July 2000

Governor Frank Keating's

TAR CREEK SUPERFUND TASK FORCE

Drainage and Flooding Subcommittee

EXECUTIVE SUMMARY

Prior to mining activities in Ottawa County, water was considered to be one of the area's greatest resources. In 1902, the water was described to be "clear and sparkling." One author predicted that "The Neosho River and Tar Creek would furnish a never failing supply of the purest and cleanest (water)." Nearly 100 years later, these same streams are contributors to the environmental problems in the area due to poor drainage and flooding as a result of mining activities.

The Tar Creek drainage area north of Miami, Oklahoma, has been greatly disturbed by more than 80 years of mining activity that has resulted in a system of poorly draining streams that are commonly bankfull of water during non-flood periods. Without modification, the Tar Creek drainage system will continue to function as it presently does with frequent flooding being experienced in the area due to the hydraulic inefficiency of the streams.

This report was prepared at the request of the Tar Creek Superfund Task Force which was established by Executive Order 2000-02 dated January 20, 2000 and signed by Governor Frank Keating. The Drainage and Flooding Subcommittee consisted of volunteers from Federal, State, and local governments as well as concerned citizens. The report addresses the nature and extent of the drainage and flooding problems experienced by the communities in the Tar Creek Superfund area and outlines alternatives for abating the problems.

The Subcommittee classified the nature of flooding problems into four major categories, 1) Stream aggradation due to mining activities, 2) Inadequate drainage systems in the communities, 3) Manmade obstructions to flow, and 4) Neosho River/Tar Creek flooding problems in the city of Miami.

Alternative solutions such as channel improvements and/or buyouts of repetitive loss structures in the Miami area could be a viable component of a comprehensive flood reduction plan for Ottawa County. Ecosystem restoration of the degraded Tar Creek upstream of Miami could improve both the natural environment and drainage characteristics in the upper basin. Ecorestoration would consist of such measures as creating wetlands to filter contaminated water and plantings of plants, trees and native grasslands to enhance habitat. Such a system would reduce runoff and provide flood storage capacity reducing downstream flooding in the Miami area.

For purposes of development of a cost estimate, a concept plan was developed which includes a combination of structural flood control, wetlands and flood plain buyouts. A feasibility study would be required to optimize benefits and minimize project costs.

The Subcommittee also identified the need for maintenance of the streams to remove obstructions to flow and for local drainage infrastructure improvements in the communities of Cardin, Commerce, North Miami, Picher, and Quapaw. Recommended immediate (1year), short term (2 to 3 years) and long term (3 to 5 years) actions are as follows:

Immediate Actions

Maintenance of streams	$ 140,000
Community Master Drainage Planning	$ 360,000
Flooding Feasibility Study	$ 3,000,000
Preparation of FHMP	$ 25,000

Short Term Actions

Community Drainage Improvements	$ 5,740,000
Grand Lake Backwater Feasibility Study	$ 1,700,000

Long Term Action

Tar/Lytle Creek Flooding Control Construction	$ 22,000,000
Acquisition of Flooding Repetitive Loss Structures	$ 15,500,000

TOTAL COST: $48,465,000

Implementation of these recommendations will provide much needed flood protection to the citizens who have been negatively impacted by health risks and economic loss due to these adverse conditions. Other recommendations included in the report which would benefit the overall Tar Creek Task Force effort are the completion of the topographic mapping of the mining district on 1-foot contours, the input of data developed by each of the subcommittees into a Geographic Information System for future use by designers, and the establishment of a permanent Tar Creek Steering Group to assist elected officials and agencies such as the Oklahoma Water Resources Board, the Oklahoma Department of Environmental Quality and

the U.S. Army Corps of Engineers in continuing the efforts to identify and implement solutions to problems that have plagued the area.

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1.0 Introduction. Ottawa County is located in the northeastern corner of Oklahoma, in the vicinity of the Picher Mining Field near the Kansas/Missouri State Line ***(Figure 1)***. Principal towns in the area include Cardin and Picher near the center of the mining field, Quapaw on the southeast, Commerce on the southwest, and North Miami and Miami on the south. Ottawa County is the most flood prone county in Oklahoma. According to the Federal Emergency Management Agency (FEMA), there have been over 400 claims from 129 repetitive loss properties in the county, with over $6,800,000 in losses due to flooding. Ottawa County accounts for more than 19 % of the repetitive loss properties in the entire state. The flooding is especially significant in the Miami, Oklahoma, area. FEMA has documented "numerous flooding instances" on the Neosho River and both lower and upper reaches of Tar Creek (FEMA, 1988, 1997). An appraisal report prepared by the U.S. Army Corps of Engineers (USACE) in 1985 and a Reconnaissance Report prepared by the USACE in 1989 identified a number of potential economically feasible structural solutions to the flooding problems. The next phase of effort, a cost-shared feasibility study, was never initiated due to lack of a non-Federal cost-sharing sponsor. The small towns north of Miami, particularly Cardin, Commerce, Picher, Quapaw, and North Miami, also experience frequent flooding. Flooding problems in these communities is compounded by poor drainage systems. The Tar Creek drainage area north of Miami, Oklahoma, has been greatly disturbed by more than 80 years of mining activity (Vitek, 1983) that has resulted in a system of poorly draining streams that are commonly bankfull of water during non-flood periods. Without

modification, the Tar Creek drainage system will continue to function as it presently does, with frequent flooding being experienced in the area due to the hydraulic inefficiency of the streams.

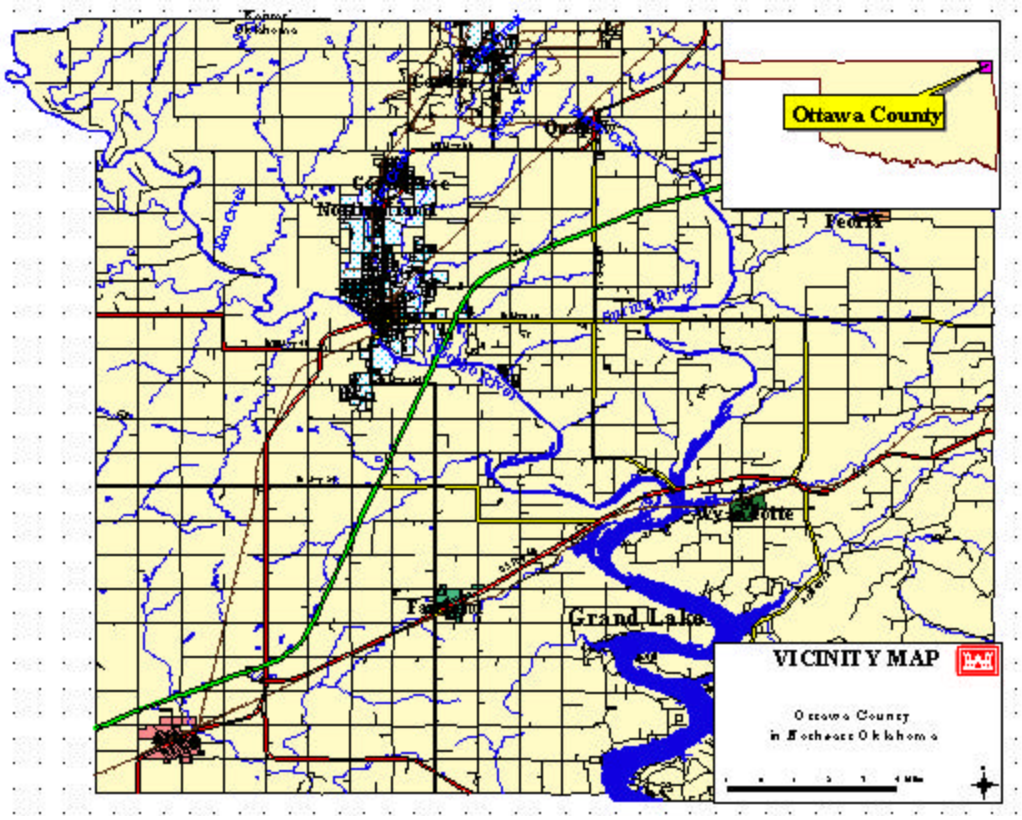


Figure 1

2.0 Study Authority.

2.1 The Tar Creek Superfund Task Force was established by Executive Order 2000-02, dated January 20, 2000, signed by Governor Frank Keating. By letter dated February 22, 2000, Brian C. Griffin, Secretary of Environment, requested that Mr. Joe Crawford, Ottawa County Commissioner, District 1 and Mr. John Roberts, U.S. Army Corps of Engineers, Tulsa District co-chair the Drainage and Flooding Subcommittee. The Drainage and Flooding Subcommittee consists of individuals who expressed interest in this subcommittee and were willing to volunteer their time to this effort. Subcommittee members are listed in Appendix A.

2.2 The objective of this subcommittee was to identify solutions to the drainage and flooding problems that have plagued Ottawa County, particularly the Miami, Oklahoma, area. In addition, the subcommittee was to evaluate any drainage and flooding concerns that have occurred in more recent years as a result of mining activities within the Tar Creek Superfund area. Taskings to the Drainage and Flooding Subcommittee from the Task Force included:

a. Evaluate the nature and extent of the drainage and flooding problems experienced by the communities in the Tar Creek Superfund area and propose any studies that might be necessary to more adequately define the extent of drainage and flooding problems in the area. If further studies are necessary, outline the scope of work needed, timeline, resources needed (both personnel and capital), and potential sources of assistance.

b. Outline the most appropriate alternatives for abating the drainage and flooding problems identified in the Tar Creek Superfund area. Once the alternatives are identified, outline the scope of work, timeline, resources needed (both personnel and capital), and potential sources of assistance.

3.0 Background.

3.1 Much information was available to the Subcommittee concerning the history of mining operations, which have ultimately impacted drainage and flooding in the area. The 1983 Tar Creek investigations provided much insight, particularly the Diking and Diversion Feasibility Study, which included reports by Vitek (Oklahoma State University, October 1983), Bollinger (U.S. Department of Agriculture, December 1983), and Riley (U.S. Department of Agriculture, December 1983). Although these reports did not specifically address the flooding problems, they described how mining operations affected drainage and considered the potential for increased flooding should diking and diversion be performed in an effort to solve water quality problems.

3.2 From approximately 1900 to 1973, humans have modified the direction of surface flow in the historic mining area. New channels developed in response to the creation of chat piles, tailing ponds, dikes, railroad tracks, and roads. Once maintenance of these human works ceased, natural processes further disrupted the alterations. Additional new stream channels (intermittent streams only) developed. Often such development was influenced by the subsidence of mines and the collapse of mine shafts (Vitek, 1983).

3.3 Removal of mineral deposits from beneath the surface required changes in the surface before the ore could be processed and transported. The most noticeable change was the chat piles, which are man-made hills composed of the rock debris remaining after the ore has been removed. Numerous dikes were constructed to retain water from the ore processing and to restrict the flow of very fine sediments produced in the milling process. The sediments in many of these tailing ponds are eroding into the streams because the unmaintained dikes have been eroded. Other natural channel modifications included the creation of embankments for roads and railroads, encroachment by chat piles, and changes associated with subsidence; i.e., the collapse of mines or mine shafts (Vitek, 1983).

3.4 The natural drainage channels (i.e., before mining began) changed in response to the formation of chat piles, tailing ponds, railroad beds, roads, and ultimately subsidence associated with the collapse of mine shafts and mine caverns. The once natural drainage network has been greatly disrupted (Vitek, 1983).

