes of dam failure were, and still are, poor engineering and natural siltation.

Dam failures had a sizable effect on early populations in some cases. For example, in 1545 in Bolivia, a prosperous location for silver mines existed at Potosi. It's total population was up to 160,000 at one time. To serve the mining industry

Potosi had a dam system of 32 structures. One dam failure wiped out more than half of the mills, and they were never rebuilt. The miners, being extremely superstitious, considered the accident to be of divine intervention, and that it was a retribution to be heeded. Of the 32 dams, 24 are still in service for a population of 45,000 (Smith 1972, 134-7).

Dam Development in the United States

Dam building of notable size started in the mid-18th century in the United States. Diversion dams of rubble masonry set in hydraulic mortar were built in San Antonio, Texas. Timber dams were more common in New England, where they were used to power grist mills, saw mills, and powder mills. Some were even used for tidal power plants, an idea that is being re-explored today. Most of these dams were made of wood, earth, or stone. Large water supply dams did not get their start until the early 1800s. One of the earliest ones was built in 1820 on the Schuylkill River by the city of Philadelphia. This was also one of the earliest dual-purpose dams, providing a water source for navigation locks at one end, and water-powered supply pumps at the other (Smith 1972, 183).

The era of canal development began in the early 1800s. The Rideau Canal, linking Ottawa to Kingston, was the largest system, requiring 52 dams and taking 6 years to construct. Many of these early dams were simple earthen structures. The canal system was quickly replaced by the development of the railroad system, so subsequently, many canal dams have been used for fishing, hydroelectric power, and as metropolitan water supply reservoirs.

As populations expanded in the nation's cities, transportation systems and other public utilities had to be centralized as well. Dams then became important

for creating large water supply reservoirs for people and industry (Smith 1972, 176-182). Reservoir dams are still being built today.

As noted earlier with the Potosi story, dams can affect population distributions. In addition to increasing urban populations, the railroads transported greater numbers of settlers to the West. As the cities of the arid West developed, dam building became crucial to survival.

The West has millions settled where nature, left alone, would have supported thousands at best. Reisner notes that everything in the West depends upon the manipulation of water -- capturing it behind dams, storing it and rerouting it over hundreds of miles. Few free flowing rivers remain in the West, and despite all these heroic efforts, and billions of dollars, all we have managed to do is turn a Missouri-sized section green (1986, 2-5).

Of supreme significance to the prolific dam building movement was the development of electro-magnetism, the only form of energy in a ready-to-use state that can be transmitted over long distances. By the end of the 19th century, three separate technologies were joined: dams, water turbines, and electric generators (Smith 1972, 216).

Masonry and mortar replaced timber and earth dams as the construction materials of choice. The first all-concrete dam was built in 1887-89 in San Mateo, California, and survived the 1906 earthquake. In 1899-1900, the Upper Otay dam was built of concrete with wire reinforcement as water supply to San Diego (Smith 1972, 210-12).

Concerning construction methods, most major dams were straight gravity or multiple arch. The first arch dam in the U.S. was built in Bear Valley in 1884. It was replaced by a multiple arch dam in 1910 only because of the need for more

water. It still exists today under water (Smith 1972, 192-208).

In the U.S., the construction of major dams like the Hoover or Grand Coulee was financed largely by the government as public works projects. Presently over 50,000 major dams exist in the U.S. (Reisner 1986, 14). Irrigation schemes, dams, and canals were successful in appeasing voters by providing jobs, and stimulating economic opportunity (O'Riordan 1971, 23). Shanks reports that federal financial aid and technical assistance in planning and construction have subsidized many of the 2.5 million small dams less than 25' high or with a capacity of less than 50 acre feet of water (1981, 109).

During the boom-time in dam building history (early 1900s), techniques in construction improved slowly. Even today, Congressionally authorized projects are outdated before their planned life span is over, due to silting or construction design errors. Modification or rebuilding can cost more than the initial construction; yet this is not considered in the cost-benefit analysis. Construction costs are underestimated and maintenance and repair are virtually ignored (Shanks 1981, 117).

It was Shanks' opinion that such underestimations allow for the continual perpetuation of many federal and state agencies, which does not necessarily provide for the best dam management. Ideally, Shanks suggests separating each project justification from the agency responsible for its construction and management. The U.S. Office of Management and Budget would be well-suited to make initial evaluations. Self-interest would not be a factor this way (1981, 121-122).

In addition to large scale dam projects, construction of smaller earthen dams also increased during this time. Powerful earth moving machines were developed,

allowing management of large volumes of soil. Other equipment was developed and used to move rocks, and by the turn of the century, rock-filled dams were becoming advanced enough to warrant building the 328' Salt Springs Dam in California. Rock-filled dam construction has had a good success rate (Smith 1972, 226).

Despite all of the advances in construction and technologies, dam failures are common. The causes of most failures are insufficient spillway capacity, incorrect laying of pipe outlets, and slips in the embankments themselves (Smith 1972, 212). The development of stress analysis now prevents most potentially disastrous dam failures.

Dam Development in Oklahoma

Many lakes in Oklahoma, including Lake Frances, were created by federal and state agencies during the dam-building boom period of the 1930s and 1940s. Early lakes in Oklahoma were developed by several agencies. The Civilian Conservation Corps, Works Progress Administration, Soil Conservation Service (Lake Carl Blackwell, 1937), U.S. Army Corps of Engineers (Great Salt Plains Reservoir, 1941; Fort Supply Reservoir, 1942), Oklahoma Water Resources Board (Lake Murray, 1937), and the Grand River Dam Authority (Grand Lake O' the Cherokees, 1940), were the primary developers. The 440 mile McClellan-Kerr Arkansas River Navigation System was completed in 1971 (OWRB 1984, 8-9). However, most of the major reservoir construction occurred in the quarter century since 1959. Primary uses for the major reservoirs are navigation, flood control, irrigation, recreation, municipal and industrial water supply, and hydropower (OWRB 1984, 10).

Small dams of earth and rock fill are plentiful in Oklahoma. Although model analyses are available to test for structural soundness, total or partial dam failures are still common. The four primary causes of failure are: the dam is overtopped by a flood, seepage under the dam undermines it, seepage through an embankment washes it away, or the slopes of the embankment slip and wash away (Smith 1972, 225).

Literature Review

Institutional arrangement studies are, by nature, highly interdisciplinary. For example, to complete a research project at the scale of a large river basin, it would require, at a minimum, the expertise of geographers, economists, geologists, civil engineers, biologists, archeologists, and political scientists. Therefore, although no institutional arrangement studies pertaining to a privately-owned dam have been done, pertinent literature in the disciplines of agricultural economics, political geography, law, and resource planning and development is available. Some scholars have developed models, frameworks for analysis, and criteria for evaluation. These provide useful models for evaluating institutional and resource problems. Case studies which illustrate this may eventually lead to theory formation. Theories have to be developed to allow for predicted effects of policy decisions on human-environment relations (Emel and Peet 1989). Such models will be evaluated below in order to determine the one most appropriate for this study. Although most of these models look at water management institutions in general, rather than dams alone, they provide the necessary background for this study.

Institutional Arrangement Studies

Geographers have contributed substantially to the body of literature devoted to institutional arrangement studies concerning many aspects of water resources management.

At the forefront of the field of geographers who have studied institutional arrangements stands Bruce Mitchell. In Geography and Resource Analysis, he devotes an entire chapter to the subject (1979). Institutional arrangement studies are strongly interdisciplinary. The wide range of literature researched for this thesis would support the merit of the idea. These studies are particularly suitable for geographers to be involved with, since this discipline traditionally seeks to understand spatial allocation of resources, the complexity of regions, or, the relationship between humanity and the environment (Mitchell 1979, 242). In the subfield of water management, Mitchell briefly describes the study done on the Great Lakes basin. The researchers discovered that the most "fundamental barrier to successful resource management was the lack of a satisfactory institutional structure." A framework for analysis was developed using management functions and criteria pertinent to the Great Lakes. The framework used in this case is particularly useful for analyzing arrangements of a large scale, not for less complicated arrangements, such as the one in Oklahoma (1979, 242).

Several other geographers have completed institutional arrangement studies of various aspects in water management. Examples include water pollution control (Grima 1981), regional water management (Kromm 1985; Wescoat, 1986; Day 1986), water rights (Wescoat, 1986; Templer 1973), institutional change process (Arnett, Clark, and Gurnell 1984), and location of institutions (Gottmann, ed. 1980).

Grima's article focuses on the articulation of policies in the interface between economic production and water quality (1981). Kromm, like Craine, examines institutions in England and Wales. He identifies the advantages and disadvantages of autonomous regional districts as a means of administrating the nation's water resources. In addition, he notes the merits of regional water management based on watersheds (1985).

Wescoat (1986) studies the impact of the Colorado River Basin Salinity Control Act of 1974. After the act was passed, a federally sponsored research team sought to identify institutional barriers to salinity control. Wescoat found that the team had neglected two of the most politically sensitive problems, one of which is the water rights implications of salinity control projects. For analysis of water rights, Wescoat uses a generalized model of western water law to illustrate the relationships between salinity control and water allocation patterns. In reference to institutional involvement, Wescoat was very thorough in describing institutional involvement, but no model was used to analyze the various entities comprising the water management institution. However, institutional analysis was not the primary purpose of his research.

Resource Planning and Development

Lyle Craine is a Professor of Resource Planning and Conservation at the University of Michigan. Craine researched the water management institutions of England. In Water Management Innovations in England, 1969, he developed a model specifically for analyzing the governmental institutions involved, defining each criterion, which, as noted earlier by Mitchell, is one of the deficiencies of many institutional studies. In addition to defining the criteria, he also defined specifically

how to apply them, and then followed through with his own case study. Craine's framework for analysis and criteria are detailed in Chapter II of this study.

Trock, from the Water Resources Institute, conducted a study of the institutional factors influencing water development in Texas. The study is extremely broad, encompassing the entire state, and not only examines the institutional arrangements regarding water import, transport, and distribution, but also examines the impacts of institutions on land and water use in a local area, the lower Rio Grande (1971, 2). The model used for the analysis in the lower Rio Grande Valley is one depicting optimum resource use in crop production, which is the primary outcome needed for water management (1971, 17). The scope in either portion of the study is wider ranging, and the production outcomes different than what is needed for the purpose of the Lake Frances Dam case study.

Other authors in the realm of water resources planning are Fernie and Pitkethly, 1985, who include a chapter on water management. They discuss management trends and elaborate on Sewell's five concepts of water management, which follow Gilbert White's suggestions. Although that book offers good background reading to the subject at hand, no framework for analysis of existing institutional arrangements was included.

Paul Hughes used a combination of five different institutional arrangement studies to analyze some alternative institutional arrangements for a study in the Washington Metropolitan Area (1971). In Appendix A of his book he outlines the criteria used by each of the five studies he consulted. The studies he used included Craine's, as well as a Syracuse University Study, the Water Resources Council Study, a Kneese and Bower Study, and finally a paper by Edwin T. Haefele. Hughes' study is an excellent example of identifying and adopting the institutional

criteria needed for a specific problem. For the purpose of this study, however, the elaborate merging of these models was not necessary. Again, the scope of this study is small, and Craine's model and criteria alone are sufficient.

Kaynor and Howards identify some constraints within the Massachusetts water resource institution by studying the decision-making process in place (1971). In their paper, they discussed constraints within the economic system, the political system, and also some that were noninstitutional. Their findings indicated that, in this particular area of decision-making in Massachusetts, institutions were less important than other variables. Although their paper was only a portion of a larger study, the criteria for analyzing the various constraints was not clear, nor was the method for discerning the constraints they chose to review. As a result, the Kaynor and Howards study was useful in expanding knowledge of water resource problems in general, but none of it was directly useful in this case.

Political Geography

Political geographers have long combined the study of law with geography. As Matthews notes, this kind of study has roots as far back as Whittlesey's works in 1935 and 1939 (1984, 11). White's natural resource work began in the early 1940s and has continued prolifically to current times. Kasperson conducted a case study uniting politics and water resources in 1969. The body of literature in this area increased significantly in the 1970s, and continues to grow. Recent work in water resources geography continues a long tradition of broadening the discourse on human use of the environment.

In 1984, Matthews developed some fundamental concepts concerning the science of studying water resources, geography, and law. He states that, "when

dealing with policy at different levels, an understanding of the legal system is essential in understanding the way water resources are used." He has developed a model to clarify this relationship between law, society, and resource use (1984, 11). Although the model does not deal specifically with institutional analysis, the concepts set forward in it were useful when searching through the maze of institutional arrangement literature. Many "informal actions" take place in this case study, and the problem of overlapping jurisdictions has been noted and included in the final model chosen.

Agricultural Economics

Kristjanson (1954) completed one of the earliest economic studies concerning water resources. His research was on the Missouri River Basin where a multiagency approach to river development was being used. After examining some of the specific conflicts involved in the development of the region, he then looked to the example of the Tennessee Valley Authority (TVA) for ideas to resolve the conflicts. One solution of an interstate Missouri River Basin Compact was being considered, with the "core" states being Kansas, Missouri, Montana, Nebraska, North Dakota, South Dakota, and Wyoming. Colorado, Iowa, and Minnesota would also be able to ratify the compact.

The TVA is continually monitored and accountable to Congress, the President and the public, and financial reports are routinely turned in to Congress. Federal-State-Local cooperation is utilized in most aspects of planning, and tax benefits are given to those whose land is taken for the TVA reservoirs. Each step in the management is accountable to a specific individual or agency, to alleviate the problem of "passing the buck."

The process used to analyze the Missouri River Basin works well on a regional scale, but not on small scale conflicts. Economical analysis was prevalent, but doesn't work for solving all conflicts. After describing all the conflicts in the Missouri River Basin and the TVA case study, the suggestions for change boiled down to four short paragraphs, with not enough specifics on exactly what to do. Suggestions were made such as, develop an administrative device adapted to the region, or place administrative authority with one or some group that can be held accountable for results. A framework or model was not used for analysis.

Agricultural economists Bromley, Butcher, and Smith (1971) reviewed the 1973 recommendations of the National Water Commission (NWC). After personal review of the document, it was understandable why they were surprised that the NWC did not address instream flow problems, such as the management of water quality and quantity. Furthermore, no flow management framework was given with which to test the recommendations (1971, 32). Thus, with the exception of the recommendation that river basin planning be put to use, few of their ideas are applicable to this case study, either in selecting a model for analysis or in making suggestions for institutional change.

Institutional Involvement With Dams and Policy Changes

The U.S. government has been involved in many dam building efforts over the years. Agencies have been created solely for the purpose of planning, constructing, and managing these dams. Legislation created some of the agencies, outlined their rules and regulations, and was designed to protect various aspects of water management, and thereby, dam management.

