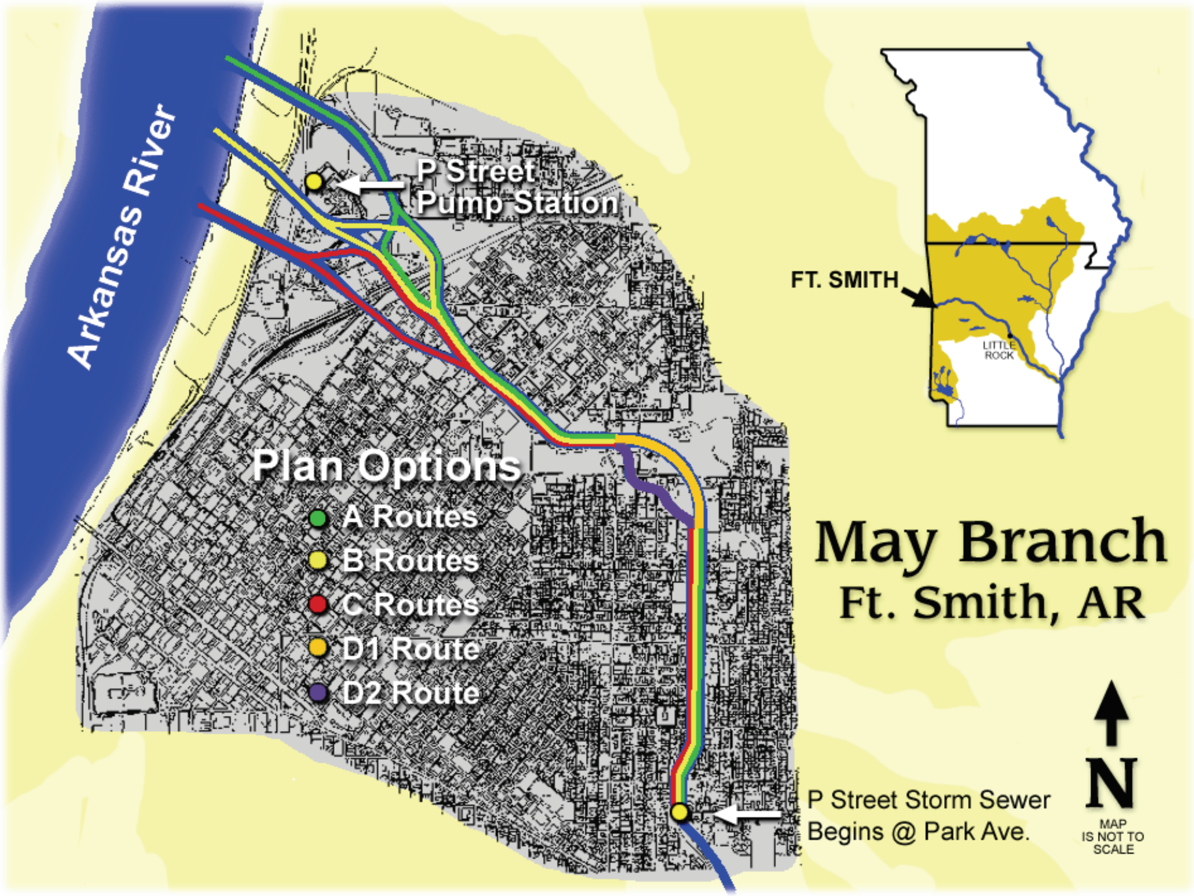
MAY BRANCH, FORT SMITH, ARKANSAS

US Army Corps
of Engineers

Little Rock District

FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT



SEPTEMBER 2006

May Branch,
Fort Smith, Arkansas
Draft Feasibility Report
And
Draft Environmental Assessment

Executive Summary

This combined feasibility report and environmental assessment evaluates and recommends to decision makers the channelization of May Branch to alleviate flooding problems. May Branch is a small tributary to the Arkansas River which lies entirely within the city limits of Fort Smith, in northwest Arkansas along the Oklahoma border. The study was conducted by Little Rock District, U. S. Army Corps of Engineers, and the City of Fort Smith, Arkansas, the non-Federal sponsor. The study complies with the Corps of Engineers and the Council of Environmental Quality requirements.

Project Purpose, Need, and Recommendation

The purpose of the feasibility study is to identify, evaluate, and recommend to decision makers a coordinated, implementable solution to the identified water resources problems and opportunities for May Branch in Fort Smith, Arkansas. It is recommended that improvements to May Branch for flood control with minor environmental restoration benefits be authorized for construction. The recommended plan is the Locally Preferred Plan (LPP). On October 27, 2005, the Assistant Secretary of the Army (Civil Works) granted an exception to allow full Federal participation in cost-sharing reaches 1 through 4 of the LPP and that reaches 5 and 6 will be constructed at 100-percent non-Federal expense.

Approximately 2.75 miles of the original channel of May Branch was covered and converted to an underground storm sewer tunnel in 1910. It extends from Park Avenue to the outfall at the Fort Smith Levee/Floodwall's P Street Pump Station located at North P Street and Clayton Expressway on the right bank of the Arkansas River. There is an evident need to reduce the incidence of flood damages along May Branch with additional channel capacity or some other type of flood reduction measures. This was know prior to the 1951 construction of the Fort Smith Levee/Floodwall with its four drainage structures and two pumping stations that is operated and maintained by the City of Fort Smith.

Flooding in the May Branch basin is flashy and of short duration. Runoff from the 5.3-square mile drainage area of May Branch often exceeds the capacity of the P Street storm sewer. Average annual flood damages amount to an estimated $1.5 million. Inadequately sized storm sewer inlets cause localized ponding problems, with this ponded water remaining in the streets until the storm sewer can accommodate the water. Several major streets cross the floodplain, and these streets are subject to flooding by the 100-year event. Runoff from a storm event with a recurrence interval of approximately ten years will exceed the storm sewer capacity. However, there are significant flood damages in the upper three reaches of May Branch with a 5-year recurrence interval.

Description of Affected Environment

Fort Smith is the county seat and largest city in Sebastian County in addition to being the second largest city in Arkansas. The Year 2000 census reported a population of approximately 80,268 persons. Economic and social opportunities in Fort Smith have attracted new residents for many years, including numerous ethnic minorities. Fort Smith has been a home to well-established Native American and African American communities since frontier days. More recent immigrants to the area have included refugees from Southeast Asia in 1975, refugees from Cuba in 1980-82, and Hispanic peoples from Mexico and Latin America who began arriving in numbers in about 1985.

The project area is 100 percent urbanized and has an extensive infrastructure associated with areas of high-density housing, low-density housing, commercial areas, and industrial areas. Several railroad tracks, serving the Missouri Pacific, Union Pacific, Arkansas-Missouri, Kansas City Southern, and Fort Smith railroads, are in current operation and traverse the project area. Most of the project area is located within a FEMA 100-year floodplain although there are only six acres of wetlands as regulated by the Corps under Section 404 of the Clean Water Act in the project area. Most wetlands that were present prior to development have been destroyed, reduced in size, or highly impacted.

Water samples have been analyzed for contaminants, which could have originated from area industries. Those analyses showed that suspected contamination exists locally. For the proposed route C1/D1, however, contamination is minimal. The Fort Smith area is in compliance with all EPA ambient air quality standards. Only ozone concentrations occasionally approach the limit of the standard. Noise includes locomotive traffic from the rail lines and vehicular traffic on the several major street arteries that cross the area.

The entire project area is a highly urbanized environment, and many parcels of land within the area are characterized by little or no maintenance and have vegetation cover dominated by weedy species. Less disturbed sites support vegetation cover dominated by woody species, many of which are introduced or weedy species.

The project area supports relatively minor wildlife populations. Species known from the area include Eastern cottontail, Virginia opossum, raccoon, striped skunk, and other small rodents. Beaver are known from impounded areas close to the Arkansas River. Eastern white-tailed deer frequent the woods along the levees, although the carrying capacity of those habitats is low. Fishery habitat is of very low quality in the lowermost portion of May Branch.

There are no federally listed threatened or endangered species having a potential for project impacts.

There are no prime farmlands within the project area.

No recorded archeological sites and no sites or properties currently listed on the National Register are known to occur within the proposed project corridor.

Discussion of 12 Alternative Alignments

A total of six downstream and two upstream alignments were developed, and comparative route costs were determined (individual route cost shown in parenthesis). The six downstream alternative alignments were A1 ($10,990,000), A2 ($10,950,000), B1 ($11,430,000), B2 ($10,290,000), C1 ($10,090,000), and C2 ($14,220,000). The two upstream alternative alignments were D1 ($2,520,000) and D2 ($2,680,000). The upstream and downstream alignments were combined to make 12 alternatives. All 12 alternatives were assumed to have the same flow capacity characteristics and channel bottom widths. Costs were estimated for those quantities that would be different for each alignment. All 12 alignments would result in reestablishment of a channel that would equally alleviate flooding problems and also provide some minor increase in environmental quality. All of these alignments have few environmental impacts, most of which are either minor or temporary over the no action alternative.

No Action Alternative

With implementation of the no active alternative, frequent flooding will continue to cause considerable damage along May Branch. Street intersections will continue to function as detention basins after curb and drop inlets have reached capacity, and excess runoff will flow between buildings and across low-lying terrain along North P Street. A storm event greater than a 10-year event will exceed the capacity of the storm sewer system, while the Fort Smith Levee/Floodwall system, together with the P Street pump station, will protect lower portions of the basin from high stages on the Arkansas River. When the pump station's capacity is exceeded by runoff, the excess can overflow the limited capacity of the sump area located in the vicinity of the City's sewage treatment facility.

Proposed Action Alternative

Route C1/D1 was selected as the preferred alternative alignment because it had the lowest cost, the least number of relocations, and the fewest environmental impacts. The C1/D1 alignment extends from the Arkansas River to Clayton Expressway through the Fort Smith Levee and then passes north and east to 13th Street by roughly paralleling North P Street. From 13th Street, it continues to the east along the north side of Martin Luther King Park, crossing May Avenue and continuing along the north side of the Arkhola plant until turning south. From that point, it crosses North O Street and continues southward along the existing storm sewer alignment to Park Avenue.

The Proposed Action Plan has a channel that would extend for 2.25 miles from the Arkansas River upstream to Grand Avenue. An extension of the channel would add 0.5 miles to Park Street. From O Street to the Fort Smith Levee, the channel would augment the flow capacity of the P Street Storm Sewer. There would be culverts at road and railroad crossings and a gated structure through the levee. The bottom width varies from

24 feet in the downstream portion to 4 feet for the upstream most 0.5 miles. The channel would be mainly trapezoidal with three horizontal to one vertical (3H:1V) side slopes. The slopes would be riprapped except for a vertical concrete wall behind the Arkhola plant and a 1,500-foot length downstream of Grand Avenue where the channel has a 2H:1V side slope and is concrete lined to avoid area buildings.

Finding of No Significant Impact (FONSI)

The FONSI for the May Branch project includes a consideration of the environmental effects disclosed in the Environmental Assessment (EA), and shows that the effects are not significant. The list of 10 criteria that must be evaluated in making a FONSI determination are provided below with a brief discussion of each as it relates to the May Branch project:

1. **The degree to which the action results in both beneficial and adverse effects. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.** The EA indicates that the Proposed Action would have beneficial effects such as reduction in flood damages and a minimal increase in environmental quality as compared to the No Action alternative that would have no impacts. Some impacts will result from project implementation, but these will be minor in intensity and construction related only. The Proposed Action will require a total of 15 building relocations, while the remaining 11 Alternative alignments combinations have building relocations ranging from 17 to 25.

2. **The degree to which the action affects public health or safety.** The Proposed Action will protect public health by alleviating flooding problems through construction of a channel. No adverse effects to public health or safety will result from the Proposed Action. Under existing conditions, no hazardous materials have been identified on the project site.

3. **The degree to which the action affects unique characteristics of the potentially affected area, such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.** No such unique characteristics or resources have been identified in the project area of the Proposed Action. Alternative Routes A1 and A2 would disturb up to 6 acres of wetlands. Alternative Routes B1, B2, C1, C2, D1, and D2 would disturb no acres of wetlands.

4. **The degree to which effects on the quality of the human environment are likely to be highly controversial.** The project will be highly beneficial to the general public; therefore, the Little Rock District, Corps of Engineers does not regard this activity as controversial, and the public response to the EA was favorable.

5. **The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.** The Proposed Action has a low degree of uncertainty involving the impacts of this action. Reestablishment of an open channel will result in short-term impacts related to construction, but the long-

term values include alleviation of flood damages and minimal improvement of biological processes within the channel.

6. **The degree to which the action may establish a precedent for future actions with significant impacts.** The action is highly unlikely to cause future actions with significant impacts. The flood plain is considered to be fully developed and open areas created with relocation of flooded properties preclude development not compatible as an open area.

7. **Whether the action is related to other actions with individually insignificant but cumulatively significant impacts.** The Proposed Action would not result in any cumulative impacts concerning any reasonably foreseeable action in the project area. Cumulative effects on disturbed soils and habitat related to construction activities under the Proposed Action are discussed in the EA.

8. **The degree to which the action may adversely affect items listed or eligible for listing in the National Register of Historic Places, or other significant scientific, cultural or historic resources.** No impacts would occur with the Proposed Action or any of the other Alternatives.

9. **The degree to which the action may adversely affect an endangered or threatened species or its critical habitat.** No endangered or threatened species or habitat for any listed species is located within the project area.

10. **Whether the action threatens a violation of Federal, State or local law or requirements imposed for the protection of the environment.** No such violations will occur. Permits from other jurisdictional agencies such as NPDES permits from the Arkansas Department of Environmental Quality are necessary and will be obtained prior to any construction activities. Continued coordination with regulatory agencies will be ongoing to ensure compliance with all Federal, State, regional, and local regulations and guidelines

Project Cost and Economic Justification

The LPP, reaches 1 through 4, has an estimated cost of $25,403,000 and the reaches 5 & 6 channel extension is estimated to cost $5,082,200, which is a total non-Federal cost. The estimated annual OMRR&R cost is $55,500. The Federal portion of the estimated cost is $14,831,300 and the estimated cost to the city of Fort Smith, Arkansas, the non-Federal sponsor, is $15,653,900 for a total project cost of $30,485,200 at an October 2005 price level.

The LPP meets the needs of the local community. At little extra cost ($1,410, 600) over the National Economic Development (NED) plan (NED cost, $19,725,800), the LPP plan provides greater flood reduction benefits and removes the maximum number of structures out of the 100-yr floodplain, (127 structures versus the 87 structures for the NED plan). The LPP is economically justified without significant adverse impact to the environment. It has a benefit to cost ratio of 1.09 to 1 at a 5.125% interest rate, $115,500 in excess benefits over costs with average annual benefits of $1,468,100 and average annual costs of $1,352,600.

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STUDY INFORMATION

STUDY AUTHORITY

By letter dated October 12, 1992, the City of Fort Smith requested a General Investigation by the Little Rock District Corps of Engineers to study the flood problems along May Branch. A copy of the request is included in Appendix A, Section A.

The May Branch, Fort Smith, Arkansas, Feasibility Study was authorized by a March 11, 1982, resolution of the Committee on Public Works and Transportation of the United States House of Representatives. The resolution, which was sponsored by Arkansas Congressman John Paul Hammerschmidt, reads as follows:

> *RESOLVED BY THE COMMITTEE ON PUBLIC WORKS AND TRANSPORTATION OF THE HOUSE OF REPRESENTATIVES, UNITED STATES, that the Board of Engineers for Rivers and Harbors, established by Section 3 of the River and Harbor Act approved June 13, 1902, is hereby requested to review in cooperation with the States of Arkansas and Oklahoma, political subdivisions, agencies and instrumentalities thereof, and appropriated Federal agencies as a shared effort, the report of the Chief of Engineers on the Arkansas River and tributaries, published as House Document No. 308, seventy-fourth Congress, and other pertinent reports, with a view to determining whether any modification of the recommendations contained therein are advisable at this time, with particular reference to developing an implementable plan for storage, conservation, treatment, and conveyance of water in the Arkansas River and tributaries in Arkansas and Oklahoma, for municipal, industrial, and agricultural uses and other purposes. This study should include an assessment of the usability of the water for various uses.*

PURPOSE AND SCOPE

The purpose of the feasibility study is to identify, evaluate and recommend to decision makers an appropriate, coordinated, implementable solution to the identified water resources problems and opportunities along May Branch in Fort Smith, Arkansas. The feasibility report presents the results of the reconnaissance and the feasibility study phases.

PROJECT AREA DESCRIPTION

Project Location

May Branch is a small tributary to the Arkansas River which lies entirely within the city limits of Fort Smith, Sebastian County, Arkansas, in northwest Arkansas along the Oklahoma border. May Branch originates in the south central section of the city just south of Rogers Avenue (Arkansas Highway 22) in Creekmore Park and flows to the north and northwest to the Arkansas River. All of the original channel of May Branch from Park Avenue to the outfall at the Fort Smith Levee/Floodwall's P Street Pump Station located at North P Street and Clayton Expressway was covered and replaced by a 2.7 mile-long underground culvert system in 1910. Moreover, the channel upstream from Park Avenue has been altered by channel relocation due to railroad construction and subsequent channelization related to drainage and flood control. There is nothing left along the original course of May Branch which could be construed as "natural." The vicinity map and study area is shown on Plate 1.

The project corridor is a highly urbanized environment. In the vicinity of Park Avenue, the underground May Branch system known as the P Street Storm Sewer passes through residential neighborhoods. As one goes further downstream, the project area enters an area consisting of both residential and small business properties. At approximately Midland Avenue, there are small business and light industrial properties. The corridor crosses three mainline railroad tracks into an industrial area where the City's sewage treatment facility is located. The storm sewer ends at the P Street pumping station after passing through a weir under the P Street Bridge. The weir allows overflows to be stored in this area until the water can be emptied through the levee into the open drainage channel outlet, which goes under Clayton Expressway west into the Arkansas River.

Climate

The Fort Smith climate is humid with variable temperatures that average 61^{O}F annually. Summers are moderately long and hot with maximum temperatures occasionally exceeding 100^{0}F. Winters are short and moderately cold. The average annual precipitation for the area is approximately 48 inches. Precipitation is distributed throughout the year, with heavier amounts occurring in the spring and lesser amounts occurring in the summer. However, high intensity rainfall causing flash floods may be experienced in any month of the year. Snowfall is light with the area receiving about 5 inches annually.

HISTORY OF THE STUDY

The Definite Project Report, dated October 1945, for the Fort Smith Levee, Floodwall and Pump Stations, noted that May Branch would flood during high intensity floods upstream of the railroad embankments and that development could aggravate the flooding. Additional studies followed. In May 1992 a Section 205, Small Flood Control Project Reconnaissance Study was completed. The City of Fort Smith, Arkansas, the non-Federal sponsor, requested that the feasibility be a general investigation study. The Section 205 report was incorporated into the Arkansas River Wetlands and Flood Control Reconnaissance Report as the flood control portion of the report. The May Branch portion of the reconnaissance report was certified in August 1993. The report recommended Federal participation in a cost shared feasibility study with the City of Fort Smith, Arkansas. At that time, the city was not prepared to enter into a Feasibility Cost Sharing Agreement (FCSA).

In August 1995, FCSA negotiations resumed. However, on April 21, 1996, a devastating tornado struck Fort Smith and the lower end of May Branch. The city committed its resources to tornado repair and not until November 13, 1998, was the FCSA signed to start the feasibility study.

NON-FEDERAL SPONSOR AND AGENCY COORDINATION

The Non-Federal sponsor is the City of Fort Smith, Arkansas. This report was prepared in coordination with the following agencies and the railroads.

Natural Resources Conservation Service. Coordination with this agency was conducted by telephone on November 23, 1999. The agency has provided oral information relevant to the preparation of the Environmental Assessment (EA), i.e., the project will have no impacts on prime farmland. The agency’s regulations specify that any prime farmland, which a state or local government has designated through zoning or planning for commercial, industrial, or residential use, i.e., “committed to urban development,” is outside the agency’s definition of prime farmland (Federal Register, Volume 49 No. 130, p. 27717).

Arkansas Natural Heritage Commission. Coordination with this agency was conducted by letter dated July 28, 1999. Appendix A, Section A, provides a letter from ANHC, dated August 12, 1999, in which the agency indicates the absence of element occurrences within the project area. Examination of the ANHC Annual Report for 2004 has shown that there have been no additional plant and animal species added to the list for tracking in Sebastian County since 1999.

State Historic Preservation Office. Coordination with this agency was conducted by letter dated July 28, 1999. The agency provided confirmation that no known cultural resources would be impacted by the project.

US Fish and Wildlife Service. The Fish and Wildlife Coordination Report is included in Appendix A, Section D. The report indicates minimal impacts on wildlife and other biota from the construction of the proposed project and that reconstructing of the open channel will provide minimal aquatic habitat improvement. Appendix A, Section A, provides a letter from US Fish and Wildlife Service (USFWS), dated August 3, 1999, in which USFWS indicates there are no federally listed threatened and endangered species having a potential for impacts within the project area. Appendix A, Section A, also includes a 2004 response from USFWS with the same finding.

Arkansas Game and Fish Commission. This agency provided a letter dated February 27, 2006, to assist the US Fish and Wildlife Service in its preparation of the Fish and Wildlife Coordination Act Report. See Appendix A, Section D.

Arkansas Department of Environmental Quality (ADEQ). A manual search of agency records was conducted in 1999 and the information obtained was used in preparation of the environmental assessment. Further coordination was done in the conduct of the Hazardous, Toxic, and Radiological Waste (HTRW) investigations. ADEQ reviewed the HTRW investigations and provided a letter dated June 18, 2004. An analysis of water samples showed that contamination for the proposed route C1/D1 is minimal, and in the June 18, 2004 letter, the ADEQ did not object to the project. See the HTRW attachment to the Engineering Appendix (Appendix C).

Railroads. Arkansas-Missouri, Kansas City Southern, Fort Smith Railroad, and Union Pacific were contacted concerning the channel alignment concerning railroad crossings and right of way. The railroad by letter dated October 10, 2002, stated that its fee-owned acres were available for purchase and that it could offer a Disclaimer for its “easement” only property. See the Engineering Appendix and the Real Estate Supplement for further discussion.

PRIOR PROJECTS AND REPORTS

The following is a partial list of the previous studies, reports and projects in the vicinity of May Branch in the Fort Smith area.

- Arkansas River Wetlands and Flood Control Reconnaissance Report dated October 1992. The flood control portion the report was certified 2 August 1993 with the feasibility to proceed under May Branch, Fort Smith, Arkansas.

- Flood Insurance Study, Fort Smith, Arkansas, dated July 1991.

- Survey Report, Arkansas River in the vicinity of Fort Smith-Van Buren, Arkansas, dated March 1987.

- Detailed Project Report, Mill Creek. Fort Smith, Arkansas, Small Flood Control Project (Section 205), dated June 1985. Construction of this channel and bridge-widening project was completed in 2003.

- Detailed Project Report, Little Massard Creek, Fort Smith, Arkansas. Small Flood Control Project (Section 205) dated June 1983. Operation and maintenance of this channel and bridge-widening project was assumed by the city of Fort Smith in 1984.

- Stage 1, Reconnaissance Report for the Fort Smith-Van Buren General Investigations Study, dated September 1983. Some of the flood problems identified in this study were addressed under the Continuing Authorities Program.

- Engineering Study, Drainage Facilities – "P" Street Combined Sewer. Fort Smith. Arkansas, Mickle Associates, dated August 1970.

- Fort Smith Levee and Floodwall. This Federally constructed local flood protection project consists of an earth-fill levee, concrete floodwall, four drainage structures and two pumping stations (including the P Street station) on the right bank of the Arkansas River at Fort Smith. The project was completed in 1951 and is operated and maintained by the city of Fort Smith.

PLANNING PROCESS AND REPORT ORGANIZATION

The feasibility study process used a systematic approach to the preparation and evaluation of alternative plans to address study area problems and opportunities. This provides a sound and documented basis for decision makers to judge the recommended solutions. The process involved all of the six functional planning steps:

(1) Specification of water and related land resources problems and opportunities;
(2) Inventory, forecast and analysis of water and related land resources conditions within the study area;
(3) Formulation of alternative plans;
(4) Evaluation of the effects of the alternative plans;
(5) Comparison of the alternative plans; and
(6) Selection of the recommended plan.

The Reconnaissance Report emphasized the identification of the water resource problems and the formulation of alternatives to determine if there was a solution that warranted Federal participation in feasibility studies. The emphasis of this Feasibility Report is on the evaluation of alternatives, assessment of impacts, and selection of a recommended plan. The goal of the feasibility study is to identify the plan that reasonably maximizes net economic benefits and to recommend for construction the plan that best meets the community goals of economic development, protecting and restoring the environmental, the well being of the people, the prevention of loss of life, and the preservation of cultural values.

The following are some of the issues that are addressed in the feasibility study and environmental analysis in consultation with state and Federal resource agencies and the public.

PROBLEMS AND OPPORTUNITIES

OVERVIEW

The problems in the May Branch Basin are:

1) Flood damages to industry, businesses and residences, and
2) Loss of aquatic habitat.

FLOOD DAMAGE REDUCTION

Typically, for small basins like the May Branch basin, flooding is of a flashy, short duration nature. Runoff from the 5.3-square mile drainage area of May Branch frequently exceeds the capacity of the P Street storm sewer, which is the major drainage outlet for the May Branch basin, and causes an estimated $1.5 million in average annual flood damages. The estimated value of the 136 structures ($13.2 million) and their contents in the 500-year floodplain is $44.2 million. The value of the 106 (127) structures in the 10-year (100-year) floodplain is $5.4 million ($9.2 million). Inadequately sized storm sewer inlets cause localized ponding problems**.** This ponded water remains in the streets until the storm sewer can pass the water. Several major thoroughfares transverse the floodplain including Midland Blvd.(Average Daily Traffic, ADT, in 2000 of 9,700), O Street (ADT-10,300), and Grand Avenue (ADT-17,000) that are subject to flooding by the 100-year event.

On April 24, 2004, a 13-year old boy slipped into one of P Street Storm Sewer's side drains during a heavy rain. He was swept through the dark tunnel for about 1.5 miles until he escaped with minor injuries at the weir at the P Street Bridge. There is an opportunity to open up the channel to allow for rescue of persons falling into the drainage system.

Runoff in excess of the sewer capacity flows overland and along the streets following the general alignment of the P Street Storm Sewer. At the point where the storm sewer intersects with the three main line railroad tracks, the runoff ponds up until it overtops the railroad embankment. The floodwaters then pond behind the Fort Smith Levee until evacuated through the levee outlet into the Arkansas River. Flow at the outlet is normally by gravity flow; however, when the river is high, the pumps are activated.

It has been determined that the runoff from a storm event with a recurrence interval of approximately ten years will exceed the storm sewer capacity. However, there are significant flood damages in the upper three reaches of May Branch with a 5-year recurrence interval. A major flood event occurred in spring 1990. At that time, the Arkansas River experienced high flows and the P Street gravity outlet on May Branch was closed. Pumping and the P Street storm sewer could not handle the flow. The heavy rainfall resulted in flooding that caused major property damage. An estimated $2.5 million in damages occurred to 26 businesses and 44 residential units. An estimated 180 people reside within the 500-year flood plain. The opportunity exists to improve the social well being of those who live and work in the flood-prone area along May Branch by alleviating the flood damages to the homes, businesses, and infrastructure.

ECOSYSTEM RESTORATION

Tunneling the lower two thirds of the May Branch channel into the P Street storm sewer around 1910 reduced to virtually nonexistent, the aquatic habitat existing along May Branch when it was an open channel. The opportunity exists to reconstruct the May Branch channel, which would restore some minor aquatic habitat.

OBJECTIVES, CONSTRAINTS AND CRITERIA

NATIONAL OBJECTIVES

The Federal objective of water and related resources planning is to contribute to national economic development (NED) consistent with protecting the Nation's environment, in accordance with national environmental statutes and applicable executive orders and law. Planning objectives are more specific in terms of expected or desired outputs. Water resources project plans have the National goal to alleviate problems and take advantage of opportunities to increase the net value of the National output of goods and services, expressed in monetary units that accrue in the planning area and the rest of the Nation. Protection of the Nation's environment is achieved when damage to the environment is eliminated or avoided and important cultural and natural aspects of our nation's heritage are preserved. Further, the objective in National Ecosystem Restoration planning is to increase the net quantity and/or quality of desired ecosystem resources and expressed quantitatively for the planning area and in the rest of the Nation.

PLANNING OBJECTIVES AND CONSTRAINTS

The planning objectives for this study are to develop a flood protection project to alleviate the flooding along May Branch. The National Economic Development plan is to be defined while preserving the environment and promoting the well-being of the people. The project's baseline cost estimate and schedule will be established. Previous studies analysis eliminated several alternative plans. Thus, the focus of this study is to determine the location, length, and width of a channel plan; and determine whether additional pump capacity is justified. The City of Fort Smith chooses not to add ecological restoration or recreation features to the project.

Objectives

a. Reduce flood damages in the May Branch Basin over the period of analysis.
b. Increase aquatic habitat along May Branch.
c. Reduce flood related transportation interruptions

Constraints

a. Maintain the flood protection provided by the Fort Smith Levee and P Street Pump Station.

b. Avoid potential contamination sites.
c. Minimize structure and infrastructure relocations
d. Adhere to the open space criteria for flood reduction measures on lands acquired under Federal Emergency Management Agency's (FEMA) Hazard Mitigation Grant Program.
e. Limit flood damage reduction solutions with full Federal participation to downstream of the point where the 10 percent discharge is greater than 800 cubic feet per second.
f. Avoid disturbance to wetlands.
g. Do not permanently interrupt railroad spur service to the Kansas City Southern track immediately east of the Fort Smith Levee/Floodwall.

PUBLIC CONCERNS

The public is concerned with flooding of buildings and vehicles, traffic interruptions, and safety.

CRITERIA

The work shall include determination of improved conditions; addressing and resolving any problems of induced damages and discharges; determining frequency-discharge relationships for with and without project conditions and stage-discharge relationships for with and without project conditions; preparing construction and operation and maintenance cost estimates for the alternative plans; computing engineering and economic feasibility of each alternative; assessing environmental and social impacts of alternatives and the selected plan, including impacts on biological resources, socioeconomic resources, cultural resources, and recreation; determining and evaluating mitigation measures; providing a real estate supplement and a gross appraisal report; developing land use and flood control economic studies; advising Fort Smith of its responsibilities under the project cooperation agreement, preparation of a floodplain management plan, HTRW (hazardous, toxic, and radioactive waste) investigations, the preliminary development of a financing plan and assessment of financial capability, and preparing the required documentation to present the studies, findings, and recommendations.

TECHNICAL CRITERIA

Comparative studies, field investigations, design, and screening level cost estimates shall be in sufficient detail to substantiate the recommended plan and the baseline estimate.

ECONOMIC CRITERIA

Annual damages were computed for both the without project condition and the with alternative flood reduction plans. The existing condition damages excluded damages to structures removed from the floodplain under the FEMA Hazard Mitigation Grant

Program. Annual benefits were computed and compared with total annual costs to identify an economically feasible plan that would alleviate flooding in the study area.

ENVIRONMENTAL CRITERIA

The Environmental Assessment is to comply with applicable laws, federal statutes, executive orders and memoranda.

PLAN FORMULATION

Plans were formulated to achieve the objectives while avoiding the constraints. The plans were weighed and compared to determine their relative efficiency in providing the desired water management improvement objectives.

MANAGEMENT MEASURES

Measures to Address Identified Planning Objectives

a. Non-Structural – Relocation of structures out of the flood plain
b. Structural - Detention ponds, channel reconstruction, place box culverts/covered channel sections or bridges at road and railroad crossings, pump stations, tunnel construction.
c. No Action

No Action Plan

The No-Action/No Build Alternative maintains existing conditions as the future without project condition. The May Branch basin is considered 100 percent urbanized; thus, there is little opportunity for development and no increases in runoff rates are anticipated. Frequent flooding will continue to cause appreciable damage along May Branch. Conveyance systems in the lower two-thirds of the basin consist of curbs, gutters, and storm sewers that provide very limited aquatic habitat. The P Street storm sewer would serve as the major outlet for the May Branch basin. Street intersections would act as detention basins after curb and drop inlets have reached capacity, and excess runoff would flow between buildings and across low-lying lands along North P Street. Runoff following a storm event having a 10 percent chance of occurring in any given year would exceed the capacity of the storm sewer system.

The Fort Smith Levee/Floodwall with the P Street pump station would protect lower portions of the basin from high stages on the Arkansas River. The North P Street storm sewer terminates at the P Street pump station, which has a design capacity for the five-pump system of 400 cfs. The design of the pump station does not allow for gravity free flow and pump discharge simultaneously. If runoff exceeds the combined capacity of the pumps, the excess would flow into the sump area.