3.5 Subcommittee members toured the area on March 16, 2000, to get a visual observation of flooding/drainage conditions in the area. The tour was led by Ottawa County Commissioner, District 1, Mr. Joe Crawford; the Mayor of Cardin, Mr. Herman McMullin; and the Mayor of Commerce, Mr. Phil Crosby, who have years of first hand knowledge of local conditions. Although there had been very little recent rainfall prior to the tour, the Subcommittee members observed that water was standing bankfull, or even out of the banks, throughout the Tar Creek and Lytle Creek area. An example is shown in ***Photo 1*** of Lytle Creek at the Oklahoma/Kansas State Line. Ditches in the towns of Picher, Cardin, Quapaw,

Commerce, and North Miami were also observed to have standing water. The tour demonstrated the inefficiency of local drainage and streams in conveying water to the Neosho River.

Photo 1. Standing Water in Lytle Creek.

3.6 Three USACE flood control reservoirs operate in the Neosho River Basin above Miami: Council Grove, Marion, and John Redmond Reservoirs, all located in Kansas ***(Figure 2)***. These reservoirs, which have been completed since the July 1951 flood, reduce flood stages significantly at Miami. The Natural Resources Conservation Service (NRCS) has seven Public Law 566 watershed projects in various stages of development in the Neosho River Basin above Miami. Currently, 32 Floodwater Retarding Structures (FWRS) control a combined 124.74 square miles of drainage area. A total of 16 FWRS that will control an

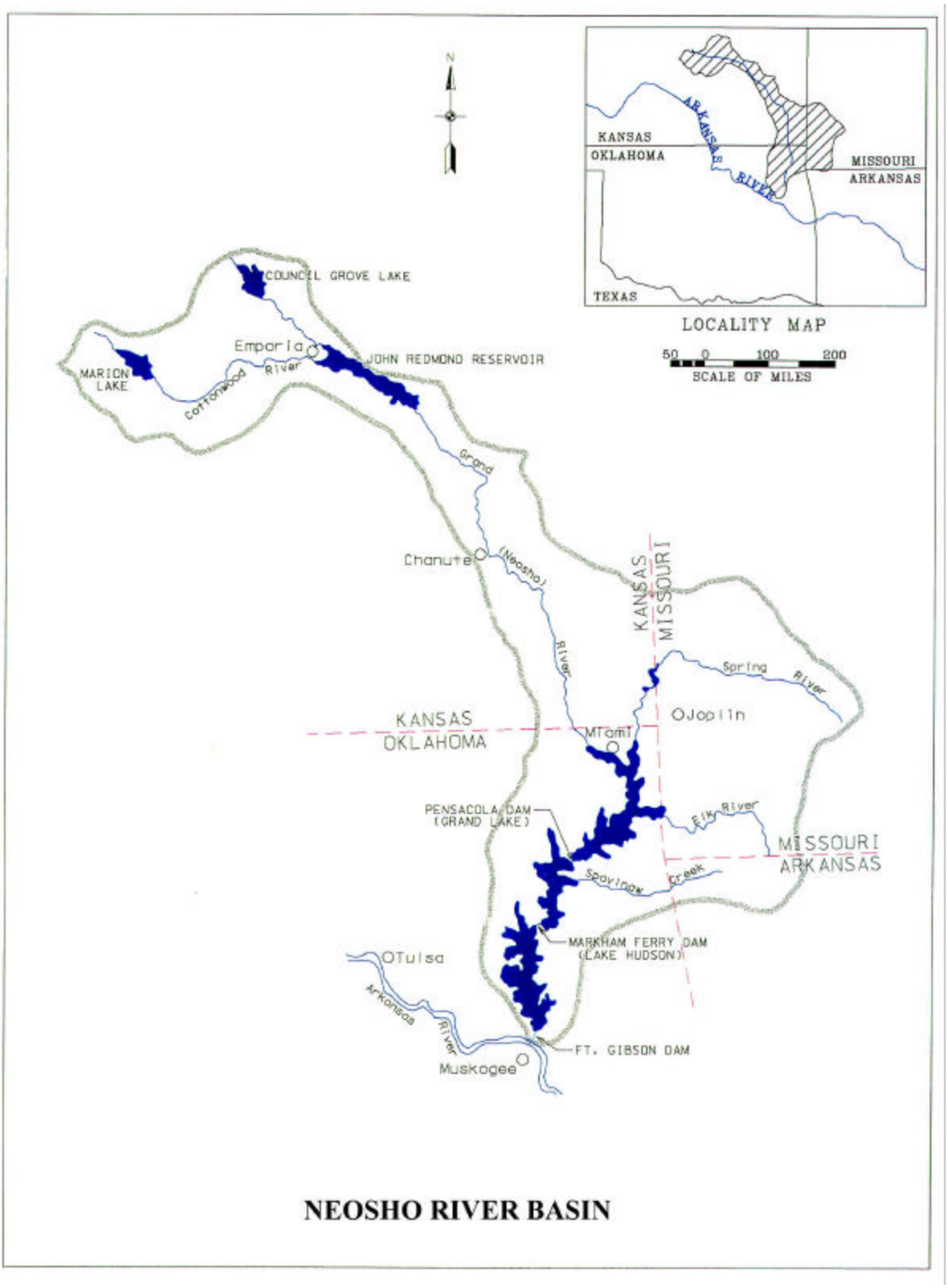

N
KANSAS
OKLAHOMA
MISSOURI
ARKANSAS
TEXAS
ARKANSAS RIVER
LOCALITY MAP
50 0 100 200
SCALE OF MILES
COUNCIL GROVE LAKE
Emporia
JOHN REDMOND RESERVOIR
MARION LAKE
Cottonwood River
Grand
Chanute
(Neosho) River
KANSAS
MISSOURI
Spring River
KANSAS
OKLAHOMA
Miami
Joplin
PENSACOLA DAM (GRAND LAKE)
Elk River
MISSOURI
ARKANSAS
Spavinaw Creek
MARKHAM FERRY DAM (LAKE HUDSON)
Tulsa
Arkansas River
FT. GIBSON DAM
Muskogee
NEOSHO RIVER BASIN

Figure 2

additional 77.63 square miles of drainage area remain to be constructed. Six of the seven watershed projects and 89% of the planned control are located above John Redmond Reservoir. Due to their location and limited size and storage, these watershed projects will have very little effect on Neosho River flooding in the Miami area.

3.7 Numerous studies have been performed to determine the backwater effects of flood control operations of Pensacola Dam, which is located approximately 35 miles downstream of Miami, Oklahoma, on the Neosho River. The Real Estate Adequacy Study performed by USACE in 1998 concluded that "theoretical backwater effects of Grand Lake flood control operations were found to exceed the limits of existing flowage easements using the criterion of a 50-year Land Acquisition Flood, including about 200 structures in the vicinity of Miami, Oklahoma."

3.8 Other studies were performed by Simons (1996), DeVries (1996), Mussetter (1997), and Simons (1998) as part of testimony for the case Dalrymple, et al. vs. Grand River Dam Authority (Reavis, 1999). The Ottawa County District Court appointed a special referee, Dr. Forrest Holly, to submit a report summarizing his findings regarding flooding along the Neosho River. In his February 1999 report, Dr. Holly concluded that "the existence and operation of Pensacola Dam caused a quantifiable increase in the magnitude and duration of flooding above 760 feet National Geodetic Vertical Datum (NGVD) from approximately river mile 139 upstream to approximately river mile 153 during most of the 14 floods that are the subject of this lawsuit."

3.9 Another report was published by USACE in 1996 that evaluated the flooding from John Redmond Reservoir in Kansas to the Kansas/Oklahoma State Line. This report showed that operation of John Redmond Reservoir consistently reduced flooding downstream, but the positive impacts of flood control operation diminished as downstream distance from the dam increased. The report also showed that while John Redmond operation reduced the peak stage of flooding, it extended the duration of in-channel flows. Flooding near the Kansas/ Oklahoma State Line was found to be caused by rainfall in the nearly 2,800 square miles of uncontrolled runoff in that portion of the basin. Thus, the Ottawa County area does not benefit appreciably from upstream flood control structures, and is adversely impacted by backwater effects from flood control operations in Grand Lake. The flooding is greatly aggravated by changes made to the drainage basin from mining activities over the past 80 years.

3.10 Ottawa County and the City of Miami participate in the National Flood Insurance Program (NFIP). Communities that participate in the NFIP have established responsibilities for maintaining flood hazard data for floodplain management and Flood Insurance Study purposes. Flood Insurance Rate Maps identify streets that are partially or totally within Special Flood Hazard Areas (SFHA) (i.e., the 100-year flood zone). The information contained in Flood Insurance Studies is used by the communities to update existing floodplain regulations as part of the NFIP. The information is also used to further promote sound land use and floodplain development. Areas that have had SFHA's identified but that are not in the program include Commerce, North Miami, and Quapaw. The Oklahoma Water

Resource Board is presently assisting these communities, as well as eight Federally recognized Indian Tribes in Ottawa County, in enrolling in the NFIP.

3.11 With the exception of the city of Miami and a few "U" shaped, rock masonry ditches in Commerce and Picher that were constructed by the Works Program Administration (WPA) in the 1930's, only minimal local drainage exists in most of the towns in the mining district. The Environmental Protection Agency (EPA) yard remediation work, which is currently being performed, has been greatly hampered by local flooding due to inadequate drainage. Some ditch work has been performed in conjunction with the yard remediation solely to enable the yard remediation effort to be accomplished and to prevent flooding to homes as a result of yard remediation efforts. Although performing ditch work has been effective in localized areas to support yard remediation, the effort has been largely ineffective in improving overall city/town drainage. In some cases, the ditch work may have aggravated localized flooding. Much additional work is needed for a comprehensive local drainage system to prevent flooding due to local drainage conditions.

3.12 Considerable debate has been ongoing concerning the clay backfill used in the yard remediation. Some local officials and residents are concerned that use of clay backfill has also aggravated local flooding. This condition has been reviewed on a property by property basis. While this is a concern of individual property owners and local officials and is being addressed by the EPA, it is not considered a major factor in the overall hydrologic conditions of the mining area.

4.0 Socioeconomic Impacts.

4.1 Until the 1960's, the mining industry provided the highest employment and largest economic base in northern Ottawa County. When the mining industry entered its declining years, 1957-1972, miners and their families began to move to other areas to seek employment. The county population declined significantly during these years. Many businesses that supported the mining industry also closed their doors. In 1986, in an unrelated event, B.F. Goodrich closed and moved their plant operations to other states. Following closure of the plant, unemployment just in the city of Miami increased to 25%.

4.2 Ottawa County has never fully recovered from the closure of these two major industries. Since the decline of the mining industry and the closure of B.F. Goodrich, the largest economic growth has been the expansion of local small businesses. The unemployment rate in Ottawa County in February 2000 was 6.2%, making Ottawa County one of ten counties in Oklahoma with unemployment rates over 6%. Wages continue to be low in the area, with many jobs paying at or slightly above minimum wage. The lack of major industry, low paying jobs, large amounts of land in agricultural use, and large tracts of land under Indian Tribal ownership results in a low tax base for the area. As a result, the small towns in the former mining field area have a difficult time funding basic infrastructure needs, such as streets, roads, and water and sewer systems. Because of this difficulty, the infrastructure needs are primarily funded through general and State grants. Funding for other important community needs, including drainage and flooding, is simply not available. The local cities and towns are dependent on outside funding to address these two important needs.

The potential for grants and relief from Federal cost sharing requirements through special provisions for economically depressed areas needs to be pursued as recommendations are implemented to provide relief from drainage and flooding problems in the area.