Water law applies not only to federal and state entities, but also to local or

private ones as well, forming a hierarchy of overlapping administrative jurisdictions (Matthews 1984). These four scales have been recognized in the land use decision process (Platt 1976), and they also apply to dam management decisions, even with a small dam such as the Lake Frances Dam. This multilevel aspect must be considered and adopted into any institutional arrangement analysis, no matter what resource issue is being analyzed. In combination, these federal, state, local and private entities comprise the water management institutions of the United States. A brief discussion of the primary entities and policies of the United States follows.

On June 17, 1902, the Reclamation Act became law to "reclaim the desert" and form the Bureau of Reclamation (43 U.S.C. § 371 et seq.). The Bureau was initially concerned with surveying, planning, and construction of irrigation projects in the western United States, but soon was the controlling authority behind hydroelectric development there as well. By 1910, the principle was established that electric power developed by the Bureau should be sold to the cities. The first dam built for this purpose was in 1911. The Roosevelt Dam, the largest masonry dam to that date at 284' high, created electric power that was sold to the city of Phoenix. Other noteworthy dams created for power generation are the Grand Coulee and Hoover Dams (Smith 1972, 226-27).

The Federal Power Act of 1920 (16 U.S.C. §§ 791-828c, as amended through 1986) created the Federal Energy Regulatory Commission, which is authorized to issue licenses to construct, operate and maintain dams, conduits, reservoirs, and transmission lines to improve navigation and to develop power from any streams or other bodies of water over which it has jurisdiction.

The Watershed Protection and Flood Prevention Act of 1954 (16 U.S.C. §§ 1001-1009, as amended through 1986) gives the Soil Conservation Service (SCS

hereafter), of the U.S. Department of Agriculture, the authority to provide planning assistance and construction funding for local projects. Restrictions on these projects limit the size of the watershed to 250,000 acres or less; provide no single structure with more than 12,500 acre feet of flood water retention; provide no single structure with more than 25,000 acre-feet of total capacity; and requires Congressional approval of projects with costs greater than \$5 million or with structures greater than 25,000 acre-feet. The original statute sought cooperation between the Federal Government, States, and municipalities to prevent flood damages.

The U.S. Army Corps of Engineers (Corps hereafter) is directed by Congress through Sec. 10 of the Rivers and Harbors Appropriation Act of 1899 (33 U.S.C. § 403) to regulate all work or structures in or affecting the course, condition, or capacity of navigable waters of the United States. The intent of that law is to protect the navigable capacity of waters important to interstate commerce. The Act also requires the Corps to give "due regard" to wildlife conservation in planning federally authorized water resources projects, normally with input from the U.S. Fish and Wildlife Service (see below). Through Sec. 404 of the Federal Water Pollution Control Act Amendments of 1972 (Clean Water Act) (33 U.S.C. § 1344), the Corps is directed to plan wetland areas as part of water development projects, and to regulate the discharges of dredged and fill material into all waters of the United States. Those waters include lakes, rivers, streams, mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, and other natural ponds. The intent of that law is to protect waters of the United States from the indiscriminate discharge of material capable of causing pollution and to restore and maintain their chemical, physical, and biological integrity. Technically, materials used to construct dams qualify as fill material.

The U.S. Fish and Wildlife Service (FWS hereafter), with the U.S. Department of the Interior, has many duties. The Fish and Wildlife Coordination Act of 1934 (16 U.S.C. §§ 661-667e) provides for the FWS to advise the Corps and other Federal agencies regarding effects of water development projects on fish and wildlife resources, and requires those agencies to consider FWS concerns. As noted above, the Corps must seek input from the FWS through the Rivers and Harbors Act of 1938 (33 U.S.C. § 540). The Endangered Species Act of 1973 (16 U.S.C. §§ 1531-1544) provides for the FWS and other Federal agencies to conserve species determined to be endangered or threatened.

Regionally, Presidential involvement in dam management has occurred over the years. President Franklin D. Roosevelt created the Tennessee Valley Authority in 1933. The TVA is charged with the regional development of the Tennessee River based on an integrated system of multi-purpose dams, 30 in all. They are managed for navigation, flood control, hydroelectric power, soil conservation, fishing, and public health (Smith 1972, 228). Three other regional systems are in place at this time, the Columbia River Basin Commission, the Susquehanna River Basin Commission, and the Delaware River Basin Commission.

Closer to home, the Arkansas River Basin Compact of 1970 (P.L. 93-152), between Oklahoma and Arkansas, apportions the waters of the Arkansas River basin, creates the Arkansas-Oklahoma Arkansas River Basin Compact Commission to administer apportionment, encourage pollution abatement programs, and facilitate cooperation for total management of water resources in the river basin. Many states now participate in interstate compact commissions.

At the state level, each state has some kind of water management agency. In Oklahoma, the agency is called the Oklahoma Water Resources Board. The

Board's duties are described in Chapter III. State agencies are usually responsible for working with local and private entities concerning water resource issues.

Because of the complexity, the U.S. water management institutions can be difficult to work within. Bromley, Butcher and Smith (1974) looked at the overall implications of the National Water Commission's report from June 1973. The report contained 290 separate recommendations and, not surprisingly, the Commission decided that the answer to the nation's water "problem" is said to lie primarily in institutional reform, broadly defined (1974, 15).

CHAPTER II

THE RESEARCH PROBLEM AND METHODOLOGY

Description of the Framework for Analysis

To analyze the Lake Frances Dam case study, Craine's 1969 framework for analysis and criteria will be used, although slightly modified to reflect some of the ideas set forth in his 1971 paper.

In the introduction of Craine's book, he recognizes the fact that the United States was at that time, and still is, in need of an effective water management system. He believed that by presenting the British developments, it would prove to be useful for the large urbanizing regions of the United States, and for individual states seeking a more effective role in water resources affairs (1969, 3). A state must be proficient at conducting its own affairs within its boundaries at the same time that it attempts to develop and participate in national strategies.

This case study analyzes one small part of that idea. There are 75 dams in Oklahoma impounding reservoirs of 1,000 to 4,999 acre feet, one of which is Lake Frances, and there are 2,833 dams impounding 999 acre feet or less (OWRB 1984, 183). Obviously, the nature of the institutional arrangement responsible for managing these small dams can greatly affect the water management of the whole state. In turn, it is the objective of this study to discover what arrangement is in place now, and make suggestions for future institutional management of these

small dams.

Craine identifies five governmental techniques for affecting water management, which will be adapted to small dam management as described in Chapter III. Since this case involves private and governmental entities, the adjective "governmental" will be eliminated. These techniques have a general progression relationship in extent of responsibility and degree of intervention, with all five techniques being employed in only the most advanced forms of institutional arrangements, (i.e. TVA). (see Figure 3).

The early stages of intelligence, as well as identification and planning can serve as a basis for regulation of water use, development of water resources, and regional distribution and disposal. The extent and kind of involvement are dependent upon specific circumstances of time and place. Craine notes that the government may choose to be involved only to provide a policy environment (which would include the first three stages), influencing private entrepreneurs, local governments, and other agencies to operate independently within this policy framework. Such is the case in this study.

The first technique is water resource intelligence. This encompasses many activities, such as collection and dissemination of hydrologic data or provision of social and economic data.

Second comes identification of resource potentials and planning. This technique can be as simple as inventorying resources, projecting growth demands, suggesting ways of responding to demands or preparing reconnaissance "planning" studies. Presumably, these reports would result in a general consensus of desired actions. The reports would also provide a framework within which independent water use and development agents can proceed towards water management goals

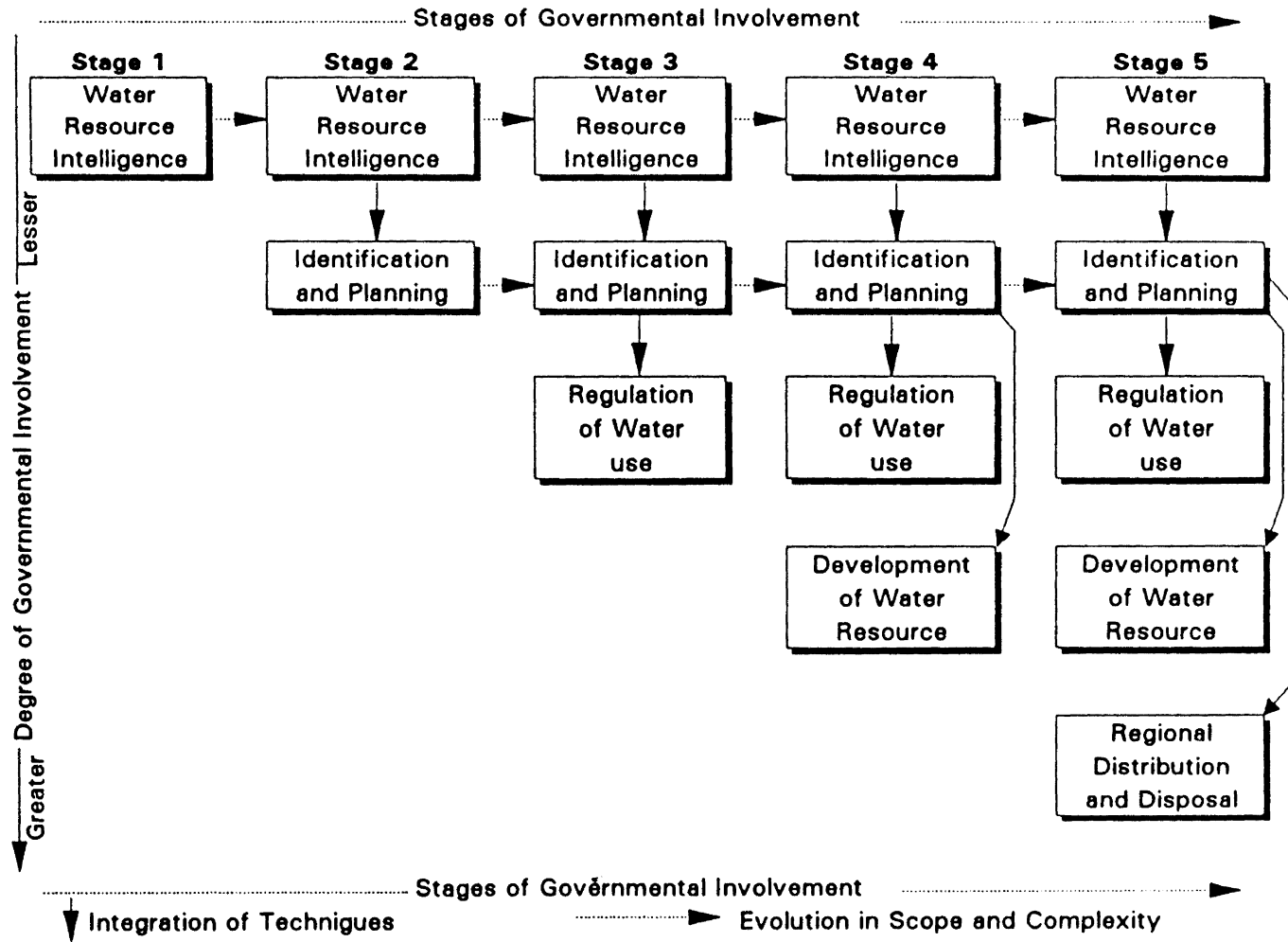


Figure 3. Governmental Techniques for Affecting Water Management (Craine 1969, 19)

without serious conflict or losses in efficiency. As a part of this notion, great emphasis has been put on the planning product, often to the neglect of the planning process as an instrument of communication and education among the interests involved. At the other extreme, the government should provide specifications and schedules of actions to be taken, and who should take them.

The third technique is regulation of water use. There are three principal public ways of regulating the use of water resources:

- (1) Promulgation and enforcement of standards prescribing conditions under which uses are permitted or constrained. (This protects water quality).
- (2) Administrative, judicial, or legislative allocations of water for specific uses and/or users. (This controls water quantity).
- (3) Pricing of water uses in such a way as to influence the kind, amount, and timing of use. (This encourages efficiency).

These three ways are not mutually exclusive but can be most effective when they supplement one another.

The fourth technique is to develop water resources. This can be characterized as the capacity to apply engineering and construction skills to an entire hydrologic system with the objective of maximizing the capacity of that specific resource to serve society. To what extent can the institutional arrangements provide development facilities that are designed and operated to avoid spillover costs and take advantage of spillover benefits associated with the interdependencies of the hydrologic system?

Three methods of providing coordinated development facilities are generally available:

- (1) direct public planning, design, construction, and operation of

development facilities;

(2) public regulation of design, construction, and operation of new projects by independent development agents; and

(3) contractual agreement between public agency and independent operator of existing facilities regarding operation of projects.

All three of these methods are presumed to be most effective if they are used to supplement one another and if they are performed by a regional water management agency that comprehends and controls the entire hydrologic system. The primary test of effectiveness is the extent to which significant externalities stemming from hydrologic interdependencies are considered and adjusted in planning, design, and operating decisions.

The fifth technique is the organization of regional water distribution and disposal systems. Achieving coordinated distribution and disposal systems depends upon three kinds of authorization:

(1) authority to design, construct, and operate a regional system;

(2) authority to acquire existing systems and to integrate their operations as indicated; and

(3) authority to direct operations and to require interconnections and sharing of common facilities among independent systems.

The above descriptive analysis of the nature of water management provides a basis for suggesting six essential characteristics of institutional arrangements. The criteria will be described here and used in Chapter IV as the basis for evaluating the institutions in Oklahoma as they apply to the management of the Lake Frances dam.

(1) Application of the Range of Techniques

- (2) Consideration and Adjustment to Externalities
- (3) Flexibility of Water Management Actions
- (4) Consideration of a Range of Relevant Values
- (5) Efficient Water Management Financing
- (6) Government as a Continuing Function

The first criterion is asking to what extent is the institutional system equipped to operate at Stage 5, which is regional distribution and disposal. To analyze this, it is necessary first to determine the stage at which the current system is operating, then establish whether the required techniques are made available through authorizations to exercise legal powers and conduct specific activities. After this determination the question then becomes whether the authorizations are appropriate and adequate to implement the technique or not, and whether the administrative responsibility for the authorized activities is under unified command or fragmented. Realizing that Oklahoma is not operating at Stage 5, the goal then becomes establishing how effectively we are operating at our present stage.

The second criterion relates to the concept of river basin management. This would mean realizing that, whether it is politically recognized or not, the Lake Frances Dam is part of the Illinois River Basin, and decisions affecting the dam affect the whole system. So in this case, how was the externality (Lake Frances Dam) handled? Who is responsible for the effects of management decisions applying to the dam? Are the affected parties considered in these decisions? Are there legal and administrative requirements for doing so?

The third criterion seeks to answer the question of flexibility within the system. What degree of administrative discretion is provided in the law? To what extent are specific decisions constrained by administrative goals, policies, and

standards? To what extent can decisions be reassessed and adjusted over time?