The sump area is located between the pump station and the railroad tracks on 4th Street (See Plate 1). The sump area is in proximity to the lower meanders of the original May Branch channel. The storm sewer surfaces in the sump and is connected by an overflow weir approximately 1,000 ft upstream of the pump station. The sump area has a limited capacity to store the May Branch runoff until the Arkansas River recedes or until the pump station can evacuate the ponded waters. The volume of storage in this area is limited in comparison to the potential volume of runoff from the drainage area.

There were two significant changes in the hydrology and hydraulics analysis since the reconnaissance study. First, the feasibility study did a forced flow analysis through the P Street Storm Drain, which increased the previously considered capacity of the drain from a 2-year event to a 10-year event. Second, the feasibility study included a detailed analysis of the coincident flooding between the Arkansas River and May Branch. The reconnaissance phase assumed a conservative estimation that the 50-, 100-, and 500-year storms would occur coincident with a 10-year recurrence Arkansas River flow. The detailed coincident flooding analysis resulted in a 5-foot drop in the computed 100-yr flood elevation in the ponding area between the railroad tracks and the levee. Because of these changes, damages were much lower than previous estimates. The coincident flooding of May Branch and the Arkansas River is discussed in the Hydrology and Hydraulics attachment to the Engineering Appendix.

The future without project condition has 72 homes and 64 businesses and industry valued at $44.2 million subject to flooding in the 500-year floodplain. (The Economic Appendix has further details on existing condition damages.) To limit flood damages to no more than the estimated existing annual damages of $1.5 million, Fort Smith would continue to operate and maintain the P Street pump station. It would also rehabilitate and maintain the P Street storm sewer to preserve its capability to contain up to the 10-year flood event. Benefits from all the plans are compared against the future without project condition plan.

PRELIMINARY PLANS

Three plans were investigated during the reconnaissance study: detention ponds, parallel storm sewer, and relief openings through the levee and railroad tracks with a connecting channel. The overwhelming problems identified in the reconnaissance study were the inability of runoff to pass beyond the railroad embankments near 4th and P streets and the limited capacity of the 12-foot diameter outlet through the levee. Following is a discussion of the three alternatives developed in the reconnaissance study plus two additional alternatives considered:

(1) Detention basins - This plan consisted of two detention basins. One would be located near the intersection of North 32nd and L Streets (the Tiles drain inlet area) and the other at North 21st and O Streets (Martin Luther King Park). See Plates 2A through 2D for street locations. (The aerial photo is dated January 2000; some of the buildings shown no longer exist.) These basins would provide a total storage of 311 acre-feet. The flood protection offered by these detention basins was found to be negligible. No cost estimate

was developed as further analysis was deemed unwarranted. No other acceptable location for a detention pond was identified that would provide significant flood retention.

(2) Relief openings - This plan consists of the construction of three 6-foot diameter culverts through the three railroad embankments at river mile 0.672 and the placement of an additional gated outlet structure in the levee in the downstream reach. These openings would be connected with a 50-foot bottom width channel. The culverts were designed to alleviate the flooding caused by the runoff in excess of the storm sewer capacity backing into the surrounding area. The levee outlet increases the flow capacity at the levee and reduces ponding landward of the levee. This plan had a first cost of $2,011,000 (November 1991 price level) and a benefit-to-cost ratio of 16.

The relief openings plan reduced total damages by only 51%, as the upstream three reaches had little to no reduction in damages. The existing condition damages were estimated to be $5,900,000 and the damages reduced were estimated to be $3,000,000 based on the hydraulic analysis used in the reconnaissance phase. Current analysis resulted in costs exceeding the benefits. This eliminated the alternative for further consideration as a stand-alone plan. However, this plan’s features were used as a basis for developing the channel plans formulated during the feasibility study.

(3) Parallel storm sewer - The 1970 Mickle Associates study investigated parallel storm sewers starting at North 18 and O Streets and extending to the P Street pump station. They investigated a double 11-foot by 12-foot 6-inch reinforced concrete box with a capacity of 3,900 cubic feet per second at a cost of $4,025,000 (1970 price level). A parallel storm sewer would have the same excavation costs, footprint, and relocation considerations as an open channel but it would also require structural concrete to form the covered channel. This plan would be more costly than an open riprapped channel and with no additional flood damage reduction benefits. Thus, no cost estimate was made and the plan was not investigated further.

(4) Nonstructural plans – Conditions changed from the reconnaissance to the feasibility phase. In 1996, a tornado destroyed businesses that were not reconstructed in the downstream portion of May Branch. As a result of the disaster caused by the tornado, FEMA provided Flood Hazard Reduction Grants to remove properties voluntarily out of the May Branch 100-yr flood plain. Nineteen property owners accepted offers by the city of Fort Smith to relocate. Thus, the acceptable nonstructural relocation measure has already been accomplished. Note that the relocated structures were excluded from the damageable property inventory. This lowered the existing condition damages from those calculated during the reconnaissance study.

Because of insufficient flood warning times, effective flood-proofing measures could not be implemented before flood damages would occur. Typically, for small basins like the May Branch basin, flooding is flashy and of short duration. Because of the short time interval before floodwaters peak, sufficiently advanced flood warnings could not be provided. Sufficient warning time is needed to implement effective measures to reduce flood damages. In addition, traffic at risk could originate outside the basin and not be aware of any warning. The only practical warning would be signage at each road crossing warning of the danger when the crossing is underwater.

(5) Additional Pump Capacity – The changed hydrology and hydraulics analysis for the feasibility phase negated the need for additional pump capacity. See the Hydrology and Hydraulics attachment to the Engineering Appendix for further details.

CHANNEL ALIGNMENT ALTERNATIVES

Following the screening of the five preliminary plans, the flood damage reduction measure to be further developed and analyzed was reconstruction of the May Branch channel with openings through the railroad tracks and levee and street crossings provided. Channelization was considered upstream to Park Street where the May Branch channel flows into the P Street storm drain. Six downstream alignments were developed with another two upstream alignment choices (route cost), D1 ($2,520,000) and D2 ($2,680,000). See Plate 1 for these alignments. These alignments were all assumed to have the same flow capacity characteristics and a channel bottom width of 35 feet. Channel quantities, land acres, (to include mitigation acres) and utilities, roads, bridges, culverts, and building relocations were cost estimated. Costs were estimated for those quantities that would be different for each alignment, i.e., quantities and costs that would be the same for each route were not estimated. Six alignments (route cost) were developed, A1 ($10,990,000), A2 ($10, 950,000), B1 ($11,430,000), B2 ($10,290,000), C1 ($10,090,000), and C2 ($14, 220,000). Their descriptions follow.

Three major construction alternatives (Alternative A, B, and C) with two variations for each were developed for the construction corridor, which extends from the Arkansas River to Park Street. See Plate 1. The limit of Federal interest is just upstream of Grand Avenue where the 10-year flow equals 800 cfs. Each of these three alternatives would extend eastward from the east bank of the Arkansas River, crossing Clayton Expressway and the Fort Smith levee generally along P Street until turning south at O Street to Grand Avenue, the limit of Federal interest to end at Park Street.

At a point near 17th and Kelly Highway, Alternative A diverges into two separate alignments, A1 and A2. Alternative B diverges into B1 and B2 at a point near the southeast corner of the sewage treatment facility. The A1 and B1 alternative paths merge near 17th Street and Kelley Highway and continue east to the vicinity of North 6th and Division streets, where the combined A1/B1 alignment merges with the combined A2/B2 alignment. Following their merger, the alignment of combined A1/B1 and A2/B2 continues east to the vicinity of 9th and North P Streets.

Alternative C2 follows a path from the Arkansas River to the vicinity of 9th and North P Street, where it too follows the same alignment as A1/B1 and A2/B2. Alternative C1 splits from C2 east of the first railroad spur going northeast to tie into A2/B2 alignment. The common alignment continues east from near 9th and North P Street to the vicinity of Greenwood and Short P Streets, where the D1 and D2 alternative alignments diverge. The D1 and D2 alternative alignments merge at 31st and M Streets, and from that point, each of the three major alternatives follows a common route south to Park Avenue. The D1 alternative places the alignment on the north side of the Arkhola facility, while the D2 alternative follows a course on the south side of the Arkhola facility. See Plate 1.

Alternative A1/A2. Alternative A is the northernmost alternative. This alternative extends from the Arkansas River to Clayton Expressway and thence east to a location just to the southwest of Kelly Highway. Alternative alignments referred to as A1 and A2 diverge at this location. From the point located southwest of Kelly Highway, A1 follows an alignment on the north side of a feed processing plant and continues to the east to 7th Street. Alternative A2 follows an alignment on the south side of the feed processing plant, crosses Ballman Road at a location just north of North P Street, and continues east to 7th Street, where the alternatives again coincide. The combined A1/A2 alignment roughly parallels North P Street and follows a path to 13th Street, where it continues to the east along the north side of Martin Luther King Park.

Just east of Greenwood Road, Alternative A diverges into the D1 and D2 alternative alignments. The D1 alternative follows the existing May Branch channel alignment, which crosses May Avenue and continues a path along the north side of the Arkhola plant, where it turns south, crosses North O Street, and continues a southeasterly path to approximately 31st and North M Streets. The D2 alternative follows an alignment on the south side of the Arkhola plant, diverging from D1 at a location between Greenwood Avenue and May Street and merging with D1 at a location near 31st and North M Streets. From 31st and North M Streets, all alternatives follow the existing storm sewer alignment to Park Avenue.

Alternative B1/B2. Alternative B is a construction alternative that occupies a middle position, flanked on the north by Alternative A and on the south by Alternative C. Alternative B closely follows much of the existing alignment of the May Branch storm sewer system. Alternative B crosses Clayton Expressway at a point just south of the sewage treatment plant and follows North P Street to the east. Near the southeast corner of the treatment plant, Alternative B1 veers to the north. Just short of Kelly Highway, it turns back to the south toward the 7th Street crossing. Alternative alignment B2 roughly parallels North P Street to 7th Street, where the B1 and B2 alternatives converge. The combined B1/B2 alternative then parallels North P Street to 13th Street, where it continues to the east along the north side of Martin Luther King Park. The combined B1/B2 alternative alignment continues east to Greenwood Avenue, where it diverges into the D1 and D2 alternatives. The D1 and D2 alternatives merge at the vicinity of 31st and North M Streets, and from that location, the B alternative continues to Park Avenue.

Alternative C1/C2. Alternative C2 is the southernmost of the three construction alternatives. This alternative crosses Clayton Expressway and Ballman Road through the railroad yards on an alignment to the south of Alternatives A and B. From a location at approximately 7th and North P Streets, Alternative C2 follows an identical route to Alternatives A and B. Alternative C1 splits from C2 east of the first railroad spur going northeast to tie into A2/B2 alignment just upstream of the overflow weir at P Street.

Alternative D1/D2. Alternative D consists of two alternative alignments, D1 and D2. The D Alternative is located just east of Greenwood Road, where Alternative A diverges into the D1 and D2 alternative alignments. The D1 alternative follows the existing May Branch channel alignment, which crosses May Avenue and continues a path along the north side of the Arkhola facility, where D1 turns south, crosses North O Street, and continues a southeasterly path to the vicinity of North 31st and M Streets. The D2 Alternative follows an alignment on the south side of the Arkhola plant, diverging from D1 at a location between Greenwood Avenue and May Street and merging with D1 at a location near North 31st and M Streets. See Plate 1.

Comparison of Alternatives

Each of the 12 alignment alternatives will require business and residence relocations, as follows:

- A alternatives will require 3 to 8 business and 9 residence relocations.
- B Alternatives will require 3 to 9 business and 9 residence relocations.
- C Alternatives will require 2 to 8 business and 4 to 9 residence relocations.

Each of these three alternatives would be combined with the D Alternatives to form the 12 alignment alternatives. See Table 9, Structures Potentially Affected by the Project.

A total of approximately 6 acres of wetlands were found within the overall project area; Alternative A provides the greatest wetland impacts and Alternative C provides the least wetland impacts with no acres impacted. The presence of hazardous and toxic substance sites has been identified within each of the alternative routes.

- Impacts to fish and wildlife resources would be minimal.
- Project implementation would eliminate recurrent flooding from the project area.
- With the elimination of the continued potential for flood damage, redevelopment of properties within the project area should occur.

Environmental Quality (EQ)

The environmental quality account is another means of evaluating the alternatives to assist in making a plan recommendation. The EQ account is intended to display the long-term effects that the alternative plans may have on significant environmental resources. The Water Resources Council defines significant environmental resources as those components of the ecological, cultural and aesthetic environments, which, if affected by the alternative plans, could have a material bearing on the decision-making process. A comparison of the effects that the proposed plans may have on the EQ resources is shown on Table 1. The Environmental Quality comparisons were done for the alternative route plans of A, B, C, and D. The subsequently formulated plans were an optimization to judge the plan's effectiveness and efficiency.

Other Social Effects (OSE)

The other social effects (OSE) account typically includes long-term community impacts in the areas of public facilities and services, recreational opportunities, transportation and traffic, man-made, and natural resources. Plans A, B, C, and D, would have very similar social effects over the no action plan. The reduced flooding would improve public health and safety. People could more easily escape from the floodwaters. Threat of flooding the sewage treatment plant is reduced. The project corridor would increase open space. The major streets and railroads would not be flooded as frequently reducing traffic interruption. Not every street would continue across the channel; thus increasing distance traveled slightly. These plans would increase aquatic habitat with the reconstruction of an open channel.

Formulation Criteria

(1) Completeness – Alignment plans A, B, and C would equally account for all necessary implementation actions.

(2) Effectiveness – Alignment plans A, B, and C would equally alleviate the flooding and environmental restoration problems.

(3) Efficiency – The alignment plan C1/D1 is the most cost effective.

(4) Acceptability – Alignment C1/D1 is also the most workable for the city of Fort Smith as it has the fewest adverse environmental effects, the fewest property relocations, and costs the least.

TABLE 1, ENVIRONMENTAL COMPARISONS OF ALTERNATIVES

Resource Area	No Build Alternative	A Alternatives	B Alternatives	C Alternatives	D Alternatives
Land Use	No impacts	Greatest impacts to wetlands	Minor impacts to wetlands	No impacts to wetlands	No impacts to wetlands
Water Resources	No Impacts	Temporary increase in turbidity due to construction	Temporary increase in turbidity due to construction	Temporary increase in turbidity due to construction	Temporary increase in turbidity due to construction
Biological Resources	No impacts	Minor vegetation cover losses	Minor vegetation cover losses	Minor vegetation cover losses	Minor vegetation cover losses
Hazardous Toxic and Radioactive Waste (HTRW)	No impacts	Potential for encountering HTRW substances during construction	Potential for encountering HTRW substances during construction	Potential for encountering HTRW substances during construction	Low potential for encountering HTRW substances during construction
Air Quality	No impacts	Construction related increase in dust and emissions from vehicles	Construction related increase in dust and emissions from vehicles	Construction related increase in dust and emissions from vehicles	Construction related increase in dust and emissions from vehicles
Noise	No impacts	Construction related increase in noise	Construction related increase in noise	Construction related increase in noise	Construction related increase in noise
Cultural Resources	No impacts	No impacts	No impacts	No impacts	No impacts
Socioeconomic	No impacts	Construction related temporary benefit to local community, long-term beneficial impact from reduced flooding, and minor potential for additional development.	Construction related temporary benefit to local community, long-term beneficial impact from reduced flooding, and minor potential for additional development.	Construction related temporary benefit to local community, long-term beneficial impact from reduced flooding, and minor potential for additional development.	Construction related temporary benefit to local community, long-term beneficial impact from reduced flooding, and minor potential for additional development.
Recreation	No impacts	No impacts	No impacts	No impacts	No impacts
Aesthetics	No impacts	Construction related short-term adverse impacts to visual aesthetics	Construction related short-term adverse impacts to visual aesthetics	Construction related short-term adverse impacts to visual aesthetics	Construction related short-term adverse impacts to visual aesthetics

Alignment Tradeoffs

The plan alignments have few environmental impacts with most being either minor or temporary over the no build alternative. The NED objective of reducing flood damages is met with the reestablishment of a channel that also would provide some minor increase in environmental quality. Alignment C1 at the lowest differential cost of $10,090,000 and alignment D1 at a lowest differential cost of $2,520,000 were combined to make the chosen alignment. Route C1/D1 had the lowest cost, the least number of relocations, and the fewest environmental impacts to make it the chosen route.

OPTIMIZATION AND INCREMENTAL ANALYSIS

To optimize the alternatives for the C1/D1 alignment, three channel plans were formulated; the 10-yr, 50-yr, and 100-yr plan such that generally the start of damage flooding would not occur until the named event was surpassed. All three of the plans had a gated structure at the levee with 3-10x10-foot culverts and extended upstream to Grand Avenue with a channel bottom width of 4 feet at the upstream limit. To accommodate the side drain inflow, the channel bottom elevation maintained the P Street Storm culvert elevations for all three of the plans. At Grand Avenue, the channel is about 9-feet deep; at O Street, it is 14 feet deep; at 6th Street, it is approximately 16 feet deep; and at the levee, it is around 17 feet deep.

Each plan included 4 railroad crossings over a covered channel section, 3 road bridges, and 10 sections of covered channel at street crossings. The mainline railroad track crossings over covered channel sections for the three plans were: 6-10x10- foot culvert for the 10-yr plan with the maximum channel width at 20 feet, 8-10x10-foot culvert for the 50-yr plan with a maximum channel bottom size of 30 feet, and 9-10x10 - foot culvert for the 100-year (except at the culverts, the 100-yr plan's bottom widths were the same size as for the 50-yr plan). The respective project costs were $21,100,000, $23,096,000 and $23, 957,000, excluding land and escalation costs at a February 2003 price level. None of these plans was economically justified.

Another four plans were formulated: C-10, C-50, C-100, and C-200 to maintain generally the 10-. 50-, 100-, and 200-year flood within channel. (Plan C-100 is shown in Plates 2A-2D.) However, these plans incorporate the flow capacity of the existing P Street Storm Drain from short L Street to the P Street pump station, Reaches 1- 3. The upstream limit of the reaches is shown in Table 3. The city will continue to operate, maintain, repair, replace, and rehabilitate the P Street Storm Drain except in Reach 4 where the drain will be replaced with open channel. This is in contrast to the previous plans that only incorporated a length of the drain from short L to 13th Streets as a collector drain and maintained the segment from the P Street overflow weir to the P Street Pump Station for use when the gated structure was closed.

This group of four plans has a culvert through the levee and the first railroad spur sized at 2-10x10-foot boxes. By maintaining a flow through P street storm drain, the culverts through the railroad are sized as 3-, 4-, 5-, & 6-10x10-foot boxes respectively for the plans

C-10, C-50, C-100 and C-200 and reduce flood heights similarly to the first group of three plans. The maximum bottom widths for the four plans are 12, 24, 24, and 26 feet respectively for the 10-, 50-, 100-, and 200-yr plans along the C1/D1 alignment. The channel depths as used for the initial three plans are maintained. Channel crossings are limited to increase channel efficiency and reduce costs. For the four plans, bridges are planned at Clayton Expressway, 6th Street, and the Arkhola plant.

The channel is concrete lined with vertical sides for 405 feet between the Arkhola plant and the hill behind in Reach Three. In the upstream most 140 feet of Reach Three and for another 1,060 feet into Reach Four, the channel is concrete lined with 2H:1V sides slopes to avoid large structure relocations. The remaining channel side slopes are 3H:1V with a 2-foot thickness of riprap of varying heights. The slope above the riprap is turfed. The five railroad crossings would go over covered channel sections, as would the four road crossings at Midland Boulevard, Greenwood Avenue, N. O Street, and Grand Ave.

See Table 2 for the economic comparison of the four plans. During the analysis of these plans, it was noted that in Reach Three the channel bank would act as a levee and offer further flood reduction benefits, which were then calculated. This consideration resulted in no damages for the 500-yr event in Reaches Three and Four for all of the plans. The channel is not considered oversized for the following reasons.

Firstly, any significant decrease in channel bottom width would result in out of channel flood flows. In Reach Four, four residences flooded with damages starting at the 25-year flood with plan C-10 with minimal average annual damages (less than $100 that were rounded to zero). In Reach Three, there are 16 structures, commercial and residential of which five would be flooded by the 25-year event with plan C-10 if not for Reach Three's high bank protection.

Secondly, narrowing the channel bottom in reaches Three and Four would not reduce construction costs significantly, as most of the cost is derived from the channel's depth and side slopes. Because Reaches Three and Four have concrete lined channel sides, the side slope costs are even greater. In addition, the concrete lining limits the flexibility for modification at a reasonable cost if flood flows were found to be higher than currently calculated.

Trade-off Analysis

The four plans, C-10, C-50, C-100, and C-200, are very similar in that the environmental impact is minor and temporary compared to the no action alternative. The channel reestablishment provides a minor increase in environmental quality for its 2.3-mile length. The number of structure relocations is the same for all of the plans. Plan C-10 provides for the greatest excess benefits over cost. Plan C-100 has a greater reduction in flood damages over Plan C-10. Plan C-100 maximizes the number of structures removed out of the 100-year floodplain, 127 structures are removed versus only 87 structures for Plan C-10. Plans C-100 and C-200 both maximize the reduction of non-Federal eligibility requirements for the National Flood Insurance Program and disaster relief included in the emergency costs. The cost of Plan C-100 would be less than that of Plan C-200. Because Plan C-100 has no greater benefits than Plan C-10 for Reaches Three and Four, another plan was formulated. For Reaches One and Two, Plan C-100 features would be combined with the features of Plan C-10 for Reaches Three and Four. This plan, C-100/C-10, has the same benefits as Plan C-100 but at a lower cost.

See Table 3 for an incremental analysis of the benefits versus costs by reach for the Combination Plan C-100/C-10. The three upstream reaches are economically justified compared to their costs. Reach One, which includes the gated structure through the Fort Smith Levee to evacuate the flood flow to the Arkansas River and the openings through the railroad tracks to pass the upstream flood flows into the sump area, is not incrementally justified based on the benefits for properties in the reach. The features in this reach are nearly half the project cost at $10.4 million. However, the plan features in Reach One are necessary to provide the flood reduction benefits for the upper reaches. The gated structure allows for gravity flow out of the sump area and the gates can be shut to preserve the flood protection provided by the Fort Smith Levee.

If there was no additional opening through the levee, floodwaters would quickly pond up until they backed up and over the mainline railroad tracks, threatening industry and the sewage treatment plant not currently in the 500-year floodplain. The 500-year floodplain is shown on Plates 3A-3D for existing conditions and Plans C-10 and C-100/C-10. In addition, as Reach One has approximately $1,000,000 more in single event damages for the 500-year event than either Reach Two or Three, its average annual damages would be greatly increased with induced flooding from upstream channelization. The benefits from the channel work in Reach Two would be reduced. If Reach One and Two were combined into one reach, that reach would not be economically justified. If the combined reach were not constructed, the work for Reach Three would be ineffective. Thus, the features of Reach One makes the C-10, C-50, C-100, and C-200 plans complete and effective while preserving the flood protection provided by the Fort Smith Levee.

TABLE 2, NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

Plan Comparisons				
	Plan C-10, NED	Plan C-50	Plan C-100	Plan C-200
Interest Rate, %	5.125	5.125	5.125	5.125
Construction Period, years	3.4	3.8	3.8	3.9
Period of Economic Analysis, years	50	50	50	50
Annualized Benefits:				
Flood damage	$ 1,152,900	$ 1,161,300	$ 1,164,200	$ 1,164,300
Emergency, Non Phys,& Utility	222,200	228,100	229,500	229,500
Auto damages	49,500	50,000	50,400	50,500
Flood Insurance	8,700	12,700	12,900	12,900
P St Sewer repair savings	11,100	11,100	11,100	11,100
Total Annualized Benefits	$1,444,400	$1, 463,400	$1,468,100	$1,468,300
Construction Costs:				
Project Construction Cost	$ 19,725,800	$21,058,400	$21,482,600	$21,963,900
Interest During Construction	1,730,200	2,084,300	2,126,300	2,236,300
Total Investment Costs	$ 21,456,000	$23,142,700	$23,608,900	$24,200,200
Annualized Costs:				
Interest	$ 1,099,500	$ 1,186,100	$ 1,210,000	$ 1,240,300
Amortization	98,500	106,200	108,300	111,000
OMRR&R	47,000	55,500	56,600	56,800
Total Annualized Costs	$ 1,245,100	$ 1,347,800	$ 1,374,900	$ 1,408,100
Excess Benefits over Cost	$199,400	$115,600	$93,200	$60,200
Benefit/Cost Ratio	1.16	1.09	1.07	1.04

Project cost includes $5,000 for wing walls at the upstream end of Reach 4 to make the limit of Federal interest plan complete.

TABLE 3, LOCALLY PREFERRED PLAN (LPP), PLAN C-100/C-10
ECONOMIC ANALYSIS BY REACH

(Interest Rate, 5.125 %)

Reach	Reach 1	Reach 2	Reach 3	Reach 4	Reaches 1 – 4
Upstream Limit	7th Street	Midland Ave	Short L St	Grand Avenue	Total
Annualized Benefits:					
Flood damage	$ 97,900	$ 341,200	$ 467,300	$ 257,800	$1,164,200
Emergency, Non Phys, & Utility	22,000	68,300	76,300	62,900	229,500
Auto damages	3,700	13,400	11,200	22,100	50,400
Flood Insurance	2,900	3,700	2,100	4,200	12,900
P St Sewer repair savings	0	0	0	11,100	11,100
Total Annualized Benefits	$ 126,500	$ 426,600	$ 556,900	$ 358,100	$1,468,100
Construction Costs:					
Project Construction Costs	$10,412,100	$4,077,500	3,752,200	2,894,600	$21,136,400
Interest During Construction	1,030,600	403,600	371,400	286,500	2,092,100
Total Investment Cost	$ 11,442,700	$4,481,100	$4,123,600	$3,181,100	$23,228,500
Annualized Costs:					
Interest	586,400	229,700	211,300	163,000	1,190,500
Amortization	52,800	20,600	18,900	14,600	106,600
OMRR&R	27,500	8,000	12,000	8,000	55,500
Total Annualized Costs	$666,400	$258,300	$242,200	$185,600	$1,352,600
Excess Benefits over Cost	($539,900)	$168,300	$314,700	$172,500	$115,500
Benefit/Cost Ratio	0.19	1.7	2.3	1.9	1.09

RISK AND UNCERTAINTY

Sensitivity to the stage on May Branch with the stage on the Arkansas River was addressed with the conduct of a detailed coincident flooding analysis. That analysis can be found in the Hydrology and Hydraulics Report of the Engineering Appendix.

Uncertainties in discharge-exceedance probability, stage-discharge, and stage-damage functions incorporate uncertainty into the economic analysis. An Office of Management and Budget Approved Survey was conducted on the structures in the study area. This reduces uncertainties with the stage-damage functions, the value of property in the flood plain, and damages computed. A risk analysis was conducted to quantify the degree of reliability of the estimated benefits and costs. The risk analysis defined the effectiveness of the alternative plans. See the Economic Appendix for the annualized damages reduced and distributed for Plan C-10 and for Plan C-100/C-10. Also included in the economic appendix are the annual exceedance probabilities for Plans C-10, C-50, C-100, and C-200 for reaches 1 through 4. Plan C-100/C-10 probabilities would be the 100-yr plan for reaches 1 and 2 and the 10-yr plan for reaches 3 and 4.

To reduce residual risk, the channel plans design includes guardrails on road crossings to avoid vehicles being washed into the channel. Fencing is planned at the vertical wall channel section. The channels have little risk of structural failure for any plan. A flood plain management plan will be developed for the project constructed and it will include advising the public of the residual risk.

Plans C-100, C-100/C-10, and C-200 would have a minimal and an infrequent amount of overbank flow and overtopping of crossings. Plans C-10 and C-50 would have deeper and more frequent flooding at the channel crossings. Plan C-10 would actually increase the chance of loss of life over that of the existing conditions. All the improvement plans create a deep open channel to carry the flood flows. Plan C-10 would have an increased chance of automobiles or pedestrians being swept into the deeper floodwaters within the channel compared to the existing shallow overland flooding.

For example, at the 6th Street Crossing in Reach 1, the new open channel would be 15 feet deep. With Plan C-10, floods greater than the 50-year event would overtop the bridge up to 1.5 feet deep (.9 feet deep for the 100-yr flood). With Plan C-100/C-10, only floods greater than the 200-yr event (1.3 feet deep for the 500-yr flood) would overtop the 6th Street Bridge. The depth of flooding for the existing 100-yr flood at this location would be around 3 feet deep (2 feet deep for the 50-yr event).

PLAN SELECTION

The following designations are made in the selection process (for reaches 1-4):

a. Designation of the NED Plan. Plan C-10 is the plan that maximizes net national economic benefits with $119,400 in excess benefits over cost. This plan is designated as the NED Plan.

b. Designation of the Locally Preferred Plan (LPP). Plan C-100/C-10 with $115,500 in excess benefits over cost is the plan that, in the opinion of the sponsor, best meets the needs of the local community. The designation is based on the following considerations. At little extra cost (a reasonable incremental cost of $1,410,600, which is a 7.2 percent increase over the NED plan), the LPP provides greater flood reduction benefits, reduces the risk of providing a level of flood damage reduction, and removes the maximum number of structures out of the floodplain. It removes 127 structures out of the 100-yr floodplain over the 87 structures for the NED plan, an additional 40 structures, which is a 46 percent increase. The LPP gives a greater reduction in non-Federal eligibility requirements for the National Flood Insurance Program and reduces the estimated subsidized requirements for flood losses including disaster relief included in the emergency cost calculations than would the NED plan. The LPP reaps the maximum benefits for flood insurance and emergency costs.

The LPP also gives greater assurance that the City's sewer plant located in Reach 1 is protected from floodwater infiltration. Less overtopping of roads would occur with the LPP than the NED plan. With the LPP, there would be reduced potential for vehicles to be washed into a flooded deep open channel. The LPP's infrequent overtopping as compared to the NED plan would reduce the risk to life. Plate 4 is a schematic of the LPP versus NED Plan by reach as presented to the ASA(CW) for the waiver request approval.

c. Designation of the Selected Plan. Plan C-100/C10, the LPP, is designated as the selected plan because it removes the maximum number of structures from the floodplain while remaining economically feasible. On October 27, 2005, the Assistant Secretary of the Army (Civil Works) granted an exception to allow the recommendation of the LPP and to allow full Federal participation in cost sharing reaches 1 through 4 and that reaches 5 and 6 of the LPP would be constructed at 100-percent non-Federal expense. A copy of the letter is in Appendix A, Section A. See the following table for a comparison by reach of the costs and benefits for the NED plan and the LPP.

Item	Reach 1	Reach 2	Reach 3	Reach 4	Reaches 1 – 4
LPP First Cost	$10,412,100	$4,077,500	$3,752,200	$2,849,600	$21,136,400
NED First Cost	9,444,200	$3,785,600	$366,200	$2,828,800	$19,725,800
Cost difference	$967,900	$291,900	$85,000	$65,800	$1,410,600
Cost percentage	10%	7.7%	2.3%	2.2%	7.2%
LPP Total Average Annual Benefits:	$126,500	$426,600	$556,900	$358,100	$1,468,100
C-10 Total Average Annual Benefits:	$118,500	$411,000	$556,900	$358,100	$1,444,400
Benefit difference	$8,000	$15,600	$0	$0	$23,700
Benefit percentage	6.8%	3.8%	-	-	1.6%

Note that Reaches 3 and 4 have a higher cost for the LPP over the NED plan. Those costs result from a change in overhead calculations from combining the two plans. No features were added in these two reaches over the NED plan. Also, the benefits by reach for the LPP were those from the reach analysis for the plans from which the LPP was derived. Therefore, the benefits for Reach 1 may be somewhat understated.

DESCRIPTION OF THE SELECTED PLAN

Plan Components

The LPP, as the selected channel plan, would extend for 2.25 miles from the Arkansas River upstream to Grand Avenue. An extension of the channel to include reaches 5 and 6 would add 0.5 miles that would terminate at Park Street. From just upstream of O Street to the Fort Smith Levee, the channel would augment the flow capacity of the P Street Storm

Sewer. The culvert through the levee at the gated structure and the first railroad spur is sized at 2-10x10- foot boxes. The culverts through the remaining four railroad tracks are 5-10x10-foot boxes. The maximum bottom width for the LPP is 24 feet along the C1/D1 alignment and the minimum width is four feet for the upstream most 0.5 miles. The channel is trapezoidal with three horizontal to one vertical side slopes and riprapped except for the vertical concrete wall behind the Arkhola plant and a 1,500-foot length downstream of Grand Avenue where the channel has a 2H:1V side slope and is concrete lined to avoid buildings in the area.