5.0 Environmental Impacts.

5.1 In a 1902 publication by O'dell, the author described the water in the Miami area as "clear and sparkling; as soft as free stone water, and can be used in boilers with good results." He added that "There is no doubt but what this water has much to recommend it and adds value to the healthfulness of Miami's environment." The author predicted that "The Neosho River and Tar Creek would furnish a never failing supply of the purest and cleanest."

5.2 Nearly 100 years later, these same streams are contributors to the environmental problems in the area due to poor drainage and flooding. Flooding of residences, businesses, and other properties provides another avenue for lead contamination of properties in the historic mining district. Lead-contaminated sediments from the stream are redeposited beyond the streambeds during floods. Thus, remediated yards are potentially recontaminated from floodwaters. Lead-contaminated sediments in the streams above Miami also have the potential to ultimately be redeposited in Grand Lake, providing other potential environmental risks. Floodwaters frequently enter the ductwork of homes and businesses in the area. Floodwaters have the potential to transport and deposit lead contaminated sediments into the ductwork of structures. Also, many homes and businesses have been constructed using chat

as backfill beneath floor slabs. Floodwaters provide the potential for migration of lead contaminated particles from the chat into the ductwork. Lead particles may ultimately become airborne inside the structures by heating and air conditioning systems.

6.0 Areas of Concern. The areas of greatest flooding/drainage concerns, as determined by the Subcommittee, the area encompassed by the mining district and the city of Miami at the confluence of the Neosho River and Tar Creek. Mining activities have altered the drainage systems of Tar Creek and its tributaries Lytle Creek and Quapaw Creek. Also potentially impacted to a lesser extent are Elm Creek, a tributary to the Neosho River in the western part of the mining district, and Beaver Creek, a tributary to the Spring River in the eastern part of the mining district. Since flooding in the Miami area is also influenced by flows from the Neosho River and backwater effects of Grand Lake, the work area was expanded to include these influences. The work area considered by the Subcommittee is shown in ***Figure 3***.

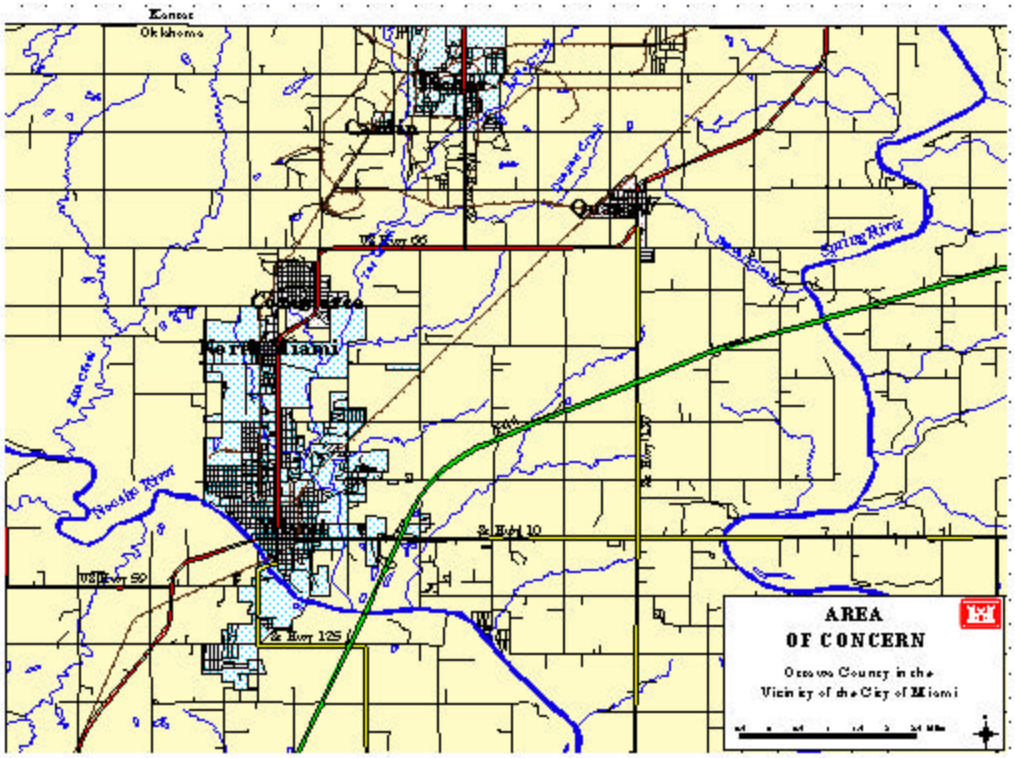

Kansas
Oklahoma
Quapaw
Spring River
Neosho River
Elm Creek
AREA
OF CONCERN
Ottawa County in the
Vicinity of the City of Miami

Figure 3

7.0 Nature and Extent of Flooding. The subcommittee classified the nature of flooding problems into four major categories, 1) stream aggradation due to mining activities, 2) inadequate drainage systems, 3) man-made obstruction to flow, and 4) Neosho River/Tar Creek flooding problems in the city of Miami. These problems are discussed in the following paragraphs.

a. Stream Aggradation Due To Mining Activities.

1. Chat Pile Impact on Runoff**.** Chat piles significantly alter the drainage characteristics of the area. The impact on runoff due to the presence of chat piles has never been studied; however, Vitek (1983) made the conclusion that "runoff volume would be greater on an undisturbed surface as compared to a chat pile. Water that infiltrates into a chat pile, however, may re-emerge at the base of the chat pile and enter a channel." These conclusions appear to have merit, considering the perviousness of the material and the general absence of obvious gullies or other features on the face of the chat piles that would suggest significant runoff. In addition, the volume of water that remains in the creeks between rainfall events would suggest a continuous source of water from the chat piles to the streams. The significance of chat piles as they impact drainage is shown in ***Figure 4***, which is a USGS digital orthophoto of the work area that shows surface features relating to alteration of the land due to mining and the 100-year floodplain.

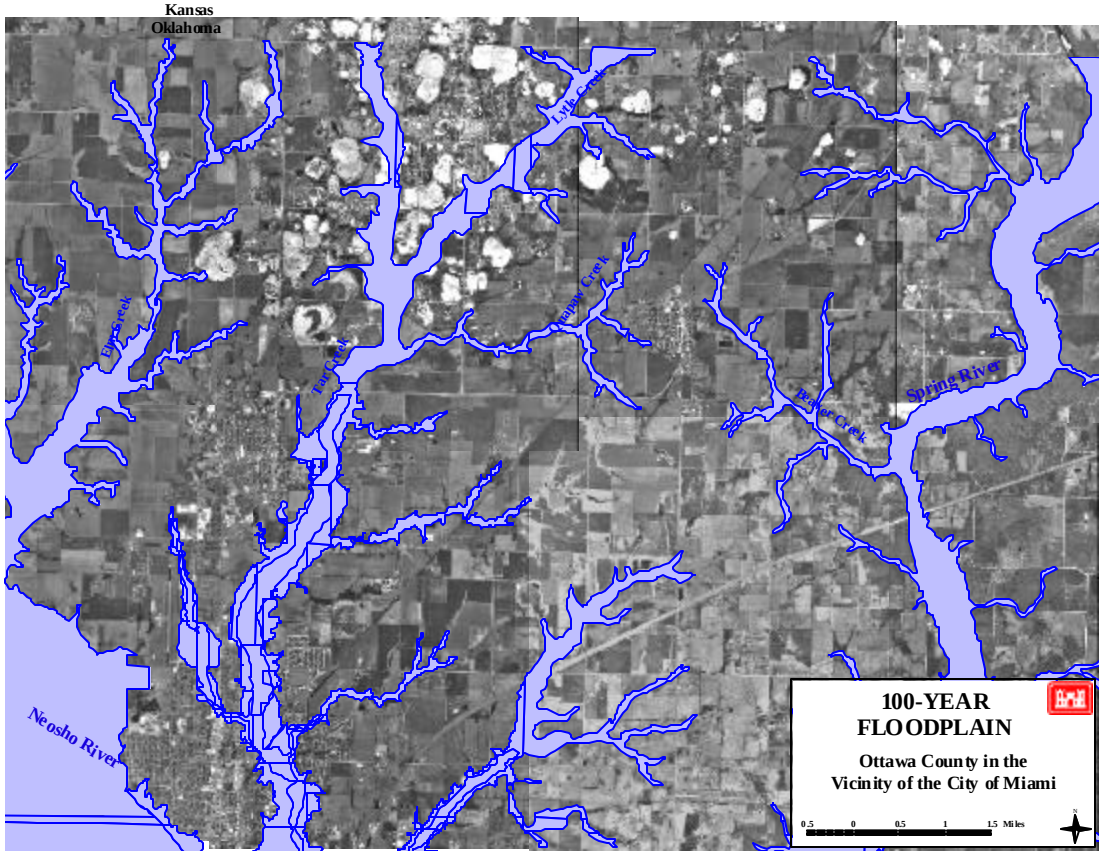

Kansas
Oklahoma
Lytle Creek
Elm Creek
Tar Creek
Honey Creek
Beaver Creek
Spring River
Neosho River
100-YEAR
FLOODPLAIN
Ottawa County in the
Vicinity of the City of Miami
0.5 0 0.5 1 1.5 Miles
N

Figure 4

2. Hydraulic Impact of Chat Piles. Significant erosion and sedimentation also contribute to flooding problems. Much of the sedimentation is due to erosion from the chat piles as shown in ***Photo 2*****.** The primary impact is reduction of the hydraulic capacity of the streams due to the significant volume of material that has been placed within the 100-year floodplain (See ***Figure 4*****).** ***Photo 3*** is an example of one such chat pile that is located adjacent to Tar Creek. The streams themselves have been altered to meander around the chat piles. Flow velocities are very low due to the meandering nature of the streams caused by the alteration of channel alignments during mining. These low flow velocities result in large deposits of sedimentation in the creek channels, which further reduce the hydraulic capacity of the streams. In any event, the reduction of capacity of the streams due to the volume of chat in the floodplain is a significant contributor to flooding problems in the area.

3. Clogged and Overgrown Drainage Areas**.** Streams with low flow velocities and significant sedimentation are conducive to the accumulation of snags and debris. Such streams are also subject to encroachment by vegetative growth. These conditions were observed in Tar Creek and Lytle Creek, as shown in ***Photo 4***. Beaver have also taken advantage of the low velocities and abundant woody growth and thrive in the area. Beaver dams also impede flow. These conditions further exasperate the flooding problems.

Photo 2. Stream Aggradation Due to Erosion of Chat Piles.

Photo 3. Chat Pile in Stream Channel.

Photo 4. Clogged and Overgrown Stream Channel.

4. Infiltration/Exfiltration from Mining Impacts. Infiltration of surface water into mine shafts and boreholes in the northern portions of the mining area and discharges of water from the mines to the surface in the southern portions also impact surface flows. According to Vitek, "water has always been a problem to mining in this area. Although water was an essential component in the milling process, its presence in the mines required removal via pumps. When mining ceased, the pumps were stopped, thereby allowing the mines to fill. In the late 1970's, numerous seeps appeared in response to geology, topography, and the hydrostatic pressure generated by water in the mines." Presently, the water level in the mines has reached equilibrium. There is still likely more surface water infiltrating the mines than drainage from mines to the surface; however, flows in the streams

have been increasing as the mine shafts have filled ***(Photo 5)***. The Drainage and Flooding Subcommittee is concerned that increased surface runoff may occur as mine shafts and drill holes are plugged in the future. However, the quantity of additional runoff will probably not be a significant factor when determining the size of channels to contain design floods. The engineering assumption can be made that no infiltration is occurring into mine shafts when performing hydrology analysis for flooding solutions.