Craine notes that a satisfactory management system should provide adequate security to independent entrepreneurs and development agencies without creating an operational straightjacket that restricts any shift in the patterns of resource use.

The fourth criterion explores the institution's ability to express and consider the range of values relevant to a water, or in this case dam, management decision. Due to the stage at which Oklahoma operates, two of Craine's original aspects of this criterion are not applicable here. They explore extension of the jurisdiction of a regional water management agency, and the role that pricing and inter-system transfer payments play. Those two questions will not be considered in this case study. However, four of the aspects are relevant. First of all, formal interagency review procedures may provide linkages through which non-monetary values find expression in the decision process. Secondly, the nature of representation provided on a governing board is a vital aspect in assuring that all relevant interests participate in decisions. Thirdly, the rules by which decisions are made within agencies are important in determining whether values are properly considered in decisions. Last of all, in many instances, requirements for consultations in formulating proposals and provisions for appeals and hearings may be the last resort for an individual or group seeking to be sure that its point of view and value are given consideration.

The fifth criterion is whether the entities of the institution have the ability to finance water management consistent with its objective of efficiency. Are there any unusual obstacles to raising capital and operating funds? What is the extent to which disconformities in the incidence of costs and the incidence of benefits encourage inefficiencies?

The last criterion is the extent to which water management is recognized and built into government as a continuing function. This means are there any ad hoc arrangements? Are there any procedures for relating water management decisions to other relevant governmental policies and operations?

Methodology

The methodology component of this case study consists of three aspects, the selection of an appropriate model with which to analyze the institutional arrangements, the preparation of a chronology of events concerning Lake Frances, and analysis of the Lake Frances case study, using the selected model.

The review of institutional arrangement studies literature was conducted at the Edmon Low Library at Oklahoma State University, with additional materials obtained through the Interlibrary Loan system. The intent of this search was to select the most appropriate model for analyzing this case study.

In researching the water management institutions of Oklahoma and how it affected the Lake Frances Dam, it was necessary to inspect historical literature and documents. The Oklahoma Scenic Rivers Commission provided records of their Commission meetings where decisions concerning the Lake Frances Dam were made. The Oklahoma Water Resources Board had inspection records and copies of correspondence with Siloam Springs city officials. These records provided information on the historic management of the dam.

Regional newspapers such as the Tahlequah Daily Pictorial Press, the Muskogee Phoenix, and the Siloam Springs Herald-Democrat, all carried additional information on the Lake Frances Dam throughout its colorful past.

Together these sources provided the necessary information to evaluate this

case study, based on Craine's criteria. Due to the nature of the problem and Craine's model, the analysis was completed with qualitative methods, rather than quantitative ones.

CHAPTER III

CASE STUDY OF LAKE FRANCES

Description of Relevant Entities

Water management can be viewed as a system to which the resource itself is the input to be managed for a variety of outputs (see Figure 4). Although this figure notes water management outputs, they are similar to what will be noted here. The desired output of any given entity will naturally affect its management decisions. As each of the relevant entities are reviewed, the desired output of each, concerning this case, will be revealed and considered as the case study develops. Figure 5 is provided as a quick reference to the key participants and their outputs for this case study.

Four federal agencies have potential involvement in the Lake Frances Dam history, the U.S. Army Corps of Engineers, the Federal Energy Regulatory Commission, the U.S. Fish and Wildlife Service, and the Environmental Protection Agency.

Until 1981, the U.S. Army Corps of Engineers (Corps) was in charge of routine dam inspections, with authority to repair or replace unsafe structures. The primary desired outputs would be water quality and dam safety.

The Federal Energy Regulatory Commission (FERC) has jurisdiction over non-federal dams providing hydroelectric power. FERC cannot allow hydroelectric

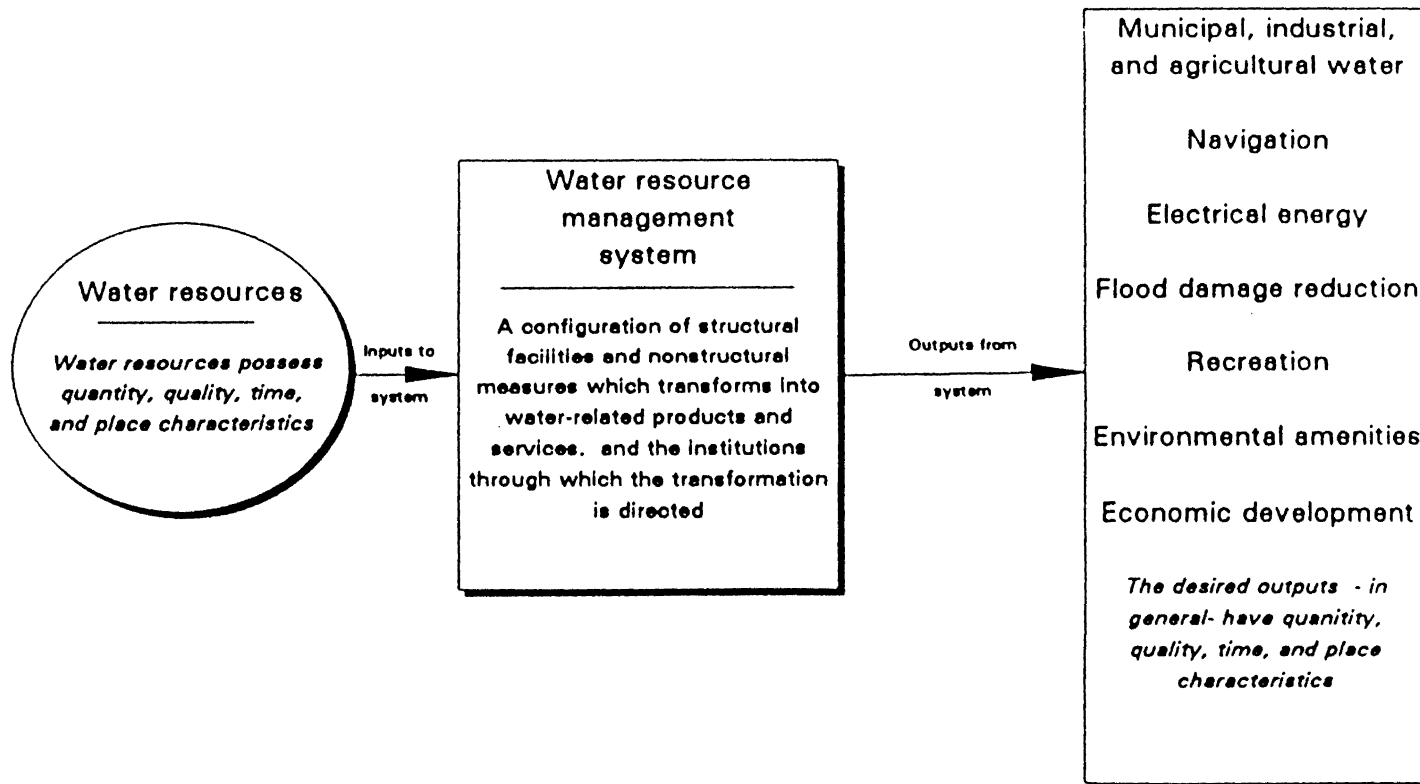


Figure 4. Water Management System (Craine 1969, 6)

<u>FEDERAL</u>	<u>STATE</u>	<u>LOCAL</u>	<u>PRIVATE</u>
<p>CORPS</p> <ul style="list-style-type: none"> -water quality -dam safety 	<p>OWRB</p> <ul style="list-style-type: none"> -dam safety -water rights -water quality 	<p>City</p> <ul style="list-style-type: none"> -water quality -water quantity -recreation 	<p>JDJ</p> <ul style="list-style-type: none"> -hydroelectric
<p>FERC</p> <ul style="list-style-type: none"> -hydroelectric power -environmental amenities 	<p>OSRC</p> <ul style="list-style-type: none"> -environmental amenities -recreation -water quality 	<p>Adair County Court</p> <ul style="list-style-type: none"> -dam safety 	<p>IRDC</p> <ul style="list-style-type: none"> -water quality -water quantity -recreation
<p>FWS</p> <ul style="list-style-type: none"> -environmental amenities 			<p>Canoe Operators</p> <ul style="list-style-type: none"> -recreation
<p>EPA</p> <ul style="list-style-type: none"> -water quality 			

Figure 5. Water Management Entities and Their Outputs

developments that would impair the values for which the river was listed (16 U.S.C. § 1278(a) 1982). The FERC must produce an environmental assessment pursuant to the National Environmental Protection Act of 1969 (42 U.S.C. § 4332, 18 C.F.R. § 380.6) The outputs it would be most interested in would be hydroelectric power feasibility and environmental amenities.

The U.S. Fish and Wildlife Service (FWS) is involved in any inspection in the state that might contain a wetland or endangered species. Its primary desired output would be environmental amenities.

The Environmental Protection Agency (EPA) granted \$100,000 to the OWRB for the purpose of a Clean Lake Study of Lake Frances. Its primary desired output would be water quality.

There are two primary, and four secondary state-level agencies involved in this case study. The Oklahoma Water Resources Board and the Oklahoma Scenic Rivers Commission are the primary agencies. The Arkansas Department of Health, the State District Court of Adair County, Oklahoma, the Oklahoma Department of Wildlife Conservation, and the Oklahoma Department of Tourism and Recreation all played small parts in the history of the Lake Frances Dam controversy.

The Eighth Legislative Assembly of Oklahoma Territory enacted the first water law in 1905, outlining the procedure for acquiring water rights, regulating the use of water, and creating the post of territorial engineer (OWRB 1984, 7). The Oklahoma Legislature created the State Planning and Resources Board in 1935 and included in its jurisdiction parks, forestry, and water resources (OWRB 1984, 8).

In 1957 the 26th Oklahoma Legislature authorized the creation of the Oklahoma Water Resources Board, a panel of seven which held its first meeting on June 14, 1957 (OWRB). In 1972, two at-large seats were added to the Board. In

1974, the Oklahoma Legislature charged the OWRB to develop a long-range plan for the orderly control, protection, conservation, development, and utilization of the water resources of the state. As a result, the Oklahoma Comprehensive Water Plan was adopted by the First Session of the 38th Legislature in 1980 (OWRB 1984, 10).

For planning purposes, the state is divided into eight regions according to the characteristics they shared. A plan of development and the costs for implementation of the plan were prepared for each region. The refinement of these plans and updating supply/demand estimates remains one of the principal concerns of the Board's Planning and Development Division (OWRB 1984, 10). The OWRB is responsible for inspections of all dams in Oklahoma, no matter what the size or who owns it. Being a state organization, the OWRB is interested in all of the outputs of the state's water resource management system.

In 1977, Title 82 O.S. §§ 1451 - 1471 gave the Oklahoma Scenic Rivers Commission (OSRC) authority for the Illinois River, Flint Creek, and a portion of Barren Fork Creek. On the Illinois River, the OSRC's authority extends from the state line to the confluence with the Barren Fork Creek. The Commission consists of twelve members. They are officially charged with the protection and development of the state's Scenic River Areas and contiguous lands. One of the most pertinent standards the Commission subscribes to is that, "should pollution or the possibility of pollution be a threat..., regardless of the distance or by whom, it will be the responsibility of the OSRC to report the problem to the State Health Department, the OWRB, the EPA, law enforcement agencies, or any other appropriate agencies for proper management (OSRC 1989, 37)." The statutory provisions give the Commission the right to request the Attorney General to bring an action for an injunction against violators of the provisions, orders, or

determinations of the Commission. Violators would be guilty of a misdemeanor. Each day upon which such violation occurs shall constitute a separate violation (OSRC 1989). Its primary desired outputs would be environmental amenities (including scenic values), flood damage reduction, and recreation.

The Arkansas Department of Health is charged with enforcement of federal regulations concerning clean water standards. The primary desired output would be water quality.

The Oklahoma Department of Wildlife Conservation (ODWC hereafter) is responsible for managing the resident fish and wildlife resources of the State of Oklahoma. They provided expert witness on inspections of Lake Frances, advising of any potential dangers to the fish of the Illinois River. The primary desired output would be environmental amenities.

The Oklahoma Department of Tourism and Recreation oversees the budget of the Oklahoma Scenic Rivers Commission. All legislative appropriations for the Commission go through the Tourism Department first. The primary desired output would be recreation.

Two local entities were involved in the case study, the City of Siloam Springs, Arkansas (City hereafter), and the District Court of Adair County. The City was, during the time of this case study, dependent upon Lake Frances for its water supply. The City also provided water for the nearby community of Watts, Oklahoma, and West Siloam Springs, Oklahoma. The three primary outputs they desired were water quality, water quantity, and recreation.

The District Court of Adair County, Oklahoma was responsible for the OWRB vs Illinois River Development Company case (No. C-89-196), which was filed with the Court. Usually, cases involved with state dams are tried in the

county in which they are located.

Some private parties were involved in this case study. The Illinois River Development Corporation, JDJ Energy Company, and local canoe operators.

The Illinois River Development Corporation (IRDC hereafter) was formed by the city officials of Siloam Springs for the purpose of operating a private dam within Oklahoma. Primary outputs desired would be municipal water supply and recreation.

JDJ Energy Company (JDJ) is a private business which, at one time, contemplated the feasibility of locating a hydroelectric power generator at the Lake Frances Dam. Its primary desired output was hydroelectric power.

The canoe operators located on the Illinois River in Oklahoma have an economic interest in the management of the Lake Frances Dam. Withholding instream flow or releasing polluted waters could substantially reduce their profits during prime floating months. Recreation was their primary desired output.

Chronology of the Lake Frances Dam Management

In the early 1920s, James W. Sloan bought 800 acres of land, then known as Forest Park, along the Illinois River. A 70-acre lake existed on the property. Sloan decided to enlarge the lake for recreational purposes in 1931. The original planning and design of the Lake Frances Dam, which included a small hydroelectric plant, was by Victor H. Cochrane, a consulting engineer from Tulsa, Oklahoma. The newly created lake was christened on Memorial Day, May 30, 1931, and the lake was named after Sloan's daughter Frances.

In developing Lake Frances as a recreational center, a grand resort was built with swank cabins and cottages nearby. Thus began the lake's true peak years of

popularity between 1931 and 1941, when motor boat races, canoeing, fishing, and parties at the resort were commonplace. Lake Frances drew vacationers from Tulsa, Dallas, Kansas City, and New Orleans, since the lake was developed before Lakes Tenkiller, Grand, or Texoma were built.

The first failure of the Lake Frances Dam happened in 1943. Although the actual cause is not known, speculation was that the failure in the earth embankment adjacent to the concrete arch could have been caused by high flow. Because of economic consequences of WWII, the levee was restored, but the dam was left in disrepair.