Bridges are included at Clayton Expressway, 6th Street, and the Arkhola plant. Covered channel sections (box culverts) would be used at the four road crossings: Midland Blvd (3-8x12-feet) (C-10, 2-8x12-feet), Greenwood Ave (2-8x8-feet), N. O Street (2-8x10-feet), Grand Ave (3-6x6-feet). The channel extension into reaches 5 and 6, would use box culverts at Kinkead and Park Aves (2-6x6-feet). See the Engineering Appendix and Hydraulics report for descriptions, drawings, typical sections, design, cost, construction, and operation and maintenance considerations. (Difference in size for Plan C-10 from the LPP were shown in parentheses above.)

Real Estate Requirements

The number of acres necessary for project construction for plan C-10 is 36.9 acres with a total estimated lands and damage cost of $3,140,000. The number of acres necessary for project construction for plan C-100/C-10 is 47.8 acres with an estimated cost of $3,277,600 including relocation assistance costs at a March 2004 price level. These acres exclude property acquired through previous Federal programs. A 25-foot construction easement along each bank will be acquired except where structures encroach on the channel. The channel alignment upstream of Ballman Road generally follows on the Union Pacific Railroad right–of-way. The railroad by letter dated October 10, 2002, stated that its fee-owned acres were available for purchase and that it could offer a Disclaimer for its "easement" only property. None of the property to be acquired is contaminated with hazardous waste. See the Real Estate Plan for further details.

Locally Preferred Plan Channel Extension Reaches 5 and 6

The city prefers to extend the channel to reaches 5 and 6, which are upstream of the limits of Federal interest. This would extend from Grand Ave. to Park Street. The work would assist in containing the flood flows within channel to reduce downstream flooding. This is estimated to cost $4,326,700 including land costs of $1,905,000 at 100-percent non-Federal expense. The channel extension is part of the with project condition Locally Preferred Plan. However, to make the limit of Federal interest plan complete in itself, a transition feature from the downstream cutoff of the P street storm sewer to the channel was added. Wing walls with an estimated cost of $5,000 were added to the LPP as a project cost and the costs of the wing walls were subtracted from the channel extension cost for the purpose of cost sharing.

Economic Summary

The estimated project construction costs and OMRR&R costs have been developed using the Corps MCACES cost estimating system. These costs, along with annualized costs, annualized benefits, net economic benefits and the benefits-to-cost ratios are shown on Tables 2 and Table 3 for the LPP. These values are based on March 2004 price levels, an interest rate of 5.125% and a 50-year period of economic analysis, and a 3.8-year construction period. The selected plan, C-100/C-10, has an investment cost of $23,228,500; an annual cost of $1,352,600; annual benefits of $1,468,100; excess benefits to cost of $115,500; and a benefit to cost ratio of 1.09. At an interest rate of 7%, the LPP is not economically justified with a benefit to cost ratio of 0.82 to 1 and excess costs over benefits of $330,200.

Note that the P Street Storm Sewer will continue to function with or without project. Thus, its maintenance and rehabilitation costs are not included in the project costs. The City of Fort Smith will repair the storm sewer prior to or in conjunction with project construction and continue to maintain it at City cost. See the attached letter from the City dated October 5, 2005 in Appendix A, Section A. However, a benefit of $11,100 for not having to repair the storm drain in Reach 4 was included in the economic evaluation. In that reach, the storm drain will be replaced by the channel modification.

Ecosystem Restoration Benefits

Although not estimated, there would be some minor increase in aquatic habitat due to reestablishing an open channel for 2.8 miles.

IMPLEMENTATION REQUIREMENTS

Institutional Requirements

Compliance with environmental statue and policy is shown on Table 4.

The schedule for project implementation assumes authorization in the proposed Water Resources Development Act of 2006. After project authorization, the project would be eligible for construction funding. The project would be considered for inclusion in the President’s budget based on: national priorities, magnitude of the Federal commitment, economic and environmental feasibility, level of local support, willingness of the non-Federal sponsor to find its share of the project cost, and the budget constraints that may exist at the time of funding.

TABLE 4, ENVIRONMENTAL STATUTE AND POLICY COMPLIANCE

Item	**Compliance**
Federal Statutes	
Archaeological and Historic Preservation Act, as amended, 16 U.S.C. 469, et. Seq.	Full Compliance
Clean Air Act of 1977, as amended, 42 U.S.C. 7609, et. seq.	Full Compliance
Clean Water Act, as amended, (Federal Water Pollution Control Act) 33 U.S.C. 1251, et. seq.	Partial Compliance
Coastal Zone Management Act, 16 U.S.C. 1451, et. seq.	N/A
Endangered Species Act, 16 U.S.C. 1531, et. seq.	Full Compliance
Estuary Protection Act, 16 U.S.C. 1221, et. seq.	N/A
Federal Water Project Recreation Act, 16 U.S.C. 460-12, et. seq.	Full Compliance
Fish and Wildlife Coordination Act, 16 U.S.C. 661, et. seq.	Full Compliance
Land and Water Conservation Fund Act, 16 U.S.C. 460/ -460/-11, et. seq.	N/A
Marine Protection, Research and Sanctuary Act, 33 U.S.C. 1401, et. seq.	N/A
National Environmental Policy Act, 42 U.S.C. 4321, et. seq.	Partial Compliance
National Historic Preservation Act, 16 U.S.C. 470a, et. seq.	Full Compliance
Rivers and Harbor Act, 33 U.S.C. 401, et. seq.	Full Compliance
Watershed Protection and Flood Prevention Act, 16 U.S.C. 1001, et. seq.	N/A
Wild and Scenic Rivers Act, 16 U.S.C. 1271, et. seq.	Full Compliance
Executive Orders, Memorandums, etc.	
Executive Order 11988, Floodplain Management, May 24, 1977 (42 CFR 26951; May 25, 1977)	Full Compliance
Executive Order 11990, Protection of Wetlands, May 24, 1977 (42 CFR 26961; May 25, 1977)	Full Compliance
Council on Environmental Quality Memorandum of August 11, 1980: Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing the National Environmental Policy Act.	Full Compliance
Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations.	Full Compliance
State and Local Policies	
NPDES	Partial Compliance
Arkansas Water Quality Certification – Section 401	Partial Compliance

Note: The compliance categories used in this table were assigned based on the following definitions:

a. Full Compliance – All requirements of the statute, executive order, or other policy and related regulations have been met for this stage of planning.
b. Partial Compliance – Some requirements of the statute, executive order, or other policy and regulations remain to be met but if applicable will be met before construction commences (i.e. 404 permits).
c. Noncompliance – None of the requirements have been met for this stage of planning.
d. Not Applicable – Statute, executive order, or other policy not applicable.

Once Congress appropriates Federal construction funds, the Corps and the non-Federal sponsor would enter into a Project Cooperation Agreement (PCA). This PCA would define the Federal and non-Federal responsibilities for implementing, operating and maintaining the project.

Following the signing of the PCA and the design approval, the Corps would officially request the sponsor to acquire the necessary real estate. The advertisement of the construction contract would follow the certification of the real estate acquisition and right-of-entry. The final acceptance and transfer of the project to the non-Federal sponsor would follow the delivery of an Operation and Maintenance Manual and as-built drawings.

Table 5 is the study/project schedule that assumes timely funding. Table 6 shows the cost apportionment for the LPP at a March 2004 price level. Table 7 displays the cost apportionment for the LPP at an October 2005 price level.

TABLE 5, SCHEDULE

Milestone	**Date**
Reconnaissance Report Approval	August 1993
Feasibility Cost Sharing Agreement Signed	November 1998
Final Feasibility Report	October 2006
Authorized Project	November 2006
Project Cooperation Agreement Signed	April 2007
Design Approved	December 2008
Real Estate Acquired	December 2009
Advertise Construction	March 2010
Construction Complete	December 2014

TABLE 6, LPP COST APPORTIONMENT
March 2004 Price Level

REACHES 1 - 4	FEDERAL	NON-FEDERAL	TOTAL
Lands and Damages	$ 137,000	$ 3,140,600	$ 3,277,600
Structures		2,639,300	2,639,300
Roads	759,100	1,261,200	2,020,300
Railroads	2,410,400	334,500	2,744,900
Channel	7,611,900	-	7,611,900
Control Structure	542,600	-	542,600
Subtotal Constr. Costs	11,324,000	4,235,000	15,559,000
E&D	1,096,200	409,900	1,506,100
S&A	986,500	369,000	1,355,500
Subtotal	13,543,700	8,154,500	21,698,200
5% Cash	(1,084,900)	1,084,900	-
Subtotal	$ 12,458,800	$ 9,239,400	$ 21,698,200
Adjustments	-	-	-
Subtotal	$ 12,458,800	$ 9,239,400	$ 21,698,200
Percent of First Cost	57%	43%	100%
REACHES 5 & 6	FEDERAL	NON-FEDERAL	TOTAL
Lands and Damages	-	$ 1,905,000	$ 1,905,000
Construction	-	$ 2,421,700	$ 2,421,700
Total, Channel Extension, R - 5 & 6	-	$4,326,700	$ 4,326,700

	FEDERAL	NON-FEDERAL	TOTAL
TOTAL FIRST COST	$ 12,458,800	$ 13,566,100	$ 26,024,900
Percent of Total	48%	52%	100%

With full Federal participation in the LPP cost sharing for reaches 1 – 4.
Land costs include relocation assistance costs. Extension channel cost, reaches 5&6, is reduced by $5K and reaches 1-4 cost is increased by $5K for the cost of the wing walls. Federal cost shown for roads and railroads is the cost of covered channel sections at crossings.

TABLE 7, LPP COST APPORTIONMENT

October 2005 Price Level

REACHES 1 - 4	FEDERAL	NON-FEDERAL	TOTAL
Lands and Damages	$ 144,700	$ 3,296,700	$ 3,441,400
Structure & Utility Relocations	-	3,019,100	3,019,100
Roads	854,100	1,476,800	2,330,900
Railroads	2,732,100	447,500	3,179,600
Channels	8,978,100	-	8,978,100
Floodway Control Structure	572,000	-	572,000
Subtotal, Construction	13,136,300	4,943,400	18,079,700
E&D	1,484,200	558,500	2,042,700
S&A	1,336,300	502,900	1,839,200
Subtotal	16,101,500	9,301,500	25,403,000
5% Cash	(1,270,200)	1,270,200	-
Total First Cost Reaches 1- 4	$ 14,831,300	$ 10,571,700	$ 25,403,000
Percent of First Cost	58%	42%	100%
REACHES 5 & 6	FEDERAL	NON-FEDERAL	TOTAL
Lands and Damages	$ -	$ 2,000,000	$ 2,000,000
Relocations	-	880,700	880,700
Roads	-	292,500	292,500
Channels	-	1,190,500	1,190,500
E&D	-	378,100	378,100
S&A	-	340,400	340,400
Total	$ -	$ 5,082,200	$ 5,082,200
Percent of Cost	0%	100%	100%
Total First Cost	$ 14,831,300	$ 15,653,900	$ 30,485,200
Percent of Total	49%	51%	100%

Extension channel cost, reaches 5&6, is reduced by $5K and reaches 1-4 cost is increased by $5K for the cost of the wing walls.

With full Federal participation in the LPP cost sharing for reaches 1 – 4.

Land costs include relocation assistance costs.

Federal cost shown for roads and railroads is the cost of covered channel sections at crossings.

Permits

A National Pollutant Discharge Elimination System (NPDES) permit from ADEQ will be acquired prior to construction. Requirements for Section 404 of the Clean Water Act of 1972, as amended, and Section 10 of the Rivers and Harbors Act of 1899, as amended, will be met prior to any construction activity.

Views Of Non-Federal Sponsor/Financial Capability

The City of Fort Smith supports the project and is prepared to provide its items of local cooperation. Fort Smith has a one-cent sales tax, Capital Improvements Program, dedicated to streets, bridges and drainage improvements. The revenue generated from this tax is currently over $15 million per year. The City's five-year capital improvements program approved in October 2005 budgeted $100,000 for the year 2006, $1.0 million for 2007, $1.0 million for 2008, $6.0 million in 2009, and $6.0 million for 2010 for the May Branch project. With the updating of Fort Smith's five-year work plan in October of 2005, it is expected that the City will continue to budget funds for the May Branch Flood Damage Reduction Project. The sponsor will pursue obtaining full Federal participation in the railroad relocations.

AFFECTED ENVIRONMENT

The major characteristics of the study area's natural and human resources are provided to promote a general understanding of the area. Existing and without project conditions of each resource is described in terms of its location, quantity, quality, and significance.

REGIONAL SETTING OF PROJECT

Fort Smith is the county seat and largest city in Sebastian County in addition to being the second largest city in Arkansas. Fort Smith is located in one of the fastest growing corridors of the state. Fort Smith is the chief trading center for west central Arkansas and east central Oklahoma, and in 2000, it had a population of approximately 80,268. Most residents of Sebastian County work in industries or supporting businesses within the Fort Smith area (Cox *et. al.*, 1975).

Fort Smith was built on the site of two frontier forts, established in 1817 and 1838. Thomas Nuttall, an English naturalist and explorer, visited western Arkansas and eastern Oklahoma in 1819 and was one of the first visitors to record observations in the Fort Smith area (Nuttall, 1821). He probably was the area's first explorer having extensive training and experience in various natural history fields, and he recorded detailed information on historical and natural history features of the Fort Smith area.

Economic and social opportunities in Fort Smith have served to attract new residents, many of which represent ethnic minorities. The proximity of Fort Smith to the former Indian Territory has made it a home for Native Americans since frontier days. In addition, a community of African-Americans has called Fort Smith home since frontier days.

Nearby Fort Chaffee served as a relocation center for refugees from Southeast Asia in 1975 and again in 1980-82 for Cuban refugees. More recently, Fort Smith has experienced a growth in Hispanic residents from Mexico and Latin America as part of a general increase in Hispanic residents in western Arkansas. Table 8 provides information on ethnic composition of Fort Smith.

TABLE 8, ETHNIC COMPOSITION OF FORT SMITH FOR 2000

2000 Population Statistics		
Race	**Population**	**% of Population**
White	61,798	76.9%
Black	6,943	8.6%
All others	11,527	14.3%
TOTALS	80,268	100%

INFRASTRUCTURE AND LAND USE

The project area is 100 percent urbanized and has an extensive infrastructure associated with areas of high-density housing, low-density housing, commercial areas, and industrial areas. Much of that infrastructure is shown on the project area maps. Much of the project area is parallel to and close to the bed of a former railroad track, which extends from an area located several blocks south of Creekmore Park (i.e., south of Rogers Avenue, north to an area several blocks northwest of Martin Luther King Park). Several railroad tracks in current operation are located in the western portions of the project area including the Missouri Pacific, Union Pacific, Arkansas-Missouri, Kansas City Southern, and Fort Smith Railroads.

Numerous utilities, i.e., gas, water, sewer, telephone, and electric transmission lines, permeate the project area. The Burlington Northern Railroad and commercial airline carriers also serve the City. Fort Smith is served by US Highways 64, 71, and 271; Arkansas State Highways 10, 22, 45, 59, and 255; and Interstate Highways 40 and 540. Highways 64, 255, and 22 are within the study area.

100-Year Floodplains

Most of the project area is mapped as occurring within a Federal Emergency Management Agency (FEMA) 100-year floodplain. May Branch, a tributary to the Arkansas River, which now flows through an underground storm sewer system, was originally a small intermittent stream. The Government Land Office (GLO) survey plat of 1827, for the upper portions of May Branch labels its channel as, “Dry Rocky”.

The May Branch basin is 100 percent urbanized and includes areas of high-density housing, low-density housing, commercial areas, and industrial areas. Historically, May Branch has suffered numerous flood events due to increased urbanization, high river levels, insufficient storm sewer capacity, limited pump volume, and an undersized levee outlet.

Wetlands

Wetlands having a potential to be regulated by the US Army Corps of Engineers under Section 404 of the Clean Water Act are of limited occurrence in the project area. Because of the highly urbanized environment of the project area, any wetland areas of major size that were present prior to development have been either destroyed, reduced in size, or highly impacted.

Remaining wetlands are of two palustrine types: (1) forested wetlands, and (2) emergent wetlands. Dominant species of forested wetlands largely include the same bottomland hardwood species that dominate any forested tract remaining in the project area: willow oak, water oak, pecan, silver maple, sugarberry, and American elm. Understories of forested wetlands are dominated by red mulberry, white mulberry, box elder, and privet hedge. The fall aspect of emergent wetlands, during periods of low water, is dominated by smartweeds (*Polygonum* spp.), curly dock (*Rumex crispus*), and giant ragweed (*Ambrosia trifida*).

Water Quality

No information was found regarding groundwater resources in the specific project area. Cordova (1963), however, provides a general discussion of groundwater resources for the Arkansas River Valley and includes well data of the region. Cordova concludes that dissolved solids generally is less than 500 ppm and only 11% of the water samples analyzed contained more than four ppm of iron. Groundwater and surface water samples were taken along the proposed channel alignments, which traverse the industrial area of Fort Smith. The water samples were analyzed for contaminants, which could have originated from the industries in the area. The analyses showed that suspected contamination exists. However, for the proposed route C1/D1, contamination is minimal, and the Arkansas Department of Environmental Quality did not object to the project. See the HTRW report in the Engineering Appendix for details.

May Branch drains into the Arkansas River. There is an abundance of available water quality data that was collected on the Arkansas River at nearby Van Buren by the Arkansas Department of Environmental Quality. Waters in the Arkansas River are known to have notably elevated levels of dissolved solids, particularly sodium chloride.

Air Quality

The Clean Air Act of 1977, as amended requires Federal facilities to comply with all Federal, state, interstate, and local requirements regarding the control and abatement of air pollution in the same manner as any nongovernmental entity, including any requirement for permits. No particular Federal requirements are involved that are not already incorporated into Arkansas State law. According to the Arkansas Department of Environmental Quality (ADEQ), the entire state of Arkansas is in compliance with all EPA ambient air quality standards. Only ozone concentrations occasionally approach the limit of the standard. The "Conformity Rule" of the Clean Air Act of 1977, as amended (CAA) states that all Federal actions must conform to appropriate State Implementation Plans (SIPs). This rule took effect on January 31, 1994, and at present applies only to Federal actions in non-attainment areas (those not meeting the National Ambient Air Quality Standards for the criteria pollutants in the CAA). The state of Arkansas including the project area is considered an "attainment area" and is therefore exempt from the "Conformity Rule" of the CAA.

Noise

The project area is 100 percent urbanized with a mix of residential, commercial, and industrial sites that also includes a railroad yard. Noise includes locomotive traffic from the rail lines and vehicular traffic on the several major street arteries that cross the project area.

NATURAL ENVIRONMENT

Physiography and Topography

Fort Smith is located in the Arkansas River Valley province, which lies between the Boston Mountains to the north and the Ouachita Mountains to the south (Croneis, 1930). The Arkansas River flows along the north edge of the city and its flow is regulated by a series of major flood control impoundments and by locks and dams that form navigable pools both upstream and downstream from Fort Smith. Several tributaries enter the Arkansas River floodplain and flow into the river in the Fort Smith area. Poteau River, Mill Creek, Massard Creek, and Little Vache Grasse Creek enter the Arkansas River from the south, and Lee Creek and Flat Rock Creek enter from the north.

Plant Communities and Wildlife Habitat

Much of Fort Smith and its surrounding area occupy sites river terrace prairies that were originally characterized by tall grass prairie vegetation (Nuttall, 1821; Armstrong, 1941; Armstrong and Moore, 1957). However, most of these prairies have been destroyed or, in the absence of fire, have experienced natural ecological succession toward a deciduous forest type (Sealander, 1979). The 1827 GLO survey plats for the Project area provide solid evidence that portions of May Branch originally passed through an upland prairie called Garrison Prairie. Massard Prairie, one of the largest of numerous river terrace prairies in the area, was located within two miles of May Branch headwaters. Forested floodplain plant communities instead of prairie vegetation probably characterized those portions of the project area closest to the Arkansas River.

Today, very little "natural" forest cover remains in areas to the east of Clayton Expressway. Remaining forested tracts in that portion of the project area have been severely impacted, primarily as a result of urbanization, and largely consist of scattered patches of immature forest cover, on which willow oak (*Quercus phellos*), water oak (*Q. nigra*), pecan (*Carya illinoensis*), silver maple (*Acer saccharinum*), sugarberry (*Celtis laevigata*), and American elm (*Ulmus americana*) are important species. In most instances, these immature forests are characterized by dense understories, in which numerous weedy species occur. Common understory species include red mulberry (*Morus rubra*), white mulberry (*Morus alba*), box elder (*Acer negundo*), and privet hedge (*Ligustrum sinense*). Soapberry (*Sapindus drummondii*) is of local occurrence at the edges of wooded parcels.

Young natural levees along the Arkansas River largely consist of deep sands that are characterized by a largely herbaceous vegetation cover. These habitats are characterized by the presence of deep sands, which are low in natural fertility. Species diversity is limited, and dominants include numerous grasses, including Johnson grass and love grasses (*Eragrostis* spp.), sandspur (*Cenchrus* spp.), cottonweed (*Froelichia* spp.), and evening primrose (*Oenothera biennis*). Woody vines are important species on these young sandy habitats, and dominants include trumpet creeper (*Campsis radicans*) and dewberry (*Rubus trivialis*). Scattered clumps of Chickasaw plum (*Prunus angustifolia*) and roughleaf dogwood (*Cornus drummondii*) provide very limited amounts of woody cover. These natural levees near the project area have experienced considerable disturbance, i.e., construction of roads, ditches, and levees.

Older natural levees on the banks of the Arkansas River, which are characterized by the presence of deep sands, support scattered small stands of mature cottonwood (*Populus deltoides*), sycamore (*Platanus occidentalis*), sandbar willow (*Salix exigua*), and black willow (*Salix nigra*). A few very small and scattered depressions having clayey sediments at the surface support silver maple and pecan, in addition to cottonwood, sycamore, and willow.

The entire project area represents a highly urbanized environment, and many parcels within the area are characterized by little or no maintenance, *i.e.*, no mowing or bush hogging. The general area located between Midland Boulevard and Clayton Expressway, in particular, includes numerous vacant lots characterized by the presence of large expanses of weedy vegetation. The fall aspect of these areas is dominated by giant ragweed (*Ambrosia trifida*), Johnson grass (*Sorghum halepense*), Bermuda grass (*Cynodon dactylon*), and other weedy species. Dense patches of privet hedge are common throughout the area. Poorly maintained ditches that parallel street and railroad rights-of-way typically support immature stands of black willow and/or sandbar willow.

Wildlife Species

The potential for the occurrence of several small game wildlife species exists between the levee and the Arkansas River on the very eastern edge of the project area. The natural levees on the banks of the Arkansas River potentially support the Eastern cottontail (*Sylvilagus floridanus*), Virginia opossum (*Didelphis virginiana*), and other small rodents. Eastern white-tailed deer (*Odocoileus virginianus*) also frequents the levees, although the carrying capacity for deer on these sandy habitats is low due to low cover values and poor forage values provided by the sparse vegetation cover.

Urban residential and commercial areas with limited forest cover, in the portion of the project area on the east side of Clayton Expressway, may provide limited habitat for the Virginia opossum, raccoon (*Procyon lotor*), and striped skunk (*Mephitis mephitis*). Some beaver (*Castor canadensis*) activity was observed within small-impounded areas near the sewage treatment plant and an auto salvage yard. Scattered patches of immature forest cover and vacant lots throughout the project area as well as heavy human activity provides for marginal habitat quality throughout the project area.

Fishery habitat quality within May Branch is very low due to the urbanized setting of the project area and prior channelization of the largely intermittent stream channel. Most of the downstream portion of the channel is contained within a covered storm sewer, although limited fisheries habitat remains in the open ditch between Clayton Expressway and the Arkansas River.

Threatened and Endangered Species

Appendix A, Section A, provides a letter from US Fish and Wildlife Service (USFWS), dated August 3, 1999, in which USFWS indicates there are no federally listed threatened and endangered species having a potential for impacts within the project area. Appendix A, Section A, also includes a 2004 response from USFWS.

A request was made to Arkansas Natural Heritage Commission (ANHC) for a search of its computerized database of elements of special concern, *i.e.*, plant and animal species and other natural features tracked by ANHC, to determine the existence of records within the project area. Appendix A, Section A, provides a letter from ANHC, dated August 12, 1999, in which the agency indicates the absence of element occurrences within the project area. Examination of the ANHC Annual Report for 2004 has shown that there have been no additional plant and animal species added to the list for tracking in Sebastian County since 1999.

Geology

Fort Smith is located on the southern flank of the McAlester Basin, in the Arkansas Valley section of the Ouachita physiographic province. There is a bluff line adjacent to the north side of Alternative No. A1 and a bluff line behind the Arkhola facility near the intersection of North O Street and May Avenue. Three geologic formations, which are all

Pennsylvanian age, crop out in the area. In ascending order, the formations are the Hartshorne sandstone, the Spadra shale and the Fort Smith formation, which consists of sandstone and sandy shale. Faulting is present in the area as is folding of the beds. These features increase in intensity southward. Groundwater generally follows the surface contours and may be found in small to moderate amounts in the residual and alluvial materials in the area. A layer of residual soil ranging up to 14 feet in thickness mantles the area. Alluvial materials of varying thicknesses can be expected along the major drainages with the area northwest of the railroad tracks in the Quaternary age alluvium of the Arkansas River.

Soils

The major soils occurring in the urbanized project area belong to the Crevasse, Leadvale, Muskogee and Severn series, which represent a range from moderately well drained to excessively drained soils (Soil Conservation Service, 1975). Crevasse series soils are found on young natural levees along the Arkansas River, and Severn series soils typically are found on natural levees of slightly greater age along the river. Muskogee series soils occur on high terraces along the river. Leadvale series soils are found on colluvial foot slopes and stream terraces on broad valleys. Crevasse and Severn soils occur on level to nearly level surfaces, and Muskogee and Leadvale soils occur on gently sloping surfaces. The Leadvale series and Muskogee series are characterized as moderately well drained; the Severn series is well drained; and the Crevasse series is excessively drained. Although none of these soil series is classified as hydric, the Crevasse, Leadvale, Muskogee, and Severn map units each has a potential to contain hydric inclusions, which typically occur in depressions (Natural Resources Conservation Service, 1999).

PRIME FARMLAND

The project area is 100 percent urbanized, and there are no areas under agricultural production or potential production. Consequently, the project area contains no areas of prime farmland.

CULTURAL ENVIRONMENT

No recorded archaeological sites and no sites or properties currently listed on the National Register are known to occur within the proposed project corridor. Cultural resources issues have been addressed by US Army Corps of Engineers, Little Rock District.

SOCIAL-ECONOMIC RESOURCES

Land use classification categories along the project route are commercial, industrial, and residential. The project area is 100 percent urbanized with minimal vacant land available for new development. Appendix A, Section B, provides socioeconomic data for the Fort Smith area based on 1990 and 2000 census data.

HAZARDOUS, TOXIC, and RADIOACTIVE WASTE (HTRW) ISSUES

A manual search of Arkansas Department of Environmental Quality (ADEQ) records was made to determine the presence of any known HTRW contamination in the project area. Areas of potential contamination within the project area include the following: an inactive landfill and associated automobile salvage yard, a former protein reclamation facility, and a former mirror production facility. In addition, it is known that several small furniture manufacturing facilities were located in proximity to the project area many years ago.

ENVIRONMENTAL CONSEQUENCES

PURPOSE OF ENVIRONMENTAL OVERVIEW

Prior to agency approval of a proposed project involving Federal funds, it is necessary to identify and consider any significant environmental impacts having the potential to restrict or prevent the project. A number of different local, state, and federal agencies have responsibility for preservation or conservation of the nation's natural resources, mitigation of detrimental effects of environmental change, and prevention of environmental damage.

EFFECTS ON SIGNIFICANT RESOURCES

Flood Plains

The current May Branch system, i.e., the no action alternative, is too small to meet the drainage requirements under flood conditions and its confined underground infrastructure simply cannot meet flood condition requirements.

Each of the major design alternatives is located within a currently designated Federal Emergency Management Agency (FEMA) 100-year floodplain. The completed project will have an overall beneficial impact by effecting local reductions in the extent of the 100-year floodplain and probably also in the 100-year floodway. The proposed open channel construction alternatives will be much more effective in collecting, conveying, and dissipating floodwaters than the largely underground system now in use.

Wetlands and Other Waters of the United States

A delineation of wetlands subject to potential Corps jurisdiction under Section 404 of the Clean Water Act was conducted throughout the proposed project corridor, including all potential alternative routes. The total amount of wetland acreage found within the entire project area is relatively small, approximately 6 acres.

The project alternatives collectively have a potential to impact several unnamed tributary channels that represent potential "waters of the US" subject to regulation by the Corps under Section 404. Table 1 provides comparative impacts to wetlands from construction activities on each of the alternative routes.

The project alternatives have a potential to impact a range of approximately 0.2 to 2.0 acres of other waters of the US, i.e., channels of ephemeral and intermittent stream channels having a potential for Corps jurisdiction under Section 404. Project alternatives A and B have a potential to impact a range of approximately 0.5 to 6.0 acres of wetlands. Project alternative C will not impact wetlands in the project area. Alternative A has the potential to impact the greatest amount of wetlands, while Alternative B appears to have a potential for impacting a smaller amount of wetlands. These wetlands generally occupy a landscape position that is characterized by extremely poor drainage potential because of surrounding elevation and infrastructure constraints. These wetlands are generally confined on the north by a bluff line, on the south by an area of higher elevation resulting from past fill deposition, and on the west by a combination of railroad tracks and levee. All three alternatives cross a sump area, which is located in the lower meanders of the original May Branch channel.

Water Quality

None of the proposed project alignments would result in significantly adverse impacts on water quality. Measures will be implemented during construction to reduce the amount of sediment entering the Arkansas River, which supports high value aquatic resources. Increased sediment input, if it were allowed to occur, would have a potential to affect respiration of fishes and aquatic larvae as well as interfere with photosynthesis of phytoplankton. Implementation of good sediment control measures will prevent adverse impacts. In addition, all disturbed areas will be seeded to establish a vegetative cover to minimize erosion and run-off. A Section 404(b)(1) Evaluation is included in Appendix A, Section C.

Air Quality

There would be a temporary degradation in air quality as a result of dust and emissions resulting from construction activities. Dust control shall be performed as construction proceeds and whenever a dust nuisance or hazard occurs. The construction period for the proposed project is estimated at approximately four years. Diesel locomotives already pass through portions of the project area and release pollutants, and the project corridor is crossed by several major street arteries that carry heavy vehicular traffic during rush hour periods.

Section 176(c) of Clean Air Act General Conformity Rule Review

The proposed action has been analyzed for conformity applicability pursuant to regulations implementing Section 176(c) of the Clean Air Act. It has been determined that the proposed activities will not exceed *de minimis* levels of direct emissions of a criteria pollutant or its precursors and are exempted by 40 CFR Part 93.153. Any later indirect emissions are generally not within the Corps continuing program responsibility and generally cannot be practicably controlled by the Corps. For these reasons, a conformity determination is not required.

Noise

Construction activities associated with the project development would temporarily increase noise levels in the surrounding area. Noise produced during construction would originate from heavy construction equipment and increased vehicular traffic to and from the construction site. The Contractor will be required to comply with Federal, State and local requirements for noise control of his vehicles and equipment. There will be room at top bank in most areas for a construction easement before the equipment would then move to a city street. The staging area would be in the industrial area between the railroad tracks and the levee. These temporary noise impacts would cease when construction is complete.

General Environmental Protection Measures

During construction, the contractor will be required to inspect all environment protection operations for compliance with contract requirements, perform all tests as required, and maintain records of his quality control for all operations, including but not limited to the following: (1) compliance with all Federal, State, and local pollution control regulations; (2) monitoring and surveillance procedures; (3) handling, storage, use, and disposal of petroleum products, chemicals, and toxic materials; (4) solid and liquid waste disposal; (5) noise control and dust control; and (6) disposal of construction materials and other debris.

FISH AND WILDLIFE AND OTHER BIOTA

US Fish and Wildlife Service prepared a Fish and Wildlife Coordination Act report that is included as Appendix A, Section D. The report indicates minimal impacts on wildlife and other biota from the construction of the proposed project. Reconstructing the open channel will provide minimal aquatic habitat improvement.

THREATENED AND ENDANGERED SPECIES

The US Fish and Wildlife Service and Arkansas Game and Fish Commission have each provided letters that indicate there are no Federal or state listed threatened and endangered (T&E) or candidate species issues of concern within the project area. In addition, Arkansas Natural Heritage Commission has provided a letter, which indicates that there are no elements of special concern, *i.e.*, rare plants and animals, outstanding natural communities, natural or scenic rivers, or other elements of special concern, within the project area. See Appendix A, Section A.

CULTURAL RESOURCES

The undertaking will have no significant effects on historical properties.