Photo 5. Discharge of Water From Mines to the Surface.

5. Wetlands/Saturated Soils. Due to the altered terrain as a result of mining activities, areas developed that will not drain, resulting in numerous wetland areas and a large amount of surface areas that have saturated soils over prolonged periods of time (***Photo 6)***. The wetlands/saturated soils also result in increased runoff and additional flooding. The existence of wetlands may also impact any proposed structural alternatives to alleviate flooding. Additional studies are required to identify jurisdictional wetlands and define the boundaries of wetlands in the area of concern.

Photo 6. Saturated Soils and Wetlands.

6. Mining Pond Dams in Lytle Creek and Tar Creek. Mining pond dams were constructed in Lytle Creek and Tar Creek to provide a source of water during mining activities. The remaining total or partial presence of these dams, such as those located north of Picher and east of Douthit Bridge, provide obstructions to flow which also contribute to flooding problems.

b. Inadequate Drainage System/Local Flooding. Other than the city of Miami, local drainage in communities in the area of concern is limited to a small number of WPA ditches constructed in the 1930's. Significant flooding is experienced by residents in the communities due to lack of adequate drainage systems. **Photos 7, 8, and 9** show some of the localized flooding in Picher, Commerce, and north of Miami.

c. Manmade Problems – Undersized Culverts and Bridges. A network of roads and railroads were constructed during and subsequent to the mining era. Visual observations by Subcommittee members resulted in the conclusion that many of the bridges and culverts may be undersized and may be acting as man-made obstructions to flow. An example of one such culvert on Lytle Creek is shown in ***Photo 10***. Additional studies are required to determine the hydraulic adequacy of bridges and culverts in the area. Any future reconstruction of these structures should be performed in consideration of and in conjunction with future drainage improvements.

Photo 7. Localized Flooding in Picher.

Photo 8. Localized Flooding in Commerce.

Photo 9 - Tar Creek Flooding, North of Miami

Photo 10. Undersized Culverts and Bridges.

d. <u>Neosho River and Tar Creek Flooding Problems in the City of Miami</u>.

1. Largely unrelated to mining activities, the city of Miami has experienced flooding problems due to high river stages on the Neosho River and the lower end of Tar Creek near their confluence (Photo 11).

Photo 11

Following the 1986 flood, public concern and frustration about Neosho River flooding and the Grand Lake flood easement issue were elevated. The intensity of public concern grew with each following flood event in the Miami area. One outlet for these issues occurred when a public meeting was held September 22, 1987, at the Miami Civic Center. The meeting was attended by hundreds of flood victims, including farmers, urban residents, and business owners. Also in attendance were business and recreational interests and representatives of local, State, and Federal agencies that were impacted by or involved in the issues.

2. Also following the 1986 flood and as a result of public concern, Congress directed the USACE to conduct a reconnaissance study to identify solutions to the flooding problems of Miami and the surrounding area. The 1989 reconnaissance report found a

number of levee alternatives to be economically justified. The USACE negotiated the scope of the potential next phase of effort, a cost-shared feasibility study, with a City-appointed Flood Committee. The proposed feasibility study was brought before the Miami City Commission, which decided not to initiate the study due to lack of funds.

3. Contributing to flooding problems in the Miami area are backwater effects from flood control operations on Grand Lake. The Real Estate Adequacy Study (USACE, 1998) documents that "Theoretical backwater effects of Grand Lake Flood control operations were found to exceed the limits of existing flowage easement using the criterion of a 50-year Land Acquisition Flood." If Grand Lake were a new project and real estate was acquired using USACE current criteria, an additional 3,560 acres of flowage easements would be recommended for acquisition. It was estimated that about 1,600 structures were located in the vicinity of Miami, Oklahoma. The locations and relative sizes of areas where backwater effects were found to exceed the limits of existing flowage easements ranged from small areas in the vicinity of Pensacola Dam and throughout the lake to larger areas along the upstream reaches of the Neosho River, including areas in and around Miami, Oklahoma. It was also estimated that about 1,600 additional residences or businesses are located within the limits of existing easements that cover an area of about 11,700 acres.

8.0 Alternatives for Abating the Drainage and Flooding Problems. As previously discussed, two of the four categories of flood problems in Ottawa County include high river stages on the Neosho River and the lower end of Tar Creek near their confluence at Miami, Oklahoma, and the degradation of Tar Creek upstream of Miami due to historic mining

activities. The other categories are related to more localized problems associated with inadequate drainage systems in the communities and flow restrictions caused by undersized culverts and bridges. Previous and ongoing studies of flooding problems at Miami suggest that alternatives such as channel improvements and/or buyouts of repetitive loss structures located in the floodplain could significantly reduce flood damages. The buyout of individual repetitive flood loss structures in the Miami area could also be a viable component of a comprehensive flood reduction plan for Ottawa County. Ecosystem restoration of the degraded Tar Creek upstream of Miami could improve the natural environment and improve drainage characteristics in the upper basin. The Subcommittee also identified the need for maintenance in the streams to remove obstructions to flow (such as debris removal) and local drainage infrastructure improvements in the communities of North Miami, Cardin, Commerce, Picher, and Quapaw. The Subcommittee identified potential intermediate, short-term, and long-term actions that would address: 1) urban flooding at Miami, 2) repetitive flooding of individual structures upstream of Miami, 3) the degraded condition of the Tar Creek watershed upstream of Miami that contributes to "nuisance" flooding of Ottawa County roads and bridges, and 4) infrastructure problems in the county and communities.

a. Immediate Actions. Immediate actions are those that can be accomplished within the next year. These are actions that are intended to alleviate frequent flooding by performing maintenance-level work - the performance of surveys for future plans, the preparation of community master drainage plans, and studies to determine the economic feasibility of alternatives to address flooding in Lytle Creek, Tar Creek, and the Neosho River.

1. Maintenance Work. In several areas, water can be kept from entering houses and compromising public roadway and utilities by simply cleaning creeks to improve flow characteristics. Work would consist of removing beaver dams, removing chat that has sloughed off tailing piles into the creek channel, clearing and grubbing underbrush and trees, and removing debris from bridges and culverts. The estimated cost for Ottawa County to perform this work is $141,000. Work would be performed in the following locations:

Creek Name	Approximate Length (miles)	Cost to Clean
Tar Creek	8.0	$ 48,000
Lytle Creek	4.0	24,000
Beaver Creek	1.0	6,000
Elm Creek	8.0	48,000
Quapaw Creek	2.5	15,000
Total Cost		$141,000

2. Community Master Drainage Planning. The Subcommittee felt that a systematic master drainage planning approach to solving the flooding problems that result from frequently occurring storms is the best approach for the area's immediate needs. The master drainage planning phase of this work would include preparation of engineering plans and specifications for 31 specific projects to deal with drainage and flooding problems in the five affected communities. These 31 projects were identified by the subcommittee with input from the 5 mayors and county commissioner.

The plans and specifications for each project, to be constructed in a systematic manner from downstream to upstream, would be prepared in bid packages. The projects would be designed to provide drainage for more frequent storms, such as the 5- to 10-year storms. Flooding will occur during larger storms, but floodwaters unaffected by Neosho River backwater should drain more quickly. The 10-year storm represents statistically 90% of all storms.

General 1-foot topographic maps of the five communities should be obtained by completing the aerial surveys that were flown in 1999 for computation of chat pile volumes. The estimated cost to complete topographic mapping for the 31 project areas is approximately $40,000. Many areas need to be ground surveyed to prepare a plan for flood mitigation. Areas within each community cannot drain because of inadequate conveyance to Tar Creek, Lytle Creek, and other streams. To establish elevations of drainage facilities within the communities, the flowline elevations of the tributaries to the creeks in the vicinity of the communities have to be established. Work accomplished in the previous paragraph

would facilitate the surveying effort. The total estimated cost for Ottawa County to perform the surveying is $30,000. The engineering fee for preparing construction plans for the five communities is estimated to be $290,000 based on an estimated total construction cost of $5.5 million. Combined with the estimated $70,000 in survey costs, the total amount of funding to prepare the immediate phase of this work is approximately $360,000.

3. Flood Prevention on Lytle Creek, Tar Creek, and Neosho River. The Subcommittee identified the following potential immediate actions that could lead to implementation of long-term solutions. A description of programs that could be used to provide financial assistance in solving the flooding due to Tar Creek, Lytle Creek, and the Neosho River is provided in Appendix C.

(a) Initiate a General Investigations Feasibility Study. A General Investigation Feasibility study could be conducted under the existing Neosho River, Oklahoma and Kansas General Investigations authority. A reconnaissance study completed in 1989 for Miami, Oklahoma and vicinity identified alternative solutions to flooding problems on Tar Creek and the Neosho River. That study could potentially be used as a basis to initiate feasibility studies for the Neosho River, Tar Creek, and other tributary streams. The feasibility study would identify opportunities in the watershed that address urban and rural flooding problems and water resource problems associated with the ecosystem degradation of Tar Creek. Feasibility studies would evaluate water resource needs in the study area and identify and evaluate an array of solutions to meet those needs. Potential solutions could include structural flood control measures such as levees or channelization

projects; non-structural measures such as flood proofing and flood plain buyouts; aquatic and ecosystem restoration measures such as creating wetlands to filter contaminated water and plantings of aquatic plants, trees, and grasslands to enhance habitat; and other measures. A concept plan which includes a combination of structural flood control, wetlands, and flood plain buyouts is shown on **figure 5.** The concept plan would involve the creation of a passive treatment system consisting of downward vertical flow (DVF) and/or combination of DVF and upward vertical flow constructed wetlands (CW's). The CW's would reduce heavy metal concentrations from acid mine drainage and chat pile run-off to acceptable levels during normal flows. During flood events, it is assumed that dilution of the acid mine drainage and chat pile run-off would be sufficient treatment. CW's would be strategically located downstream of the Tar and Lytle Creeks confluence. Additional CW's would be located upstream of the Tar and Lytle Creeks confluence to treat chat pile run-off until a use for the chat could be determined. The technology would be based on similar projects nation wide, an EPA demonstration project at Beaver Creek near Quapaw, and a USACE Section 206 project at the Mayer Ranch near Commerce. Although the final location of the CW's would be made during a detailed feasibility study, they could include the storage capacity necessary to reduce flooding at Miami. The flood control reservoir(s) would provide additional flood control along Lytle and Tar Creeks and could provide a supplemental supply of water to replenish wetlands during drought conditions. Repetitive flood loss structures within the 100 year flood would be purchased and businesses/residences relocated. In this concept plan, treatment systems would include about 1000 acres of constructed wetlands to treat acid mine drainage and chat pile run-off contamination. Flood control for Miami would consist of an upstream dry detention structure on Quapaw Creek. Approximately 2500 acres