The neglected Lake Frances was given hope of new use in 1954 by the City. They purchased the project, through the IRDC. The lake was to be used as a water supply for Siloam Springs. The corporation was established because the city was advised that an out-of-state municipality could not own property in Oklahoma (Couch 1990, 1). Plans for reconstruction were prepared by Fell and Wheeler, consulting engineers, from Tulsa, Oklahoma. The reconstruction was completed shortly thereafter. In 1955 a water treatment plant was constructed.

The Arkansas River Basin Compact of 1970 was negotiated between Oklahoma and Arkansas, giving Arkansas 60% of the annual flow of the Illinois River Subbasin. The OWRB issued a stream water appropriation permit to Siloam Springs for 9,000 acre-feet annually. According to Dean Couch, the permit did contain a condition that the authorized water come from Arkansas' share (1990, 1).

The water quality of the Lake began to deteriorate due to eutrophication, and in October of 1971, a meeting was held to discuss the issue. The EPA; SCS; Arkansas Planning Commission; Watts, OK; Oklahoma State Department of Health; Siloam Springs, AR; and OWRB were represented. No decisions were made at this

meeting.

To increase the available water supply, the City decided to raise the spillway elevation. On June 5, 1975, plans were submitted to the OWRB to raise the spillway elevation 1.5' with a concrete wall. McGoodwin, Williams, and Yates (MWY hereafter) were consulting engineers for the City. These plans were approved by the OWRB on July 8, 1975.

In December of the same year it was necessary for the OWRB to remind MWY that a notice of completion was required for their June 5, 1975 proposal. MWY responded to the OWRB in January, 1976, advising that the city had not been able to begin construction. The new spillway was later completed.

The next recorded event did not occur until February of 1978, when a Phase I Safety of Dams Inspection was performed on Lake Frances Dam by Col. A. Smith of the Corps, an OWRB representative, and Dennis Daniels, Water Plant Superintendent for the City. The Corps stated that the dam and spillway were inadequate, and classified the dam as high hazard potential (see Appendix A). A report to that effect was sent to Mayor Knight, of Siloam Springs, Oklahoma State Senator Herbert Rozell, and Oklahoma State Representative Wiley Sparkman.

In response to that report, the OWRB received a request in May from Carl Yates, consulting engineer for Siloam Springs, asking how to obtain a Phase I report. In June, 1978, the OWRB sent a letter to Mayor Knight containing the plans and specifications. Yates sent the OWRB a letter in December, 1978, stating that the electric power generation feature of Lake Frances was to be abandoned. The response from the OWRB included a letter to Mayor Knight asking what the City planned to do and when. This same letter was sent again in January, 1979. It took two months for Yates to send a letter to the OWRB stating that the City would give

the Board a report on the proposed plans. The next correspondence did not occur until July 1979, when the OWRB sent a letter to the new Mayor Gosney again asking what the City planned to do and when. Gosney responded with a letter detailing the maintenance work to be completed. No official plans were submitted.

It had then been two and a half years since the original safety inspection was completed. Siloam Springs hired a new City Administrator, Sid Moore, who quickly sent a letter to the OWRB asking for 90 - 120 days to review the situation and submit a report. Finally on Dec. 23, 1980, the OWRB received a report from Moore detailing maintenance measures that would be taken, although Moore questioned the magnitude of possible flooding and extent of hazard projected by the safety inspection.

In February of 1981, the OWRB received a \$100,000 grant from the Environmental Protection Agency for a scientific study of the problems of Lake Frances, and the state matched the grant with \$42,000. It took two years to complete the study. The EPA has a program, called a Clean Lakes Program, which gives states the opportunity to identify lakes in need of help for restoration. There are several phases in the process. The study completed on Lake Frances was a Phase I study (Threlkeld). After the EPA reviews the Phase I reports, it chooses the projects to invest in. Unfortunately, Lake Frances was not chosen, so the Phase I report was the end of this option for help.

The Phase I study was useful in identifying many aspects of the whole management problem of Lake Frances, and was excellent in including the local residents in the process. One method the OWRB used to include public participation, was to set up a public meetings in surrounding communities, such as Watts, OK. The purpose of the public meeting was to get citizens' ideas on how to

solve sedimentation and nutrient pollution of the lake. The OWRB also set up a citizens' advisory committee to work with the state on evaluating alternatives for solving the problems, and restoring the water quality of the lake. Some of the proposed options on improving the lake included dredging, draining, bulldozing, or lakeshore stabilization.

From April to October of 1981, several letters passed among the OWRB, the OSRC, the Arkansas Department of Pollution Control, the Corps, and Senator Rozell. Most of the inquiries were either concerning the specifics of repairing the dam, such as breach analysis results, or the legal issues related to the background of the lake, such as requests for a copy of the Warranty Deed.

In October of 1981, the National Dam Safety Act (33 U.S.C. § 467 et seq.) transferred jurisdiction over all water, which included authorization to repair or replace all water storage facilities, from the Corps to the OWRB. From this point on, the safety inspections and enforcement of the recommendations would be the responsibility of the OWRB.

The first formal action by the Oklahoma Scenic Rivers Commission was taken in May of 1982. The OSRC enacted a resolution asking Siloam Springs to postpone draining the Lake. This was to have been done in order to make repairs at a water intake valve. The valve had been inoperative for a number of years due to a submerged log jam (Bone 1982a).

The Commission cited four reasons for the resolution. First of all, the flushing would destroy spawning fish populations in the lake and river. Jim Smith of the Oklahoma Department of Wildlife Conservation agreed with this point. Second, it would ruin the integrity of a Clean Lake Study being done on Lake Frances. Third, it would violate Oklahoma water quality standards, and last, it

would cause a hardship on the float trip business. The City had been trying to do the repairs since the preceding fall, but construction equipment was not available. According to City administrators, the City would save several thousands of dollars by hiring equipment that was already in the area. To bring the contractor back would cost \$5,000 to \$6,000.

Rep. Bill Willis, D-Tahlequah, and Senator Herb Rozell, D-Tahlequah, promised to seek a \$3,000 to \$4,000 state appropriation if Siloam Springs officials agreed to wait. The appropriation would be included in the OSRC budget to help offset the increased costs Siloam Springs would incur by a delay.

Canoe operators feared that the river would be too low to float while the lake was being refilled after repairs. Julian Fite, a Muskogee attorney, represented the operators, and promised to take legal action if the draining was not postponed (Pruitt 1982). At the following Siloam Springs Board of Directors meeting, they voted to postpone the scheduled drainage of Lake Frances (Bone 1982b).

On September 27, 1982, Jack Hoyt, a Siloam Springs official, furnished emergency contact information to the OWRB, and advised of a lake drawdown.

In January of 1983 repairs on the Lake Frances Dam were almost complete, but the money Oklahoma legislators say was appropriated to pay the extra cost of delaying the project was actually to be spent on a base station radio for Illinois River rangers. The OSRC voted to endorse a budget committee recommendation to that effect. This was contrary to the informal agreement reached at the May 1982 meeting. At the previous meeting, OSRC members present had stressed the importance of a friendly solution to the problem. The Oklahoma Department of Tourism and Recreation prepared a contract in November, agreeing to pay the city \$3,500 for the additional expenses. The money was included in the OSRC budget,

but was not earmarked specifically for the dam repair. The OSRC was funded at \$138,000 for the year, and had an additional carryover cash balance of \$20,000. The \$3,500 was included in the budget recommendations to the Commission by OSRC administrator John Shannon. The recommendation was then deleted by the Commission, who voted instead to use the money for the base station radio. Commission spokesmen claimed that the legislators (not the OSRC) had promised the extra money. Tourism Director Abe Hesser had understood that the OSRC had approached the legislators, found it disturbing that the Commission would ignore the intended purpose, and called the decision an "unwise one". Jack Hoyt laughed and said the repair work could be finished in two weeks once the weather cleared up (Bone 1983).

On February 1, 1983, the OWRB requested a progress report on the dam repairs. Jack Hoyt advised that the service gates had been repaired, and tree and brush cutting was being accomplished.

It was not until after the next routine inspection that the OWRB reported that the repairs made were not sufficient. So, in October of 1984, the City of Siloam Springs passed a resolution to repair the Lake Frances Dam and Spillway, indicating that work to correct deficiencies would be initiated in April 1985, and would be completed in January 1986.

Dean Couch, OWRB staff attorney, notified Jack Hoyt of the time frame for completion of remedial measures, requiring the application for modification to be filed by Jan. 18, 1986. In February, 1985 Jack Hoyt wrote to Couch requesting an extension of time until Feb 19, 1987, to file the permit for modification.

By this time the lake had been steadily filling up with sediment to the point that the City had been considering other sources for their municipal water supply.

One of their proposals was to elevate the dam and spillway level, by installing flashboards across the dam, to create a higher volume of available water. The OSRC requested the OWRB to deny the permit to obstruct the downstream flow of the Illinois River. In May, 1985, Couch denied the permit for installing flashboards.

Harold Springer, OWRB engineer, noted to Hoyt that an OWRB staff member would be going to look at the lake on June 8th or 9th, 1985. The inspection was completed, and the repairs at the dam were found to be insufficient.

In December of 1985 an application for hydroelectric power was submitted to the Federal Energy Regulatory Commission by JDJ Energy Company, to refurbish an abandoned powerhouse, and to locate a small power generator at the Lake Frances Dam. This was another option for use of the dam that the City of Siloam Springs was exploring. If they could get a company interested in locating a power generator at the dam, they would receive help with the cost of repairing the dam.

The next routine inspection of the Lake Frances dam came on May 29, 1986. In attendance were Harold Springer, OWRB Chief Engineer; Art Cotton and Gavin Brady, from OWRB; Jack Hoyt, City of Siloam Springs; Alan Fortenberry, Engineer with MWY; and Ed Fite, Director of the OSRC. The necessary repairs and a schedule of time for compliance were discussed and agreed upon. This inspection was followed up by a letter from Springer to Hoyt, summarizing the inspection and requesting certain items.

In August of 1986, the OWRB received the draft Phase II Report and original Phase I Report for repairs to Lake Frances from Fortenberry. In September of 1986, OWRB staff found discrepancies with USGS topographic maps that would change the size classification of the project, and thereby change the requirements for repairs. That information was requested by JDJ Energy Company since it would

affect their plans for hydroelectric power development. The OWRB responded to JDJ in April of 1987, stating that Lake Frances was still classified as a high hazard dam.

On May 19, 1987, Ed Fite called Springer about Siloam Springs' opening of a sluice gate at Lake Frances, thereby releasing poor quality water downstream. They also discussed the status of the dam and repair schedule problems. Several calls to Alan Fortenberry resulted.

On July 2, 1987, over four months past the due date, the OWRB received an application to repair and improve the Lake Frances Dam from the Illinois River Development Company. The application also requested that the dam be redesignated as a small structure, significant hazard, instead of the current listing of large structure, high hazard (see Appendix A), the main difference being in the final cost of repair. As of 1977, the OWRB had used the dam breach analysis test to model a dam failure to estimate the loss of property and life, thereby setting the hazard level (Application No. DS-87-09).

A public hearing on application DS-87-09, set by the OWRB, commenced in Tulsa on August 26, 1987. The hearing reconvened on October 22, 1987.

In September of 1987, the City installed a makeshift 18" high wooden wall across the dam, in an effort to raise the lake level to insure an ample drinking water supply. Since the sluice gates were inoperative, the Illinois River level was lowered, causing distress among the canoe operators. On September 9, 1987, the OWRB, OSRC, and six canoe operators inspected the dam. Art Cotton, OWRB representative, immediately initiated an attempt to file an injunction against the city, and sent a letter to Siloam Springs officials saying they could not impede the flow of water to downstream users. The letter was to have been mailed Friday, the

11th, but in the early hours of Thursday morning, a vigilante removed the boards.

In an attempt to help the City, the OSRC voted on September 16, 1987, for Director Ed Fite to research the feasibility of Siloam Springs using Beaver Lake in Arkansas as a water supply. The OSRC has jurisdiction over Lake Frances, but did not want to declare it a public nuisance until the city could find another water supply (Hales 1987).

Also in September, 1987, the OWRB sent a letter to JDJ stating denial of Section 401 Certification. With this option exhausted, the OWRB inspected the dam again. Present at the inspection were Russell LaForce, and Gavin Brady, both of OWRB; Jim Corl and Stu Thomas, Siloam Springs; Ed Fite and Archie Payton, OSRC; and Alan Fortenberry, Project Engineer.

The hearing from August was reopened on October 22, 1987, on application DS-87-09 with witnesses giving testimony and additional exhibits being presented. The final analysis from the OWRB was officially documented on January 12, 1988. These Findings of Fact, Conclusions of Law and Board order were approved by the OWRB on application DS-87-09 (see Appendix B). Among the numerous unsafe features of the dam was a horizontal crack in the main spillway, approximately 4" wide on the upstream side, and approximately 75' long. The Board found that the crack in the dam did not have a significant probability of slipping or being lost, and therefore anchors did not need to be inserted. This crack caused the inevitable failure in May 1990. The Board also ordered the City to install a siren, and file an emergency action plan that was to have been reviewed, and approved by, the OWRB, the Adair County Civil Defense and the OSRC by April 11, before the 1988 recreation season began on the Illinois River (Frank 1988a). The OWRB followed this up with a letter requesting an update from the City.

A newspaper article dated May 6, 1988, states that Jim Corl, Siloam Springs City administrator, reportedly told the OWRB that the City did not need to comply with the order (Frank 1988a).

On June 22, 1988, the OSRC voted to ask the State Attorney General's office to file a class action suit against the city of Siloam Springs, citing Lake Frances Dam and Reservoir as public nuisances. The Commission specified water quality and dam safety as primary concerns to be addressed in the suit. This came on the heels of a suit filed by the OWRB against the Illinois River Development Co., Siloam Springs and James D. Corl III, Siloam Springs city administrator, for failure to comply with a board order to submit an emergency action plan, and install a siren for the area below the dam and spillway (Frank 1988b).

In August of 1988, the OSRC directed Ed Fite to contact the State Attorney General's office to find out its decision as to whether or not to pursue the suit against Siloam Springs. Fite had notified the Attorney General after the June meeting, but had not received a reply as to its position. The OSRC stated it would probably hire legal counsel of its own if the Attorney General's office did not pursue the suit. The OSRC was prompted to take action after what they felt was a lack of cooperation and good faith on the part of Siloam Springs city officials (no action was ever taken). A television reporter from Tulsa, who would testify, said Corl told him he was not concerned with the water quality of the Illinois River (Edelman 1988).