SOCIOECONOMICS/ENVIRONMENTAL JUSTICE

Executive Order No. 12898, "Federal Actions to Address Environmental Justice in Minority and Low-Income Populations," was issued by President William J. Clinton in 1994. It requires individual federal agencies to develop approaches to address environmental justice concerns in agency programs, policies, and procedures. A primary purpose of Executive Order 12898 was to ensure that federal agencies address human health and environmental conditions in minority communities and low-income communities. The order requires federal agencies to develop strategies to address environmental justice concerns within the context of agency operations. Executive Order 12898 was accompanied by a Presidential memorandum, which stresses that existing laws, e.g., National Environmental Policy Act (NEPA) as promulgated by the Council on Environmental Quality (CEQ), should provide opportunities for federal agencies to consider environmental hazards in minority communities and low-income communities.

EPA released a document in April 1995 titled "Environmental Justice Strategy: Executive Order 12898", which defines the approaches by which EPA will promote environmental justice. This document ensures that disproportionately high and adverse human health or environmental effects on minority communities and low-income communities, which are referred to as Environmental Justice Communities Of Concern (EJCOC), are identified and addressed.

The project area encompasses a mixture of residential neighborhoods, commercial and industrial areas, and municipal areas such as a sewage treatment facility and a city park. Residential neighborhoods in the more southern portions of the project area do not represent minority and low-income communities. Some of the residential neighborhoods in the more central portions of the project area, however, represent minority and low-income communities that might be expected to have a potential for the presence of environmental justice issues. The absence of a flood control project within the May Branch corridor has historically provided adverse impacts to these minority and low-income communities. A primary purpose of the May Branch project is to improve the environment for the majority of residents living in these minority and low-income communities. The number of residences affected by the project is relatively small and limited to those occupying a location that is within the project corridor.

At the present time, neighborhoods located along the May Branch project corridor experience flooding of their homes and/or personal property on a regular and continuing basis. Implementation of the no action alternative would allow for continued flooding. The Implementation of the action alternative, however, will provide a flood-free environment for the majority of the residents of these neighborhoods, including the minority and low-income communities in the more central portions of the project corridor. Very few vacant lots are present within the project corridor, but it is possible that residents may replace some of their existing substandard structures after flooding is eliminated.

Flood losses serve to drain government and community resources, and that affects all taxpayers. The relatively small number of residence relocations in the minority and low-income communities associated with the May Branch flood reduction project is the most cost-effective method of addressing the risk of flood damages to these residents. At the same time, the May Branch project will reduce flooding and improve the environment for other residents of these minority and low-income communities outside the footprint of the channel alignment.

RELOCATION IMPACTS

A total of 39 structures have been identified within all of the alternative alignment corridors as having a potential for relocation. See Table 9. Of these 39 structures, 12 structures represent residences (Three structures appear to be vacant.). Of the remaining 27 structures, all appear to have some relationship to business operation. Four of these structures are vacant businesses and seven appear to be storage buildings or other outbuildings with a direct relationship to business operations.

Residences Affected

Within all alternatives, 12 are single-family residences; 9 single-family residences are occupied and 3 single-family residences appear to be vacant. Therefore, only 9 occupied single-family residences, have a potential for relocation. Eight of the 12 structures (two of which are vacant residences) occur between 9th Street and Greenwood Avenue, a portion of the corridor that is common to all routes. Three of the remaining residences are between 6th and 9th streets. Another residence is vacant and occurs south of O Street and south of the Arkhola plant along corridor D2.

Table 9 shows the number of single-family residences that will be affected by each alternative alignment. Depending on whether the D1 or D2 alternative is chosen, Alignments A, B, and C1 would affect 11 or 12 residences. Alignment C2 would affect the least number of residences at either 6 or 7 residences.

Businesses Affected

A total of 16 active business or business-related structures occur within the path or immediately adjacent to all the alternative corridors. These businesses have 4 additional structures that are vacant or in dilapidated condition; 7 structures represent currently used outbuildings associated with businesses within or near the proposed alignments. The majority of the businesses occur along alignments routes C2 and D2. Table 9 shows the number of business that will be affected by each alternative alignment. Alignments A and B would affect 6 to 13 structures, while Alignment C will affect 4 to 18 business structures with Alignment C1/D1 affecting the least number, 4, of business structures.

TABLE 9, STRUCTURES POTENTIALLY AFFECTED BY THE PROJECT

Route Alternative	Structures Impacted					
	Commercial			Residential		Total
	Active	Shed	Vacant	Active	Vacant	
A1 w/ D1	3	0	3	9	2	17
A1 w/ D2	8	2	2	9	3	24
A2 w/D1	3	0	3	9	2	17
A2 w/ D2	8	2	2	9	3	24
B1 w/D1	3	0	3	9	2	17
B1 w/ D2	8	2	2	9	3	24
B2 w/ D1	4	0	3	9	2	18
B2 w/ D2	9	2	2	9	3	25
C1 w/ D1	2	0	2	9	2	15
C1 w/ D2	7	2	1	9	3	22
C2 w/ D1	3	5	4	4	2	18
C2 w/ D2	8	7	3	4	3	25
Total	16	7	4	9	3	39

ADDITIONAL INFRASTRUCTURE

Each of the three project alternatives crosses a complex of active railroad tracks in the area immediately west of Midland Boulevard. These railroad tracks provide through rail service as well as playing an important role to local small business and industrial facilities in the area by way of small spur lines. It is anticipated that the project will require construction of new bridges at three road crossings, covered channel sections at six road crossings, covered channel sections at three main line and two spur railroad crossings, and a gated structure at the Fort Smith Levee/Floodwall. Utility lines including gas, water, sewer, telephone, and electric transmission lines, are closely related to streets and roadways within the project area. Relocation of utility lines would be required.

HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE ISSUES

A HTRW investigation was conducted for areas affected by the construction alternatives. Subsurface explorations were performed to assist in determining the most feasible channel layout. No significant HTRW concerns were identified in the proposed channel location although each of the three construction alternatives had at least some potential for encountering hazardous wastes. All the alternatives cross the railroad tracks. Alternative A crosses an inactive landfill and automobile salvage yard. Alternative B passes through a former protein reclamation facility, but most of that site has been cleaned up recently. Alternative C passes near a former mirror plant that once dumped waste into an existing channel. See the HTRW section of the Engineering Appendix.

Right-of-Way Acquisition Considerations

Before any property is acquired for Project purposes, an initial site assessment will be performed for the presence of any hazardous or regulated materials. This assessment will determine if any substantial contamination exists. If substantial contamination is identified, the current landowner will be required to remediate the site in conformance with EPA regulations prior to acquisition. Asbestos, which is friable or could be rendered friable during structure demolition, should be remediated prior to demolition of a structure if it exists in the building. Potential problems could include asbestos-containing materials, leaking underground storage tanks and other petroleum related products, and other unknown hazardous wastes (contained or uncontained) from past industrial operations and waste disposal practices. The preliminary assessment of the proposed route found no hazardous materials of concern. See the HTRW section of the Engineering Appendix.

PUBLIC RECREATION SITES

The only public recreation site within the project area is Martin Luther King Park. The park is a part of the City's public park system. All of the channel alignment alternatives are located on the north side of Martin Luther King Park. The proposed channel would convert some of the parkland from a flat activity area into channel bank and bottom.

Construction activities would cause temporary interruptions to recreational activities in the park due to the presence of heavy equipment; a probable lay down area for construction materials, and actual construction of the drainage project. These impacts will possibly have a greater impact on those park areas designated for toddler activities than for those of older children and adults.

PRIME FARMLAND

The entire project route is located within the city limits of Fort Smith, and there are no prime farmland sites within the Project area. The Federal Register dated July 5, 1984 addresses the Farmland Protection Policy Act (FPPA), Subtitle 1 of Title XV of the Agriculture Food Act of 1981, Public Law 97-98. The FPPA Final Rule specifies that any prime farmland, which a state or local government has designated through zoning or planning for commercial, industrial, or residential use, will not be covered by the Act. This is because the farmland will be defined to be "committed to urban development" and thus outside the Act's definition of prime farmland (Federal Register, Volume 49 No. 130, p. 27717).

LAND USE

Direct Impacts

Direct impacts are those that result from right-of -way acquisition, construction, operation, and maintenance of the proposed flood reduction project. The conversion of land from its existing use to an open ground channel will constitute the primary direct impacts of this project. A total of 4 to 18 business relocations and 6 to 12 residential locations could be affected by the project, depending on the chosen alternative route. The tentatively selected route C1/D1 would affect 15 structures.

Secondary and Cumulative Impacts

Secondary impacts are generally defined as land use changes that occur because of modifications in access or proximity of the facility. Cumulative impacts are defined as those impacts that "result from the incremental consequences of an action when added to other past and reasonably foreseeable future actions (Bank, 1992). Foreseeable actions are usually defined as those for which plans exist. No Federal or private actions for major developments in proximity to the proposed project have been made public.

Secondary development that could occur because of the proposed project has a potential to affect daily lives of project area residents. Development of the project has a potential to cause conversion of undeveloped properties to residential areas and other land uses, new area businesses, increased employment opportunities, increased population, and increased demands for utilities and social services. Growth in residential areas would also increase the demand for consumer services, including retail, banking, medical, and recreational. However, the area is already urbanized and the proposed project is not expected to change the local planning environment. In addition, any new development would be restricted from the properties acquired by the FEMA Flood Hazard Grant Program. Those properties must remain as "open space."

Because the project has a potential to alleviate problems of severe local flooding, project area changes may occur. In the elimination of severe flooding, for example, one might expect redevelopment activities that would result in a replacement of substandard project area housing with housing of higher quality. Similarly, some businesses would possibly replace older structures with new or remodeled structures.

The May Branch channel has been previously altered by railroad construction and channelization related to drainage and flood control. Nothing has been left along the original course of May Branch which could be considered natural. Heavy human activity and prior development of the area has resulted in scattered patches of immature forest habitat. Fishery habitat quality is virtually nonexistent due to the urbanized setting of the project area and prior channelization and tunneling of the largely intermittent stream channel. Any future development in the area related to the proposed project is unlikely to contribute to further environmental degradation of the area. The reestablishment of an open channel could provide a minor increase in aquatic habitat.

UTILITY RELOCATIONS

Utility relocations would be required to facilitate construction of the Project. See the Engineering Appendix for details.

PUBLIC INVOLVEMENT, REVIEW AND CONSULTATION

PUBLIC INVOLVEMENT PROGRAM

A public notice was made in Fort Smith for the public review period. The draft report and environmental assessment were made available at the city offices, Engineering Department, and a copy was provided to the Reference Desk, Main Library, 3201 Rogers Avenue, Fort Smith, Arkansas 72901.

PUBLIC VIEWS AND RESPONSES

Pursuant to 40 CFR 1501.4(e)(2) and ER 200-2-2 Procedures for Implementing NEPA, the draft EA and draft FONSI was circulated to interested agencies and the public for a minimum 30 calendar day review period. The public review period began on July 28, 2006, and ended on September 6, 2006. The following agencies responded during the comment period:

State Agencies: Arkansas Department of Environmental Quality, Arkansas Department of Health, Arkansas Forestry Commission, Arkansas Geological Commission, Arkansas Game and Fish Commission, Arkansas Natural Resources Commission, and the Arkansas State Clearinghouse.

Federal Agencies: U.S. Department of Agriculture/Natural Resources Conservation Service, U.S. Environmental Protection Agency, and U.S. Fish and Wildlife Service.

All comments were in support of the proposed action and there were no negative comments received. Any recommendations included in the comments received were evaluated and, if practical, were incorporated into the proposed action. A complete list of public comments is in Appendix A, Section A, Agency Correspondence.

RECOMMENDATIONS

I have considered all significant aspects in the overall public interest. The aspects considered included environmental, social, and economic effects; and engineering feasibility.

I recommend that improvements for flood control for the May Branch, Fort Smith, Arkansas, project be authorized for implementation with such modifications thereof as in the discretion of the Commander, HQUSACE, may be advisable. I recommended the Locally Preferred Plan to construct a channel that would extend for 2.77 miles from the Arkansas River upstream to Park Avenue. There would be covered channel sections at road and railroad crossings plus three road bridges and a gated structure through the Fort Smith Levee.

The plan is estimated to cost $30,485,200 at an October 2005 price level. Reaches 1 through 4 would cost $25,403,000 and reaches 5 and 6 would be an additional cost of $5,082,200 at 100-percent non-Federal expense. The estimated annual OMRR&R cost is $55,500. The Federal portion of the estimated project cost is $14,831,300 and the estimated cost to the city of Fort Smith, Arkansas, the non-Federal sponsor, is $15,653,900.

My recommendation is subject to cost sharing, financing, and other applicable requirements of Federal and State laws and policies, including Public Law 99-662, the Water Resources Development Act of 1986, as amended, and in accordance with the following required items of cooperation that the non-Federal sponsor shall, prior to project implementation, agree to perform:

a. Provide a minimum of 35 percent but not to exceed 50 percent of total project costs allocated to reaches 1 through 4 of the project, as further specified below:

(1) Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs;

(2) Provide, during construction, any additional funds needed to cover the non-Federal share of design costs allocated to reaches 1 through 4;

(3) Provide, during construction, a cash contribution equal to 5 percent of total project costs allocated to reaches 1 through 4;

(4) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of reaches 1 through 4;

(5) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and

stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of reaches 1 through 4; and

(6) Provide, during construction, any additional costs as necessary to make its total contribution equal to at least 35 percent of total project costs allocated to reaches 1 through 4.

b. Provide 100 percent of total project costs allocated to reaches 5 and 6 of the project, as further specified below:

(1) Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs;

(2) Provide, during construction, any additional funds needed to cover 100 percent of design costs allocated to reaches 5 and 6;

(3) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of reaches 5 and 6;

(4) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of reaches 5 and 6; and

(5) Provide, during construction, any additional costs as necessary to make its total contribution equal to 100 percent of total project costs allocated to reaches 5 and 6.

c. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land which the non-Federal sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project.

d. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the project or completed functional portions of the project, including mitigation features, without cost to the Government, in a manner compatible with the project’s authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

e. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal interest has entered into a written agreement to furnish its required cooperation for the project or separable element.

f. Hold and save the United States free from all damages arising for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the United States or its contractors.

g. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and Local Governments in 32 CFR Section 33.20.

h. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government.

i. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Government determines necessary for the construction, operation, or maintenance of the project.

j. Agree that, as between the Government and the non-Federal sponsor, the non-Federal sponsor shall be considered the operator of the project for the purpose of CERCLA liability, and, to the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that will not cause liability to arise under CERCLA.

k. Prevent obstructions of or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) which might reduce the level of protection it affords, or hinder its operation and maintenance, or interfere with its proper functioning, such as any new development on project lands or the addition of facilities which would degrade the benefits of the project.

l. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act.

m. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army"; and all applicable Federal labor standards requirements including, but not limited to, 40 U.S.C. 3141-3148 and 40 U.S.C. 3701-3708 (revising, codifying and enacting without substantive change the provisions of the Davis-Bacon Act (formerly 40 U.S.C. 276a *et seq.*), the Contract Work Hours and Safety Standards Act (formerly 40 U.S.C. 327 *et seq.*) and the Copeland Anti-Kickback Act (formerly 40 U.S.C. 276c)).

n. Comply with Section 402 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 701b-12), which requires a non-Federal interest to prepare a floodplain management plan within one year after the date of signing a Project Cooperation Agreement. The plan shall be designed to reduce the impacts of future flood events in the project area, including but not limited to, addressing those measures to be undertaken by non-Federal interests to preserve the level of flood protection provided by the project. As required by Section 402, implement the plan not later than one year after completion of the construction of the project. Provide an information copy of the plan to the Government upon its preparation.

o. Provide the non-Federal share of that portion of the costs of archeological data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement.

p. Participate in and comply with applicable Federal floodplain management and flood insurance programs.

q. Publicize floodplain information in the area concerned and provide this information to zoning and other regulatory agencies for their use in adopting regulations, or taking other actions, to prevent unwise future development and to ensure compatibility with protection levels provided by the project.

r. Do not use Federal funds to meet the non-Federal sponsor’s share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

s. Inform affected interests, at least annually, regarding the extent of the protection afforded by the project.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil

Works construction program nor the perspective of higher review levels within the Executive Branch.

Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the States, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Date: 20 Sept 2006

Wally Z. Walters
Colonel, US Army
District Engineer

FINDING OF NO SIGNIFICANT IMPACT

NAME OF PROPOSED ACTION: May Branch, Fort Smith, Arkansas.

PURPOSE AND NEED FOR THE PROPOSED ACTION. The Little Rock District, U.S. Army Corps of Engineers proposes to reduce flood damages along May Branch in Fort Smith, Arkansas. The need for additional channel capacity or some other type of flood reduction measures along May Branch has been evident since the construction of the Fort Smith Levee and Floodwall including the P Street Pump Station in 1951.

ALTERNATIVES. The following alternatives were evaluated in detail in the attached Environmental Assessment (EA):

Alternative Alignments: A1, A2, B1, B2, C1, C2, D1, and D2. Six downstream and two upstream alignments were developed (route cost shown in parenthesis). The upstream and downstream alignments were combined to make 12 alternatives. Upstream alignments were D1 ($2,520,000) and D2 ($2,680,000). Downstream, the six alignments were A1 ($10,990,000), A2 ($10, 950,000), B1 ($11,430,000), B2 ($10,290,000), C1 ($10,090,000), and C2 ($14, 220,000). All 12 alignments were assumed to have the same flow capacity characteristics and channel bottom widths. Costs were estimated for those quantities that would be different for each alignment. Thus, the 12 alignments would equally alleviate the flooding problems with the reestablishment of a channel that also would provide some minor increase in environmental quality. All the plan alignments have few environmental impacts with most being either minor or temporary over the no build alternative. Alignment C1 at the lowest differential cost of $10,090,000 and alignment D1 at a lowest differential cost of $2,520,000 were combined to make the chosen alignment.

Route C1/D1 had the lowest cost, the least number of relocations, and the fewest environmental impacts to make it the chosen route. The C1/D1 alignment extends from the Arkansas River to Clayton Expressway through the Fort Smith Levee and thence north and east to roughly parallel North P Street following a path to 13th Street. It continues to the east along the north side of Martin Luther King Park, crosses May Avenue, and continues along the north side of the Arkhola plant, where it turns south. It crosses North O Street and continues a southward path following the existing storm sewer alignment to Park Avenue.

Alternative Channel Widths: C-10, C-50, C-100, C-200, and C-10/C-100: To optimize channel width sizing, additional plans were formulated using the C1/D1 alignment. The final plans were formulated: C-10, C-50, C-100, and C-200 to maintain generally the 10-. 50-, 100-, and 200-year flood within channel. These plans incorporated the flow capacity of the existing P Street Storm Drain from Short L Street to the P Street pump station. Each of these plans was economically justified. The recommended plan is a combination plan using the C-100 sizing for the first two downstream reaches that extend upstream to Midland Avenue. The upstream reaches assumed the Plan C-10 sizing upstream to Park Avenue.

Plan C-100/C-10's culvert through the levee and the first railroad spur are sized at 2-10x10-foot boxes. The culverts through the next set of railroad lines are five 10x10-foot boxes. The channel has a maximum bottom width of 24 at its downstream end. The channel depths are 9 feet at Grand; at O Street, it is 14 feet deep; at 6th Street, it is approximately 16 feet deep; and at the levee, it is around 17 feet deep. Bridges are planned at Clayton Expressway, 6th Street, and the Arkhola plant. The channel is concrete lined with vertical sides for 405 feet between the Arkhola plant and the hill behind in Reach Three. In the upstream most 140 feet of Reach Three and for another 1,060 feet into Reach Four, the channel is concrete lined with 2H: 1V sides slopes. The remaining channel side slopes are 3H: 1V with 2 feet of riprap of varying heights. The slope above the riprap is turfed. The five railroad crossings would use culverts, as would the six road crossings at Midland Blvd, Greenwood Ave, N. O Street, Grand Ave, Kinkead Ave, and Park Ave.

<u>No Action</u>: Under this alternative, frequent flooding will continue to cause appreciable damage along May Branch. Street intersections would act as detention basins after curb and drop inlets have reached capacity, and excess runoff would flow between buildings and across low-lying lands along North P Street. A storm event greater than a 10-year event would exceed the capacity of the storm sewer system. The Fort Smith Levee/Floodwall with the P Street pump station would protect lower portions of the basin from high stages on the Arkansas River. When runoff exceeds the pumps' capacity, the excess could overflow the limited capacity of the sump area.

During the planning process, an array of alternatives was considered. Some of these alternatives were eliminated for further consideration. These included nonstructural measures such as flood proofing measures and relocations. Because of insufficient flood warning times, flood-proofing measures would not be practicable. The acceptable nonstructural measure has already been accomplished by the city and the Federal Emergency Management Agency; thus, this alternative was not pursued further.

Structural measures initially considered early in the process included detention ponds, parallel storm sewer, additional pump capacity, and relief openings through the levee and railroad tracks with a connecting channel. The flood protection offered by the detention basins was found to be negligible and the plan was not considered further. The parallel storm sewer would be more costly than an open channel and was not considered further. The changed hydrology and hydraulics analysis for the feasibility phase negated the need for additional pump capacity. The concept for the relief-opening plan was the basis for the channel plans formulated.

ANTICIPATED ENVIRONMENTAL IMPACTS:

Consideration of the effects disclosed in the EA, and a finding that they are not significant, is necessary in order to prepare a FONSI. This determination of significance is required by 40 CFR 1508.13. Additionally, 40 CFR 1508.27 defines significance at it relates to consideration of environmental effects of a direct, indirect or cumulative nature.

Criteria that must be considered in making this finding are addressed below, in terms of both context and intensity. The significance of both short and long-term effects must be viewed in several contexts: society as a whole (human, national); the affected region; the affected interests; and the locality. The context for this determination is primarily local, as shown in Figure 1 of the EA. The context for this action is not highly significant geographically, nor is it controversial in any significant way. Consideration of intensity refers to the magnitude and intensity of impact, where impacts may be both beneficial and adverse. Within this context, the magnitude and intensity of impacts resulting from this decision are not significant. The determination for each impact topic is listed below.

1. **The degree to which the action results in both beneficial and adverse effects. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.** The EA indicates that the Proposed Action would have beneficial effects such as reduction in flood damages and a minimal increase in environmental quality as compared to the No Action alternative that would have no impacts. There would be adverse construction activity related effects from implementation of Alternative C1/D1, alignment and C-100/C-10, channel width, (Proposed Action) or all the other alignment and channel width alternatives but these would be minor in intensity and construction related only. The Proposed Action will have the least number of building relocations, 15. The other 11 Alternative alignments combinations have building relocations that range in number from 17 to 25.

2. **The degree to which the action affects public health or safety.** The Proposed Action will protect public health by alleviating flooding problems by construction of a channel. No adverse effects to public health or safety will result from the Proposed Action. Under existing conditions, no hazardous materials are identified on the project site. Implementing the Proposed Action would not create hazardous conditions affecting public health or safety.

3. **The degree to which the action affects unique characteristics of the potentially affected area, such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.** No such unique characteristics or resources have been identified in the project area of the Proposed Action. Alternative Routes A1 and A2 would disturb up to 6 acres of wetlands. Alternative Routes B1, B2, C1, C2, D1, and D2 would disturb no acres of wetlands.

4. **The degree to which effects on the quality of the human environment are likely to be highly controversial.** The project will benefit the public therefore the Little Rock District, Corps of Engineers does not regard this activity as controversial, and the public response to the EA was favorable.

5. **The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.** The Proposed Action has a low degree of uncertainty involving the impacts of this action. The reestablishment of an open channel will engender short-term construction related impacts. It will alleviate flood damages and minimally improve biological processes in the longer term.

6. **The degree to which the action may establish a precedent for future actions with significant impacts.** The action is unlikely to cause future actions with significant impacts. The flood plain is considered to be fully developed and the open areas created with the FEMA buyout of flooded properties preclude any development not compatible as an open area.

7. **Whether the action is related to other actions with individually insignificant but cumulatively significant impacts.** Cumulative effects analyses for the physical and biological resources that would potentially be affected are present in the EA. Cumulative effects on these resources focus on disturbed soils and habitat relating to construction activities involved in the Proposed Action. The Proposed Action would not result in any cumulative impacts concerning any reasonably foreseeable action in the project area.

8. **The degree to which the action may adversely affect items listed or eligible for listing in the National Register of Historic Places, or other significant scientific, cultural or historic resources.** No significant impacts would occur with the Proposed Action or any of the other Alternatives.

9. **The degree to which the action may adversely affect an endangered or threatened species or its critical habitat.** No endangered or threatened species are in the project area.

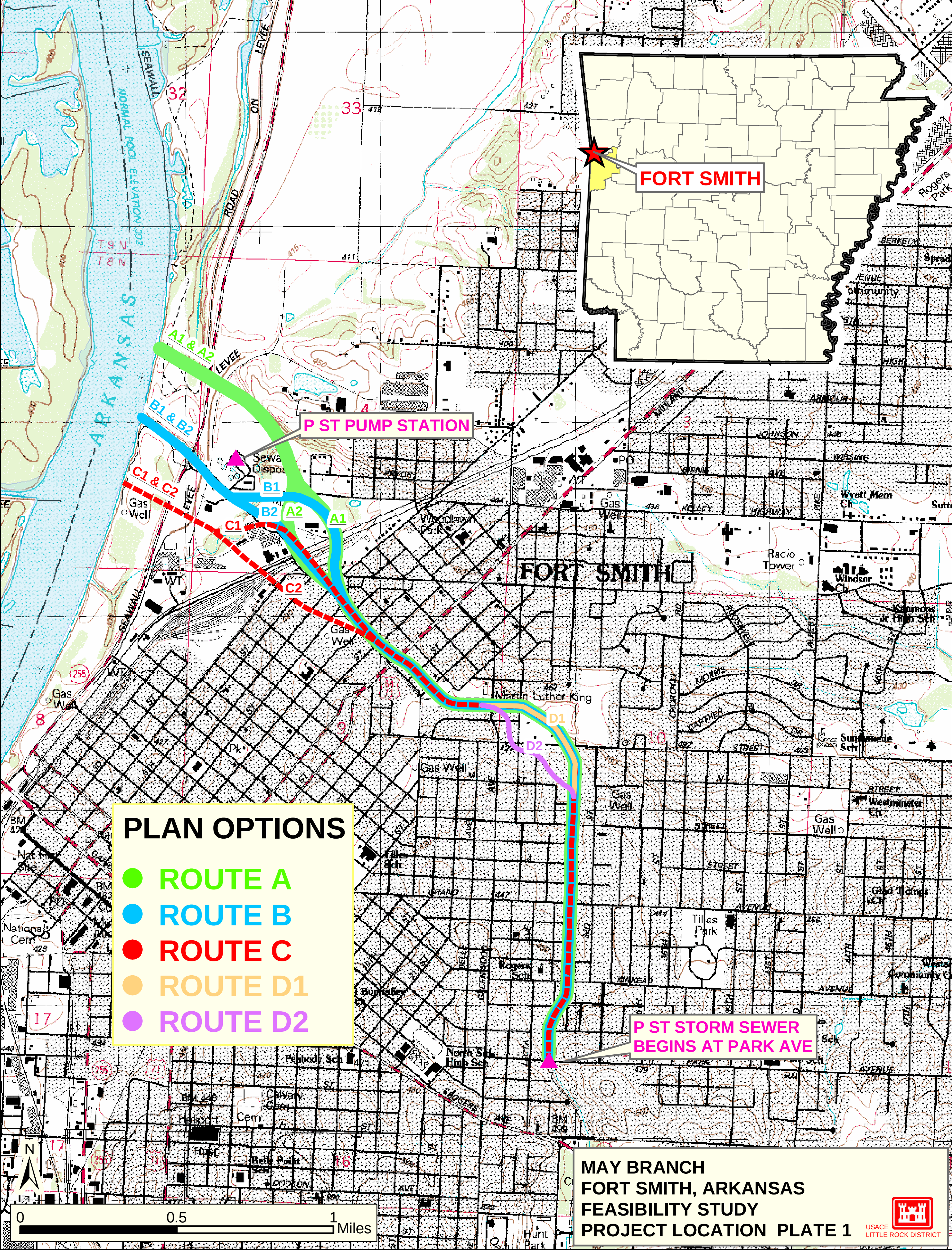
10. **Whether the action threatens a violation of Federal, State or local law or requirements imposed for the protection of the environment.** No such violations will occur. Permits from other jurisdictional agencies such as NPDES permits from the Arkansas Department of Environmental Quality are necessary and will be obtained prior to any construction activities. Continued coordination with regulatory agencies will be ongoing to ensure compliance with all Federal, state, regional, and local regulations and guidelines

CONCLUSIONS:

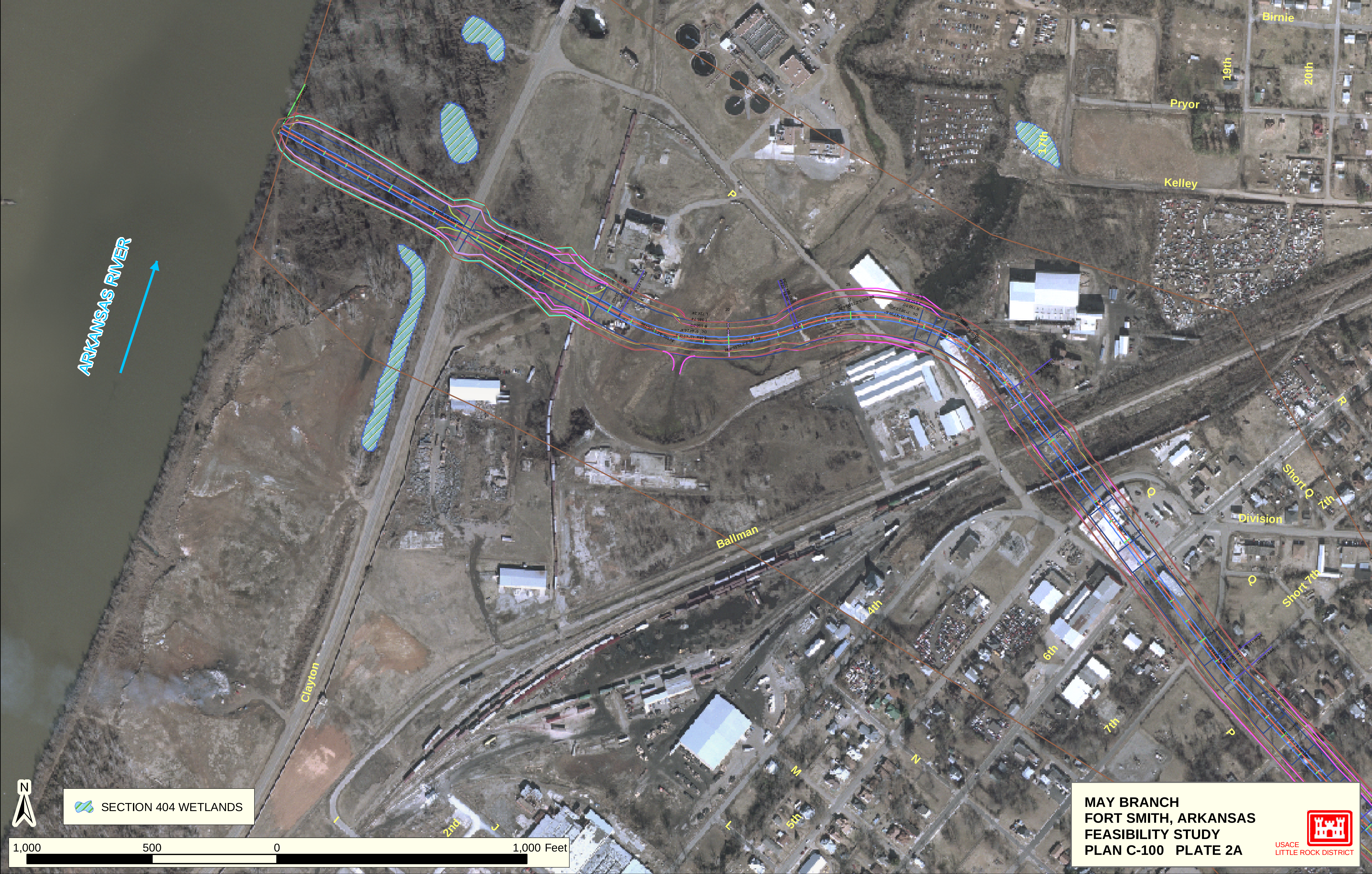
The impacts identified in the prepared EA have been thoroughly discussed and assessed. No impacts identified in the EA would cause any significant adverse effects to the human environment. Therefore, due to the analysis presented in the EA and comments received from a 30-day public review period that began on July 28, 2006, and ended on September 6, 2006, it is my decision that the preparation of an Environmental Impact Statement (EIS) as required by the National Environmental Policy Act (NEPA) is unwarranted and a "Finding of No Significant Impact" (FONSI) is appropriate. The signing of this document indicates the Corps final decision of the proposed action as it relates to NEPA. The EA and FONSI will be held on file in the Planning and Environmental Office for future reference. Consultation with regulatory agencies will be ongoing to ensure compliance with all Federal, state, regional and local regulations and guidelines.