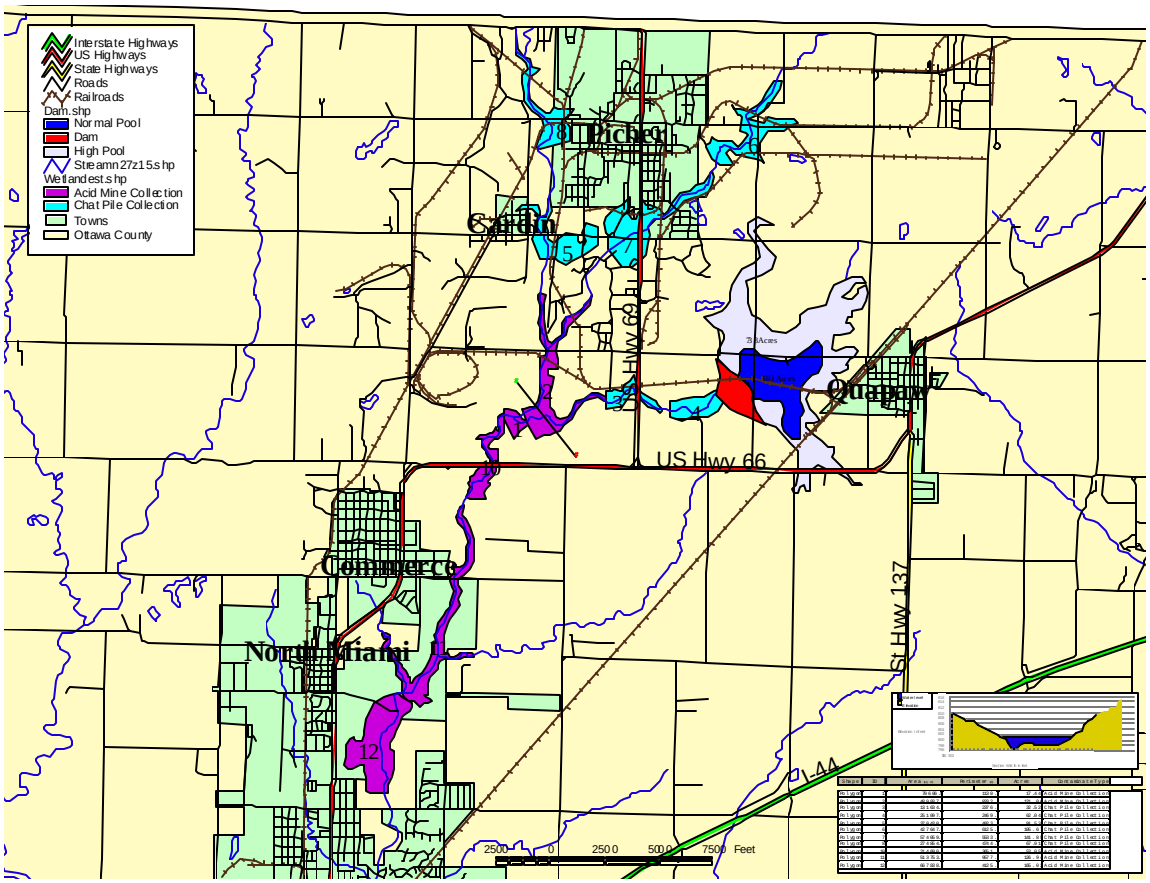
of land would be acquired for the wetlands and flood control reservoir. Approximately 130 structures (residences and businesses) would be acquired and relocation assistance provided to residents. Estimated cost of the concept plan is as follows:

Acquisition and relocation of 130 structures:	$15,500,000
Constructed Wetlands	$17,000,000
Flood Control Reservoir	$ 5,000,000

Feasibility studies typically take up to 36 months and can cost from $1 million to $3 million. A time line diagram of a typical General Investigations project is shown at ***Figure 6.*** The timeframe is often dictated by appropriation of funds and manpower restrictions. Under an accelerated approach with adequate resources, the timeline could be condensed.

(b) If a comprehensive General Investigations study is not possible, alternative measures could include the following:

Under the authority of Section 205 of the 1948 Flood Control Act, update existing project cost and economic benefits information that was developed during the March 1989 Miami, Oklahoma, and Vicinity Reconnaissance Study. The purpose of the update would be to determine if there is still potential for a Federally supported project to reduce flood damages at Miami. The update would be fully Federally funded and could be completed in approximately 3 months following the receipt of funds.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Chat Pile Collection
Towns
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Picher
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Figure 5

(c) Develop Flood Hazard Mitigation Plans (FHMP's) for individual repetitive loss structures in the Tar Creek Basin upstream of Miami. The FHMP's could potentially be funded through the USACE Flood Plain Management Program and/or local non-Federal contributions. The FHMP's would then be available to submit to the Oklahoma Department of Civil Emergency Management (ODCEM) for consideration of cost-shared funding assistance for the implementation of buyouts or other flood mitigation measures. Following approval and selection, the FHMP is sent to FEMA for review. The process from the time the FHMP is initiated until the completion of the FEMA review takes about 12 months. The cost to prepare a FHMP is about $25,000.

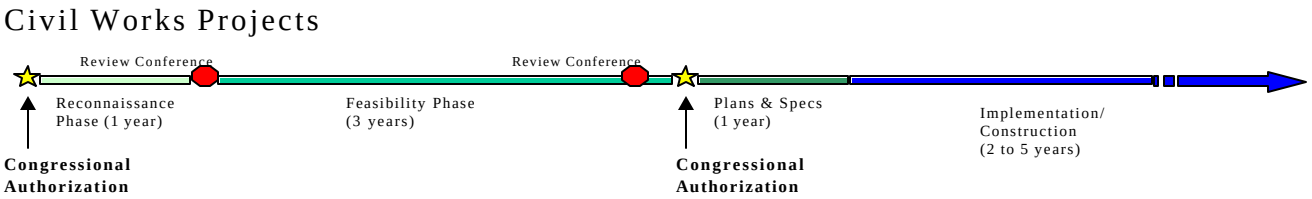

Figure 6 - Typical General Investigation Project Schedule

(c) Determine the potential for Federal and local interest in ecosystem restoration of Tar Creek and its tributaries upstream of Miami, Oklahoma. Due to extensive historic mining activities in Ottawa County, the Tar Creek watershed was drastically altered from its natural condition. If restored to a more natural condition, it is likely that some of the natural flood control characteristics of the Tar Creek Basin that existed prior to mining activities could result in reduced flood damages within the Tar Creek watershed. If funded, a determination of the potential for a Federally supported ecosystem restoration project could be accomplished under the authority of Section 206 of the Water Resources Development Act of 1996 (WRDA 96) and Section 1135 of WRDA 86, at full Federal expense. If the initial study finding indicates the potential for a Federally supported ecosystem restoration project upstream of Miami, Oklahoma, efforts would be initiated to identify potential Federal and local funding sources to initiate a cost-shared feasibility study.

(d) Near the completion of each study, conduct a come-and-go public workshop to provide updated information to the public and solicit public comments. The workshops could also provide information to the public on completed or other ongoing initiatives to alleviate flooding in Ottawa County. The workshops would be paid for by study funds.

b. Short-Term Actions. Short-term actions are those that can be accomplished in 2 to 3 years. These actions include constructing drainage improvements in the communities

and conducting feasibility studies to solve flooding problems along Tar Creek watershed and the Neosho River in the Miami area.

1. Community Drainage Improvements. These actions would include implementation of the Master Drainage Plans developed during the immediate actions. The construction cost for the anticipated 31 project areas in the five communities is $5.74 million. The anticipated improvements would include culvert and bridge replacements where required, sized to carry a consistent flood level through each stream. The ditches and streams themselves would be cleaned out and regraded to provide positive drainage throughout the stream system.

The ditches and streams would be designed with an Oklahoma Department of Transportation (ODOT) standard concrete ditch liner in the bottom. The ditch liner would provide a maintainable section that can be cleaned more easily. Without the ditch liner, attempts to remove sediment and silt would result in an uneven slope and ponding areas between structures, unless the ditches are surveyed and staked each time they are maintained.

The 31 localized areas identified by the subcommittee are described in Appendix B, along with a potential plan for solving each drainage problem. The concept plan is provided as a basis for potential construction cost. Construction costs are based on unit prices for general items of work. Ten percent of the subtotal of those items was added as a general estimate of utility relocations, the extent of which is unknown at this time. A 35% contingency factor was then added to the sum of those items to deal with other unknown design requirements. Additional cost for special handling of soils was not considered necessary.

2. Flood Protection on Lytle Creek, Tar Creek, and Neosho River.

(a) Section 205. If a General Investigations Feasibility Study is not possible and the Section 205 program updates performed in the immediate actions (Section 8a.) determine that there is potential for an economically justified project, additional efforts would be initiated to determine whether to continue cost-shared feasibility study activities. The feasibility study would consider structural solutions, such as channel improvements, and non-structural solutions, such as residential buyouts. Remaining activities following completion of the feasibility study include Plans and Specifications, real estate acquisition, contracting, and construction. A time line of the Section 205 process is shown at ***Figure 7.***

(b) Property Buyouts. If the ODCEM decides to buyout flood prone properties, there are two potential funding sources. Federal funds are provided through FEMA's Hazard Mitigation Grant Program or the Flood Mitigation Assistance Program.

ID	Task Name
1	Feasibility Study Phase
2	Plans and Specifications
3	Real Estate Acquisition
4	Contracting
5	Construction
6	
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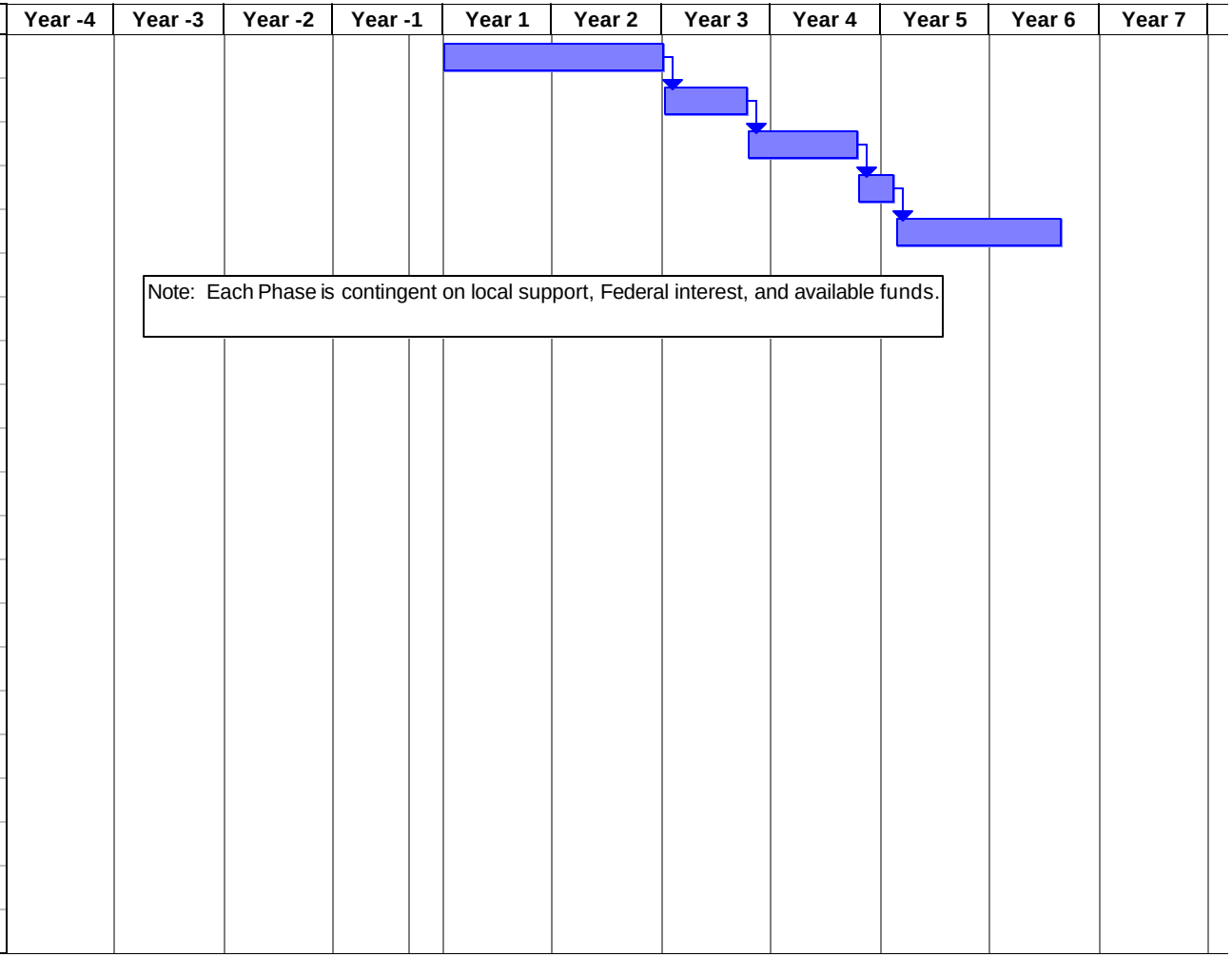

Figure 7 - Typical Section 205 Project Schedule

Through House Bill 1841, the State of Oklahoma has initiated a law to provide flood mitigation assistance in addition to the FEMA programs.