Once again, in August of 1988 an on-site inspection was made by the OWRB, OSRC, Siloam Springs, and several engineers, to determine whether the cracks and the uncertain condition of a 7,000' earthen section of the dam were unsafe. The lake level had fallen to 18". The OWRB Hearing Examiner gave Siloam

Springs 31 days, (Sept. 26), to come up with a time frame for making repairs. The inspection report said they were waiting for the FERC's report as to the suitability of the site for a hydroelectric power generator. Rex Earl Starr, attorney for the city of Siloam Springs, interrogated the OWRB engineer regarding inspections he made in 1985 and 1986. Starr said the engineer failed to make any notations in subsequent memos and reports, indicating that the dam was unsafe. LaForge, of the OWRB, did say he observed some seepage through cracks in the spillway as early as 1985. He saw no immediate problem, but said that didn't mean there weren't any. Earlier, an engineer with a Fayetteville consulting firm said that a stability analysis indicated that the materials used to build the dam and its foundation were strong. Jim Corl said the city was seeking a municipal bond to help pay for any improvements ordered (Frank 1988b).

The first action taken by the Arkansas Dept. of Health was to give the City 55 months (4 years and 7 months, April 1993) to abandon the lake as a water source. The Department informed the City that failure to meet time frame deadlines would make such measures as mandatory conservation and connection bans necessary.

In December, 1988, the OWRB ordered the City and the IRDC to complete necessary repairs by Oct. 1, 1989, with repairs to be initiated by May 1989. The report does not state what the penalty for not complying would be.

On April 4, 1989, the Siloam Springs Board of Directors voted for Joe Tarvin, of MWY, to study the possibility of drawing water from the lake and constructing a supplemental water supply, with the cost of the continued study not to exceed \$35,000. The Board reportedly was concerned over using the river due to uncertainty about the long-range water quality, and whether it had adequate flow

to meet the needs of the city's growing population. Another option was to continue to use the city-owned Lake Frances, and build a new impoundment, or use the Illinois River supplemented by wells or the nearby Beaver Lake. The river proposal would also include a new water treatment plant. At the time Siloam Springs also provided water for West Siloam Springs, OK, and Watts, OK. If they decided not to use Lake Frances, Tarvin said he would suggest the city do nothing with it and see what the state of OK would do with the structure (Bielser 1989a).

A June, 1989, article reported that the City of Siloam Springs had recently offered to sell the Lake Frances Dam to the State of Oklahoma for \$1. The OSRC considered the offer with five alternatives upon acceptance:

- (1) leave the dam in its present condition with the exception of removing the gates,
- (2) repair the dam and dredge the lake,
- (3) build a larger dam and raise the lake level,
- (4) remove the dam and stabilize the bottom of the stream by planting grass,
- (5) or build a new channel around the lake (Edelman 1989a).

The Attorney General's office said that the OSRC would need to confer with other state agencies before purchasing the lake. Ed Fite cited an OK law empowering the commission to accept real and personal property to implement the OK Scenic Rivers Act. Such action was never taken.

Bob Henry, chairman of IRDC, said the city borrowed the money to fix the dam, then decided against the repairs. They didn't have enough to dredge the lake, but they did have enough to have made the necessary repairs at one time. He contends it would be to Oklahoma's advantage to dredge the lake since they are downstream (Hales 1989a).

Siloam Springs appealed the December, 1988, OWRB order in Adair District Court, in Stilwell. In July, 1989, the appeal was rejected. The City's options were then to appeal to the State Supreme Court, or to ignore the OWRB order. If they ignored it, the city would be guilty of a misdemeanor for each day of noncompliance. The OWRB could file a criminal complaint, based on the potential damage.

Ignoring the compliance, the Siloam Springs officials contacted the Arkansas Department of Health in July of 1989 for permission to move their water intake upstream from Lake Frances. The new Mayor M.L. "Moose" Van Pouche said, "We're going to try to do everything we can to assist Oklahoma in working this thing out and make sure we're all shooting for the same thing." The OSRC decided they did not have the money to face the problems with taking the Lake over. Ed Fite said City officials had promised to mail a letter in August outlining their proposal about Lake Frances. Van Pouche said the letter might not be written until September, depending on when the Department of Health submitted their report (Hales 1989b).

In the meantime, the OSRC asked the Attorney General's office to pursue avenues to remove the dam and have the lake drained. Ed Fite and commissioners attended a meeting Friday, July 7, 1989, where the city said it never offered to sell the lake. Officials said they would send a letter to the OSRC detailing what they intend to do about the dam, but the letter had not arrived by Tuesday (Edelman 1989b). At this point a reporter writes that there seemed to be a recurrence of bad communications between Fite and Corl, something that had plagued discussions about Lake Frances for years. The promised letter had been mailed Monday evening, July 12th. By way of explanation, the OSRC meeting that evening was a

special business meeting that was held a week earlier than their bi-monthly general meeting, causing a misunderstanding about the deadline (Bielser 1989b).

As prompted by the OSRC on July 11th, Attorney General Robert Henry asked three state agencies for ammunition to assist his office in the effort to force Siloam Springs to repair the dam. The OSRC, OWRB, and ODWC were to submit a memorandum to the Attorney General's office, which would include what the agencies felt was the problem with the dam and lake. At the July 11th meeting, the OSRC declared the dam, spillway, and lake a nuisance, a necessary step before the commission could involve itself in any legal action.

Predictably, an October 2, 1989, inspection by the OWRB found the dam and spillway to be in a substantially unsafe condition. On October 22, 1989, the OWRB filed a contempt of court motion against the IRDC when they failed to act on the court order requiring repairs. The order, filed in Adair County Court, Oklahoma, had given them until October 1, 1989 to complete repairs (Edelman 1989c).

On November 2, 1989, the Adair County Court ordered (No. C-89-196) that a temporary injunction be issued prohibiting Siloam Springs from continuing in violation of the administrative order issued by the OWRB on Dec. 13, 1988. The Court ordered that the defendants proceed immediately to initiate the remedial measures of the order, as expeditiously as possible, weather permitting. Repairs should be completed by July 1, 1990. Furthermore, the defendants should file a written status report at the end of each month, setting forth in detail all actions taken with regard to bringing Lake Frances Dam and Spillway into safe condition and in compliance with this Order. A copy should also be provided by the defendants to the OWRB.

At a January 16, 1990 meeting in Siloam Springs between the OSRC and the

Siloam Springs Board of Directors it was reported that the lake was now believed to have an average depth of 3 feet, making the cost of dredging infeasible. Therefore, the city was in the midst of building a 1.5 million gallon storage tank. Siloam Springs said it had complied with three of the nine measures necessary in the OWRB order. Ed Fite disagreed that the measures had been complied with fully. Previously the Siloam Springs voters had approved a \$400,000 bond issue, with a portion of that having been spent on the three measures. The City also reported that it had received quotes ranging from \$20,000 to \$25,000 on patching the "leak" (Edelman 1990a).

At a February, 1990, meeting the OSRC voted to reinstate the intent of the motion, made in July, calling for the Attorney General's office to pursue all legal avenues to have Lake Frances declared a public nuisance, and seek a court order to have the dam removed and the lake drained. The intent of the commission was to have the two gates of the dam opened in an attempt to improve the water quality of the Illinois River. Ed Fite said the top gate was completely closed, while the bottom gate was opened slightly. The City reportedly accepted a bid from the Haliburton Co. to fill the crack with grout at an estimate of \$11,000 to \$25,000. Fite noted that the estimate was a far cry from the figures that had projected in past years, which ranged anywhere from a quarter million to a half million dollars. The work was to begin that week, Fite said.

IRDC officials adopted a resolution on April 17 to have City administrator Jim Corl negotiate with "any and all OK authorities for the transfer of title to Lake Frances." The resolution stipulated that the City would retain ownership and control of necessary backup pumping facilities that could provide an alternate form of water withdrawal. The offer would be open until Sept. 1, 1990, when, if no one

accepted the offer, the city administrator was instructed to file the necessary papers that would have the ultimate effect of removing Lake Frances as a water impoundment (Bielser 1990).

On May 3, 1990, a 75' portion of the dam above the crack was swept away by floodwaters. The main cap on the spillway shifted from six to eight feet, damaging the control mechanism and preventing officials from making adjustments to lower the level of the lake. Under ordinary circumstances, officials said, the spillway gate was raised and lowered by attaching a cable and pulling it with a tractor (Poindexter 1990).

In July of 1990 the FERC issued its hydropower license to JDJ, although it cited nine major environmental issues related to construction of a hydroelectric facility on Lake Frances. Before the final FERC report was made, it received official requests to deny the permit from the OSRC and the OWRB, and the OWRB filed a motion for rehearing with the FERC, due to the failure of the dam (Couch 1990, 3).

This concludes the approximately 70-year chronology of the management of the Lake Frances Dam that this case study covers. It is by no means an exhaustive report of the correspondence and happenings, it is only the highlights of the dam safety issue. Notes, not documented newspaper articles, were obtained through the records of the Oklahoma Water Resources Board file on Lake Frances, or the Oklahoma Scenic Rivers Commission file on Lake Frances. The records are public and can be accessed during normal business hours.

Appendix B contains a complete copy of the original Adair County Court Order, and the OWRB Findings of Fact, Conclusions of Law and Board Order. These give a complete technical description of the case, including the law behind the OWRB actions.

CHAPTER IV

ANALYSIS AND RESULTS

In Chapter II, Craine's Framework for analysis was outlined. He identified five techniques for affecting water management, with all five techniques being employed in only the most advanced forms of institutional arrangements (see Figure 3, page 27). These techniques illustrate the general nature of water management. To determine the extent and degree of efficiency to which they are being applied, Craine suggests six criteria. Some minor changes to the criteria will be necessary in this case study since the management of the Lake Frances Dam is the focus, not the water resource itself. All five techniques will be discussed, followed by an analysis using the six criteria.

Most of the information used for the analysis is assembled, and fully documented, in Chapter III, in the form of a chronology of the Lake Frances Dam management. Also provided in Chapter III is a quick reference to the entities involved in this case, and the abbreviation used for each. For technical reference, Appendix B contains the Adair County Court Order from the OWRB for the repairs of the Dam, and the OWRB Findings of Fact in the case.

Technique Analysis

Water Resource Intelligence

The first, and most basic technique of water resource intelligence encompasses many activities, such as collection and dissemination of hydrologic data or provision of social and economic data. During the years considered in this case study, three primary types of data have been collected; hydrologic, dam safety, and repair potential.

When the lake and dam were first established in 1931, they were privately owned and developed by James W. Sloan. Since they were privately owned, the collection of hydrologic data was done by Victor Cochrane, the consulting engineer. The Corps conducted routine dam safety inspections until 1981, when the responsibility was given to the OWRB. Also in 1981, the OWRB received a \$100,000 grant from the EPA to conduct a scientific study of the problems and repair options of the Lake and Dam. The state also contributed \$42,000 to the study. The study included every aspect of the Lake and surrounding area (Threlkeld 1983). The data collected by the Clean Lake Study was particularly helpful to the OWRB in bringing the problems of the Lake into sharper focus, and formulating solutions.

As far as dissemination of the data collected goes, the reports made by the OWRB are open to the public, and have been shared with the City, the OSRC, or any other interested parties over the course of the years included in this study.

The collection of any economic data, concerning the possibilities of repairing the dam, was strictly the City's responsibility, due to private ownership by the IRDC.

Identification of Resource Potentials and Planning

The second technique affecting dam management is the identification of resource potentials and planning. This technique includes such projects as inventorying resources, projecting growth demands, suggesting ways to respond to those demands, and preparing reconnaissance planning studies.

The first aspect of inventorying resources included monitoring dam safety and the effects of dam management on the water supply. In 1954, the IRDC bought Lake Frances for a municipal water supply for the City of Siloam Springs, AR. The OWRB inventories and manages the waters of the state, so it granted water rights permits to the City. The City then sold water, by contract, to the nearby communities of Watts, OK, and West Siloam Springs, OK. It was the City's responsibility, as managers of the dam, to ensure an adequate supply of clean water in the reservoir.

Since the Dam is located in Oklahoma, the OWRB had authority over it and monitored it for safety. As noted earlier, the Corps was responsible for routine safety inspections of the dam until 1981, when the OWRB took over the inspections. The OWRB conducts routine safety inspections, and files reports indicating the findings. Copies of the reports were sent to the City administrators with specific actions to be taken outlined to remedy the problems. The dam was found in disrepair several times over the years.

The second and third aspects, projecting growth demands and suggesting ways of responding to them, are primarily the City's responsibility. The City managed the dam to provide municipal water supply for itself, as well as for Watts, OK, and West Siloam Springs, OK. Part of this responsibility would include

projecting their own growth demands to determine whether their water supply was adequate for all parties. In response to increased demands or inadequate supply, the City could ask for suggestions from the OWRB, but they have generally not followed the OWRB suggestions when given. The OSRC voted, at one time, to help the City by researching the feasibility of the City using Beaver Lake in Arkansas as a water supply.

The fourth aspect of this technique is preparing reconnaissance planning studies. The foremost concern of the OWRB has been dam safety. It filed reports each time an inspection was completed, and copies were sent to concerned parties. The reports always contained desired actions to be taken. Other than the routine safety inspections, the OWRB, by way of a grant by the EPA, conducted a Clean Lake Study as reviewed in Chapter III, although not required to by law. The private dam owners developed an Emergency Action Plan to minimize downstream damage in case of a dam breach. The Plan was required and approved by the OWRB.

In theory, the combination of these various reports would result in a general consensus of desired actions. The reports would also provide a framework within which independent water use and development agents could proceed towards dam management goals without serious conflict or losses in efficiency. Craine notes that in the past, as a part of this notion, great emphasis has been put on the planning product, often to the neglect of the planning process as an instrument of communication and education among the interests involved. The other extreme would have more governmental involvement, with the government providing specifications and schedules of actions to be taken, and specifying by whom they should be taken.

In this case, the theory did not work smoothly. Although the OWRB provided many opportunities for resolving conflicts of its reported management goals, City officials and the OSRC had serious problems in reaching a consensus of desired actions. The planning process faltered, not only in the communication realm, but also in educating the City concerning the severity of the dam safety issue. City officials did not believe that a dam failure was imminent.

Regulation of Water Use

The third technique is regulation of water use. There are three principal ways of regulating the use of water resources. First of all is the promulgation and enforcement of standards prescribing conditions under which uses are permitted or constrained. The purpose of this would be to protect water quality. The OWRB controls the standards concerning dam safety and quality, thereby controlling the downstream water quality. The Lake Frances Dam is located on the Illinois River, a state-designated scenic river. Due to its location, the Dam directly affects the water quality and quantity of the Illinois, and so the OSRC has a vested interest in seeing that the standards set by the OWRB are carried out. The OSRC is often referred to as the "watchdog of the Illinois." If it suspects the OWRB standards are being violated, it can report directly to the OWRB. If corrective actions are not made, it can suggest that the Oklahoma Attorney General's Office look into filing a lawsuit against the City, citing the Lake Frances Dam and Reservoir as public nuisances. The Commissioners have requested that this action be taken a few times (see chronology).