20 Sept 2006
Date

WALLY Z. WALTERS
Colonel, US Army
District Engineer



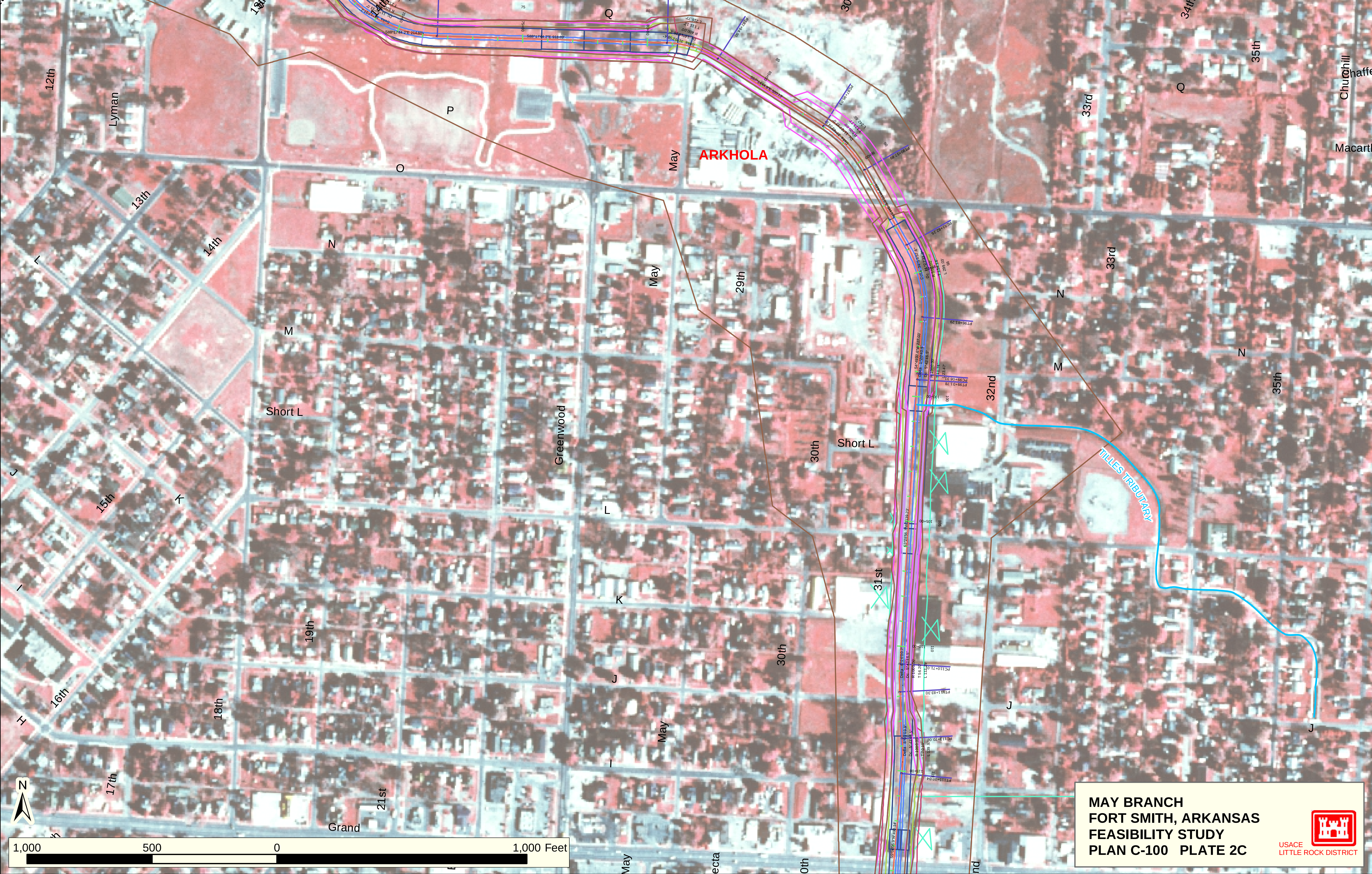
MAY BRANCH
FORT SMITH, ARKANSAS
FEASIBILITY STUDY
PROJECT LOCATION PLATE 1



MAY BRANCH
FORT SMITH, ARKANSAS
FEASIBILITY STUDY
PLAN C-100 PLATE 2A

MAY BRANCH
FORT SMITH, ARKANSAS
FEASIBILITY STUDY
PLAN C-100 PLATE 2B

USACE
LITTLE ROCK DISTRICT

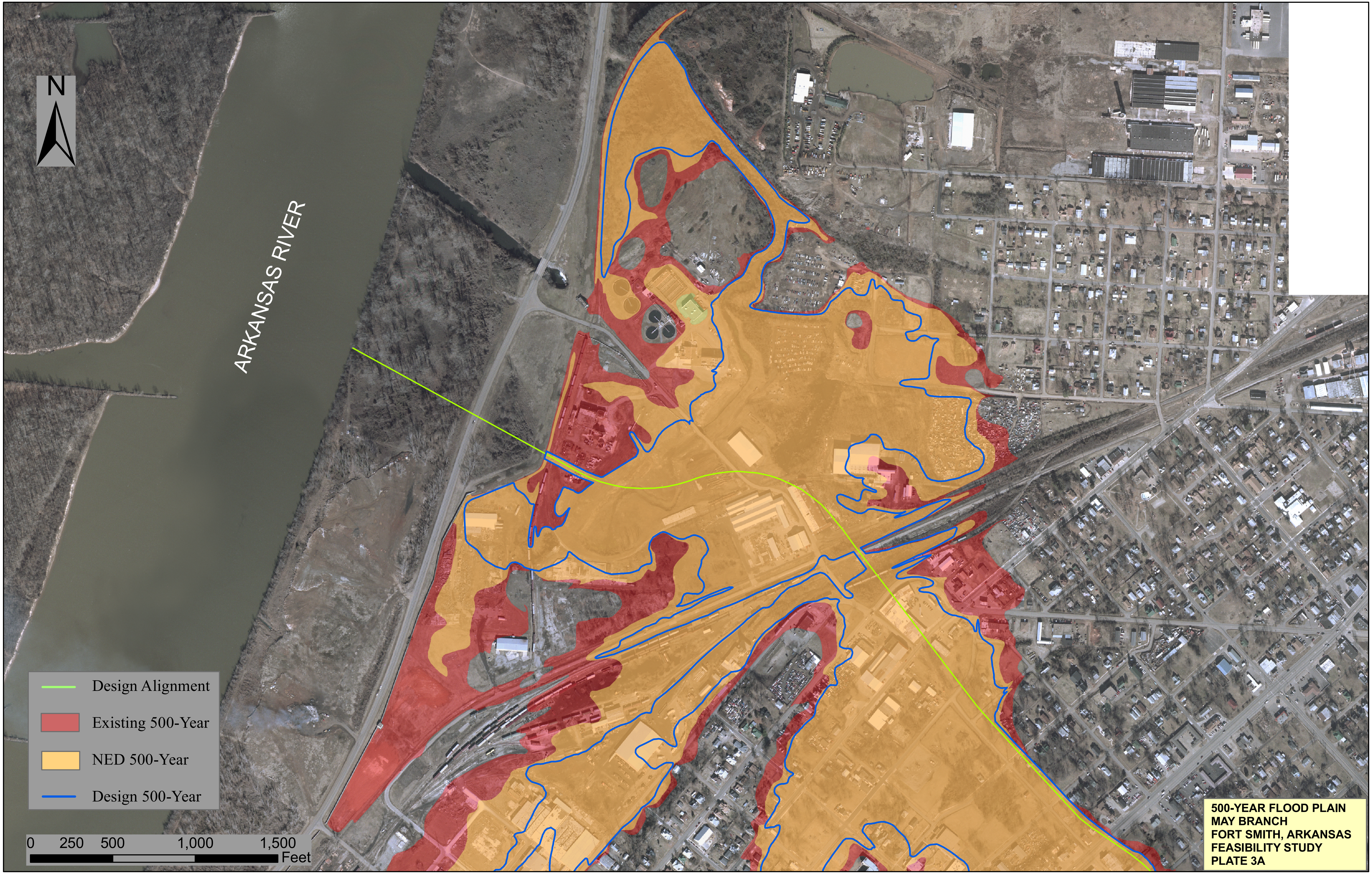


MAY BRANCH
FORT SMITH, ARKANSAS
FEASIBILITY STUDY
PLAN C-100 PLATE 2C

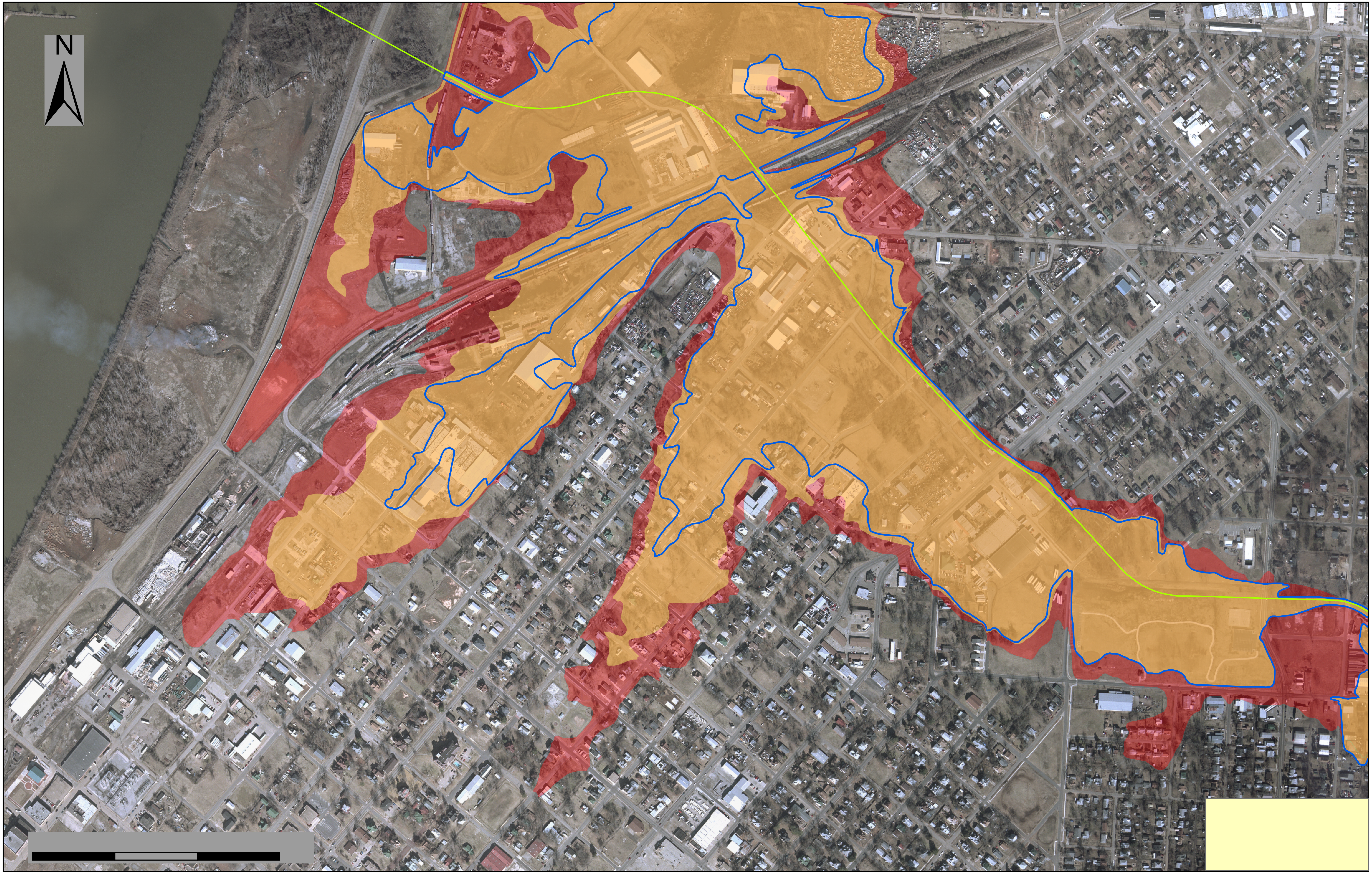
USACE
LITTLE ROCK DISTRICT

MAY BRANCH
FORT SMITH, ARKANSAS
FEASIBILITY STUDY
PLAN C-100 PLATE 2D

USACE
LITTLE ROCK DISTRICT



500-YEAR FLOOD PLAIN
MAY BRANCH
FORT SMITH, ARKANSAS
FEASIBILITY STUDY
PLATE 3A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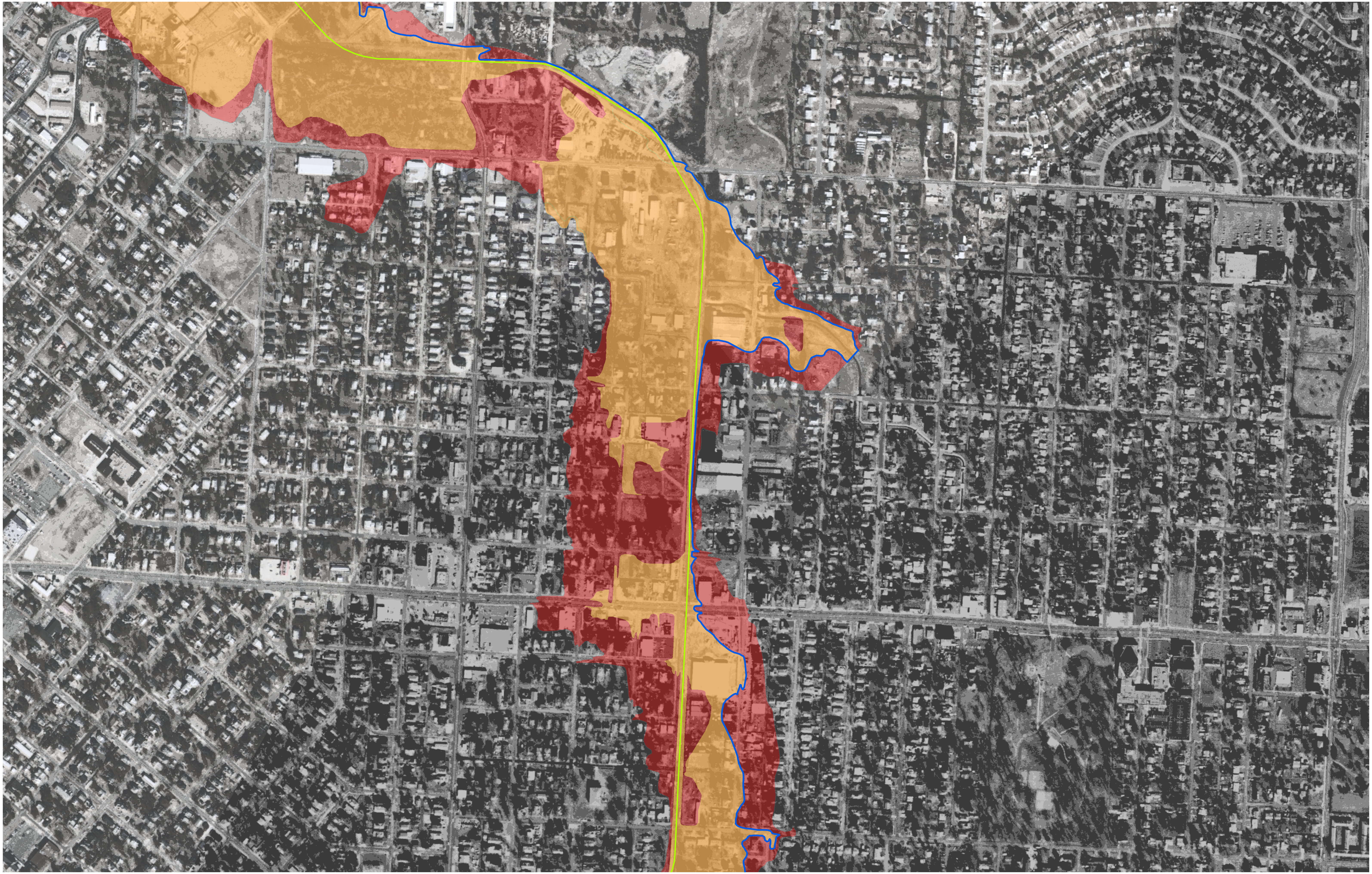

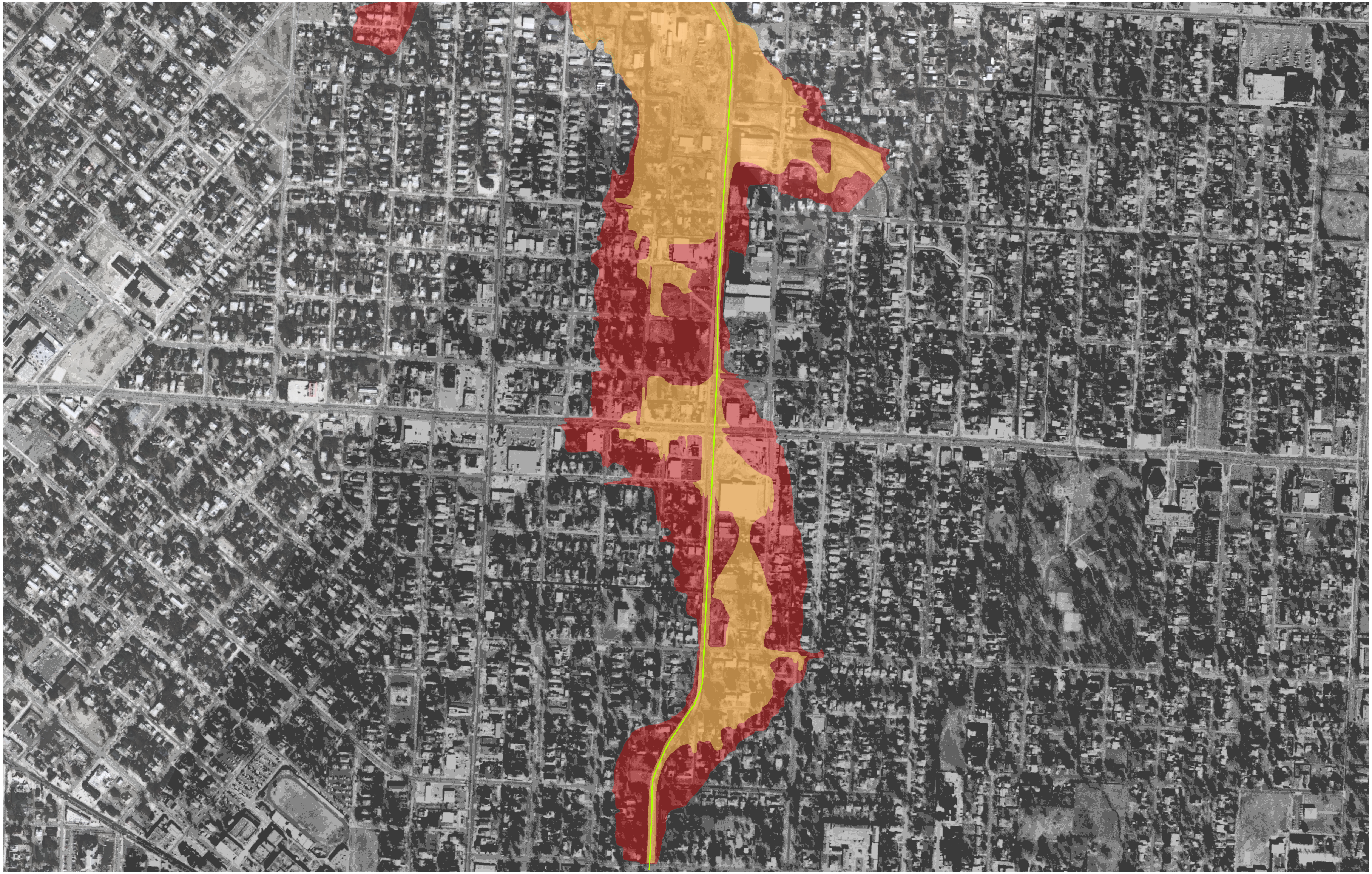

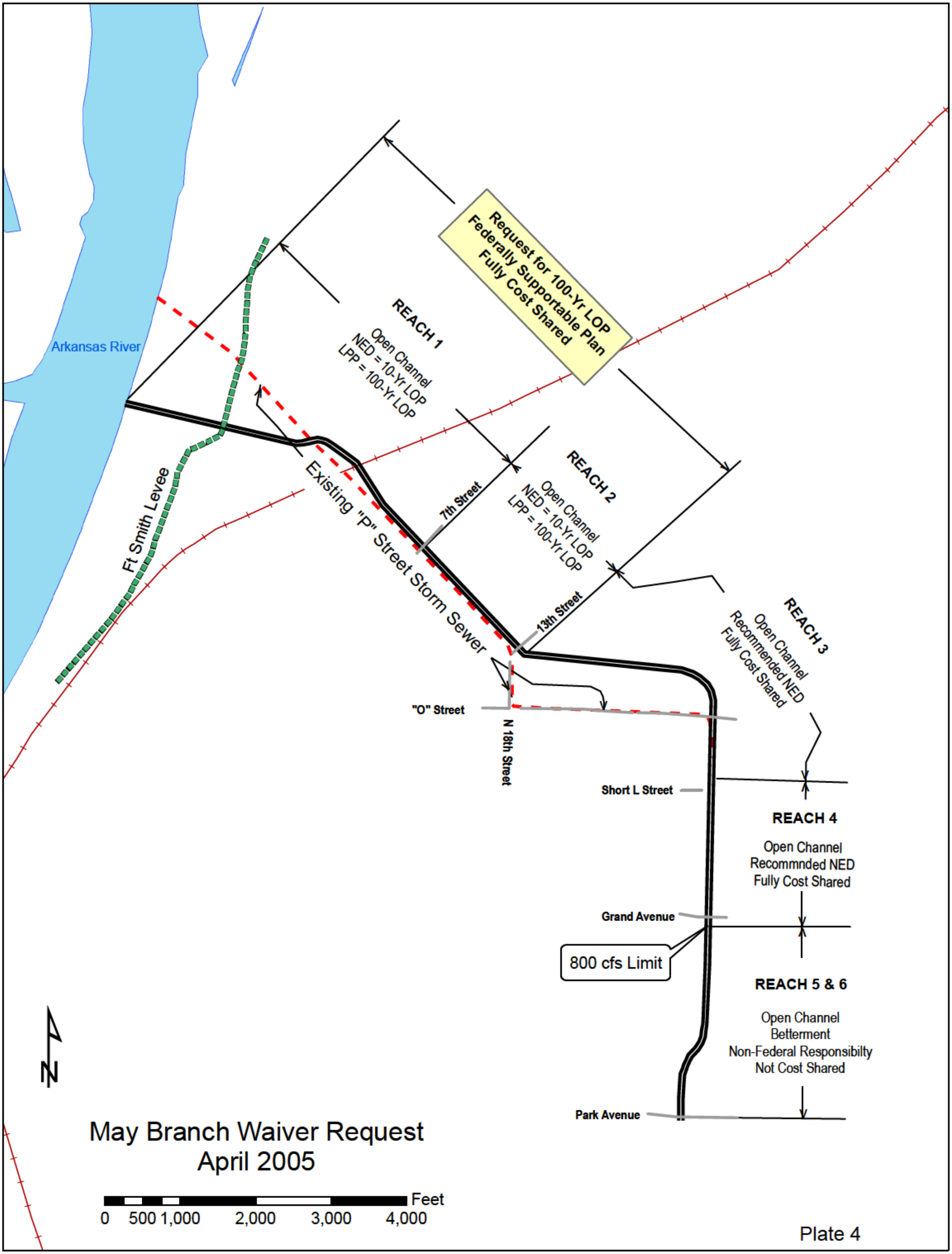

May Branch Waiver Request
April 2005

Plate 4

APPENDIX A
AGENCY CORRESPONDENCE
AND
OTHER ENVIRONMENTAL ASSESSMENT DATA

APPENDIX A
Section A
Agency Correspondence

DEPARTMENT OF DEFENSE UNITED STATES OF AMERICA

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

27 OCT 2005

MEMORANDUM FOR DIRECTOR OF CIVIL WORKS

SUBJECT: May Branch, Fort Smith, Arkansas – Deviation from the National Economic Development (NED) Plan

I am responding to CEMP-SWD memorandum dated July 19, 2005, requesting that I grant an exception to the requirement to recommend the NED plan and to allow the Army Corps of Engineers to recommend Federal participation in the locally preferred plan (LPP) for flood control improvements at May Branch, Fort Smith, Arkansas.

After reviewing the materials you provided, I have decided to grant the requested policy exception because implementation of the locally-preferred 100-year level of protection, instead of a 10-year level, for reaches 1 and 2 (out of 6) increases the number of structures removed from the 100-year floodplain from 88 to 126, an overall increase of 43 percent. Additionally, this approach will remove 126 of 127 structures in all reaches from the 100-year floodplain. The total project cost for the NED plan is $20.3 million. The additional cost to implement the LPP of $1.4 million is not unreasonable in accordance with Corps regulations and the damages are thereby reduced significantly. The basin is already 100 percent urbanized so implementing the LPP would not materially change the local planning environment. Finally, implementing the LPP will reduce non-Federal eligibility requirements for the National Flood Insurance Program, has the potential to reduce future net subsidized reimbursements for flood losses. Finally, there are no additional non-structural measures that could be implemented.

The Little Rock District may prepare a draft report and environmental impact statement recommending Federal participation in the locally preferred plan (100-year level of protection for all 6 reaches) and cost share this entire plan in accordance with Section 103 of the Water Resources Development Act, as amended. The cost of any betterments upstream of the 800 cfs limit in reaches 5 and 6 must be a 100 percent local responsibility.

If there are any questions, your staff may contact Mr. Chip Smith, Assistant for Environment, Tribal, and Regulatory Affairs at (703) 693-3655.

John Paul Woodley, Jr.

John Paul Woodley, Jr.
Assistant Secretary of the Army
(Civil Works)

The City of Fort Smith
ARKANSAS

October 5, 2004

Julia Smethurst
Project Manager
U.S. Army Corps of Engineers - Little Rock District
P.O. Box 867
Little Rock, Arkansas 72203-0867

Re: May Branch Feasibility Study
Fort Smith, Arkansas

Dear Ms. Smethurst:

This letter is written as a follow up to the issue of the "P" Street storm sewer repair costs that was raised during the Alternative Formulation Briefing held on September 22, 2004. As part of the May Branch Feasibility Study, the existing "P" Street storm sewer was inspected and repair costs were determined. For reaches 1 through 4, the estimated repair cost is $1.2 million. The damages for the "without" project conditions assumes that the "P" Street storm sewer will continue to function. As such, the costs of repairs "with" or "without" project are the same and are not included in the total project estimate.

The City currently maintains the "P" Street storm sewer and will continue to maintain this storm sewer after completion of the May Branch project. At the future time of construction of the May Branch project, the City will also repair the "P" Street storm sewer as noted above. The City has a sales tax dedicated to drainage and street improvements and has budgeted $16.6 million over the next five years for the May Branch project.

We look forward to continuing our work with the Little Rock District on the May Branch Drainage Project. Should you need any additional information please contact me.

Sincerely,

Stan Snodgrass

Stan Snodgrass, P.E.
Director of Engineering

c: Ray Gosack

U:\My Documents\98-12-B (Maybranch)\smethurst 100504.wpd

623 Garrison Avenue
P.O. Box 1908
Fort Smith, Arkansas 72902
(501) 785-2801
Administrative Offices FAX (501) 784-2407

The City of Fort Smith

October 12, 1992

Colonel David R. Ruf
District Engineer
U.S. Army Corps of Engineers
P.O. Box 867
Little Rock, AR 72203-0867

RE: May Branch, Fort Smith, Arkansas

Dear Colonel Ruf:

The City's engineering staff has reviewed the Reconnaissance Report for the May Branch basin in Fort Smith, which was accomplished under Section 205 of the Flood Control Act of 1946, as amended. We understand that the May Branch study can be incorporated into the Arkansas River Wetlands and Flood Control Study. We request that change.

The City strongly supports flood improvement. Therefore, we request that a General Investigation be conducted with additional alternatives evaluated and a more extensive project be considered in order to address the flooding on a more comprehensive scale.

We are aware that under Public Law 99-662 the next step in the implementation of a flood reduction project along May Branch is the preparation of a 50-50 cost shared feasibility study. We understand that the construction of any project is contingent upon showing the considered works of improvement are cost effective and in the overall public interest for reducing flood damages. We further understand that during construction, the minimum required non-federal contribution is equal to 25 percent of the cost of the project assigned to flood control, including a 5 percent cash contribution. The maximum non-federal share is not to exceed 50 percent of the cost assigned to flood control.

The City collects $9.5 million a year from a sales tax dedicated to improvements including drainage. We are prepared to recommend to the City's Board of Directors that we fund our share of study and construction costs out of these revenues.

We look forward to participating in the study and project. Please contact us when you are ready to initiate feasibility study negotiations.

Sincerely,

Stribling Boynton

Stribling P. Boynton
City Administrator

SPB/mdp

The Department of
Arkansas
Heritage

Mike Huckabee, Governor
Cathie Matthews, Director

Arkansas Arts Council
▪
Arkansas Natural Heritage Commission
▪
Delta Cultural Center
▪
Historic Arkansas Museum
▪
Mosaic Templars Cultural Center
▪
Old State House Museum

Arkansas Historic Preservation Program

1500 Tower Building
323 Center Street
Little Rock, AR 72201
(501) 324-9880
fax: (501) 324-9184
tdd: (501) 324-9811
e-mail: info@arkansaspreservation.org
website:
www.arkansaspreservation.org

August 30, 2006

Mr. Jim D. Ellis
Little Rock District Corps of Engineers
Planning Branch
Post Office Box 867
Little Rock, Arkansas 72203-0867

RE: Sebastian County - Fort Smith
Section 106 Review - COE
May Branch Project
AHPP Tracking No: 61099

Dear Mr. Ellis:

This letter is written in response to your inquiry regarding properties of architectural, historical, or archeological significance in the area of the referenced project. My staff has reviewed the documentation regarding the above-referenced undertaking. Our records show that one historic site (SB0490S - Martin Luther King, Jr. Monument) is located adjacent the subject project and may be affected by the proposed construction. This monument should be avoided and protected during construction activity.

In July 1999, we found that this undertaking would have no effect on historic properties and that finding still stands. However, if cultural remains, such as Native American pottery, stone tools, bones, old bottles or china are discovered during project implementation, work in the area of discovery should stop and the District Archeologist should be contacted immediately. We will evaluate his documentation as expeditiously as possible.

Thank you for the opportunity to comment on this undertaking. If you have any questions, please contact Steve Imhoff of my staff at (501) 324-9880.

Sincerely,

Ken Grunewald
Deputy State Historic Preservation Officer

cc: Ms. Margaret Bell, Wichita & Affiliated Tribes
Mr. Robert Cast, Caddo Nation of Oklahoma
Mr. Christopher G. Davies, Little Rock District Corps of Engineers
Dr. Ann M. Early, Arkansas Archeological Survey
Ms. Carrie V. Wilson, Quapaw Tribe of Oklahoma

STATE OF ARKANSAS
Department of Finance
and Administration

OFFICE OF INTERGOVERNMENTAL SERVICES
1515 West Seventh Street, Suite 417
Post Office Box 8031
Little Rock, Arkansas 72203-8031
Phone: (501) 682-1074
Fax: (501) 682-5206
http://www.state.ar.us/dfa

September 6, 2006

Mr. Jim D. Ellis
U.S. Army Corps of Engineers
Little Rock District, Planning Branch
P.O. Box 867
Little Rock, AR 72203-0867

RE: PUBLIC DRAFT - Feasibility Report, Enviormental Assessment
May Branch, Fort Smith, Arkansas.

Dear Mr. Ellis:

The State Clearinghouse has received the above document pursuant to the Arkansas Project Notification and Review System.

To carry out the review and comment process, this document was forwarded to members of the Arkansas Technical Review Committee. Resulting comments received from the Technical Review Committee which represents the position of the State of Arkansas are attached.

The State Clearinghouse wishes to thank you for your cooperation with the Arkansas Project Notification and Review System.