(c) Ecosystem Restoration (Section 206). Following approval of a fully Federally funded Preliminary Restoration Plan report, cost-shared activities would include preparation of an Ecosystem Restoration Report (18-24 months) followed by Plans and Specifications (9 months), real estate acquisition (12-18 months), contracting (4 months), and construction monitoring activities. The process from initiation of the Ecosystem Restoration Report phase until the start of construction is shown on ***Figure 8.***

(d) Grand Lake Backwater Effects**.** In September 1998, USACE completed the Grand Lake Flood Easement Adequacy Report, which stated that a feasibility study would be necessary to address continuing flood problems due to backwater effects of the operation of Grand Lake. The study would include development of a project study plan, acquisition of supplemental mapping, inventory of floodplain structures, and evaluation of Grand Lake operational impacts. The feasibility study should be conducted to minimize flood impacts in the Miami area. Cost of the feasibility study is $1.7M and would require congressional legislation.

c. Long-Term Actions. These actions are in the 3- to 5-year time frame and are actions necessary to design and construct the recommended alternatives determined during the feasibility studies performed in the short-term actions. The recommended alternatives may consist of channelization, levees, detention reservoirs, acquisition, operational changes

ID	Task Name
1	Feasibility Study Phase
2	Plans and Specifications
3	Real Estate Acquisition
4	Contracting
5	Construction/Monitoring
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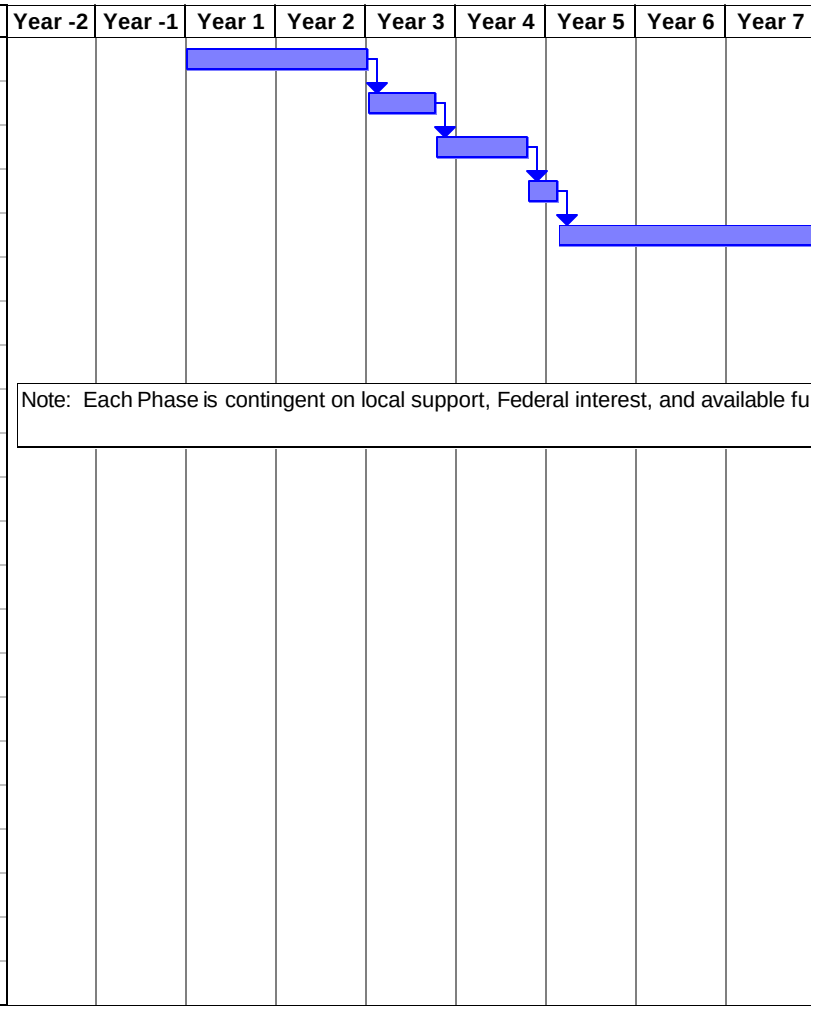

Figure 8 - Process for Ecosystem Restoration Project

of existing flood control structures, or a combination of the above. Costs of remedial actions will be determined during the feasibility studies. Cost of the concept plan described in this report is $37,500,000. Because of the environmental impacts discussed in paragraph 5, the Subcommittee recommends that the potential for funding of remedial actions be addressed as part of the Environmental Protection Agency's Superfund Program.

9.0 Recommendations. Alternatives for abating the drainage and flooding problems in the historic mining area are discussed in paragraph 8.0. A summary of the recommended alternatives, is as follows:

a. Immediate Actions (1 year).

1. Clean the creeks to improve flow characteristics. Work would consist of removing beaver dams, removing chat that has sloughed off tailing piles into the creek channel, clearing and grubbing underbrush and trees, and removing debris from bridges and culverts. ($141,000).

2. Prepare a systematic master drainage planning approach to solving the community flooding problems that result from frequently occurring storms. The master drainage planning would include preparation of engineering plans and specifications for 31 specific projects in Cardin, Commerce, North Miami, Picher and Quapaw. Required surveying would include general 1-foot topographic maps of the five communities and field surveys to establish elevations of existing drainage facilities and flowline elevations of the tributaries to the creeks in the vicinity of the communities ($360,000).

3. Conduct a General Investigations Feasibility Study. The study would identify opportunities in the watershed that address urban and rural flooding problems and water resource problems associated with the ecosystem degradation of Tar Creek. Potential solutions include structural flood control measures such as levees or channilization projects, non-structural measures such as flood proofing and flood plain buyouts, and aquatic or ecosystem restoration measures such as creating wetlands to filter contaminated water and planting of aquatic plants, trees and grasslands to enhance habitat. The concept plan presented in this report involves a combination of these solutions. Although the subcommittee desires an action biased plan that would preclude additional studies, a feasibility study is required to develop alternative remedies to ensure technical feasibility, optimize effectiveness, and minimize cost. ($3,000,000).

4. Develop Flood Hazard Mitigation Plans for individual repetitive loss structures in the Tar Creek Basin upstream of Miami ($25,000).

b. Short-Term Actions (2 to 3 years).

1. Implement the Master Drainage Plans developed during the immediate actions. The anticipated improvements would include culvert and bridge replacements where required. The ditches and streams would be cleaned out and regraded to provide positive drainage throughout the community drainage system ($5,740,000).

2. Conduct a feasibility study to address continuing flooding problems in the Miami area due to backwater effects of Grand Lake. The study would include development of a project study plan, acquisition of supplemental mapping, inventory of floodplain structures, and evaluation of Grand Lake operational impacts ($1,700,000).

c. Long-Term Actions (3 to 5 years). Construct the recommended alternative from the General Investigation Feasibility Study performed in the immediate actions. The recommended alternative may consist of a combination of channelization, detention reservoirs, acquisition of flood prone structures, operational changes of existing flood control structures. A concept plan is shown on figure 5. ($22,000,000 for construction and $15,500,000 for acquisition of structures).

d. General Recommendations.

1. Complete the 1-foot topographic mapping of the entire mining district for use in future feasibility studies, design and construction.

2. Input the data from each of the subcommittees into a Geographic Information System.

3. Establish a permanent Tar Creek Steering Group to assist elected officials and agencies such as the Oklahoma Water Resource Board, Oklahoma Department of Environmental Quality and U.S. Army Corps of Engineers in continuing the efforts to identify and implement solutions to problems that have plagued the area.

10.0 Conclusion. The drainage and flooding problems in Ottawa County have been severely compounded by historic mining activities. The frequent flooding is likely contributing to the spreading of lead-contaminated sediments and health risks to citizens in the area. The immediate, short-term, and long-term actions described in this report are recommended to provide much needed flood protection to the citizens who have been negatively impacted by these adverse conditions. The Subcommittee also has a concern for continuation of effort to address flooding and drainage problems in the historic mining area. The problems that have plagued the citizens have been documented in reports for at least the last 20 years. The Subcommittee recommends the establishment of a Tar Creek Steering Group to assist elected officials and agencies such as the Oklahoma Water Resources Board, the Department of Environmental Quality, and USACE in continuing the efforts to identify opportunities in solving the problems.

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LIST OF ACRONYMS

CAP	Continuing Authorities Program
EPA	Environmental Protection Agency
FCA	Flood Control Act
FCSA	Feasibility Cost Sharing Agreement
FEMA	Federal Emergency Management Agency
FHMP	Flood Hazard Mitigation Plans
FPMS	Flood Plain Management Services
FWRS	Floodwater Retarding Structures
GI	General Investigations
HQUSACE	Headquarters, U.S. Army Corps of Engineers
NFIP	National Flood Insurance Program
NGVD	National Geodetic Vertical Datum
NRCS	Natural Resources Conservation Service
ODCEM	Oklahoma Department of Civil Emergency Management
ODOT	Oklahoma Department of Transportation
PAS	Planning Assistance to States
PDA	Planning and Design Analysis
SFHA	Special Flood Hazard Areas
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WPA	Works Program Administration
WRDA	Water Resources Development Act

APPENDIX A

LIST OF
DRAINAGE AND FLOODING SUBCOMMITTEE MEMBERS

LIST OF DRAINAGE AND FLOODING SUBCOMMITTEE MEMBERS

Joe Crawford
Co-Chairperson
Ottawa County Commissioner

John Roberts
Co-Chairperson
U.S. Army Corps of Engineers

Ed Keheley
Resident of Quapaw

Gary Utley
Natural Resources Conservation Svc

Jim Thompson
Attorney, City of Miami

Jo Rainbolt
Office of Congressman Tom Coburn

J. Gavin Brady
Oklahoma Water Resources Board

Mike Mathis
Oklahoma Water Resource Board

John Dalgarn
Bureau of Indian Affairs

J.D. Strong
Office of the Secretary of Environment

Janet Meshek
Meshek and Assoc., Inc.

Gene Lilly
U.S. Army Corps of Engineers

Lonnie Ward
FEMA

David Cates
Department of Environmental Quality

Dennis Datin
Department of Environmental Quality

Jo Montana
Grand Gateway, EDA

Phil Crosby
Mayor of Commerce

Lori Hunninghake
U.S. Army Corps of Engineers

APPENDIX B

CONCEPT PLAN FOR COMMUNITY DRAINAGE PROBLEMS

CONCEPT PLAN FOR COMMUNITY DRAINAGE PROBLEMS

Quapaw

Quapaw - Area 1.