The second way to regulate water use is to control allocations of water for specific uses and/or users by administrative, judicial, or legislative means. Again,

in Oklahoma the OWRB processes water rights applications. The primary use for the water is included and considered in the process. The OWRB has granted rights to the City, which did, in turn, contract for some of its apportionment to go to Watts, OK, and West Siloam Springs, OK.

The third way to regulate water use is to price water uses in such a way as to influence the kind, amount, and timing of use. This would, hopefully, encourage efficiency. This particular aspect has been irrelevant in the management of the Lake Frances Dam. These three ways to regulate water use are not mutually exclusive but can be most effective when they supplement one another.

Development of the Water Resource

The fourth technique is to develop water resources. This can be characterized by the capacity to apply engineering and construction skills to an entire hydrologic system with the objective of maximizing the capacity of that specific resource to serve people. Also, to what extent can the institutional arrangements provide development facilities that are designed and operated to avoid spillover costs and take advantage of spillover benefits associated with the interdependencies of the hydrologic system?

Three methods of providing coordinated development facilities are generally available:

- (1) direct public planning, design, construction and operation of development facilities.
- (2) public regulation of design, construction and operation of new projects by independent development agents.
- (3) contractual agreement between public agency and independent operator

of existing facilities regarding operation of projects.

All three of these methods are presumed to be most effective if they are used to supplement one another and if they are performed by a regional water management agency that comprehends the entire hydrologic system. The primary test of effectiveness is the extent to which significant externalities stemming from hydrologic interdependencies are considered and adjusted in planning, design, and operating decisions.

In seeking to find the depth to which this technique was employed in this case, it was revealed that, although Oklahoma and Arkansas are participants in the Arkansas River Basin Compact of 1970, the Compact does not provide for a separate supervising agency. It utilizes the water resource agencies and personnel within each state, and exists mainly to see that water rights and water quality standards are adhered to. At this point there does not seem to be any unified planning for the Arkansas River hydrologic system. The OWRB does use subbasin planning strategy, but its jurisdiction stops at the Oklahoma state line.

Creation of a planning agency for the Arkansas River Basin can be achieved by an interstate water compact, which is ratified by all participating states, and the federal government. For the Arkansas River Basin, the states included in the compact would be Colorado, New Mexico, Kansas, Oklahoma, Texas, Missouri, and Arkansas.

Regional Water Distribution and Disposal Systems

The fifth technique is the organization of regional water distribution and disposal systems. Achieving coordinated distribution and disposal systems depends upon three kinds of authorization:

- (1) authority to design, construct, and operate a regional system.
- (2) authority to acquire existing systems and to integrate their operations as indicated.
- (3) authority to direct operations and to require interconnections and sharing of common facilities among independent systems.

Again, the Lake Frances Dam is not a part of a regional hydrologic management plan. It is clear that, although efficient integrated water management would use all five techniques, Oklahoma's system has missing or weak elements.

Criterion Analysis

The above descriptive analysis of the nature of water management provides a basis for suggesting six essential characteristics of institutional arrangements. The criteria will be described here and used as the basis for evaluating the techniques that the water management institution in Oklahoma uses, as it applies to the management of the Lake Frances dam.

Application of the Range of Techniques

First, to what extent is the institutional system equipped to operate at Stage 5, which is regional distribution and disposal. To analyze this, it is necessary first to determine at what stage the current system is operating, and then establish whether or not the required techniques are made available through authorizations to exercise legal powers and to conduct specific activities.

As noted earlier, Oklahoma is a participant in an interstate water compact. However, the compact does not fully provide for regional hydrologic management. Only the first three techniques have been used in the history of the Lake Frances

Dam management, and will be considered here.

Were the required techniques made available through authorizations to exercise legal powers and conduct specific activities? OWRB is legally authorized to make inspections of the Dam. Although they used grant money from the EPA to conduct the Clean Lake Study, they were not legally responsible for doing it. Because Lake Frances is privately owned by the IRDC, they were responsible for the collection of any hydrologic data needed to bring the dam up to OWRB standards, and the OWRB has cooperated in providing specifications as to what its standards are. The City was responsible for collecting the economic data needed to make the repairs.

After this determination, the question then becomes whether or not the authorizations were appropriate and adequate to implement the technique, and was the administrative responsibility for the authorized activities under unified command or fragmented?

The authorizations needed for executing technique one were sufficient, however, there were problems concerning technique two. There seemed to be no shortage of plans and specifications for what the City "should have done". The problem has been that the OWRB lacks the authority to enforce the timely implementation of its suggestions, without resorting to legal action. The OWRB did finally file a suit against the City, the IRDC, and Jim Corl, City Administrator, for failure to comply with the Board order to submit an Emergency Action Plan for the area below the Dam and spillway. The City did not have the funds to make the necessary repairs for many years, and when they did have the funds, they chose instead to invest in a new water supply source. The OSRC tried to help with negotiations, and threatened, or took, legal action when all other options were

exhausted.

The administrative authority for managing the dam is fragmented. The OWRB, the City, the IRDC, and the OSRC, all have some kind of authority for either managing the Dam, or seeing that it is managed in a particular way. Each had their own management priorities, and they rarely agreed on management goals, and how to achieve them (see Chapter III).

Consideration and Adjustment to Externalities

The second criterion relates to the concept of river basin management. Although Lake Frances is not managed under a unified agency, management decisions affect the rest of the system. There are a number of questions relating to this aspect, beginning with, how was the externality (Lake Frances Dam) handled? In this case, the Lake Frances Dam is part of the Arkansas River hydrologic system. The Arkansas River Compact Commission has been involved with a pending change in the City's water rights, but they have no jurisdiction in the dam safety matter, since the dam is clearly located in Oklahoma.

Who was responsible for the effects of management decisions of the Dam? The City was responsible, although there was no timely way to make them compensate for mismanagement of it. Were the affected parties considered in these decisions? The City seemed willing to listen to the concerns of the OSRC, and the OWRB. However, when it came down to acting upon them, the City consistently failed to follow through, and only acted when legally ordered to do so. For the OWRB's part, whenever permits were considered for modification of the Dam, public hearings were held. Anyone could submit comments to the OWRB, and could attend the hearings. The OWRB also held a public meeting in Watts, during

the Clean Lake Study, for the purpose of allowing citizens' input to influence the decision-making process. The OSRC was the foremost affected party involved in negotiating the desired outcomes, and representatives of it attended the hearings, Dam inspections, and City meetings when Lake Frances was discussed.

Were there legal and administrative requirements for considering the other parties? The City Board meetings were open to the public by law, but the Board was not required to notify affected parties when the Dam was on the agenda. The OWRB regulations require public hearings and, when there was a dispute involved, the affected parties were notified.

Flexibility of Water Management Actions

The third criterion seeks to answer the question of flexibility within the system. What degree of administrative discretion was provided in the law? There is a substantial amount of discretion within Oklahoma water management institutions, and consistently, the City took advantage of this. The City repeatedly missed deadlines for repairs to be made, which were set by the OWRB, and the OWRB was slow to respond at times. Within institutional systems, discretion can be used for positive outcomes. In this case, however, the discretion allowed noncompliance.

To what extent are specific decisions constrained by administrative goals, policies and standards? The goals of each entity involved in this case are different. As discussed previously, the OWRB lacks strong capabilities to enforce the dam safety standards it sets, and it seemed reluctant to act quickly when the City was apathetic. This weakness has been at the root of the Dam controversy for many years, and the City has taken full advantage of it. The OWRB's reluctance to act

possibly stemmed from the pending outcome of the Clean Lake Study, or the program demands of pursuing legal action. Possible causes for the City's apathy include a desire to save funds, an opinion that dam failure was not imminent, or that another water source would soon be utilized.

To what extent can decisions be reassessed and adjusted over time?

Decisions were changed many times over the course of the years. For example, the severity and extent of the Dam safety was variable, depending upon which person was asked about it. Options for funding the reparation of the Dam were reassessed many times. Within the legal boundaries of the Oklahoma water management institution, the decisions made could, and were, widely adjusted.

Consideration of a Range of Relevant Values

The fourth criterion explores the institution's ability to express and consider the range of values relevant to a water, or in this case dam, management decision. Due to the stage at which Oklahoma operates, the first two aspects that Craine suggested of this criterion are not applicable here. Those two questions will not be considered in this case study. However, four of the aspects are relevant.

First of all, formal interagency review procedures may provide linkages through which non-monetary values find expression in the decision-making process. During the history of the Lake Frances Dam, there were many opportunities to raise non-monetary issues. As noted earlier, the OWRB hearings were open to public participation, and public comments could be formally submitted. During the inspections of the Dam, the ODWC sent a biologist to assess the extent to which the management decisions being considered would significantly affect fish and wildlife resources. In this case, no significant effects were found. If

there were problems, the ODWC would submit formal comments to the OWRB, which would be considered in management decisions.

The process of obtaining a FERC permit for a hydroelectric project was an interagency process. The OWRB and the OSRC submitted formal comments to FERC, citing environmental concerns. The OSRC also brought up the fact that FERC must produce an environmental impact statement pursuant to the National Environmental Protection Act (42 U.S.C. § 4332, 18 C.F.R. § 380.6), which they did.

Another good example of raising a non-monetary issue came when the City was considering draining the Lake to make repairs to the water intake valve. The OSRC was concerned that the draining would destroy spawning fish populations in the Lake and River. The ODWC provided the expert witness confirming this point. The OSRC also believed the draining would destroy the integrity of the Clean Lake Study being done at that time. As a result of these two non-monetary beliefs, and other reasons, the OSRC passed a resolution asking the City to postpone the draining of the Lake (see chronology). The City postponed the action. These examples seemed to suggest that non-monetary values are adequately considered across agency lines, and acted upon in some cases.

Secondly, the nature of representation provided on a governing board is a vital aspect in assuring that all relevant interests participate in decisions. Lake Frances has no singular governing board, so the governing boards of the primary entities will be explained here. All OWRB personnel are paid officials, and City officials are either elected or appointed from local residents.

The composition of the OSRC is a bit more complicated. The Commission consists of twelve members. The Governor appoints three members, one of which must be a representative of the Oklahoma Conservation Commission, or the

Oklahoma Tourism and Recreation Commission. The President Pro Tempore of the Oklahoma State Senate appoints two members, one of which must be a member of a statewide citizens' conservation or environmental group. The Speaker of the Oklahoma House of Representatives appoints two members, one of which must be a resident of one of the counties containing the scenic river area. The additional members are elected in a nonpartisan election to represent the registered voters who reside or own property within the territorial jurisdiction of the Commission. The elected persons represent the county in which they live or own property. This provision allows non-resident property owners to participate in decisions. Two at-large members are elected at the same time (OSRC 1989, 5).

In contrast with Craine's stance on the degree of importance of this aspect, if a party is truly interested in either an issue, or one of these entities, there are ways to have input other than being on the governing boards. The OWRB allows public participation in all matters requiring permits. The elected City officials can be replaced if the decisions they are making are unsatisfactory, or a person can participate on a citizens' advisory committee to the City on a particular issue. As noted above, the OSRC elects two members at-large, providing the opportunity for concerned parties, who do not live in the area, the chance to have input to decisions.

Thirdly, the rules by which decisions within agencies are made are important in determining whether values are properly considered in decisions. As noted in Chapter III, each entity involved with this case has its own management goals. Neither the OSRC or the City have rules stipulating consideration of any goals other than its own. This is not to say that neither of them did this. The OWRB has a wider range of goals, simply because it is responsible for the waters of

the entire state, and although the City has recorded the primary use of Lake Frances as a municipal water supply, the OWRB considered many values when making decisions regarding the Dam or Lake. In this case, the OWRB had jurisdiction to make the final decisions regarding the dam. This allowed for the proper consideration of values.

Last of all, in many instances, requirements for consultations in formulating proposals and provisions for appeals and hearings may be the last resort for an individual or group seeking to be sure that its point of view and value are given consideration. As established previously, there were many opportunities for concerned parties to indicate their point of view. This aspect was not a problem in this case.

Efficient Water Management Financing

The fifth criterion seeks to answer whether or not the entities of the institution have the ability to finance water management consistent with its objective of efficiency. Two questions will be discussed in answer to this criterion.

Were there any unusual obstacles to raising capital and operating funds? Herein lies the main problem of this case. For many years, Siloam Springs could not afford to repair the dam. The city is located in an economically depressed area where commonplace fundraising efforts were unsuccessful. The income level and property tax base is low. They tried to sell Lake Frances to Oklahoma for \$1. They tried to develop a hydroelectric project, and so far, it has failed, too. Another failed attempt for funding came when Oklahoma's State Senator and State Representative for the area arranged for special appropriations to be made to the OSRC. These appropriations were to be given to the City to make repairs, realizing that it would

benefit the OSRC also. The special funds were not given to the City, but used within the OSRC instead (see chronology). The problem could also have been solved when the City was willing to sell the Lake, if the OWRB could have afforded to purchase it. The cost of dam repair for the benefit of a private user was considered, but the option to buy was decided against. The desired outcome by the OWRB was for the City to make the repairs, and OWRB regulations have no provision to help fund repairs when the owner cannot afford to do so.

What is the extent to which disconformities in the incidence of costs and the incidence of benefits encourage inefficiencies? Although it is difficult to specify the extent to which this is true, it is safe to say that safety of the Lake Frances Dam is such a small part of the OWRB's responsibilities, that it could afford to overlook this inefficiency. Also, because of ongoing conflicts concerning water rights and water quality, the dam safety issue is only one part of the whole problem. Pursuing legal action is costly, with very little benefit in this case.

Government as a Continuing Function

The last criterion covers the extent to which water management is recognized and built into government as a continuing function. For example, were there any ad hoc arrangements, or were there any procedures for relating Dam management decisions to other relevant governmental policies and operations? In attempting to manage Lake Frances, the OSRC and the OWRB worked together at times. The OSRC also made several attempts at working with the City. This endeavor was rarely successful, so no coherent arrangement was formed.

In the matter of relating Dam management decisions to other relevant governmental policies and operations, it would appear that the Lake

Frances Dam controversy was a useful example. Throughout the Dam's history, many private as well as local, state, and federal government agencies were involved, and all procedures for working together were followed. Chapter III offers an outline of all the entities playing parts, both big and small, and the chronology notes many instances where integrated management techniques were followed.

CHAPTER V

RECOMMENDATIONS AND SUMMARY

Discussion of the Results

This discussion will cover two topics, the results of the case study, followed by the results of how well the model dealt with the problem. The quality and composition of the administrative authority was addressed using the first criterion. The administration of authority over the Lake Frances Dam was found to be fragmented, augmenting the continued disrepair of the Dam. Each of the entities had different management goals, which also contributed to the problem.