Sincerely,

Tracy L. Copeland, Manager
State Clearinghouse

TLC/th
Enclosure
CC: Randy Young, ANRC

Arkansas Natural Resources Commission

J. Randy Young, PE
Executive Director

101 East Capitol, Suite 350
Little Rock, Arkansas 72201
http://www.anrc.arkansas.gov/

Phone: (501) 682-1611
Fax: (501) 682-3991
E-mail: anrc@arkansas.gov

Mike Huckabee
Governor

MEMORANDUM

TO: Mr. Tracy Copeland, Manager
State Clearinghouse

FROM: Mr. J. Randy Young, P.E., Chairman
Technical Review Committee

RECEIVED
SEP 06 2006
INTERGOVERNMENTAL
SERVICES
STATE CLEARINGHOUSE

SUBJECT: PUBLIC DRAFT – Feasibility Report
Environmental Assessment
May Branch, Fort Smith, Arkansas

DATE: September 6, 2006

Members of the Technical Review Committee have reviewed the above referenced project; the purpose of the feasibility study is to identify, evaluate, and recommend to decision makers a coordinated, implementable solution to the identified water resources problems and opportunities for May Branch in Fort Smith, Arkansas. It is recommended that improvements to May Branch for flood control with minor environmental restoration benefits be authorized for construction. The project area supports relatively minor wildlife populations. There are no prime farmlands within the project area. If nothing is done, frequent flooding will continue to cause considerable damage along May Branch. Street intersections will continue to function as detention basins after curb and drop inlets have reached capacity, and excess runoff will flow between buildings and across low-lying terrain. The project cost is estimated to be $21,698,200.00, which excludes a $4,326,700.00 betterment that is a total non-Federal cost. The report meets the needs of the local community.

The Committee supports this project. Agency comments are included for your review.

The opportunity to comment is appreciated.
JRY/ddavis

STATE OF ARKANSAS

Department of Finance and Administration

OFFICE OF INTERGOVERNMENTAL SERVICES

1515 West Seventh Street, Suite 412
Post Office Box 8031
Little Rock, Arkansas 72203-8031
Phone: (501) 682-1074
Fax: (501) 682-5206
http://www.state.ar.us/dfa

MEMORANDUM

TO: All Technical Review Committee Members

FROM: Tracy L. Copeland TLC Manager - State Clearinghouse # 2010

DATE: July 27, 2006

SUBJECT: PUBLIC DRAFT – Feasibility Report and Environmental Assessment May Branch, Fort Smith, Arkansas.

Please review the above stated document under provisions of Section 404 of the Clean Water Act, Section 102(2) of the National Environmental Policy Act of 1969 and the Arkansas Project Notification and Review System.

Your comments should be returned by August 11, 2006 to - Mr. Randy Young, Chairman, Technical Review Committee, 101 E. Capitol, Suite 350, Little Rock, AR 72203.

If you have no reply within that time we will assume you have no comments and will proceed with the sign-off.

NOTE: It is Imperative that your response be in to the ASWCC office by the date requested. Should your Agency anticipate having a response which will be delayed beyond the stated deadline for comments, please contact Ms. Debby Davis of the ASWCC at (501) 682-1611 or the State Clearinghouse Office.

______ Support

✓ Comments Attached

______ No Comments

______ Do Not Support (Comments Attached)

______ Support with Following Conditions

______ Non-Degradation Certification Issues (Applies to ADEQ Only)

Name(print) Colbert Agency ANRC Date 9-1-06

Telephone Number______________

Arkansas Natural Resources Commission

J. Randy Young, P.E.
Executive Director

101 East Capitol Avenue, Suite 350
Little Rock, Arkansas 72201
http://www.aswcc.arkansas.gov/

Phone: (501) 682-1611
Fax: (501) 682-3991
E-mail: anrc@arkansas.gov

Mike Huckabee
Governor

August 16, 2006

Mr. Jim D. Ellis
Planning & Environmental Office
USACE, Little Rock District
Post Office Box 867
Little Rock, Arkansas 72203-0867

Re: Draft Feasibility Report and Environmental Assessment (EA) and Draft Finding of No Significant Impact (FONSI) for the May Branch, Fort Smith, Arkansas Project

Dear Mr. Ellis:

Thank you for the opportunity to comment on the proposed Draft Feasibility Report and EA and Draft FONSI regarding the channelization of May Branch to alleviate flooding problems in Fort Smith, Arkansas. Approximately 2.75 miles of the original channel of May Branch was covered and converted to an underground storm sewer tunnel in 1910. It is recommended that improvements to May Branch for flood control with minor environmental restoration benefits be authorized for construction.

My staff has reviewed the Draft Feasibility Report and EA, and concurs with the findings presented in the Draft FONSI. I recommend the project move forward with the Locally Preferred Plan.

If you have any questions or need further assistance, please contact Kenneth Colbert of my staff at 501-682-1608. Again, thank you for the opportunity to review and comment on the Draft Feasibility Report and EA and Draft FONSI regarding the channelization of May Branch.

Sincerely,

J. Randy Young, P.E.
Executive Director

JRY/kc

STATE OF ARKANSAS

Department of Finance and Administration

OFFICE OF INTERGOVERNMENTAL SERVICES

1515 West Seventh Street, Suite 412
Post Office Box 8031
Little Rock, Arkansas 72203-8031
Phone: (501) 682-1074
Fax: (501) 682-5206
http://www.state.ar.us/dfa

MEMORANDUM

RECEIVED
JUL 28 2006

TO: All Technical Review Committee Members

FROM: Tracy L. Copeland, Manager - State Clearinghouse

DATE: July 27, 2006

SUBJECT: PUBLIC DRAFT – Feasibility Report and Environmental Assessment
May Branch, Fort Smith, Arkansas.

Please review the above stated document under provisions of Section 404 of the Clean Water Act, Section 102(2) of the National Environmental Policy Act of 1969 and the Arkansas Project Notification and Review System.

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______ Support	______ Do Not Support (Comments Attached)
X Comments ~~Attached~~ Below	______ Support with Following Conditions
______ No Comments	______ Non-Degradation Certification Issues (Applies to ADEQ Only)

Project will need to meet stormwater and Section 404/401 water quality certification requirements

Name(print) Keith Brown Agency ADEQ Date 7-31-06

Telephone Number 682-0653

STATE OF ARKANSAS

Department of Finance and Administration

OFFICE OF INTERGOVERNMENTAL SERVICES

1515 West Seventh Street, Suite 412
Post Office Box 8031
Little Rock, Arkansas 72203-8031
Phone: (501) 682-1074
Fax: (501) 682-5206
http://www.state.ar.us/dfa

MEMORANDUM

Bob,
please rev. + comment

TO: All Technical Review Committee Members

FROM: Tracy L. Copeland TLC Manager - State Clearinghouse

DATE: July 27, 2006

SUBJECT: PUBLIC DRAFT – Feasibility Report and Environmental Assessment May Branch, Fort Smith, Arkansas.

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______ Support

[✓ Comments Attached]

______ No Comments

________ Do Not Support (Comments Attached)

________ Support with Following Conditions

________ Non-Degradation Certification Issues (Applies to ADEQ Only)

Name(print) Robert K. Leonard Agency AGFC Date 8-7-06

Telephone Number 978-7301

Arkansas Game and Fish Commission

2 Natural Resources Drive Little Rock, Arkansas 72205

Scott Henderson
Director

Mike Gibson
Deputy Director

David Goad
Deputy Director

Loren Hitchcock
Deputy Director

August 4, 2006

Mr. Jim D. Ellis
U.S. Army Corps of Engineers
Little Rock Planning Branch
P.O. Box 867
Little Rock, AR 72203-0867

Dear Mr. Ellis:

Your letter dated July 26,2006 concerning the Draft Feasibility Report and Environmental Assessment and the Draft Finding of No Significant Impact Report for the proposed May Branch project Located in Fort Smith, Sebastian County, Arkansas, has been referred to me for reply.

Biologists from our agency have reviewed this report and recommend the locally preferred plan (LPP). Our agency would recommend constructing baffles in the runoff area to increase dissolved oxygen in the water and trash racks to collect trash before it enters into the river. We would also suggest placing fabric and rip-rap at the outlet to control erosion. Our fisheries biologist feel that the storm water runoff should be separated from the P Street sewage system to avoid impacts to fisheries habitat.

Our agency appreciates the opportunity to review these comments and look forward to working cooperatively with your agency in the future.

Sincerely,

Michael D Gibson

Michael D. Gibson
Deputy Director

Cc: Doyle Shook
Mike Armstrong
USFWS

Phone: 501-223-6300 Fax: 501-223-6448 Website: www.agfc.com

The mission of the Arkansas Game and Fish Commission is to wisely manage all the fish and wildlife resources of Arkansas while providing maximum enjoyment for the people.

STATE OF ARKANSAS

Department of Finance and Administration

OFFICE OF INTERGOVERNMENTAL SERVICES

1515 West Seventh Street, Suite 412
Post Office Box 8031
Little Rock, Arkansas 72203-8031
Phone: (501) 682-1074
Fax: (501) 682-5206
http://www.state.ar.us/dfa

MEMORANDUM

TO: All Technical Review Committee Members

FROM: Tracy L. Copeland TLC Manager - State Clearinghouse

DATE: July 27, 2006

SUBJECT: PUBLIC DRAFT – Feasibility Report and Environmental Assessment May Branch, Fort Smith, Arkansas.

Please review the above stated document under provisions of Section 404 of the Clean Water Act, Section 102(2) of the National Environmental Policy Act of 1969 and the Arkansas Project Notification and Review System.

Your comments should be returned by August 11, 2006 to - Mr. Randy Young, Chairman, Technical Review Committee, 101 E. Capitol, Suite 350, Little Rock, AR 72203.

If you have no reply within that time we will assume you have no comments and will proceed with the sign-off.

NOTE: It is Imperative that your response be in to the ASWCC office by the date requested. Should your Agency anticipate having a response which will be delayed beyond the stated deadline for comments, please contact Ms. Debby Davis of the ASWCC at (501) 682-1611 or the State Clearinghouse Office.

✓ Support

_____ Do Not Support (Comments Attached)

_____ Comments Attached

_____ Support with Following Conditions

_____ No Comments

_____ Non-Degradation Certification Issues (Applies to ADEQ Only)

Name(print) JAMES L [illegible] Agency ________ Date 2 Aug 06

Telephone Number 501-296-1813

Attachment

STATE OF ARKANSAS

Department of Finance and Administration

OFFICE OF INTERGOVERNMENTAL SERVICES

1515 West Seventh Street, Suite 412
Post Office Box 8031
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_______ Support

_______ Do Not Support (Comments Attached)

_______ Comments Attached

_______ Support with Following Conditions

_______ No Comments

_______ Non-Degradation Certification Issues (Applies to ADEQ Only)

RECEIVED

Name(print) Harold Seifert Agency ENGINEERING SECTION Date 08-01-06

Telephone Number 501-661-2623

DIVISION OF HEALTH - SLOT H37
AR DEPT. OF HEALTH & HUMAN SERVICES
P.O. BOX 1437
LITTLE ROCK, AR 72203-1437

STATE OF ARKANSAS

Department of Finance and Administration

OFFICE OF INTERGOVERNMENTAL SERVICES

1515 West Seventh Street, Suite 412
Post Office Box 8031
Little Rock, Arkansas 72203-8031
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MEMORANDUM

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DATE: July 27, 2006

SUBJECT: PUBLIC DRAFT – Feasibility Report and Environmental Assessment
May Branch, Fort Smith, Arkansas.

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Your comments should be returned by August 11, 2006 to - Mr. Randy Young, Chairman, Technical Review Committee, 101 E. Capitol, Suite 350, Little Rock, AR 72203.

If you have no reply within that time we will assume you have no comments and will proceed with the sign-off.

NOTE: It is Imperative that your response be in to the ASWCC office by the date requested. Should your Agency anticipate having a response which will be delayed beyond the stated deadline for comments, please contact Ms. Debby Davis of the ASWCC at (501) 682-1611 or the State Clearinghouse Office.

✓ Support

✓ Comments Attached

____ No Comments

____ Do Not Support (Comments Attached)

____ Support with Following Conditions

____ Non-Degradation Certification Issues
(Applies to ADEQ Only)

Name(print) William Prior Agency AGC Date 7-28-2006

Telephone Number 683-0117

Arkansas GEOLOGICAL COMMISSION
VARDELLE PARHAM GEOLOGY CENTER•3815 WEST ROOSEVELT ROAD• LITTLE ROCK, ARKANSAS 72204

Mike Huckabee
Governor
Bekki White
Director and State Geologist

July 28, 200

Mr. Randy Young
Chairman, Technical Review Committee
101 E. Capitol, Suite 350
Little Rock, Arkansas 72203

Dear Mr. Young:

This letter is a response to your request for comments on the proposed rechannelization of May Branch in the City of Fort Smith, Sebastian County, Arkansas. The following comments pertain to the Geologic section of the Environmental Assessment on page 35.

The geologic descriptions given come from a very old reference and also seem to contain soil information. The project area contains bedrock of the Pennsylvanian age McAlester that is composed of beds of sandstone, siltstone and shale. Overlying this bedrock is Quaternary age local stream alluvium composed of sandstone cobbles, fine to medium sand and clay. The area northwest of the railroad tracks is in the Quaternary age alluvium of the Arkansas River which contains coarser sand less clay and chert cobbles.

If you have any questions about these comments please feel free to contact me.

Sincerely,

William Lee Prior

William Lee Prior
Geologist Supervisor

PHONE: (501) 296-1877; FAX: (501) 663-7360
agc@arkansas.gov
www.state.ar.us/agc/agc.htm
An equal opportunity employer

ARKANSAS FORESTRY COMMISSION

3821 West Roosevelt Road Little Rock, Arkansas 72204-6396
(501) 296-1940 fax: (501) 296-1949

John T. Shannon, R.F.
State Forester

August 2, 2006

Jim D. Ellis
U.S. Army Corps of Engineers
Little Rock District, Planning Branch,
P. O. Box 867
Little Rock, Ar 72203-0867

RE: Draft Feasibility Report and Environmental Assessment and the Draft Finding of No Significant Impact for the May Branch, Fort Smith, Arkansas Project

Dear Jim Ellis:

The above project should have no adverse impacts on the forest resources of the area.

If we can be of service, please contact us at any time.

Sincerely,

James L. Northum
Arkansas Forestry Commission
Forest Health
501-296-1863
jim.northum@arkansas.gov

www.forestry.state.ar.us

United States Department of Agriculture

NRCS

Natural Resources Conservation Service
Room 3416, Federal Building
700 West Capitol Avenue
Little Rock, Arkansas 72201-3225

Mr. Jim Ellis
Department of the Army
Little Rock District Corps of Engineers
P.O. Box 867
Little Rock, Arkansas 72203-0867

Dear Mr. Ellis:

This letter is in response to your request for comments on the Draft Feasibility Report and Environmental Assessment and the Draft Finding of No Significant Impact for the May Branch, Fort Smith, Arkansas, Project. This area is residential/urban and therefore does not fit the criteria for Prime Farmland or Farmland of Statewide Importance. Our agency concurs with the locally preferred plan. Best management practices to prevent erosion and sedimentation should be used to prevent soil erosion and to ensure good water quality. Attached is form CPA-106 for your records.

Should you have any questions or need additional information, please call me at (501) 301-3172.

Sincerely,

EDGAR P. MERSIOVSKY
Assistant State Soil Scientist

Attachment

U.S. DEPARTMENT OF AGRICULTURE
Natural Resources Conservation Service

NRCS-CPA-106
(Rev. 1-91)

FARMLAND CONVERSION IMPACT RATING FOR CORRIDOR TYPE PROJECTS

PART I *(To be completed by Federal Agency)*

3. Date of Land Evaluation Request **8/11/06**

4.

1. Name of Project **May Branch**

5. Federal Agency Involved **USACE**

2. Type of Project **Drainage Corridor**

6. County and State **Sebastian County, Arkansas**

PART II *(To be completed by NRCS)*

1. Date Request Received by NRCS **7/28/06**

2. Person Completing Form **Edgar Mersiovsky**

3. Does the corridor contain prime, unique statewide or local importan
(If no, the FPPA does not apply - Do not complete additional parts (YES ☐ NO ☑

4. Acres Irrigated | Average Farm Size

5. Major Crop(s)

6. Far ı Government Jurisdiction Acres: %

7. Amount of Farmland As Defined in FPPA Acres: %

8. Name Of Land Evaluation System Used

9. Name of Local Site Assessment System

10. Date Land Evaluation Returned by NRC

		Alternative Corridor For Segment			
PART III *(To be completed by Federal Agency)*		**Corridor A**	**Corridor B**	**Corridor C**	**Corridor D**
A. Total Acres To Be Converted Directly					
B. Total Acres To Be Converted Indirectly, Or To Receive Services					
C. Total Acres In Corridor		0	0	0	0
PART IV *(To be completed by NRCS)* **Land Evaluation Information**					
A. Total Acres Prime And Unique Farmland					
B. Total Acres Statewide And Local Important Farmland					
C. Percentage Of Farmland in County Or Local Govt. Unit To Be Converted		0			
D. Percentage Of Farmland in Govt. Jurisdiction With Same Or Higher Relative Value					
PART V *(To be completed by NRCS) Land Evaluation Information Criterion Relative value of Farmland to Be Serviced or Converted (Scale of 0 - 100 Points)*					
PART VI *(To be completed by Federal Agency) Corridor Assessment Criteria (These criteria are explained in 7 CFR 658.5(c))*	Maximum Points				
1. Area in Nonurban Use	15				
2. Perimeter in Nonurban Use	10				
3. Percent Of Corridor Being Farmed	20				
4. Protection Provided By State And Local Government	20				
5. Size of Present Farm Unit Compared To Average	10				
6. Creation Of Nonfarmable Farmland	25				
7. Availablility Of Farm Support Services	5				
8. On-Farm Investments	20				
9. Effects Of Conversion On Farm Support Services	25				
10. Compatibility With Existing Agricultural Use	10				
TOTAL CORRIDOR ASSESSMENT POINTS	160	0	0	0	0
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland (From Part V)	100				
Total Corridor Assessment (From Part VI above or a local site assessment)	160	0	0	0	0
TOTAL POINTS *(Total of above 2 lines)*	260	0	0	0	0

1. Corridor Selected:

2. Total Acres of Farmlands to be Converted by Project:

3. Date Of Selection:

4. Was A Local Site Assessment Used? YES ☐ NO ☐

5. Reason For Selection:

Signature of Person Completing this Part:

DATE

NOTE: Complete a form for each segment with more than one Alternate Corridor

CORRIDOR - TYPE SITE ASSESSMENT CRITERIA

The following criteria are to be used for projects that have a linear or corridor - type site configuration connecting two distant points, and crossing several different tracts of land. These include utility lines, highways, railroads, stream improvements, and flood control systems. Federal agencies are to assess the suitability of each corridor - type site or design alternative for protection as farmland along with the land evaluation information.

(1) How much land is in nonurban use within a radius of 1.0 mile from where the project is intended?
More than 90 percent - 15 points
90 to 20 percent - 14 to 1 point(s)
Less than 20 percent - 0 points

(2) How much of the perimeter of the site borders on land in nonurban use?
More than 90 percent - 10 points
90 to 20 percent - 9 to 1 point(s)
Less than 20 percent - 0 points

(3) How much of the site has been farmed (managed for a scheduled harvest or timber activity) more than five of the last 10 years?
More than 90 percent - 20 points
90 to 20 percent - 19 to 1 point(s)
Less than 20 percent - 0 points

(4) Is the site subject to state or unit of local government policies or programs to protect farmland or covered by private programs to protect farmland?
Site is protected - 20 points
Site is not protected - 0 points

(5) Is the farm unit(s) containing the site (before the project) as large as the average - size farming unit in the County ? (Average farm sizes in each county are available from the NRCS field offices in each state. Data are from the latest available Census of Agriculture, Acreage or Farm Units in Operation with $1,000 or more in sales.)
As large or larger - 10 points
Below average - deduct 1 point for each 5 percent below the average, down to 0 points if 50 percent or more below average - 9 to 0 points

(6) If the site is chosen for the project, how much of the remaining land on the farm will become non-farmable because of interference with land patterns?
Acreage equal to more than 25 percent of acres directly converted by the project - 25 points
Acreage equal to between 25 and 5 percent of the acres directly converted by the project - 1 to 24 point(s)
Acreage equal to less than 5 percent of the acres directly converted by the project - 0 points

(7) Does the site have available adequate supply of farm support services and markets, i.e., farm suppliers, equipment dealers, processing and storage facilities and farmer's markets?
All required services are available - 5 points
Some required services are available - 4 to 1 point(s)
No required services are available - 0 points

(8) Does the site have substantial and well-maintained on-farm investments such as barns, other storage building, fruit trees and vines, field terraces, drainage, irrigation, waterways, or other soil and water conservation measures?
High amount of on-farm investment - 20 points
Moderate amount of on-farm investment - 19 to 1 point(s)
No on-farm investment - 0 points

(9) Would the project at this site, by converting farmland to nonagricultural use, reduce the demand for farm support services so as to jeopardize the continued existence of these support services and thus, the viability of the farms remaining in the area?
Substantial reduction in demand for support services if the site is converted - 25 points
Some reduction in demand for support services if the site is converted - 1 to 24 point(s)
No significant reduction in demand for support services if the site is converted - 0 points

(10) Is the kind and intensity of the proposed use of the site sufficiently incompatible with agriculture that it is likely to contribute to the eventual conversion of surrounding farmland to nonagricultural use?
Proposed project is incompatible to existing agricultural use of surrounding farmland - 10 points
Proposed project is tolerable to existing agricultural use of surrounding farmland - 9 to 1 point(s)
Proposed project is fully compatible with existing agricultural use of surrounding farmland - 0 points

ADEQ

ARKANSAS
Department of Environmental Quality

August 14, 2006

Mr. Jim D. Ellis
U.S. Army Corps of Engineers – LR Dist.
Planning & Environmental Office
P.O. Box 867
Little Rock, Arkansas 72203-0867

RE: May Branch - Fort Smith, Arkansas Project

Dear Mr. Ellis:

The Arkansas Department of Environmental Quality has reviewed the information submitted in the referenced project. The Water Division offers the following comments:

- The project will need to comply with the requirements for NPDES Stormwater Program.
- Obtain a Section 401 Water Quality certification, in conjunction with any Section 404 permit issued.
- And, best management practices should be incorporated into the design to minimize impacts of construction to surface waters.

Thank you for the opportunity to comment and if you have any questions or concerns, please contact Keith Brown at (501) 682-0653.

Sincerely,

Nathaniel P. Nehus

Nathaniel P. Nehus
Chief Ecologist

ENVIRONMENTAL PRESERVATION AND TECHNICAL SERVICES DIVISION
8001 NATIONAL DRIVE / POST OFFICE BOX 8913 / LITTLE ROCK, ARKANSAS 72219-8913 / TELEPHONE 501-682-0937 / FAX 501-682-0936
www.adeq.state.ar.us

Arkansas Department of Health and Human Services
Division of Health
Paul K. Halverson, DrPH, Director
Engineering Section – Environmental Health Branch – Center for Local Public Health
Postal Address P. O. Box 1437, Slot H-37 Little Rock, AR 72203-1437 1-501-661-2623 TDD: 1-800-234-4399
Physical Address for UPS or Fedex 4815 West Markham St., Slot H-37 Little Rock, AR 72205 Fax: 1-501-661-2032

August 3, 2006

Roger C. Hicklin, P.E., Acting Chief
Planning and Environmental Office
Little Rock District Corps of Engineers
P.O. Box 867
Little Rock, AR

Re: May Branch Channelization
Feasibility Report and Environmental Assessment
Fort Smith, AR

Dear Mr. Hicklin,

The above reference report was received by this agency and referred to our office by Dr. Paul Halverson, Director. The report has been reviewed and there are no adverse public health impacts anticipated by the proposed work.

If we can be of further assistance, feel free to contact us. The report is being kept for our files.

Sincerely,

Robert Hart

Robert Hart, P.E., Chief Engineer
Engineering Section

Cc: Dr. Paul Halverson, Director, Division of Health

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 6
1445 ROSS AVENUE, SUITE 1200
DALLAS, TX 75202-2733

AUG 2 1 2006

Mr. Jim D. Ellis
U.S. Army Corps of Engineers
Little Rock District, Planning Branch
P.O. Box 867
Little Rock, Arkansas 72203-0867

Dear Mr. Ellis:

The Environmental Protection Agency has reviewed the Draft Feasibility Report and Environmental Assessment and Draft Finding of No Significant Impact for the May Branch, Fort Smith, Arkansas project, dated July 2006.

We concur with the Finding of No Significant Impact and the determination that an environmental impact statement is not warranted. We believe that the planning effort and environmental analyses are very well done and that the project as presently planned complies with the Clean Water Act, Section 404 (b)(1) Guidelines.

Please keep us informed about the status of this project by contacting Jeanene Peckham at 214-665-6411, or peckham.jeanene@epa.gov , or at the above mailing address.

Sincerely yours,

Sharon Fancy Parrish

Sharon Fancy Parrish
Chief
Marine and Wetlands Section

United States Department of the Interior

FISH AND WILDLIFE SERVICE
110 South Amity Road, Suite 300
Conway, Arkansas 72032
Tel.: 501/513-4470 Fax: 501/513-4480

IN REPLY REFER TO:

August 21, 2006

Mr. Jim D. Ellis
U.S. Army Corps of Engineers
P.O. Box 867
Little Rock, Arkansas 72203-0867

Dear Mr. Ellis:

The Fish and Wildlife Service (Service) has reviewed the Draft Feasibility Report, Environmental Assessment, and Finding of No Significant Impact (FONSI) for the May Branch project, Sebastian County, Arkansas supplied with your letter dated July 26, 2006. Our comments are submitted in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401. 16 U.S.C. as amended, 616 et seq.).

The Service notes that our Fish and Wildlife Coordination Act report dated February 27, 2006, has been included in the document along with the Arkansas Game and Fish Commission's (AGFC) letter dated February 17, 2006. As noted in our report, the project is located in an urban area and the fish and wildlife in the project area are low. However, the Arkansas River does support high value aquatic resources. Therefore, provided that the recommendations contained in our report and in the AGDC letter are incorporated into the proposed project, the Service has no objection to the proposed project nor to the FONSI.

We appreciate the opportunity to work with your agency during this study and look forward to working with you in the future.

Sincerely,

Margaret Harney

Margaret Harney
Acting Field Supervisor

cc:
Arkansas Game and Fish Commission, Little Rock, Arkansas
    Attn: Craig Uyeda
Arkansas Natural Heritage Commission, Little Rock, Arkansas
    Attn: Cindy Osborne
Environmental Protection Agency, Dallas, TX

ftn
Associates Ltd.
[illegible]

March 15, 2004

US Fish and Wildlife Service
ATTN: Ms. Margaret Harney
1500 Museum Road
Conway, AR 72032

RE: Request for Information Regarding Potential Threatened and Endangered Species Issues, Proposed Replacement of Existing Underground Storm Sewer System on May Branch, Fort Smith, Sebastian County, Arkansas
FTN No. 4340-130

Dear Ms. Harney:

FTN Associates, Ltd. (FTN) was selected by the City of Fort Smith to prepare an Environmental Assessment for the replacement of an existing underground storm sewer system that was installed in the early 1900's to replace the original open channel of May Branch (the Project). The enclosed underground storm sewer system, which follows the original course of the May Branch channel and terminates at the P street pumping station near Clayton Expressway, will be replaced by an open channel and attendant drainage/flood control structures. Because runoff from the area of May Branch often exceeds the capacity of the storm sewer system, local flooding of the lower reaches of the basin and a largely commercial and industrial area often causes serious impacts to industrial, commercial, and industrial properties. Implementation of the proposed project will alleviate the flooding problems.

In the past, FTN has coordinated threatened and endangered species issues (and other fish and wildlife resource issues) associated with the May Branch project with your office. In a letter dated August 3, 1999 you wrote: "Our records indicate no endangered or threatened species or their critical habitat exist within or adjacent to May Branch within the city limits of Fort Smith. Therefore, no further consultation in accordance with the ESA will be required.

With this letter, we hereby request confirmation that the information provided in your 1999 clearance letter remains unchanged. Please provide us with any information to the contrary.

Legal descriptions for the proposed project area include parts of Sections 4, 5, 9, 10 and 15, Township 8 North, Range 32 West. The proposed area is encompassed within the following coordinates:

Northwest corner:	35° 24' 40"
	94° 25' 30"
Southwest corner:	35° 22' 30"
	94° 25' 30"
Northeast corner:	35° 24' 00"
	94° 23' 40"
Southeast corner:	35° 24' 00"

If you have questions or need additional information, please feel free to call me or David Rupe (501) 225-7779.

Kindest regards,
FTN ASSOCIATES, LTD.

Gary E. Tucker

Gary E. Tucker, PhD, PWS
Environmental Scientist

P:\WP FILES\4340-1301-HARNEY-7.DOC

No federally listed endangered,
threatened or candidate species present

No federally listed endangered,
threatened or candidate species present

Margaret Harney
Environmental Coordinator
U.S. Fish and Wildlife Service

Log#____________________

June 24 2004
Date

MARCH 3, 1849

IN REPLY REFER TO:

United States Department of the Interior

FISH AND WILDLIFE SERVICE
1500 Museum Road, Suite 105
Conway, Arkansas 72032

August 3, 1999

Ms. Shannon P. Holbrook
Environmental Scientist
FTN Associates, Ltd.
3 Innwood Circle, Suite 220
Little Rock, Arkansas 72211

Dear Ms. Holbrook:

The Fish and Wildlife Service has reviewed the information supplied with your letter dated July 28, 1999, requesting information concerning any endangered, threatened or proposed species that may be present in the vicinity of May Branch, within the city of Fort Smith, Sebastian County, Arkansas. Our comments are provided in accordance with the Endangered Species Act (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

Our records indicate no endangered or threatened species or their critical habitat exist within or adjacent to May Branch within the city limits of Fort Smith. Therefore, no further consultation in accordance with the ESA will be required.

We appreciate your interest in the preservation of endangered species.

Sincerely,

Margaret Harney

Margaret Harney
Environmental Coordinator

cc:
U.S. Army Corps of Engineers, Little Rock, AR
Attn: Jim Ellis
Arkansas Game and Fish Commission, Little Rock, AR
Attn: Craig Uyeda

RECD AUG 05 1999

ftn
Associates Ltd.
water resources / environmental consultants

Bob
Cn

RECEIVED
JUL 2 1999
RIVER BASIN

July 28, 1999

ARKANSAS GAME & FISH COMMISSION
Our records indicate no federally listed endangered and/or threatened fish and wildlife species occur in the project area.

Date: 8-5-99

Signed: Robert K. Leonard

Mr. Bob Leonard
Arkansas Game and Fish Commission
#2 Natural Resources Drive
Little Rock, AR 72205

RE: Request for Information Regarding Potential Threatened and Endangered Species Issues, Proposed Replacement of Existing Underground Storm Sewer System on May Branch, Fort Smith, Sebastian County, Arkansas
FTN No. 4340-130

Dear Mr. Leonard:

FTN Associates, Ltd. (FTN) has been selected by the City of Fort Smith to prepare an Environmental Assessment for the replacement of an existing underground storm sewer system that was installed in the early 1900's to replace the original open channel of May Branch (the Project). The enclosed underground storm sewer system, which follows the original course of the May Branch channel and terminates at the P street pumping station near Clayton Expressway, will be replaced by an open channel and attendant drainage/flood control structures. Because runoff from the drainage area of May Branch often exceeds the capacity of the storm sewer system, local flooding of the lower reaches of the basin often causes serious impacts to residential, commercial, and industrial properties. Implementation of the proposed project will alleviate the flooding problems.

May Branch lies entirely within the city limits of Fort Smith and has its origin in the south central section of the city. The Project will take place in a highly urbanized environment in which there are few remaining natural environmental features. Although this area lacks a natural vegetative cover, we are requesting information regarding potential federally listed threatened and endangered (T&E) species issues and their habitat and other species of concern within the Project area.

Enclosure 1 provides a general outline of a corridor, based on the USGS topographic quadrangle map Fort Smith ARK-OKL (1987), that includes all project alternatives. We would appreciate receiving information regarding the potential for T&E species issues and their habitat and other species of concern within the outlined corridor, for use in evaluation of potential Project alternatives.

REC'D AUG 13 1999

Legal descriptions for the proposed project area include parts of Sections 4, 5, 9, 10 and 15, Township 8 North, Range 32 West.

If you have questions or need additional information, please feel free to call me or Dr. Gary Tucker at 225-7779.

Kindest regards,
FTN ASSOCIATES, LTD.