Problem: A drain course extends from Highway 69 west of Main, northeasterly through the intersection of N4605 and Fourth Street, thence easterly to a tributary of Beaver Creek, itself a tributary of Spring River. Localized flooding occurs because of limited capacities of both the ditches and culverts. This picture shows a nursing home that was constructed over a small pipe. The home has to be evacuated during moderately frequent storms.

Potential Plan: Relocate the creek around the nursing home. Construct approximately 2,000 linear feet of ODOT standard ditch liner and replace ten roadway and driveway culverts.

Cost Estimate: Approximately $169,000.

Quapaw - Area 2.

***Problem*:** This subdivision was constructed with very flat slopes, making internal drainage nearly impossible, as shown at left. The storm runoff drains to a pond at the northeast corner of the subdivision, which has silted in to a large degree.

Potential Plan: Construct approximately 2,500 linear feet of ODOT standard ditch liner and replace 12 roadway and driveway culverts.

Cost Estimate: Approximately $160,000.

Quapaw - Area 3.

The picture at left is taken from the east at the upstream side of the culvert and shows the debris line several feet high following the May 9, 2000, flood.

Problem: A county bridge culvert approximately 1 mile west of the Ottawa County District 1 barn experiences significant overtopping of as much as 5 feet on a frequent basis. This is a constant safety and maintenance problem. It also eliminates access, causing traffic to be re-routed approximately 4 miles during any washout.

Potential Plan: Replace the culvert and construct adequate upstream and downstream transitions.

Cost Estimate: Approximately $105,000.

North Miami/Commerce

North Miami/Commerce - Area 13.

Problem: This area along Main Street between North Miami and Commerce has inadequate drainage facilities, causing continual water ponding and roadway damage. Stormwater runoff must flow northerly to a bridge culvert just south of D Street in Commerce.

The picture above shows the condition of the downstream areas at this culvert, including sedimentation from chat in the stream and debris buildup. Immediately downstream, chat piles block flow and render the culvert nearly useless.

Main Street south of this location has an essentially non-existent drainage system. Water continually ponds on the roadway, causing pavement pumping and associated damage.

Potential Plan: Construct approximately 500 linear feet of ODOT ditch liner and 1,500 linear feet of storm sewers. Clean out the creek east of the culvert and provide a ditch liner to the confluence with the creek discharging from River Street in Commerce.

Cost Estimate: Approximately $479,000.

North Miami/Commerce - Area 14.

Problem: Water stands along Locust Street and overtops the bridge to the west under Neuman Road. The picture at left shows the limited depth as well as the pavement damage caused by frequent overtopping of the roadway.

Potential Plan: Construct 1,500 linear feet of ODOT ditch liner along Locust Street, replace two roadway and eight driveway culverts, and replace the culvert at Neuman Road.

Cost Estimate: Approximately $99,000.

North Miami/Commerce - Areas 15 and 17.

Problem: This area floods frequently, causing continual road problems and flooding buildings. The city has prepared plans for an underground storm sewer in Area 15, with inlets to deal with the problem. Construction is underway for the lower portion.

Upstream, as shown in the picture, the project needs to be continued for one more block (Area 17) to complete the work necessary along this reach.

Potential Plan: Construct a storm sewer system.

Cost Estimate: Approximately $45,000.

North Miami/Commerce - Area 16.

Problem: The Highland Avenue bridge is inadequate, causing backwater flooding in the Belmont Run residential area.

Potential Plan: Replace the culvert with adequate upstream and downstream transitions.

Cost Estimate: Approximately $55,000.

Commerce

Commerce - Area 1.

Problem: This is a low-water crossing connecting McBee with L Street. Frequent flooding cuts off access at this location.

Potential Plan: Construct a bridge or culvert to convey a larger storm event.

Cost Estimate: Approximately $62,000.

Commerce - Areas 2 and 3.

Problem: The stream flowing on the north side of Commerce has several localized problems. An underground 5-foot-diameter culvert east of U.S. 69 (Mickey Mantle) is smaller than upstream culverts shown in this picture.

Upstream, under U.S. 69 and under 3rd Street, are two double-barrel box culverts. This picture shows the culvert under U.S. 69, with the 3rd Street culvert shown next.

North of 3rd Street the water is contained in a smaller pipe culvert for a distance of several hundred feet upstream. This is shown in the picture related to this project area.

This system of box and pipe culverts causes water to back up throughout the residential area upstream. Several homes flood on a moderately frequent basis, and yard and street flooding occurs one or two times every year. A picture of the channel upstream from the enclosed portion is shown in the next picture.

Potential Plan: Remove the obstructions, construct 4,200 linear feet of a combination of storm sewer and ODOT ditch liner, and replace eight undersized culverts.

Cost Estimate: Approximately $537,000.

Commerce - Area 4.

Problem: Stormwater runoff from areas north and west flood 6th Street near Quincy several times a year. The lack of a drainage system causes continual pavement failures.

Potential Plan: Provide 200 linear feet of ODOT ditch liner and replace two roadway and two driveway culverts.

Cost Estimate: Approximately $34,000.

Commerce - Area 5.

Problem: Flow is blocked in several locations along the railroad ditch west of Main Street, causing localized flooding and access problems. The contractor for the Tar Creek yard remediation project has provided some grading work to drain the area.

Potential Plan: Construct 1,500 feet of ODOT ditch liner and replace one roadway culvert.

Cost Estimate: Approximately $78,000.

Commerce - Areas 6 and 12.

Problem: This tributary of Tar Creek is restricted just upstream of U.S. 69 at the recreational fields shown on the left. The lower end of the creek has been confined to a pipe.

The channel upstream from this location is overgrown and not well defined south of D Street as shown in this picture. This creek channel and the undersized culvert under D Street shown in the next picture causes water to back up into Commerce as far as 1st Street.

Note the vertical location of the houses upstream from the culvert at D Street. The two houses shown have finished floor elevations nearly as low as the flowline of the creek.

Localized flooding occurs along River Street both north and south of the downtown area. Several buildings have experienced flooding. This area has been modified by the Superfund cleanup work under construction. The pavement has been damaged due to repeated flooding and no drainage system.

At the south end of River Street, drainage is confined to old WPA ditches, which are undersized and deteriorated.

Potential Plan: Provide grading and a paved channel bottom from Highway 66 upstream to D Street. Construct ODOT ditch liner and seven culvert replacements or a storm sewer system along River Street. The downstream improvement will provide additional relief for Area 13 in North Miami.

Cost Estimate: Approximately $864,000.

Commerce - Area 7.

Problem: Localized flooding occurs on a very frequent basis due to backwater from downstream areas. There is no drainage or storm sewer system throughout downtown. Commerce Commerce Street is constructed with a crown that is higher than upstream gutter elevations, causing water to pond and damaging pavement.

Potential Plan: Provide a storm sewer system that will connect with the upstream and downstream projects in Area 6.

Cost Estimate: Approximately $178,000.

Commerce - Area 8.

Problem: Localized flooding on a very frequent basis occurs along D Street and between C and D Streets due to an inadequate conveyance system to Tar Creek. The pictures at left show flooding that occurred in May 1999.

Potential Plan: Construct 4,000 linear feet of ODOT ditch liner and replace 2 roadway and 20 driveway culverts.

Cost Estimate: Approximately $224,000.

Commerce - Area 9.

Problem: Drainage is poor along D Street because of small drainage culverts and ditches that have silted in. This affects the neighborhoods from B Street to D Street, from approximately Cherry Street to Highway 69 (Mickey Mantle). Poor drainage has damaged the pavement and blocked access at several locations.

Potential Plan: Construct 2,500 linear feet of ODOT ditch liner and replace 11 roadway culverts and 40 driveway culverts. One of the roadway culverts crosses Highway 69.

Cost Estimate: Approximately $333,000.

Commerce - Area 10.

Problem: The areas generally south of D Street draining to the intersection of E Street and Jeffery Street have no outlet to the creek downstream. This causes standing water and flooding, as well as continual pavement damage.

Potential Plan: Provide a limited storm sewer system near this intersection.

Cost Estimate: Approximately $134,000.

Commerce - Area 11.

Problem: Midway Village was constructed with no storm sewer system. The runoff is conveyed along curb and gutter streets to an outlet point at grade. The downstream conveyance is poor due to creek conditions. This picture is taken at the end of a roadway stub-out which is the outlet point for the water. The lift station flooded in the May 6, 2000, flood and has flooded several times before. The pavement in the subdivision is damaged in all locations where water stands, and flooding occurs within the subdivision.

Potential Plan: Provide grading and a paved channel bottom from the Tar Creek confluence to Midway Road. Construct a storm sewer system in the two locations where water outlets at grade if possible.

Cost Estimate: Approximately $428,000.

Picher/Cardin

Picher/Cardin - Area 1.

Problem: The drainage system along Columbus is poor due to inadequate drainage ditches, and undersized drainage structures at Third Street and the railroad. The picture at left shows the erosion problems occurring north from the intersection of Columbus and Patterson.

The railroad bridge and the narrow channel section downstream restrict the ditch to the south. This area of downtown Picher floods during a moderately frequent storm.

Potential Plan: Construct 2,000 linear feet of a combination of ODOT ditch liner and concrete-lined ditch along Columbus and replace the culverts at First, Second, Third, and Fourth Streets, as well as the railroad.

Cost Estimate: Approximately $332,000.

Picher/Cardin - Area 2.

Problem: The drainage structure at A Street east of Connell is undersized. Water ponds upstream from "A" Street and splits south at this location, some flowing west towards Connell and most flowing east along the south side of "A" Street to Lytle Creek. A dam on the south side, blocking drainage to the east, further complicates the drainage. Access is interrupted to several houses in the Develiers Circle on a frequent basis.

Potential Plan: Replace the structure at "A" Street and provide a stabilized ditch from this point either to the ditch along Columbus or east along Picher.

Cost Estimate: Approximately $99,000.

Picher/Cardin - Area 3.

Problem: A pond east of Ottawa causes localized flooding.

Potential Plan: Repair or remove the pond and replace the drainage culvert at Ottawa.

Cost Estimate: Approximately $81,000.

Picher/Cardin - Area 4.

Problem: Two houses northwest of Treece and C Street flood frequently because of a dam constructed around the tailing pile north and west of this location. Localized flooding occurs on a constant basis. This picture shows the tailing pile encroaching on the creek. The tailings fill the creek and block drainage.

Potential Plan: Move the tailing piles and provide for prevention of further clogging of the stream. Repair the seeps and provide 500 linear feet of concrete-lined ditch to carry the water away from this area.

Cost Estimate: Approximately $154,000.

Picher/Cardin - Areas 5 and 6.

Problem: This reach of Lytle Creek is very difficult to maintain. Water floods three houses and floods a sanitary sewer from rainstorms as small as 1-1/2 inches. The pictures at left show the view downstream from the bridge between 7th and 8th Streets. The lower view is from U.S. 69 looking east (upstream).

Potential Plan: The obstructions need to be removed to drain the area so that it can be surveyed to provide engineering plans for improvement. The channelized area needs to have a stabilized bottom, preferably concrete, to prevent the quick overgrowth and beaver dams from recurring on such a frequent basis.

Cost Estimate: Approximately $325,000.

Picher/Cardin - Area 7.

Problem: This bridge on Twelfth Street at the east end of Cardin causes backwater flooding of upstream areas. As shown in the picture, a large sanitary sewer conduit has been attached to the bottom of this bridge, further reducing the waterway area.