Two more administrative problems surfaced, which speak to the quality of administrative authority. First was the OWRB's inability to enforce its standards. This was not a legislative problem, because the OWRB ultimately had legal authority over the City. However, administrative processes within the OWRB were what allowed the disrepair of the Dam to exist for so long. If the OWRB had administrative authority to order dam safety repairs, and assess fines for noncompliance, the Lake Frances Dam would never have failed.

There are many other municipal dams in Oklahoma that have been in noncompliance, but usually the owners have made repairs without a Court order being issued. The Lake Frances Dam is unique in that it is located within the OWRB jurisdiction, but is operated from Arkansas. The ongoing water rights and

water quality problems contributed to the contrary nature of the City officials. Since the end of the chronology of this case study, the City repaired and modified the dam to a small structure, low hazard classification (see Appendix A), and obtained a Corps permit to move the water intake valve upstream. These actions eliminated the dam safety and water rights issues, and partially solved the water quality issue.

The second problem was the limit of options available to the OWRB when the private owners of a small dam cannot afford to make repairs. This leads to the financial aspect of the case. Herein lies the greatest problem. The City genuinely tried many times to find options for help in repairing the dam. These options were discussed in the fifth criterion analysis. The City did borrow the money to make repairs, and then decided against using the money for that purpose. The OWRB filed a lawsuit against the City to force the repairs, but the dam failed before any action was taken. The point is that the dam should have been repaired many years before the failure occurred.

Concerning the legislative aspect, no major obstacles were uncovered during this analysis. As noted above, and in the chronology, the OWRB and the OSRC had legal alternatives and exercised them. The weakness was in the timeliness of the actions. However, since the conclusion of the chronology, Senator Rozell, and Representative Benson, wrote new legislation, creating the Oklahoma Dam Safety Act. Part of this new Act gives the OWRB the power to "impose administrative penalties to dam owners who fail, refuse or neglect to comply with the provisions" of the act. Previously, the OWRB was forced to pursue action in the State courts. This legislation was created, in part, due to the Lake Frances Dam controversy.

Did the model enable all aspects of the case to be identified and considered?

It did not. Emel and Peet addressed what could be a missing key element. They state that "efforts at resource management cannot be explained by depersonalizing the actors...or by oversimplifying the policy-making and implementation process (1989, 57)." Certainly Craine's model allowed the policy-making and implementation process to be fully considered. However, in this case it was discovered that when key persons within a group had personality clashes, poor decisions followed. After many miscommunications between the City and the OSRC, the problem was addressed by the OSRC which suggested a retreat for the City officials and Commissioners to resolve the problems. Although the retreat never came about, at least an attempt was made.

This proves Dorsey's point, regardless of the potential effectiveness of the institutions, the success in handling problems will ultimately depend on the people in the process, and particularly on the manner in which they are able to interact with others (1986, 258). However, Mitchell states, and it seems true, that capable people can make things happen despite the system in which they work, and mediocre or incompetent individuals are unlikely to accomplish a great deal regardless of the adequacy of the institutional arrangements within which they function (1979, 259).

Mitchell also notes that measurement of this aspect is difficult because many of the concepts relevant to this problem, such as values, customs, leadership, power, fragmentation, and influence, are difficult to operationalize (1979, 261-7). Also needed for analysis are explicit criteria and specific descriptions of which functions are being analyzed.

Institutional Recommendations

The resolution of the Lake Frances Dam problem came too late for it to be affected, but numerous researchers have shown the advantages of a regional water management system. To illustrate the necessary components of such an institution, Craine followed his 1969 study, with a study on institutions for managing lakes and bays. He states that delineating an institutional system for lake\bay management involves two interdependent considerations. The first concerns the role of various jurisdictions of general government-federal, state, counties, and municipalities-particularly the kinds of intervention powers they may be motivated to enact. The second concerns the nature of a lake\bay agency, including the scope of powers delegated to it, its geographic jurisdiction, the operational linkages between it and other agencies and its organizational form.

An essential difference exists between interstate compact commissions and river basin planning commissions. Disputes involving the former are solved in the court system, while the latter, if federally authorized, include mandatory dispute resolution procedures. Successful examples are the TVA, the Columbia River Basin Commission, Susquehanna River Basin Commission, and the Delaware River Basin Commission.

The National Water Commission supported the idea of river basin planning, and although the NWC Report's thrust is on national institutional reform (Bromley, Butcher and Smith 1974, 16), perhaps the beginnings could come from the states involved in particular conflicts. For Lake Frances, this would mean a federally authorized Arkansas River Basin Authority. The Water Resource Commission has suggested that the needs of a basin should be determined, and the major outlines of

a basin-comprehensive plan for the conservation, development, and management of the basin should be clearly defined before any institutional change takes place. The NWC also noted that any existing agencies that would be adequate for the newly defined functions should be utilized before creating a new entity within the arrangement. In this case, perhaps the Arkansas River Compact Commission could expand its management functions and goals to incorporate more than water rights.

To fund these kinds of projects the NWC made a recommendation for the Water Resources Council to have appropriations for land use and river basin planning, as well as planning grants to states (Bromley, Butcher, and Smith 1974, 16).

Aside from institutional reform, another option could be considered. To prevent similar cases, the owner of a high hazard dam could be required to post a bond with the State, sufficient to cover the cost of removing the hazard posed by the dam, and dedicated for that purpose, should the owner abandon the structure. This suggestion would be an extremely low cost alternative for the OWRB.

Recommendations for Further Research

This case study was done to test one framework of analysis for an institutional arrangement. Many case studies have to be done before theories can be developed for the field. As discussed in the literature review, one of the primary problems of institutional arrangement studies is that they do not use the same definitions and criteria for analysis. However, a definition can be refined, or a criterion added, to improve the model, without impairing the integrity of the model.

The model needs a seventh criterion addressing the issue of personal factors

impacting institutional decisions. The criterion would consist of four parts:

- (1) identifying the key players,
- (2) defining their roles and authority,
- (3) identifying communication problems, and
- (4) defining barriers to dispute resolutions.

This addition to the model needs to be included in subsequent case studies, in order to develop an accurate theory of institutional arrangement studies.

Summary

In summary, the analysis produced the following conclusions. The administration of authority over the Lake Frances Dam was found to be fragmented, augmenting the continued disrepair of the Dam. The administrative processes within the OWRB were what allowed the disrepair of the Dam to exist for so long. The OWRB has a limited number of options when the private owners of a small dam cannot afford to make repairs. Finally, the analysis of personality conflicts restricting communications of the involved parties was not included in the model.

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STATUTES CITED

- Endangered Species Act of 1973 (16 U.S.C. §§ 1531-1544)
- Federal Power Act of 1920 (16 U.S.C. §§ 791-828c)
- Federal Water Pollution Control Act Amendments of 1972 (Clean Water Act) (33 U.S.C. § 1344)
- Fish and Wildlife Coordination Act of 1934 (16 U.S.C. §§ 661-667e)
- National Dam Safety Act of 1981 (33 U.S.C. §§ 467 et seq.)
- National Environmental Policy Act of 1969 (42 U.S.C. § 4332)
- Reclamation Act of 1902 (43 U.S.C. §§ 371 et seq.)
- Rivers and Harbors Appropriation Act of 1899 (33 U.S.C. § 403)
- Rivers and Harbors Act of 1938 (33 U.S.C. § 540)
- Watershed Protection and Flood Prevention Act of 1954 (16 U.S.C. §§ 1001-1009)

APPENDIX A

CLASSIFICATION OF DAM SIZE AND HAZARD POTENTIAL

CLASSIFICATION OF DAM SIZE AND HAZARD POTENTIAL
(OWRB 1991, 30)

CLASSIFICATION OF DAM SIZE

<u>SIZE CLASSIFICATION</u>	<u>MAXIMUM STORAGE (Ac-Ft)</u>	<u>MAXIMUM HEIGHT (Ft)</u>
Small	less than 10,000	and less than 50
Intermediate	between 10,000 and 50,000	or between 50 and 100
Large	over 50,000	or over 100

CLASSIFICATION OF HAZARD POTENTIAL

<u>CATEGORY</u>	<u>EXTENT OF DOWNSTREAM DEVELOPMENT</u>	
	<u>LOSS OF LIFE</u>	<u>ECONOMIC LOSS</u>
Low	None (No probable future development; may be zoned to prevent future development)	Minimal (Undeveloped to occasional structure or agriculture)
Significant	None (Potential for future development exists; habitable structures may exist in <u>inflow design flood</u> floodplain, however, dam failure would not endanger lives that would not be endangered if structure did not exist)	Appreciable (Notable agricultural, industrial or structural)
High	Yes (One or more habitable structures with loss of life due to dam failure likely) More than a few (Rural communities and/or developments)	Excessive (Extensive community, industrial or agricultural)

APPENDIX B

EXHIBIT A - OKLAHOMA WATER RESOURCES BOARD

IN THE DISTRICT COURT IN AND FOR ADAIR COUNTY
STATE OF OKLABOMA

THE OKLABOMA WATER RESOURCES)	
BOARD,)	
)	
Plaintiff,)	
)	
v.)	No. C-89-196
)	
THE ILLINOIS RIVER DEVELOPMENT)	
CO. and THE CITY OF SILOAM)	
SPRINGS, ARKANSAS,)	
)	
Defendants.)	

ORDER

On this 2nd day of November, 1989, the above-styled and numbered cause comes on for hearing. Plaintiff is represented by its attorney, Lou Klaver, and defendants are represented by their attorney, Rex Earl Starr. After hearing oral argument from counsel and reviewing the petition and administrative order filed herein, this Court finds as follows:

1. Plaintiff, an administrative agency of the State, issued an order on December 13, 1988, which included findings that Lake Frances Dam and Spillway is in an unsafe condition and ordered defendants to initiate and complete certain remedial measures to bring the works into a safe condition. These corrective measures were to be completed by October 1, 1989.

2. Defendants attempted to appeal the administrative order in the District Court of Adair County pursuant to Title 75



O.S. 1981, §318. However, defendants failed to comply with the statutory requirements set forth in that section and this Court dismissed the appeal.

3. Defendants have never sought, and this Court has never issued, a stay of the Board's administrative order authorized and allowed pursuant to 75 O.S. 1981, §319. That provision makes it clear that seeking judicial review of an agency decision does not by itself stay enforcement of that decision, but rather the agency decision remains in full force and effect and must be complied with unless or until a stay is requested and issued by the Court.

4. Plaintiff inspected the subject works on October 2, 1989, and found them to be in substantially the same unsafe condition as when the administrative order described in paragraph 3 was issued.

5. The defendants' failure to comply with the plaintiff's order constitutes irreparable injury for which plaintiff has no adequate remedy except by Order and Injunction of this Court as authorized by 12 O.S. 1981, §§1381 et seq., and 82 O.S. 1981, §105.20.

IT IS THEREFORE ORDERED that a temporary injunction is hereby issued prohibiting defendants from continuing in violation of the administrative order issued by the Oklahoma Water Resources Board on December 13, 1988, and incorporated by reference herein.

IT IS FURTHER ORDERED that defendants proceed immediately to initiate of the remedial measures incorporated and ordered herein. In recognition of the inconsistent weather patterns that exist at this time of the year, defendants shall proceed as expeditiously as possible with completion of the remedial measures and shall complete all remedial measures by July 1, 1990, unless otherwise ordered by this Court.

IT IS FURTHER ORDERED that defendants shall file with this Court a written status report at the end of each month setting forth in detail all actions taken with regard to bringing Lake Frances Dam and Spillway into a safe condition and in compliance with this Order. A copy of the monthly report shall also be provided by the defendants to the Oklahoma Water Resources Board.

Dated this 2nd day of November, 1989,



JUDGE OF THE DISTRICT COURT
ADAIR COUNTY

BEFORE THE OKLAHOMA WATER RESOURCES BOARD
STATE OF OKLAHOMA

N THE MATTER OF Lake Frances dam)
 nd spillway owned and operated)
 y the Illinois River Development)
 ompany and the City of Siloam)
 prings, Arkansas. Located in)
 he W 1/2 of Section 17, 19 N.)
 6 E, I.M. Adair County, Oklahoma.)

FINDINGS OF FACT, CONCLUSIONS OF LAW AND BOARD ORDER

This matter came on for individual hearing before the Oklahoma Water Resources Board ("Board") on August 11, 1988, on the above styled and captioned matter concerning the dam and spillway works owned and operated by the Illinois River Development Company and the City of Siloam Springs, Arkansas, the same being an administrative hearing authorized and conducted under 75 O.S. 1981, Sections 301 et seq., as amended, and the rules, Regulations and Modes of Procedure of the Board. A hearing on the condition of the Lake Frances dam and spillway was scheduled and the owner was given written notice of same by certified mail. Said hearing was scheduled for August 11, 1988, at 10:30 a.m., in the Board's offices in Tulsa, Oklahoma.

Mr. Harold L. Springer, P.E., presided as hearing examiner for the Board. The instant proceedings were duly opened and all parties were introduced for the record. Present from the Board were C. Lou Klaver, Staff Attorney and Russell LaForce, Staff Engineer. Dean Couch was the hearing examiner's legal advisor and Laurie Cornish was the recording secretary. Present for the City of Siloam Springs ("City") were Rex Earl Starr, Attorney, Jim Earl, City Administrator, Alan Fortenberry, Engineer from Goodwin, Williams and Yates, Inc. ("MWY"), Dennis Daniels and Bob Henry, of the Illinois River Development Company. Others present included Jerry Chastain and Marcus Alegre from the Federal Energy Regulatory Commission, Ed Fite from the Oklahoma Scenic Rivers Commission, and Representative Larry Adair. Participating witnesses were duly sworn, instruments and exhibits were admitted, opening remarks were entertained. The hearing examiner inquired whether anyone objected to his serving as hearing examiner on this matter since he had been involved with this project in the past. No objections were made. Board staff introduced several exhibits. The respondent's attorney requested additional time to review said documents. Respondent also requested the hearing examiner make a field inspection of the dam and spillway as a part of the proceedings.

The hearing was continued to August 25, 1988, at which time an on-site inspection of the dam and spillway was made. The hearing and the record were then reopened later that day at Flint Ridge at approximately 3:30 p.m. and proceeded until approximately 7:00 p.m. The hearing at that time was further continued to September 13, 1988, at 1:00 p.m. in the offices of the Board in Oklahoma City, then rescheduled to November 15, 1988, at 1:00 p.m. at the offices of the Board in Oklahoma City. Additional exhibits were introduced and testimony was given. The hearing was closed at approximately 4:00 p.m. with the record being left open until November 28, 1988, for the submittal of photographs showing construction of the dam and spillway. The attorneys were given until November 21, 1988, to submit proposed findings to the hearing examiner.