Shannon P. Holbrook

Shannon P. Holbrook
Environmental Scientist

Enclosure

P:\WP_FILES\4340-130\L-LEONRD.WPD\GET

AHPP
JUL 30 1999

ftn
Associates Ltd.
water resources / environmental consultants

July 28, 1999

3989
RECD

Ms. Cathy Slater
State Historic Preservation Office
1500 Tower Building, 323 Center
Little Rock, AR 72201

RE: Request for Information Regarding Cultural Resources Issues, Proposed Replacement of Existing Underground Storm Sewer System on May Branch, Fort Smith, Sebastian County, Arkansas
FTN No. 4340-130

Dear Ms. Slater:

FTN Associates, Ltd. (FTN) has been selected by the City of Fort Smith to prepare an Environmental Assessment for the replacement of an existing underground storm sewer system that was installed in the early 1900's to replace the original open channel of May Branch (the Project). The enclosed underground storm sewer system, which follows the original course of the May Branch channel and terminates at the P street pumping station near Clayton Expressway, will be replaced by an open channel and attendant drainage/flood control structures. Because runoff from the drainage area of May Branch often exceeds the capacity of the storm sewer system, local flooding of the lower reaches of the basin often causes serious impacts to residential, commercial, and industrial properties. Implementation of the proposed project will alleviate the flooding problems.

May Branch lies entirely within the city limits of Fort Smith and has its origin in the south central section of the city. The Project will take place in a highly urbanized environment in which there are few remaining natural environmental features. Enclosure 1 provides a map of the proposed project area. Legal descriptions for the proposed project area include parts of Sections 4, 5, 9, 10 and 15, Township 8 North, Range 32 West.

We are requesting information regarding potential impacts on significant historic or prehistoric cultural resources within the Project area.

If you have questions or need additional information, please feel free to call me or Dr. Gary Tucker at 225-7779.

Kindest regards,
FTN ASSOCIATES, LTD.

Shannon P. Holbrook

Shannon P. Holbrook
Environmental Scientist

Enclosures
F:\WP_FILES\4340-130\L-SLATER.WPD\GET

Date 7/30/99
This undertaking will have no effect on significant historic properties.

Cathy Buford Slater
State Historic Preservation Officer

ARKANSAS NATURAL HERITAGE COMMISSION
1500 TOWER BUILDING
323 CENTER STREET
LITTLE ROCK, ARKANSAS 72201

Harold K. Grimmett
Director

Mike Huckab
Governor

Date: August 12, 1999
Subject: Elements of Special Concern
Storm Sewer System, May Branch
Fort Smith, Arkansas
FTN No. 4340-130
ANHC No.: P-CF.-99-072

Ms. Shannon Holbrook
FTN Associates, Ltd.
3 Innwood Circle
Suite 220
Little Rock, AR 72211

Dear Ms. Holbrook:

Staff members of the Arkansas Natural Heritage Commission have reviewed our files for records indicating the occurrence of rare plants and animals, outstanding natural communities, natural or scenic rivers, or other elements of special concern within or near the May Branch Storm Sewer System in Fort Smith, Sebastian County, Arkansas. We find no records at the present time.

A Sebastian County Element List is enclosed for your reference. Represented on this list are elements for which we have records in our database. A legend is enclosed to help you interpret the codes on the list.

Please keep in mind that the project area may contain important natural features of which we are unaware. Staff members of the Arkansas Natural Heritage Commission have not conducted a field survey of the project site. Our review is based on data available to the program at the time of the request. It should not be regarded as a final statement on the elements or areas under consideration, nor should it be substituted for on-site surveys required for environmental assessments. Because our files are updated constantly, you may want to check with us again at a later time.

Thank you for consulting us. It has been a pleasure to work with you on this study.

Sincerely,

Cindy Osborne

Cindy Osborne
Data Manager

Enclosure: Legend
Sebastian County Element List
Invoice

An Agency of the Department of Arkansas Heritage An Equal Opportunity Employer
Phone (501) 324-9619 / Fax (501) 324-9618 / TDD (501) 324-9811
http://www.heritage.state.ar.us/nhc/

REC'D AUG 13 1

LEGEND

STATUS CODES

FEDERAL STATUS CODES

C = Candidate species. The U.S. Fish and Wildlife Service has enough scientific information to warrant proposing these species for listing as endangered or threatened under the Endangered Species Act.

LE = Listed Endangered; the U.S. Fish and Wildlife Service has listed these species as endangered under the Endangered Species Act.

LT = Listed Threatened; the U.S. Fish and Wildlife Service has listed these species as threatened under the Endangered Species Act.

LELT = Listed Endangered and Threatened; the U.S. Fish and Wildlife Services has listed these species as endangered and threatened in different parts of the breeding range.

PE = Proposed Endangered; the U.S. Fish and Wildlife Service has proposed these species for listing as endangered.

PT = Proposed Threatened; the U.S. Fish and Wildlife Service has proposed these species for listing as threatened.

T/SA
E/SA = Threatened (or Endangered) because of similarity of appearance.

STATE STATUS CODES

INV = Inventory Element; The Arkansas Natural Heritage Commission is currently conducting inventory work on these elements to determine their status in the state. These-elements may include outstanding examples of Natural Communities, colonial nesting sites, outstanding scenic and geologic features as well as plants and animals which, according to current information, may be rare, peripheral, or of an undetermined status in the state.

SE = State Endangered; The Arkansas Natural Heritage Commission applies this term to native taxa which are in danger of being extirpated from the state.

ST = State Threatened; The Arkansas Natural Heritage Commission applies this term to native taxa which are believed likely to become endangered in Arkansas in the foreseeable future, based on current inventory information.

DEFINITION OF RANKS

Global Ranks

G1 = Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 = Imperiled globally because of rarity (6-20 occurrences or few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G3 = Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; in terms of occurrences, in the range of 21 - 100.

G4 = Apparently secure globally, though it may be quite rare in parts of its range, especially at the periphery.

23 MAR 1999

ARKANSAS NATURAL HERITAGE COMMISSION
DEPARTMENT OF ARKANSAS HERITAGE
INVENTORY RESEARCH PROGRAM
ELEMENTS OF SPECIAL CONCERN
SEBASTIAN COUNTY, ARKANSAS

ELEMENT NAME	FEDERAL STATUS	STATE STATUS	GLOBAL RANK	STATE RANK
** Animals				
* Invertebrates				
NICROPHORUS AMERICANUS, AMERICAN BURYING BEETLE	LE	INV	G1	S?
* Vertebrates				
AIMOPHILA AESTIVALIS, BACHMAN'S SPARROW	-	INV	G3	S3B
AMMODRAMUS SAVANNARUM, GRASSHOPPER SPARROW	-	INV	G5	S3B
CEMOPHORA COCCINEA COPEI, NORTHERN SCARLET SNAKE	-	INV	G5T5	S2?
DENDROICA PETECHIA, YELLOW WARBLER	-	INV	G5	S3B,S5N
HALIAEETUS LEUCOCEPHALUS, BALD EAGLE	LT	INV	G4	S2B,S3N
HIODON ALOSOIDES, GOLDEYE	-	INV	G5	S2?
MACROCLEMYS TEMMINCKII, ALLIGATOR SNAPPING TURTLE	-	INV	G3G4	SU
PHENACOBIUS MIRABILIS, SUCKERMOUTH MINNOW	-	INV	G5	S1
POLYODON SPATHULA, PADDLEFISH	-	INV	G4	S2?
REGINA RIGIDA SINICOLA, GULF CRAYFISH SNAKE	-	INV	G5T5	S2?
REITHRODONTOMYS HUMULIS, EASTERN HARVEST MOUSE	-	INV	G5	S1?
STERNA ANTILLARUM ATHALASSOS, INTERIOR LEAST TERN	LE	INV	G4T2Q	S2B
TERRAPENE ORNATA ORNATA, ORNATE BOX TURTLE	-	INV	G5T5	S2
THRYOMANES BEWICKII, BEWICK'S WREN	-	INV	G5	S2B,S3N
** Plants				
* Vascular Plants				
CAREX GRAVIDA VAR. GRAVIDA, A SEDGE	-	INV	G5T?	S2
COOPERIA DRUMMONDII, EVENING RAINLILY	-	INV	G5	S1S2
EQUISETUM LAEVIGATUM, SMOOTH SCOURING RUSH	-	INV	G5	S1
IVA ANGUSTIFOLIA, NARROWLEAF MARSH-ELDER	-	INV	G5?	S1
LITHOSPERMUM INCISUM, NARROW-LEAVED PUCCOON	-	INV	G5	S2S3
MINUARTIA DRUMMONDII, DRUMMOND'S SANDWORT	-	INV	G5	S2S3
QUERCUS ACERIFOLIA, MAPLE-LEAVED OAK	-	ST	G1	S1
** Natural Communities				
TALLGRASS PRAIRIE	-	INV	-	S2

Department of Arkansas Heritag

ARKANSAS NATURAL HERITAGE COMMISSION

Konecny Prairie Natural Area

Submitted to:

Governor Mike Huckabee and the General Assembly

December 1, 2002

9/18/2002

Arkansas Natural Heritage Commission
Department of Arkansas Heritage
Inventory Research Program
Sebastian County

Scientific Name	Common Name	Federal Status	State Status	Global Rank	State Rank
Animals-Invertebrates					
Lucanus elephas	giant stag beetle	-	INV	G3G5	S?
Nicrophorus americanus	American burying beetle	LE	INV	G2G3	S?
Animals-Vertebrates					
Cemophora coccinea copei	northern scarlet snake	-	INV	G5T5	S5
Haliaeetus leucocephalus	bald eagle	LT-PD	INV	G4	S2B,S4N
Hiodon alosoides	goldeye	-	INV	G5	S2?
Hybognathus placitus	plains minnow	-	INV	G4	SX
Macrochelys temminckii	alligator snapping turtle	-	INV	G3G4	S4
Phenacobius mirabilis	suckermouth minnow	-	INV	G5	S1
Polyodon spathula	paddlefish	-	INV	G4	S2?
Regina rigida sinicola	gulf crayfish snake	-	INV	G5T5	S3
Reithrodontomys humulis	eastern harvest mouse	-	INV	G5	S1?
Sterna antillarum athalassos	interior least tern	LE	INV	G4T2Q	S2B
Terrapene ornata ornata	ornate box turtle	-	INV	G5T5	S2
Thryomanes bewickii	Bewick's wren	-	INV	G5	S2B,S3N
Plants-Vascular					
Carex gravida var gravida	a sedge	-	INV	G5T5?	S2
Cooperia drummondii	evening rainlily	-	INV	G5	S1S2
Equisetum laevigatum	smooth scouring rush	-	INV	G5	S1
Iva angustifolia	narrowleaf marsh-elder	-	INV	G5?	S1
Lithospermum incisum	narrow-leaved puccoon	-	INV	G5	S2S3
Minuartia drummondii	Drummond's sandwort	-	INV	G5	S2S3
Quercus acerifolia	maple-leaved oak	-	ST	G1	S1
Valerianella nuttallii	Nuttall corn-salad	-	INV	G1G2	S1
Special Elements-Natural Communities					
Post oak-blackjack oak forest		-	INV	-	S2
Tallgrass prairie		-	INV	-	S2

APPENDIX A

Section B

Socioeconomic Data

Back Home

[redacted]

DIRECTIONS
New Resident
New Business
Relocation Info

- SOS! (Search Our Site)
- Perfect Homes
- Excellent Education
- Quality Living
- Health Care
- Statistical Summary
- Communications
- Economic Development
- 2002 Economic Data Report
- Message From The Chairman
- Frequently Asked Questions

Fort Smith Chamber of Commerce
P.O. Box 1668
Fort Smith, AR 72902
479.783.6118
fax 479.783.6110

This section is full of those boring official government numbers that we use to prove that a) Life is Worth Living in Fort Smith, Arkansas, or, b) Fort Smith is the Perfect Home for Business and You.

Take your pick.

2000 Population Data

Fort Smith	80,268
Sebastian County	115,071
Crawford County	53,247
Fort Smith Regional Trade Area	312,850

Source: Bureau of the Census 2000 report
Regional Trade area includes Crawford, Franklin, Logan, Scott and Sebastian Counties in Arkansas and Haskell, LeFlore and Sequoyah Counties in Oklahoma.

Census Data

FORT SMITH CITY:	**2000 POPULATION**	**1990 POPULATION**
Total Population:	80,268	72,798
White:	61,798 - 76.9%	62,790 - 90.2%
Black:	6,943 - 8.6%	5,590 - 6.8%
Others:	11,527 - 14.3%	4,418 - 3.0%
Total Non Whites:	18,470 - 23.0%	10,008 - 9.8%

FORT SMITH M.S.A. (Three Counties - Sebastian and Crawford in Arkansas and Sequoyah in Oklahoma)

	2000 POPULATION	**1990 POPULATION**
Total Population:	202,146	175,911
White:	170,380 - 84.3%	155,580 - 88.4%
Black:	8,276 - 4.1%	6,831 - 3.9%
Others:	23,490 - 11.6%	13,500 - 7.7%
Total Non Whites:	31,766 - 15.7%	20,331 -

11.6%

FORT SMITH REGION

Economic/Census Profile - 2001 (Sebastian, Crawford and Sequoyah Counties)
(Source: Sales and Marketing Management - August 2001)

Population - 209,700
Median Age of Population - 36.2
Number of Households - 81,200

Percent of Households by Income Groups

$20,000 - $34,999	25.5%
$35,000 - $49,999	17.8%
$50,000 and up	24.9%

Median Household Effective Buying Income - $30,306

Retail Sales by Store Group ($000)

Food	$232,899
Eating and Drinking Est	$218,085
General Merchandise	$463,522
Furniture/Appliances	$118,871
Automotive	$692,573

Source: Sales and Marketing Management, August 2001

Fort Smith MSA Cost of Living Index for First Quarter of 2002 (Released June 2002)

U.S. Composite Index	100.0
Fort Smith AR	89.6
Fayetteville/ Springdale-Rogers AR	92.6
Los Angeles CA	135.3
Nashville TN	91.2
Denver CO	106.5
Atlanta GA	99.0
Shreveport LA	94.6
Jackson MS	92.4
Springfield MO	90.1
Omaha NE-IA	91.9
Albuquerque NM	103.7
New York NY	218.6
Charlotte NC	95.1
Memphis TN-AR-MS	89.4
Dallas TX	100.6
Richmond VA	104.4
Cheyenne WY	97.7

Source: American Chamber of Commerce Researchers Association Comparative Data survey of 323 Urban areas since 1968.

Labor Force Numbers (July 2002)

Unemployment Rate

Fort Smith MSA	4.6%
Sebastian County	4.3%
Arkansas	5.7%
United States	6.0%

Total Nonfarm Payroll Jobs..................99,500
Goods Producing..................................31,500
Service Sector...68,000
- Trade: 20,500
- Finance 3,100
- Health 11,000
- Government 11,000

Fort Smith Building Permits

Year	*Permits*	*Valuation*
2001	2,638	$128,753,601
2000	2,467	$141,913,542
1999	2,376	$151,756,617
1998	2,356	$118,276,986
1997	2,172	$81,416,413
1996	3,308	$98,027,759
1995	2,257	$86,945,520
1994	2,029	$71,485,818
1993	1,921	$73,377,205
1992	1,926	$49,709,385
1991	1,789	$52,769,223
1990	1,637	$46,209,199
1989	1,837	$55,297,555

Source: City of Fort Smith

Assessed Valuation of Real & Personal Property in Fort Smith

2001........$884,433,620
2000........$826,333,175
1999........$767,766,200
1998........$721,781,327
1997........$695,841,285
1996........$684,852,065
1995........$639,223,630
1994........$599,675,660
1993........$576,955,805
1992........$560,295,250
1991........$544,217,480

(all figures exclude utilities)
Source: Sebastian County Assessor's Office

2000 Fort Smith Crime Index

	Fort Smith MSA(a)	West South Central(b)	United States
Total Crime Index	7,174.0	4,907.0	4,124.0
Violent Crime	N/A	550.7	506.1
Property Crime	N/A	4,356.2	3,617.9

(rates per 100,000 inhabitants) Source: 2000 FBI National Uniform Crime Reports - released March 2001

(a) Sebastian, Crawford Counties in Arkansas and Sequoyah County in Oklahoma

(b) Arkansas, Louisiana, Oklahoma and Texas

Tax Structures

Local Sales Tax:

State - 5.125%, City - 2.25%*, County-wide - 1%; Total 8.375%

* collected on the first $2,500 of a single purchase sale.

Corporate Income Tax

The tax in Arkansas is based on net income and is adjusted by a formula that determines how much of the income is applicable to the Arkansas operation. The rate is on a scale of 1 to 6 percent on the first $100,000 of taxable income. Net taxable income greater than $100,000 is taxed at 6.5 percent of the entire amount of the total income.

Sales and Use Taxes

The Arkansas sales tax is 5.125 percent and is paid by the consumer at the point of final sale. The Arkansas compensating use tax of 4.5 percent is levied on property purchased from outside the state for use in the state.

Exemptions, Credits, and Refunds

Not only is Arkansas committed to continuing standard sales and use tax exemptions for machinery and equipment used in manufacturing, our state has redefined the term "manufacturing" to include exemptions for technologically advanced equipment used in the manufacturing process.

Businesses that purchase waste reduction, reuse, or recycling equipment used exclusively for the purpose of reducing, reusing, or recycling solid waste are eligible for a corporate income tax credit of 30 percent of the cost of the equipment.

An investment tax credit against sales and use taxes is available for manufacturing companies that have been in operation in the state for at least two years and make substantial new investments in plants and equipment.

Arkansas' Free Port Law exempts from inventory or property taxes raw materials and finished goods in transit or awaiting shipment ot out-of-state customers.

Property Taxes

Arkansas does not have a state property tax. Arkansas' cities and counties collect a property tax as their principal source of revenue. The tax is calculated on 20 percent of fair market value.

Unemployment Insurance Tax
The Unemployment Insurance Tax rate for an employer with no previous employment record is 4.0 percent on the first $8,500 of each employee's earnings. This rate stays in effect until the company's experience with its work force is established, usually three years. Once the company's employment record has been established by the Arkansas Employment Security Department, the contribution rate is based on the company's history.
New employers who do not experience much fluctuation in their work force after three years of benefit experience could have a contribution as low as 1.2 percent assigned. The rates could go as high as 7.1 percent if benefits exceed contributions for more than two years. The average contribution rate for Arkansas employers in 1992 was 2.4 percent, and the average weekly benefit for 1992 was $150.63. Arkansas' Unemployment Insurance Trust Fund balance is $64.7 million.

Other
A summary of all Arkansas tax rates is available from the Fort Smith Chamber of Commerce.

Thoughts? Comments? Questions? Let us know.

Fort Smith Population and Demographics

Fort Smith Arkansas Population and Demographics Resources

Web Search:

Search

Fort Smith City, Arkansas Statistics and Demographics (US Census 2000)

	Number	Percent
Fort Smith Population:	80268	100.00%
Sex and Age		
Male	38918	48.49%
Female	41350	51.51%
Under 5 years	6083	7.58%
5 to 9 years	5581	6.95%
10 to 14 years	5363	6.68%
15 to 19 years	5586	6.96%
20 to 24 years	5681	7.08%
25 to 34 years	11454	14.27%
35 to 44 years	12040	15%
45 to 54 years	10513	13.1%
55 to 59 years	3884	4.84%
60 to 64 years	3082	3.84%
65 to 74 years	5376	6.7%
75 to 84 years	4113	5.12%
85 years and over	1512	1.88%
Median age (years)	35.3	
18 years and over	59862	74.58%
Male	28527	35.54%
Female	31335	39.04%
21 years and over	56499	70.39%
62 years and over	12790	15.93%
65 years and over	11001	13.71%
Male	4207	5.24%
Female	6794	8.46%
Race		
One race	77864	97.01%
White	61798	76.99%
Black or African American	6943	8.65%
American Indian and Alaska Native	1358	1.69%
Asian	3682	4.59%

Asian indian	107	0.13%
Chinese	149	0.19%
Filipino	81	0.1%
Japanese	36	0.04%
Korean	49	0.06%
Vietnamese	1641	2.04%
Other Asian	1619	2.02%
Native Hawaiian and Other Pacific Islander	43	0.05%
Native Hawaiian	3	0%
Guamanian or Chamorro	22	0.03%
Samoan	1	0%
Other Pacific Islander	17	0.02%
Some other race	4040	5.03%
Two or more races	2404	3.0 %

Hispanic or Latino and race

Total Population	80268	100.00%
Hispanic or Latino(of any race)	7048	8.78%
Mexican	5068	6.31%
Puerto Rican	144	0.18%
Cuban	78	0.1%
Other Hispanic or Latino	1758	2.19%
Not Hispanic or Latino	73220	91.22%
White alone	59436	74.05%

Relationship

Total Population	80268	100.00%
In households	78278	97.52%
Householder	32398	40.36%
Spouse	15274	19.03%
Child	22554	28.1%
Own child under 18 years	18206	22.68%
Other relatives	4064	5.06%
Under 18 years	1571	1.96%
Nonrelatives	3988	4.97%
Unmarried partner	1656	2.06%
In group quarters	1990	3.6 %
Instituntionalized population	1632	2.03%
Noninstitutionalized population	358	0.45%

Households by Type

Total Households	32398	100.0 %
Family households (families)	20647	63.73%
With own children under 18 years	9971	30.78%
Married-couple family	15274	47.14%
With own children under 18 years	6699	20.68%
Female householder, no husband present	3989	12.31%
With own children under 18 years	2530	7.81%

NonFamily households	11751	36.8 %
Householder living alone	9950	30.71%
Householder 65 years and over	3529	10.89%

Households with individuals under 18 years	10942	33.77%
Households with individuals 65 years and over	7618	23.51%

Average Household size	2.42
Average family size	3.03

Housing Occupancy

Total housing units	35341	100.00%
Occupied housing units	32398	91.67%
Vacant housing units	2943	8.33%
For seasonal, recreational, or occasional use	144	0.41%
Homeowner vacancy rate (percent)	2.5	
Rental vacancy rate (percent)	8.1	

Housing Tenure

Occupied housing units	32398	100.00%
Owner-occupied housing units.	18253	56.34%
Renter-occupied housing units.	14145	43.66%

Average household size of owner-occupied units	2.52
Average household size of renter-occupied units	2.29

Based on 2000 US Census data. For more information on population visit U.S. Census Bureau, providing access to a full range of U.S. Census information and data products.

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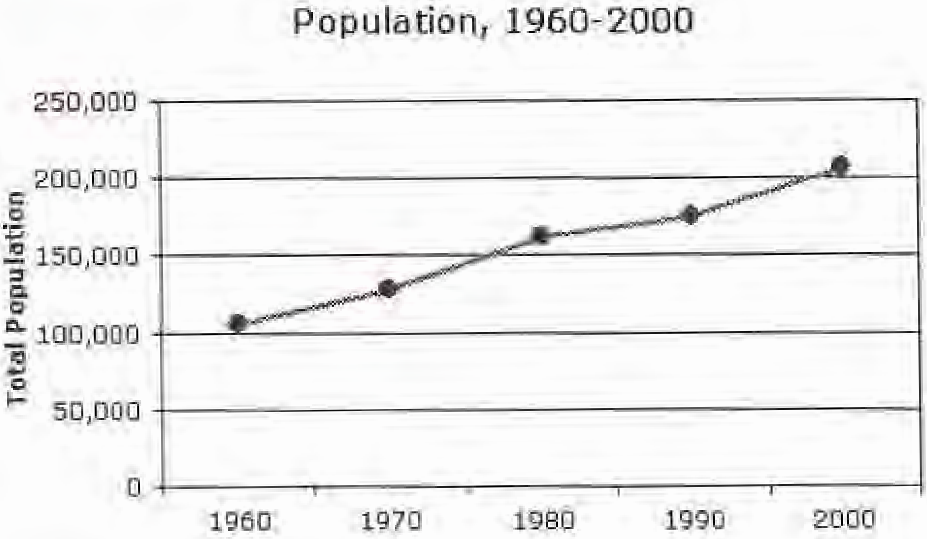
CensusScope

HTTP://WWW.CENSUSSCOPE.ORG

Fort Smith, AR-OK

POPULATION GROWTH



Population, 1960-2000

One of the primary purposes of the census to measure who lives where. Although the nation as a whole has continued to grow, this growth has been far from uniform: between 1990 and 2000, 684 of the nation's 3142 counties reported a population loss, many of them in the Great Plains states. At the same time, five counties, three in Colorado and two in Georgia, more than doubled their population between 1990 and 2000, and another 80 counties experiences growth rates greater than 50%. Altogether, 1109 of the nation's counties reported growth that exceeded the national growth rate of approximately 13% between 1990 and 2000. For more information on population growth in the United States, see our rankings.

Population, 1960-2000

	1960	1970	1980	1990	2000
Total	106,004	128,284	162,813	175,911	207,290
Change		22,280	34,529	13,098	31,379
Percent Change		21.0%	26.9%	8.0%	17.8%

Source: Census 2000 analyzed by the Social Science Data Analysis Network (SSDAN).

Fort Smith, AR-OK **Print**

POPULATION GROWTH

Population Growth
Population by Race
Multiracial Profile
Age Distribution
Household & Family Structure
- Educational Attainment
- Language
- Migration
- Nativity & Citizenship Status
- Income

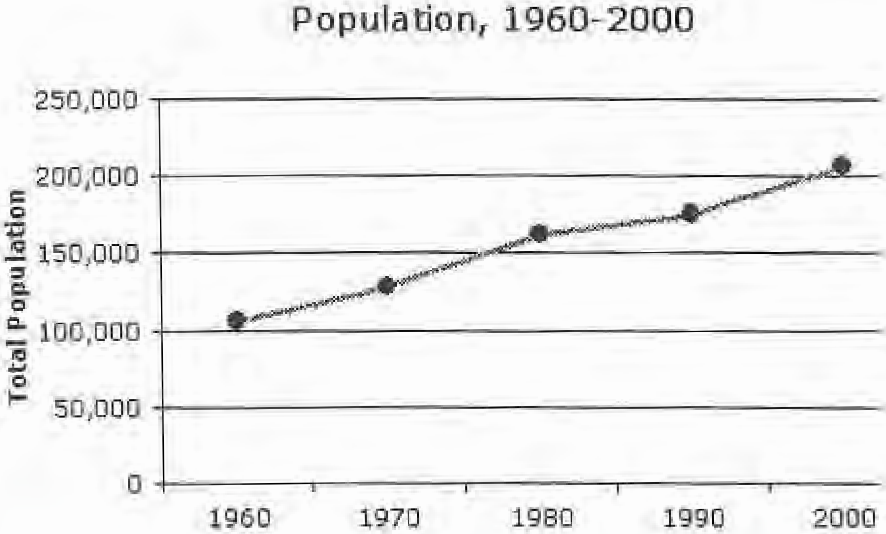
SHOW LOCATION

Zoom in and out of geography at levels: US, States or Metro Areas, and Counties within States.

You can **zoom out** to United States

ssdan.net

CensusScope is a product of the Social Science Data Analysis Network.



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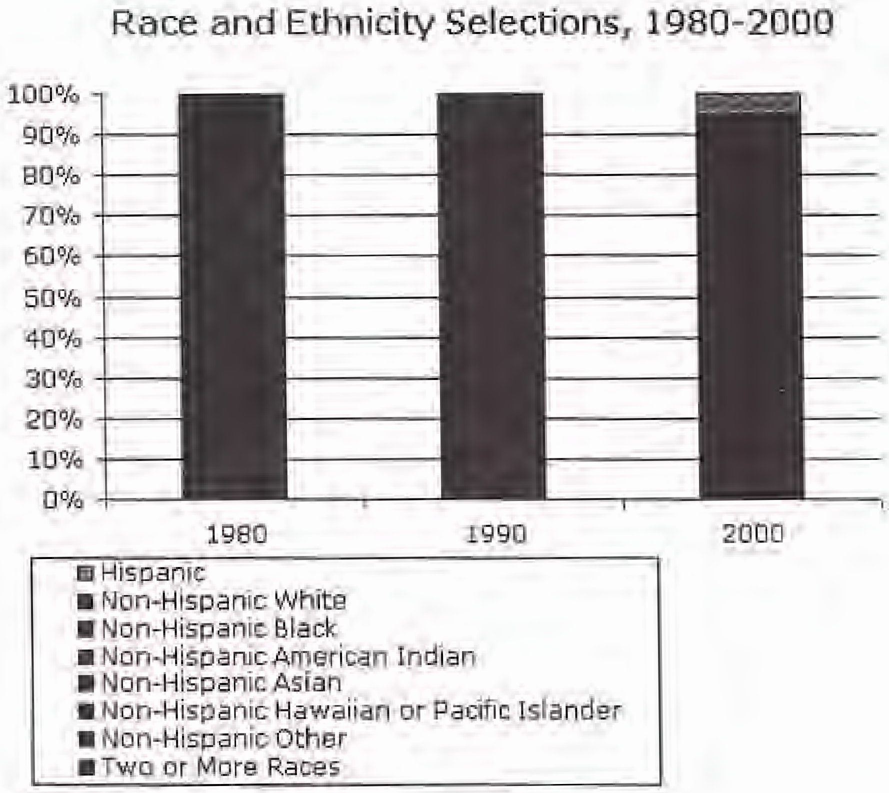
Source: Census 2000 analyzed by the Social Science Data Analysis

CensusScope

HTTP://WWW.CENSUSSCOPE.ORG

Fort Smith, AR-OK

POPULATION BY RACE



Census data on race and ethnicity can be difficult to interpret: "race" and "Hispanic ethnicity" are asked as separate questions. Thus, a Hispanic person can be of any race. Changes over time in the Census categories regarding race can also make trend data difficult to interpret: for example, persons who selected "Native Hawaiian or Other Pacific Islander" on the 2000 Census, the first to offer this category, could have responded in a number of different ways on previous Censuses. The 2000 Census also marked the first time that respondents were allowed to select more than one racial category. On earlier Censuses, multiracial individuals were asked to chose a single racial category, or respond as Some Other Race. For more information on the multiracial population in 2000, please see the multiracial profile .

Hispanic Population and Race Distribution for Non-Hispanic Population

	1980		1990		2000	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Total Population	162,813	100.00%	175,911	100.00%	207,290	100.00%
Total Hispanics	1,348	0.83%	2,120	1.21%	10,246	4.94%
White*	147,441	90.56%	154,363	87.75%	166,605	80.37%
Black*	6,105	3.75%	6,760	3.84%	8,189	3.95%
American Indian and Eskimo*	6,242	3.83%	8,955	5.09%	10,290	4.96%
Asian*	1,321	0.81%	3,661	2.08%	4,715	2.27%
Hawaiian and Pacific Islander*	-	-	-	-	52	0.03%
Other*	356	0.22%	52	0.03%	105	0.05%
Two or More Races*	-	-	-	-	7,088	3.42%

* Non-Hispanic only; in 1980 and 1990 "Asians" includes Hawaiians and Pacific Islanders.

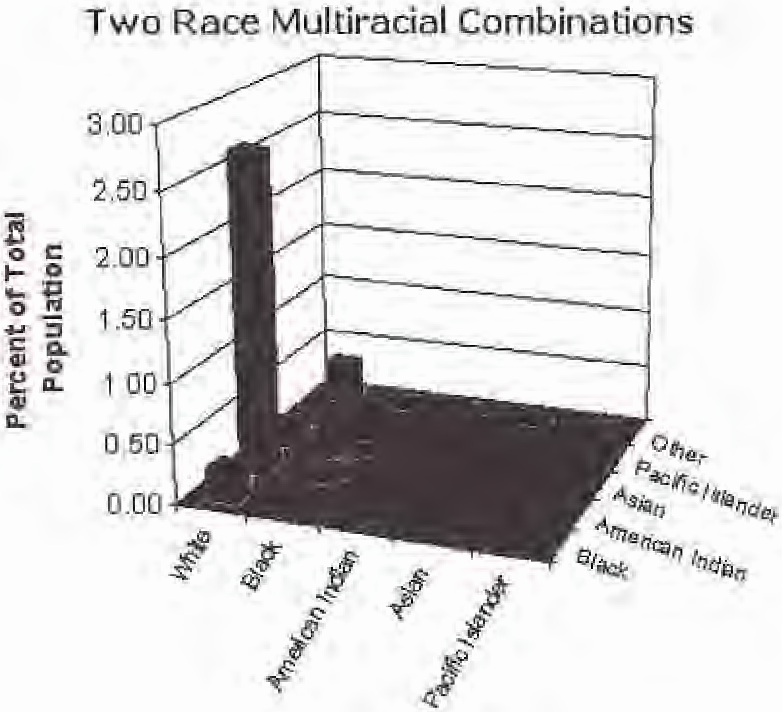
Source: Census 2000 analyzed by the Social Science Data Analysis Network (SSDAN).

CensusScope

HTTP://WWW.CENSUSSCOPE.ORG

Fort Smith, AR-OK

MULTIRACIAL PROFILE



The 2000 Census was the first Census that allowed respondents to select more than one race . Nationwide, approximately 2.4% of the population, or over 6.8 million Americans, identified with two or more races. As is the case with many racial and ethnic groups, the multiracial population is not evenly distributed across the U.S.: Hawaii is the most multiracial state, with 24.1% of its population identifying with two or more races, and Alaska following a distant second with a 5.4% multiracial population. The five least most multiracial states, Mississippi, West Virginia, Maine, Alabama and South Carolina, all have multiracial populations of less than 1%. For more on the geography of the U.S. multiracial population, please see our multiracial map .