Looking north (upstream), in this picture, deposition of silt and tailings has seriously impeded the flow. The water slows at the bridge, further aiding the buildup of debris and silt upstream.

Potential Plan: Provide adequate transitions upstream and downstream and relocate the sanitary sewer.

Cost Estimate: Approximately $205,000.

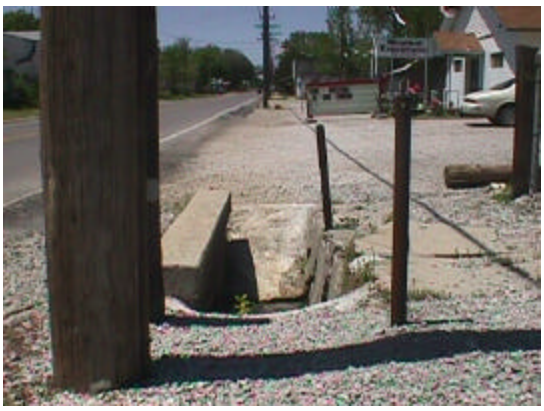
Picher/Cardin - Area 8.

Problem: Drainage on the north side of Cardin is poor, backing up water into residential areas to the south. The picture to the left shows the areas upstream from N4570 Road. The water backs up into residential neighborhoods upstream.

Downstream, tailing piles and debris block the waterway, rendering the culvert under the roadway useless.

Potential Plan: Construct 2,000 linear feet of ODOT ditch liner from the railroad east to the confluence with Tar Creek and replace two roadway culverts.

Cost Estimate: Approximately $133,000.



Picher/Cardin - Area 9.

Problem: Localized flooding occurs along Twelfth Street. There is essentially no ditch along the highway. The picture to the left shows the only inlet for the north side of the highway. Downstream, the outlet to Tar Creek has been modified so much by mine activity that it is impossible to tell where the water is supposed to flow.

Potential Plan: Construct 1,500 linear feet of a combination of storm sewer and ODOT ditch liner with a stabilized bottom and positive drainage to an outlet point.

Cost Estimate: Approximately $223,000.

Picher/Cardin - Area 10.

Problem: This poorly draining stream floods three houses near the intersection of Oneida and Sixth Street, as well as a sanitary sewer. The picture to the left shows the creek behind and immediately adjacent to residential properties. A railroad bridge east of Oneida causes additional backup of water.

Potential Plan: Construct 2,000 linear feet of ODOT ditch liner from Cherokee Street to Tar Creek and replace the railroad culvert.

Cost Estimate: Approximately $116,000.

Picher/Cardin - Area 11.

Problem: This poorly draining area of Lytle Creek causes flooding of upstream areas, including a sanitary sewer lift station, shown in the picture on the left.

Potential Plan: Construct 800 linear feet of ODOT ditch liner from along the creek to the outlet in Lytle Creek.

Cost Estimate: Approximately $46,000.

Picher/Cardin - Area 12.

Problem: A highway ditch along U.S. 69 causes flooding in several houses north of A Street west of U.S. 69.

Potential Plan: Construct 500 feet of ODOT ditch liner and replace the “A” Street culvert.

Cost Estimate: Approximately $40,000.

APPENDIX C

POTENTIAL PROGRAMS TO PROVIDE FINANCIAL ASSISTANCE

POTENTIAL PROGRAMS TO PROVIDE FINANCIAL ASSISTANCE

STATE

Several loan/grant programs may be available for the impacted communities in the mining district. Community Block Development Grants (CBDG) are designed to address some drainage issues and are available to communities that have no open CBDG grants. Small Cities Grants are available to communities with populations of 2,500 to 30,000. The EDA Title 9-Sewer Impact Grant may also include some assistance to negate flooding.

FEDERAL

Following is a description of several programs and funding sources from the USACE that could be useful for solving the flooding due to Tar and Lytle Creeks and the Neosho River:

a. **General Investigations Program**. The General Investigations or "GI" Program is the name given to a group of laws, which authorize USACE involvement in water resource studies. When referring to GI program funding, this is an overall category which includes a number of study types, including studies conducted under authority of the Planning Assistance to States (PAS) and the Flood Plain Management Services (FPMS) programs, as well as reconnaissance or feasibility level studies specifically funded by Congress.

1. GI Funding. The GI program is funded each year as part of the fiscal year Energy and Water Development Appropriations Act. Specific studies are funded by line item appropriation. The PAS and FPMS programs are funded as line items. Funding for specific studies within those programs is then distributed to USACE Divisions by HQUSACE and to USACE Districts by Division offices.

2. GI Studies. In general, GI studies refer to specific GI reconnaissance or feasibility studies funded by Congress. Those studies are linked to a GI study authority, previously provided by law – typically a Water Resources Development Act (WRDA) or a Flood Control Act (FCA), which directs the USACE to evaluate one or more water resource needs in a specific geographic area, such as a river basin – and will be conducted in two phases, as described below. Studies focus on a wide array of water resource problems and can identify solutions that provide for many water resource needs, including flood damage reduction and environmental restoration.

a) Reconnaissance Phase. The reconnaissance phase of a project is traditionally 12 to 18 months long and is done at full Federal expense. The original purposes of reconnaissance studies were to establish whether at least one alternative solution to an identified water resource problem was economically justified and to determine whether there was a Federal interest in continuing to the feasibility phase. In an effort to decrease the amount of time it takes for a project to get authorized, an expedited reconnaissance process has been developed by HQUSACE. Reconnaissance studies are now limited to $100,000 (100% Federally funded) and can be completed in 6 to 9 months. The emphasis is on

determining if there is Federal interest in and non-Federal support for continuing studies and on developing and signing a Feasibility Cost Sharing Agreement (FCSA) with a non-Federal sponsor. There is very little of a technical nature that is done under the expedited reconnaissance phase.

b) Feasibility Phase. The feasibility phase of a project typically takes 2 to 4 years and is cost-shared equally by the USACE and a non-Federal sponsor following the signing of the FSCA. The purpose of the feasibility study is to identify and recommend the alternative solution that meets non-Federal needs and Federal standards and has the greatest net benefits. The feasibility study will result in a recommendation to Congress for construction authorization.

c) Planning Assistance to States (PAS). The PAS program was authorized by the WRDA of 1974 and gives the USACE the authority to use its technical expertise in water and related resource management to help States and Native American Tribes with their water resource problems. The program is funded annually (maximum of $10 million), and funds are distributed on a priority basis by HQUSACE. Each State or Tribe can receive up to $500,000 annually. Federal funds are matched equally with non-Federal funds provided by the study sponsor. Cost sharing is arranged through letter agreements signed by the District Engineer and the head of the sponsoring agency. In Oklahoma, the USACE works through the Oklahoma Water Resources Board and in Kansas through the Kansas Water Office. The USACE also works with Native American Tribes but, to date, only one tribal PAS study has been performed due to limited PAS funds. Study

purposes are varied under the PAS program and have included evaluations of water and wastewater systems, port development on the navigation system, design studies on water supply lakes, and economic and environmental evaluations of proposed projects. PAS studies do not lead to Federal construction projects.

d) Flood Plain Management Services (FPMS). The FPMS program was authorized by Section 206 of the FCA of 1960 and authorized the USACE to use its technical expertise to provide guidance in floodplain management matters to all private, local, State, and Federal entities. The objective of the program is to support comprehensive floodplain management planning. Information and assistance is provided through the program to individuals and to both the public and the private sector. The program is funded annually, and funds are distributed by HQUSACE. However, a nominal cost-recovery fee is charged to private users and Federal agencies. Studies conducted are varied based on needs but have included evaluations of floodplain mapping, development of solutions for small flooding problems, and evaluations of non-structural flood damage reduction measures, such as flood proofing and early warning systems.

b. Continuing Authorities Program (CAP). The CAP is actually a group of authorities that allows the USACE to plan, design, and construct small projects without specific Congressional authorization. Generally, the CAP authorities allow for a much quicker response time from the time a study is initiated until a project is constructed, and solve smaller, more specific water resource problems than the GI studies.

1. **Section 205 – Flood Damage Reduction**. Section 205 of the FCA of 1948 provides the USACE authority to study, plan, design, and construct small flood control projects, such as levees, floodwalls, and small detention structures; to add improvements to existing facilities; or to remove structures from the floodplain. The first $100,000 of a Section 205 project is fully Federally funded. If feasibility study costs exceed $100,000, the study is cost shared on a 50-50 basis after the signing of a cost sharing agreement with a non-Federal sponsor. If a feasibility study identifies a cost effective project, the construction phase can be initiated following signing of a Project Cooperation Agreement. The non-Federal sponsor typically pays 35 to 50% of project construction. The maximum Federal cost of a Section 205 project is $5 million. Typically, due to the limited funds available for the program nation-wide, the District will initially receive $25,000 to $50,000 per project to assess whether a cost effective alternative to the flood problem can be identified and will get the remainder of the first $100,000 following that "check-point." Additional Federal funds are provided, if needed, following the signing of a cost sharing agreement with a non-Federal sponsor. Tulsa District currently has a backlog of about 10 projects waiting funding under the Section 205 authority.

2. **Section 14 – Emergency Streambank Protection**. Section 14 of the FCA of 1964 authorizes the USACE to provide protection to public facilities from streambank erosion. Facilities that can be protected include bridges, highways, municipal water plants and distribution systems, sewage disposal plants, and other public facilities. Churches, hospitals, schools, and other non-profit public facilities may also qualify. Initial funds of $40,000 are allocated for the District to do a Planning and Design Analysis (PDA) for a

project. Following completion and approval of the PDA, a cost sharing agreement can be signed, and construction can be initiated. The maximum Federal cost of a Section 14 project is $500,000. Tulsa District has worked with Division and HQUSACE to develop an expedited process that can allow Section 14 project construction to be initiated as soon as 1 year after the project is initiated. Non-Federal sponsors are required to sign cost sharing agreements and typically pay 35 to 50% of project costs.

3. Section 1135 – Environmental Restoration. Section 1135 of the WRDA of 1986 authorizes the USACE to participate in projects to restore habitat or environment lost as a result of construction of a USACE project. The habitat can be restored as a result of additional construction or modifications to existing projects. Examples of habitat restoration projects include plantings in lakes to provide fisheries habitat and to decrease lake turbidity, modifications to hydropower generation facilities to increase downstream dissolved oxygen, and construction of a flow control structure. Following completion of a fully Federally funded Initial Appraisal report, cost-shared feasibility studies can be initiated. If project construction is approved and a cost sharing agreement is signed with a non-Federal sponsor, construction can be initiated. The non-Federal sponsor's share of project cost is 25%.

4) Section 206 - Aquatic Ecosystem Restoration. Section 206 of the WRDA of 1996 authorizes the USACE to carry out aquatic ecosystem restoration projects if they will improve environmental quality, are in the public interest, and are cost effective. Section 206 projects require 35% non-Federal funding, and Federal costs are limited to $5 million per

project. The program is similar to the Section 1135 program but does not have to be tied to a USACE or Federal project.

5) <u>Section 208 – Snagging and Clearing for Flood Control</u>. Section 208 of the FCA of 1954 is the USACE's authority to clear clogged channels. Under this program, the USACE evaluates the economic, environmental, and engineering feasibility of clearing a channel of vegetation, fallen trees, or other debris. The cost of a Section 208 study is usually totally Federally funded since the cost rarely exceeds the cost-share requirement. After a feasibility study is completed, a cost-shared Plans and Specification/Construction Phase could be initiated, with the Federal Government paying 50% to 75% of the cost.