FINDINGS OF FACT

Based upon a review and consideration of all relevant documents, exhibits, evidence and public records, the Board makes, finds and determines the following Findings of Fact, all being as supported by substantial and competent evidence available and appearing as part of the record herein:

1. Lake Frances Dam and Spillway are located in the W 1/2 of Section 17, Township 19 North, Range 26 East of Indian Meridian, Adair County, Oklahoma, on the Illinois River. The realty on which the dam lies is owned by the Illinois River Development Company. The dam and spillway are maintained by the City, and water impounded by the dam is used by the City for municipal use.

2. Pertinent data related to Lake Frances Dam and Spillway is as follows:

Drainage area: 635 square miles
 Top of dam elevation: 931.0 ft. MSL
 Spillway crest elevation: 918.55 ft. MSL
 Auxiliary spillway crest elevation: 918.80 ft. MSL
 Conservation pool storage: 1,530 acre-feet
 Top of dam storage: 9,585 acre-feet
 Type of dam: earthfill and concrete double arch
 Maximum height of dam: approximately 30 feet
 Regulating outlet: 54 x 54 inch sluice gate
 Type of spillway: concrete ogee weir
 Main spillway length: 162 feet
 Auxiliary spillway length: 518 feet

3. The initial planning and design of the dam and spillway was done by Victor B. Cochrane, consulting engineer, Tulsa, Oklahoma. The original project with some modifications was completed in 1931. A failure of the earth embankment adjacent to the double concrete arch was reported in 1943. High flow exceeding the spillway capacity apparently caused the dam to be

overtopped, and approximately 700 feet of the embankment washed out. Details of the failure do not indicate whether the dam was low in this area and overtopping thus caused the failure, or if foundation problems, piping or some other problem caused failure during the high pool at this location. There was no indication of the type and amount of damage which occurred as a result of the failure. See Page 3, Phase II Report, MWY, June, 1987.

4. In 1954, the City of Siloam Springs expressed intentions to rebuild the dam for use as a water supply. Plans for reconstruction of the earth embankment were prepared by Fell and Wheeler Consulting Engineers, Tulsa, Oklahoma. Provisions for a small concrete cutoff wall and possibly a 200 foot section of sheet piling adjacent to the double concrete arch were included in the plans to reduce the possibility of a recurring failure. The remaining portion of the earth embankment was raised 2.5 feet and extended approximately 700 feet. See Page 3, Phase II Report.

5. On February 15, 1978, Lake Frances dam and spillway were inspected by the U.S. Army, Corps of Engineers (COE) and the Oklahoma Water Resources Board and accompanied by Dennis Daniels, Water Plant Superintendent for the City. A "Phase I Report" detailing said inspection was prepared. The following is the brief assessment of the project and recommended action set forth in the Phase I Report:

"Preliminary computations indicate the project can only pass approximately 20 percent of the PMF (probable maximum flood) without overtopping the embankment. Under PMF and 1/2 PMF conditions the embankment would be overtopped by 8.1 feet and 4.3 feet of water, respectively. Overtopping of such magnitude would result in failure of the project, therefore, remedial measures would be required to assure the project can safely pass the design flood.

"Seepage was observed downstream of the embankment on the left side of the spillway. Additional investigations will be necessary to further evaluate these conditions.

"Engineering data indicate the possibility for differential settlement and cracking of the embankment within the area adjacent to the concrete arch dam. Additional investigations, including a stability analysis and visual inspection with the pool below the spillway crest, will be required."

Phase I Report, by the COE and Board, February, 1978.

6. On April 26, 1978, a copy of the Phase I Report was transmitted to Mayor Knight of the City with a letter advising that the dam and spillway were inadequate.

7. The Board sent the City additional letters advising and requesting action concerning deficiencies regarding Lake Frances dam and spillway on December 14, 1978, January 17, 1979, July 16, 1980, February 1, 1983; January 18, 1985, June 6, 1986 and April 28, 1988.

8. On October 19, 1984, the City passed a resolution to repair Lake Frances dam and spillway, indicating that work to correct deficiencies would be initiated in April 1985 and would be completed in January 1986.

9. On February 19, 1985, Jack Hoyt, City Administrator for the City, requested an extension of time, to February 19, 1987, to file an application for approval of plans and specifications to modify the dam and spillway at Lake Frances.

10. On August 20, 1986, the Board received two copies of the draft Phase II Report for Lake Frances Dam from Alan Fortenberry of M&Y. That draft Phase II Plans acknowledged deficiencies in the dam and spillway and set forth recommended actions.

11. On July 2, 1987, over four months out of time, the Board received an application for approval of plans and specifications to repair and improve the earthen embankment of Lake Frances dam from the Illinois River Development Company. The final Phase II Report by M&Y dated June 1987 was also included. The additional inspection and Phase II Report constitutes, at least in part, the "additional investigations" required under the Phase I Report. See Finding of Fact 5.

12. The application, plans and specifications, and other matters were considered and approved by the Board on January 12, 1988.

(a) The plans and specifications addressed several items, including:

(i) Embankment protection, including establishment of of vegetation, addition of rip rap with proper bedding material and filter blanket,

(ii) Grading the crest of the dam to make it level.

(iii) Filling and compacting a low area on the north end of the embankment.

(b) The hazard potential classification was changed from "high" to "significant", thereby decreasing the percent of PMF required to be passed by the spillway.

(c) A warning and evacuation plan was ordered to be updated, submitted to the Adair County Civil Defense and Oklahoma Scenic River Commission for approval, then submitted to the Board.

(d) The Board's order did not specify when the work on the earthen embankment was to begin or to be completed.

(e) The Board's order was not appealed.

13. Regarding, the earthen embankment, the Board finds as follows:

(a) As of the date of the Hearing Examiner's personal on-site inspection, the trees and vegetation along the embankment extending south from the concrete spillway approximately 2000 feet have been cleared, and a substantial amount of grading and earthwork has taken place. A few animal burrow holes remain. Rip rap has not been added to the upstream nor the downstream side. The top of the embankment has not been precisely leveled. The City intends to place Compacted Fill on the top of the embankment and establish grass type vegetation on the downstream slope to prevent erosion. Footpaths varying in width and depth exist along the downstream side of the embankment near the concrete part of the dam. Such paths could lead to further and more severe erosion from heavy rainfall events or in case of overtopping. Erosion from overtopping could also occur if the crest of the embankment is not level, thus resulting in isolated flow patterns or from backwater conditions. The downstream toe of the dam would be particularly vulnerable under such condition.

(b) Piezometer wells have been installed in five locations on the earthen embankment to obtain groundwater information. At the August 1988 on-site inspection, the Hearing Examiner saw one such well made of PVC pipe. It had been severed at the ground surface on the crest of the embankment approximately 1000 feet from the concrete portion of the dam. No other piezometers were located. Permanent markers or protection barriers were not in place so that maintenance machinery could avoid them or so that they could be located easily for monitoring and measuring the water level therein.

(c) A specific time frame for completion of remedial work on the earthen embankment was not provided by the City.

14. Regarding the concrete portion of the dam, including the main spillway, the Board finds as follows:

(a) The total spillway capacity is approximately 113,000 cubic feet per second when the lake elevation is at 931.0 feet, which is approximately twenty (20) percent of the PMF flow.

(b) A horizontal crack in the main spillway at the approximate elevation of 909 feet exists. It allows water to pass through the concrete which forms the main spillway. The crack is approximately 4 inches wide on the upstream side, and is approximately 75 feet long and extends horizontally to the right of center of the spillway. The Board finds that the concrete above the crack does not have a significant probability of slipping or being lost, therefore anchors do not need to be inserted. However, water flowing through the crack and the potential freeze and thaw cycle damage to concrete weakens the concrete and creates additional risk of failure over time.

Therefore, the crack must be repaired by placing epoxy grout or other substance deemed appropriate by acceptable engineering practices into the crack to seal it. The sealing treatment must be inspected annually before September 1 of each year, and further treatment applied as necessary to maintain the seal.

(c) The double arch concrete portion of the dam contains minor scaling, spalling, cracks and leaks, with one leak flowing approximately 1 gallon per minute when the water elevation is at the top or near the top of the main spillway. Said scaling and leaks weaken the concrete structure and increase potential for failure. Therefore, concrete repair work on this portion of the dam must be completed.

(d) There is one gate to allow water to pass from the lake through the main spillway downstream to the Illinois River. The gate was operated during the August 1988 on-site visit by an electric motor switched from a utility pole approximately 700 feet from the main spillway. The gate closing was slow, taking approximately 10 minutes to decrease the flow of water approximately 10 percent. The water level on the date of the inspection was approximately 10 feet below the top of the main spillway crest.

(e) There are water boils or seeps coming from the rock foundation under the auxiliary spillway. The Board finds that there is a high probability that the water passes through the rock in natural channels. The boils or seeps should be monitored routinely for indication of increased turbidity or dramatic increase in flow, which could indicate foundation problems.

15. The Board finds that acceptable engineering and dam safety practices include preparation, implementation and updating of an operation and maintenance (O & M) plan for dams. The plan addressed and referred to in the Phase II Report should be revised to include annual inspection and maintenance of the horizontal crack seal in the main spillway discussed in Finding of Fact 14 above. The O & M plan should also be revised to include annual review, by September 1, of each year, of the Emergency Action Warning and Evacuation Plan. The O & M plan should then be adopted, implemented immediately and reviewed at least annually.

16. The City has considered and approved a bond sale of over Two Million Dollars for municipal improvements, with approximately \$400,000 of that amount to be used for repairs to Lake Frances. The Bond sale has not taken place and probably will not until after January 1, 1989. The City is also considering alternative water supply sources and dam sites.

17. The City did not provide an anticipated time schedule for initiation and completion of remedial measures.

CONCLUSIONS OF LAW

The Board makes and enters the following Conclusions of Law:

1. The Board possesses adequate jurisdiction and authority to entertain and adjudicate the instant matter pursuant to 82 O.S. 1981, §105.27, as amended, and 82 O.S. 1981, §1085.2, as amended.

2. Notice of the instant proceedings was due and proper and the hearings and proceedings held were proper and in accord with

82 O.S. 1981, §1085.10, 75 O.S. 1981, §309 et seq., as amended, and the rules and regulations of the Board.

3. The Board concludes that any dam and spillway which does not meet the minimum spillway capacity requirements set forth in the Board's rules, or which contains deficiencies or conditions that do not meet acceptable engineering practices regarding construction, operation and maintenance of a dam and spillway, is considered unsafe and a menace to life and property and needs to be put in a safe condition, as required by 82 O.S. 1981, §105.27, as amended. The Board concludes that the Lake Frances dam and spillway in its current condition is unsafe and a menace to life and property.

(a) Under Board rules, the minimum design capacity requirement applicable to Lake Frances (small size, significant hazard classification) is to pass 40% of the PMF. See Board Rule 720.1(a).

(b) Deficiencies and conditions of the Lake Frances dam and spillway that do not meet acceptable engineering practices for dam safety include without limitation the current condition of the earthen embankment (see Finding of Fact 13), the current condition of the main spillway and double arch portion of the dam (see Finding of Fact 14), the current condition of the piezometers (see Finding of Fact 13), and the adoption and implementation of an adequate O & M plan (see Finding of Fact 15).

4. The Board therefore concludes that certain changes are necessary and a reasonable time shall be provided for putting the Lake Frances dam and spillway in a condition that meets Board rules and acceptable engineering practices regarding the construction, operation and maintenance of a dam and spillway.

ORDER

IT IS THEREFORE ORDERED that the City of Siloam Springs and Illinois River Development Corporation shall initiate and complete the following measures and actions within the dates set forth:

1. Complete work, construction and measures on the earthen embankment, as provided in the plans and specifications approved by the Board on January 12, 1988, by October 1, 1989. The work, construction and activities include without limitation the leveling of the crest, the completion of earth work on the downstream slope including removal of all animal burrows and footpaths, and the establishment of vegetation cover to prevent erosion, initiation and completion of rip rap work, repair of the piezometers and installation of markers for piezometers, and measures to prohibit the driving of vehicles on the slopes of the embankment.

2. Regarding the concrete portion of the dam, respondents shall:

(a) Initiate repairs to seal the crack in the main spillway by May 1, 1989 and complete said repairs by October 1, 1989.

(b) Initiate repairs to cracks in concrete wall forming the double arch portion of dam by May 1, 1989 and complete said repairs by October 1, 1989.

3. Regarding the Operation and Maintenance Plan and maintenance items to be carried out:

(a) The "Proposed Operation and Maintenance Guidelines," found on page C-6 and following of the "Report of Investigation with Plans and Specifications for Remedial Measures" by McGoodwin, Williams and Yates, Inc., January, 1985, hereafter O & M Guidelines, should be revised to include an annual inspection and maintenance of the seal to the crack in the main spillway as required in Paragraph 2(a) above.

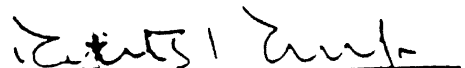
(b) The O & M Guidelines shall also be revised to include a requirement to monitor the piezometer wells monthly and keep current written records on the results of such monitoring to be included in the written report as set forth below.

(c) The O & M Guidelines shall also be revised to include a requirement that the Emergency Action Warning and Evacuation Plan be reviewed at least annually and revised as necessary.


(d) The O & M Guidelines as revised shall be adopted and implemented immediately, and shall be reviewed at least annually and further revised as necessary. An updated copy of the O & M Guidelines shall be submitted to the Board.

(e) A written report detailing the results of the annual inspection of the seal and other components of the dam shall be submitted to the Board in the format as set forth in the attachments to the O & M Guidelines or such other format deemed appropriate by Respondents and that contains information substantially similar to that found in the attachments.

DCNE in regular and open meeting of the Oklahoma Water Resources Board on the 13th day of December, 1985.


Robert S. Kerr, Jr., Chairman

ATTEST:


R G Gonnson, Secretary

VITA 2

Darlene Benne Martinez

Candidate for the Degree of

Master of Science

Thesis: INSTITUTIONAL FACTORS INFLUENCING SMALL DAM
MANAGEMENT IN OKLAHOMA: A CASE STUDY OF THE LAKE
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Personal Data: Born in Oklahoma City, Oklahoma, December 18, 1963, the daughter of Lewis E. and Lois E. Benne.

Education: Graduated from Edmond Memorial High School, Edmond, Oklahoma, in May, 1982; received Bachelor of Science Degree in Geography from Oklahoma State University in May, 1990; completed requirements for the Master of Science Degree at Oklahoma State University in July, 1993.

Professional Experience: Teaching and Research Assistant, Department of Geography, Oklahoma State University, August, 1989, to May, 1991.

Professional Memberships: National Council for Geographic Education, Association of American Geographers, Oklahoma Academy of Science, Gamma Theta Upsilon.