Number of Races Selected

	Number	Percent of Total	Percent of Multiracial
Two Races	7,684	3.71%	96.97%
Three Races	220	0.11%	2.78%
Four Races	10	0.00%	0.13%
Five Races	10	0.00%	0.13%
Six Races	0	0.00%	0.00%

Multiple Race Combinations by Frequency

Rank	Multiple Race Selection	Number	Percent of Total Population	Percent of Multiple Race Population
1.	White and American Indian	5,501	2.65%	69.42%
2.	White and Some Other Race	699	0.34%	8.82%
3.	White and Black	553	0.27%	6.98%
4.	White and Asian	386	0.19%	4.87%
5.	Black and American Indian	171	0.08%	2.16%
6.	Asian and Some Other Race	107	0.05%	1.35%
7.	White and Black and American Indian	79	0.04%	1.00%
8.	American Indian and Some Other Race	61	0.03%	0.77%
9.	American Indian and Asian	57	0.03%	0.72%
10.	White and American Indian and Some Other Race	48	0.02%	0.61%
11.	Black and Some Other Race	43	0.02%	0.54%
12.	White and Hawaiian or Other Pacific Islander	35	0.02%	0.44%
13.	Asian and Hawaiian or Other Pacific Islander	30	0.01%	0.38%
14.	White and American Indian and Asian	26	0.01%	0.33%
15.	White and Black and Some Other Race	20	0.01%	0.25%
16.	Black and Asian	18	0.01%	0.23%
17.	White and Asian and Hawaiian or Other Pacific Islander	16	0.01%	0.20%
18.	Hawaiian or Other Pacific Islander and Some Other Race	14	0.01%	0.18%
19.	White and Asian and Some Other Race	12	0.01%	0.15%
20.	White and Black and American Indian and Asian and Hawaiian or Other Pacific Islander	9	0.00%	0.11%
21.	Black and Hawaiian or Other Pacific Islander	5	0.00%	0.06%
22.	American Indian and Hawaiian or Other Pacific Islander	4	0.00%	0.05%
23.	Black and American Indian and Asian	4	0.00%	0.05%
24.	Black and American Indian and Some Other Race	4	0.00%	0.05%
25.	White and American Indian and Asian and Some Other Race	4	0.00%	0.05%
26.	White and American Indian and Hawaiian or Other Pacific Islander	3	0.00%	0.04%
27.	White and Hawaiian or Other	3	0.00%	0.04%

Pacific Islander and Some Other Race			
28. Black and Asian and Some Other Race	2	0.00%	0.03%
29. White and Black and American Indian and Asian	2	0.00%	0.03%
30. Black and American Indian and Asian and Hawaiian or Other Pacific Islander	2	0.00%	0.03%
31. White and Black and Hawaiian or Other Pacific Islander	1	0.00%	0.01%
32. American Indian and Asian and Hawaiian or Other Pacific Islander	1	0.00%	0.01%
33. Asian and Hawaiian or Other Pacific Islander and Some Other Race	1	0.00%	0.01%
34. White and American Indian and Asian and Hawaiian or Other Pacific Islander	1	0.00%	0.01%
35. White and Asian and Hawaiian or Other Pacific Islander and Some Other Race	1	0.00%	0.01%
36. White and Black and American Indian and Asian and Some Other Race	1	0.00%	0.01%

Source: Census 2000 analyzed by the Social Science Data Analysis Network (SSDAN).

CensusScope
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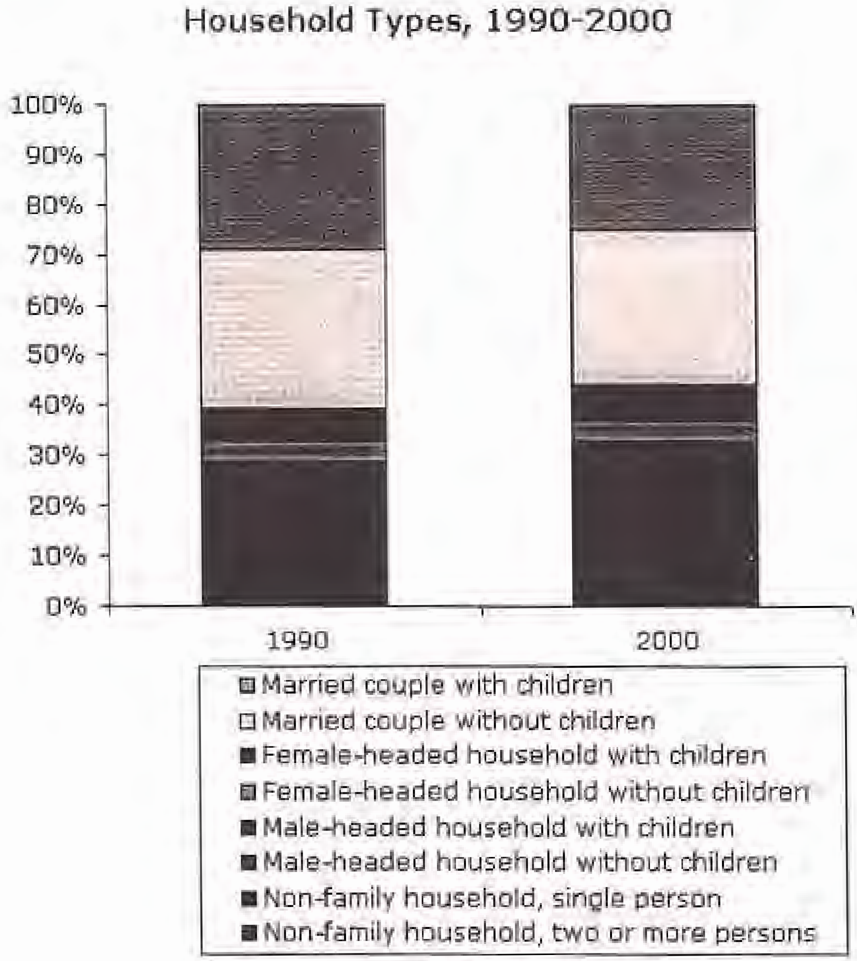
Fort Smith, AR-OK

HOUSEHOLD AND FAMILY STRUCTURE



Household Types, 1990-2000

	1990		2000	
	Number	**Percent**	**Number**	**Percent**
Total Households	**66,884**	100.0%	**79,763**	100.0%
Married Couple	**40,670**	60.8%	**44,600**	55.9%
With Children*	19,337	28.9%	19,834	24.9%
Without Children*	21,333	31.9%	24,766	31.0%
Female Householder, no spouse	**6,779**	10.1%	**9,023**	11.3%
With Children*	4,149	6.2%	5,639	7.1%
Without Children*	2,630	3.9%	3,384	4.2%
Male Householder, no spouse	**1,964**	2.9%	**3,249**	4.1%
With Children*	1,000	1.5%	1,827	2.3%
Without Children*	964	1.4%	1,422	1.8%
Non-Family Households	**17,471**	26.1%	**22,891**	28.7%
Living Alone	15,772	23.6%	19,702	24.7%
Two or More Persons	1,699	2.5%	3,189	4.0%

* For the purposes of this table, "children" are people under age 18.

Source: Census 2000 analyzed by the Social Science Data Analysis Network (SSDAN).

CensusScope
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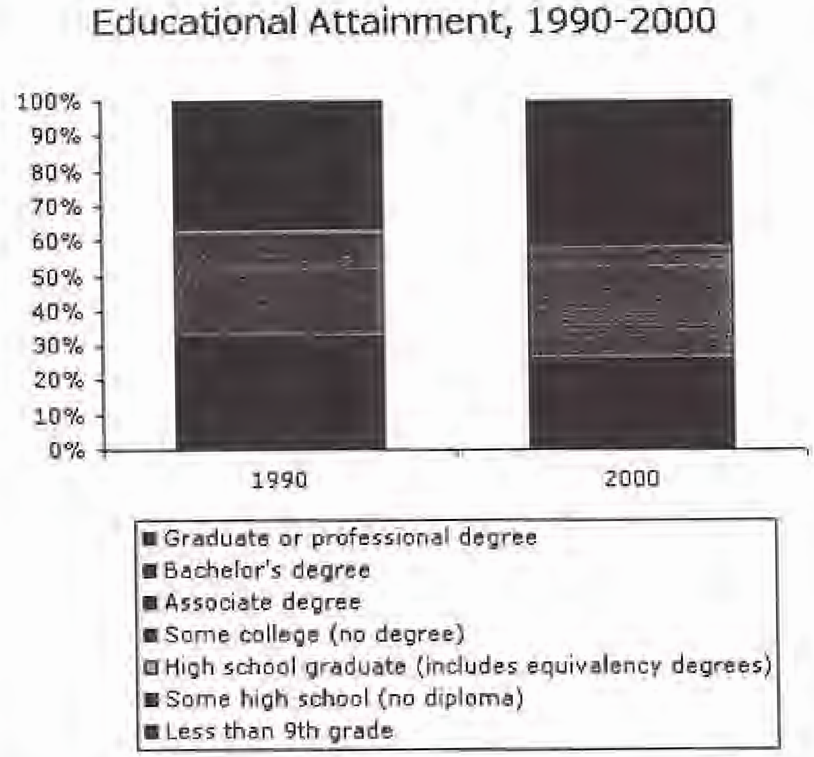
Fort Smith, AR-OK

EDUCATIONAL ATTAINMENT



The Census reports on the level of education attained by adults age 25 and older. As older, less-educated cohorts begin to fade from dominance, younger, more educated groups take their place.

Educational Attainment in Population 25 Years and Over, 1990-2000

	1990		2000	
	Number	Percent of Total	Number	Percent of Total
Less than 9th grade	15,029	13.45%	12,934	9.70%
Some high school, no diploma	21,272	19.04%	21,611	16.21%
High school graduate*	34,884	31.22%	44,136	33.10%
Some college, no degree	20,964	18.76%	28,482	21.36%
Associate degree	6,369	5.70%	7,799	5.85%
Bachelor's degree	8,896	7.96%	11,889	8.92%
Graduate or professional degree	4,338	3.88%	6,495	4.87%
Total Population Age 25+	111,752	100.00%	133,346	100.00%

* "High school graduate" includes people with the G.E.D. and similar equivalents.

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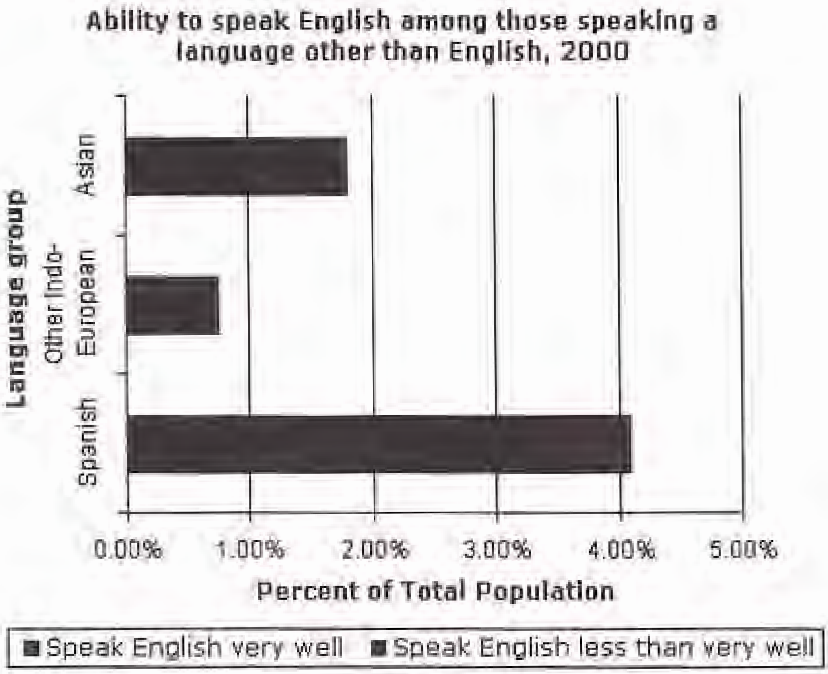
Fort Smith, AR-OK

LANGUAGE



Language Spoken at Home, 1990-2000

	1990		2000	
	Number	Percent	Number	Percent
Only English	155,904	95.61%	178,142	92.77%
Spanish	1,917	1.18%	7,863	4.09%
Other Indo-European*	1,498	0.92%	1,437	0.75%
Asian Language**	2,761	1.69%	3,455	1.80%
Other	975	0.60%	1,127	0.59%
Total Population Age 5+	163,055	100.00%	192,024	100.00%

Population Speaking English Less Than "Very Well" in 2000

Language Spoken at Home:	Number	Percent
Spanish	4,429	56.33%
Other Indo-European*	306	21.29%
Asian Language**	2,059	59.59%
Other Language	307	27.24%
Total	7,101	3.70%

Population Speaking English Less Than "Very Well" in 1990

Language Spoken at Home:	Number	Percent
Spanish	610	31.67%
Other Indo-European*	319	21.30%
Asian Language**	1,511	54.73%
Other Language	301	30.87%
Total	2,741	1.63%

* "Other Indo-European" excludes English and Spanish. "Indo-European" is not synonymous with "European." French, German, Hindi, and Persian are all classified as Indo-European. Hungarian, on the other hand, is lumped into "Other Language."

** "Asian Language" includes languages indigenous to Asia and Pacific islands areas that are not also Indo-European languages. Chinese, Japanese, Telugu, and Hawaiian are all classified here.

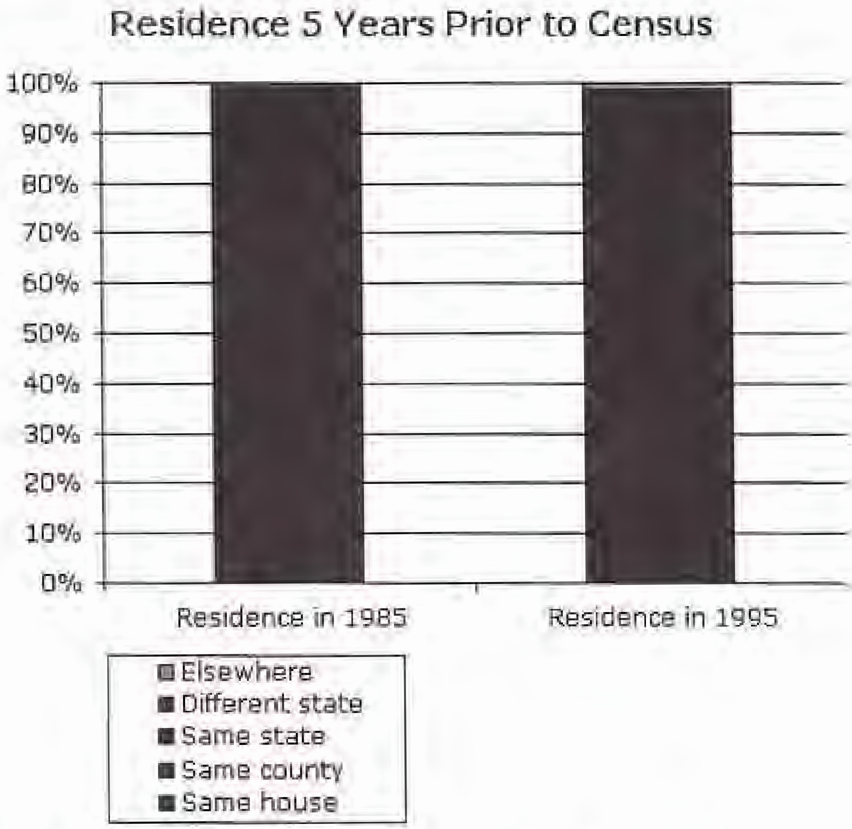
Also note that ability to speak English "very well" is based on the self-assessment of those responding to Census questions, not on a test of language ability.

Source: Census 2000 analyzed by the Social Science Data Analysis Network (SSDAN).

CensusScope
HTTP://WWW.CENSUSSCOPE.ORG

Fort Smith, AR-OK

MIGRATION & IMMIGRATION



Migration, 2000: Residence 5 Years Prior to Census

Residence in 1995	Number	Percent
Same house	99,201	51.66%
Different house	92,823	48.34%
Same county	50,136	26.11%
Different county	40,148	20.91%
Same state	18,676	9.73%
Different State	21,472	11.18%
Elsewhere in 1995*	2,539	1.32%
Total Population Age 5+	192,024	100.00%

Migration, 1990: Residence 5 Years Prior to Census

Residence in 1985	Number	Percent
Same house	84,664	51.92%
Different house	78,391	48.08%
Same county	42,502	26.07%
Different county	34,669	21.26%
Same state	14,368	8.81%
Different State	20,301	12.45%
Elsewhere in 1985*	1,220	0.75%
Total Population Age 5+	163,055	100.00%

Source: Census 2000 analyzed by the Social Science Data Analysis Network (SSDAN).

CensusScope

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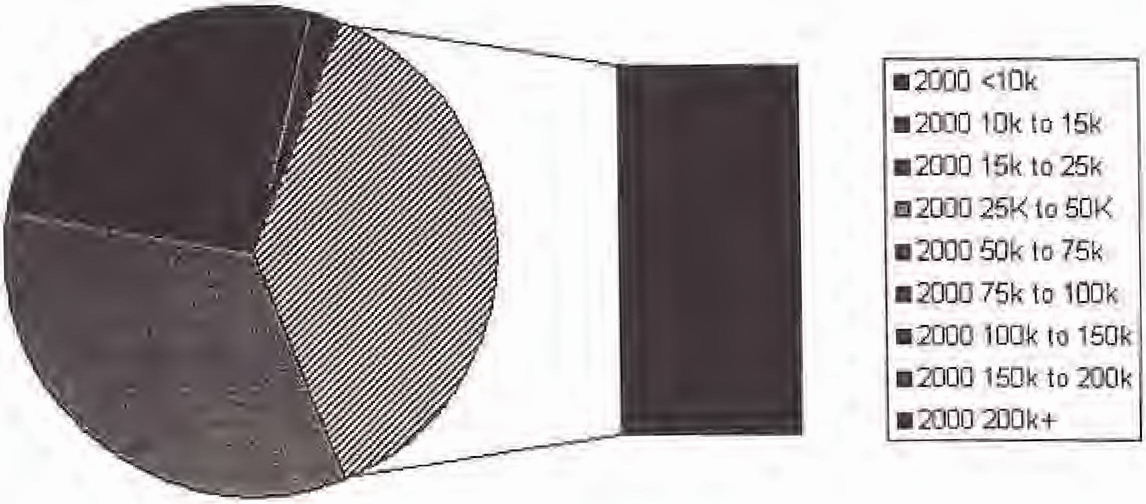
Fort Smith, AR-OK

HOUSEHOLD INCOME

Household Income, 2000 (1999 Income)



The Census does not measure trends in income so much as provide us with a snapshot of a region at two different points in time-- incomes may fluctuate greatly in the ten year interval between Censuses. However, the data still provide us with a general picture of where incomes have risen, where they have fallen, and how much they have changed.

Household Income, 2000 (1999 Income)

	Number	Percent of Total Households
Total Households	79,818	100.00%
Less than $9999	9,777	12.25%
$10000 - $14999	7,166	8.98%
$15000 - $24999	13,284	16.64%
$25000 - $34999	12,645	15.84%
$35000 - $49999	14,368	18.00%
$50000 - $74999	12,930	16.20%
$75000 - $99999	5,025	6.30%
$100000 - $149999	2,930	3.67%
$150000 - $199999	638	0.80%
$200000 and above	1,055	1.32%

Household Income, 1990 (1989 Income)

	Number	Percent of Total Households
Total Households	66,964	100.00%
Less than $9999	13,846	20.68%
$10000 - $14999	8,213	12.26%
$15000 - $24999	15,048	22.47%
$25000 - $34999	11,691	17.46%
$35000 - $49999	9,864	14.73%
$50000 - $74999	5,762	8.60%
$75000 - $99999	1,175	1.75%
$100000 - $149999	798	1.19%
$150000 and above	567	0.85%

Income by Decile, 1990-2000

	1989 (Adjusted to 1999 dollars)	1999
10% of households made less than	$6,496.96	$8,163.03
20% of households made less than	$12,993.94	$14,315.77
30% of households made less than	$18,540.35	$20,270.72
40% of households made less than	$24,372.03	$26,344.42
50% of households made less than	$30,350.04	$32,656.01
60% of households made less than	$37,116.71	$40,239.21
70% of households made less than	$44,811.27	$48,571.54
80% of households made less than	$56,773.66	$62,788.35
90% of households made less than	$76,533.89	$83,289.22

Source: Census 2000 analyzed by the Social Science Data Analysis Network (SSDAN).

APPENDIX A
Section C
Section 404(b) Guidelines

SHORT-FORM
Evaluation of Section 404(b)(1) Guidelines

<u>Formal review should follow close of public notice comment period.</u>

APPLICANT: ____________________

APPLICATION NUMBER: __________

1. Review of Compliance (Section 230.10(a)-(d)). A review of the permit application indicates that: — Preliminary 1/ | Final 2/

a. The discharge represents the least environmentally damaging practicable alternative and if in a special aquatic site, the activity associated with the discharge must have direct access or proximity to, or be located in the aquatic ecosystem to fulfill its basic purpose (if no, see section 2 and information gathered for EA alternative);.................................. YES ☒ NO[ ]* YES [ ] NO[ ]

b. The activity does not appear to: 1) violate applicable state water quality standards or effluent standards prohibited under Section 307 of the CWA; 2) jeopardize the existence of Federally listed endangered or threatened species or their habitat; and 3) violate requirements of any Federally designated marine sanctuary (if no, see section 2b and check responses from resource and water quality certifying agencies);.............................. YES ☒ NO[ ]* YES [ ] NO[ ]

c. The activity will not cause or contribute to significant degradation of waters of the U.S. including adverse effects on human health, life stages of organisms dependent on the aquatic ecosystem, diversity, productivity and stability, and recreational, aesthetic, and economic values (If no, see section 2);.. YES ☒ NO[ ]* YES [ ] NO[ ]

d. Appropriate and practicable steps have been taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem (If no, see section 5). .... YES ☒ NO[ ]* YES [ ] NO[ ]

*1/, 2/ See page 3.

2. Technical Evaluation Factors (Subparts C-F).

a. Physical and chemical characteristics of the Aquatic Ecosystem (Subpart C-F)

	N/A	Not Significant	Significant
1) Substrate impacts.		X	
2) Suspended particulates/turbidity impacts.		X	
3) Water column impacts.		X	
4) Alteration of current patterns and water circulation.		X	
5) Alteration of normal water fluctuations/hydroperiod.		X	
6) Alteration of salinity gradients.	X		

b. Biological Characteristics of the Aquatic Ecosystem (Subpart D).

	N/A	Not Significant	Significant
1) Effect on threatened/endangered species and their habitat.		X	
2) Effect on the aquatic food web.		X	
3) Effect on other wildlife(mammals, birds, reptiles, amphibians)		X	

c. Special Aquatic sites (Subpart E).

	N/A	Not Significant	Significant
1) Sanctuaries and refuges.	X		
2) Wetlands.		X	
3) Mud flats.		X	
4) Vegetated shallows.		X	
5) Coral reefs.	X		
6) Riffle and pool complexes.	X		

d. Human Use Characteristics (Subpart F).

	N/A	Not Significant	Significant
1) Effects on municipal and private water supplies.		X	
2) Recreational and Commercial fisheries impacts.		X	
3) Effects on water-related recreation.		X	
4) Aesthetic impacts.		X	
5) Effects on parks, national and historical monuments, national seashores, wilderness areas, research sites, similar preserves.	X		

Remarks: Where a check is placed under the significant category, preparer add explanation below.

3. Evaluation of Dredged or Fill Material (Subpart G). 3/

a. The following information has been considered in evaluating the biological availability of possible contaminants in dredged or fill material. (Check only those appropriate.)

1) Physical characteristics..☐
2) Hydrography in relation to known or anticipated sources of contaminants........................☐
3) Results from previous testing of the material or similar material in the vicinity of the project..☐
4) Known, significant, sources of persistent pesticides from land runoff or percolation..........☐
5) Spill records for petroleum products or designated (Section 311 of CWA) hazardous substances.☐
6) Other public records of significant introduction of contaminants from industries, cities or other sources...☐
7) Known existence of substantial material deposits of substances which could be released in harmful quantities to the aquatic environment by man-induced discharge activities.............☐
8) Other sources (specify)..☐

List appropriate references (attach sheet if necessary).

b. An evaluation of the appropriate information in 3a above indicates that there is reason to believe the proposed dredge or fill material is not a carrier of contaminants, or that levels of contaminants are substantively similar at extraction and that the dredged material will be constrained and not allowed to flow beyond the boundaries of the disposal site. The material meets the testing exclusion criteria ....YES☐ NO☐

4. Disposal Site Delineation (Section 230.11(f)).

a. The following factors, as appropriate, have been considered in evaluating the disposal site

1) Depth of water at disposal site...☐
2) Current velocity, direction, and variability at disposal site..................................☐
3) Degree of turbulence..☐
4) Water column stratification..☐
5) Discharge vessel speed and direction..☐
6) Rate of discharge...☐
7) Dredged material characteristics (constituents, amount, and type of material, settling velocities) ....☐
8) Number of discharges per unit of time..☐
9) Other factors affecting rates and patterns of mixing (specify)...................................☐

List appropriate references (attach sheet if necessary).

b. An evaluation of the appropriate factors in 4a above indicates that the disposal site and/or size of mixing zone are acceptable...YES☐ NO☐

5. Actions to Minimize Adverse Effects (Subpart H).

All appropriate and practicable steps have been taken, through application of recommendation of Section 230.70-230.77 to ensure minimal adverse effects of the proposed discharge.

List actions taken. (attach sheet if necessary)...YES☐ NO☐

N.B. Return to section 1 for final stage of compliance review. See also note 3/, page 3.

6. Factual Determination (Section 230.11).

A review of appropriate information as identified in items 2-5 above indicates that there is minimal potential for short or long-term environmental effects of the proposed discharge as related to:

a. Physical substrate at the disposal site (review sections 2a, 3, 4, and 5 above).........YES[ ] NO[ ]
b. Water circulation, fluctuation and salinity (review sections 2a, 3, 4, and 5)...........YES[ ] NO[ ]
c. Suspended particulates/turbidity (review sections 2a, 3, 5, and 6)......................YES[ ] NO[ ]
d. Contaminant availability (review sections 2a, 3, and 4).................................YES[ ] NO[ ]
e. Aquatic ecosystem structure and function (review sections 2b and c, 3, and 5)...........YES[ ] NO[ ]
f. Disposal site (review sections 2, 4, and 5)...YES[ ] NO[ ]
g. Cumulative impact on the aquatic ecosystem..YES[ ] NO[ ]
h. Secondary impacts on the aquatic ecosystem..YES[ ] NO[ ]

7. Evaluation Responsibility (*See page 3).

a. This evaluation was prepared by: b. This evaluation was reviewed by:

Position: Project Manager
Date:

Position: Acting Chief, Regulatory Evaluation
Date:

8. Findings.

a. The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines..........[ ]

b. The proposed disposal site for discharge of dredged or fill material complies with the Section 404(b)(1) guidelines with the inclusion of the following conditions: (attach sheet if necessary)..........[ ]

c. The proposed disposal site for discharge of dredged or fill material does not comply with the Section 404(b)(1) guidelines for the following reason(s):

1) There is a less damaging practicable alternative..........[ ]
2) The proposed discharge will result in significant degradation of the aquatic ecosystem.......[ ]
3) The proposed discharge does not include all practicable and appropriate measures to minimize potential harm to the aquatic ecosystem..........[ ]

SIGNATURE Gary E. Ducker

* A negative, significant, or unknown response indicates that the permit application may not be in compliance with the Section 404(b)(1) Guidelines.

1/ Negative responses to three or more of the compliance criteria at this stage indicate that the proposed projects *may* not be evaluated using this "short term procedure." Care should be used in assessing pertinent portions of the technical information of items 2 a thru d below before completing the final review of compliance.

2/ Negative response to one of the compliance criteria at this stage indicates that the proposed project does not comply with the guidelines. If the economics of navigation and anchorage of Section 404(b)(2) are to be evaluated in the decision-making process, the "short form evaluation process is inappropriate."

3/ If the dredged or fill material cannot be excluded from individual testing, the "short-form" evaluation process is inappropriate.

APPENDIX A
Section D
Fish and Wildlife Coordination Act Report

United States Department of the Interior

FISH AND WILDLIFE SERVICE
110 South Amity Road, Suite 300
Conway, Arkansas 72032
Tel.: 501/513-4470 Fax: 501/513-4480

IN REPLY REFER TO:

February 27, 2006

Colonel Wally Z. Walters
District Engineer
U.S. Army Corps of Engineers
P.O. Box 867
Little Rock, Arkansas 72203-0867

Dear Colonel Walters:

The Fish and Wildlife Service (Service) has prepared this Fish and Wildlife Coordination Act report (FWCA) in response to the Corps of Engineers (Corps) request for planning assistance relative to the proposed May Branch project, Sebastian County, Arkansas. The study is being conducted under the authority of a March 11, 1982 resolution of the Committee on Public Works and Transportation, U.S. House of Representatives. Our comments have been coordinated with the Arkansas Game and Fish Commission (AGFC), and their letter of comment is attached. Our report is submitted in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401. 16 U.S.C. as amended 616 et seq.).

May Branch drains a 5.3 square mile basin located within the city of Fort Smith, Sebastian County, Arkansas. May Branch runs north and west through the city to its confluence with the Arkansas River near river mile 307. The upstream segment of May Branch consists of an open channel which has been relocated due to railroad construction and channelized to improve drainage and provide flood control. At Park Avenue, May Branch channel enters a 2.7 mile long underground culvert storm sewer system constructed in 1910 which terminates at an outfall and pump station located at the Fort Smith levee along the Clayton Expressway. The Corps of Engineers constructed the 400 cfs pump station in 1948 to evacuate May Branch flows during periods of high flow on the Arkansas River. The design of the pump station does not allow for gravity flow and pump discharge simultaneously. An open ditch then carries May Branch flows 0.2 miles to the Arkansas River. The levee along the Arkansas River provides flood protection to the city of Fort Smith when the Arkansas River is at flood stage.

A reconnaissance report identifying a federal interest in the need for flood control on May Branch was included in the Arkansas River Wetlands and Flood Control Report, dated October 1992. A major flood occurred in spring 1990 when the Arkansas River experienced high flows, and gravity flow from May Branch could not occur for a prolong period. Heavy rains resulted in flooding which caused major property damage. An estimated $2.5 million in damages occurred to 26 businesses and 44 residential units in 1990. The present study is investigating alternatives to reduce flooding in the May Branch basin.

Description of Fish and Wildlife Resources

Due to the urbanized setting of the May Branch project area, the channelization that has occurred on the upstream third of May Branch, and the fact that the downstream two thirds of the channel is contained within a culverted storm sewer, fishery resource values within May Branch are very low. Wildlife habitats within the May Branch basin are limited to scattered patches of immature forest cover and vacant lots vegetated with ragweed, Johnson grass, and other weedy species. These habitats support wildlife adapted to urban areas including eastern cottontail, gray and fox squirrel, and other small mammals.

The fishery resources of the Arkansas River are typical of a large warm water river and include largemouth bass, crappie, bluegill, catfish, carp, and buffalo. Throughout the Arkansas River, the lakes formed by the dams and the tailwaters downstream of the dams provide fishing opportunities for both sport and commercial fishermen.

In accordance with the Endangered Species Act (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), a list of threatened or endangered species that may occur in the project area should be provided to the Corps. The Service provided the Corps a letter dated January, 1993 which stated that the endangered American burying beetle had been discovered at nearby Fort Chaffee. However, it is unlikely that the beetle would be found within the project area and no adverse impact to this species was anticipated. In response to an inquiry by FTN Associates, the Service in a letter dated August 3, 1999, stated that no endangered or threatened species or their critical habitats exist within or adjacent to May Branch.

Description of Potential Alternatives

The Locally Preferred Plan (LPP), which is also the recommended plan, consists of a channel which would extend for 2.25 miles from the Arkansas River upstream to Grand Avenue. An extension of the channel beyond the point of federal responsibility, identified as a betterment channel, would extend the channel 0.5 miles to Park Street (Figure 1). From just upstream of O Street to the Fort Smith levee, the channel would augment the flow capacity of the P Street storm sewer. The channel would be trapezoidal with three horizontal to one vertical side slopes and rip-raped except for the vertical concrete wall behind the Arkhola plant and a 1,500-foot length downstream of Grand Avenue where the channel has a 2H:1V side slope and is concrete lined to avoid buildings in the area. Associated bridges and culverts as needed are included in the project plans.

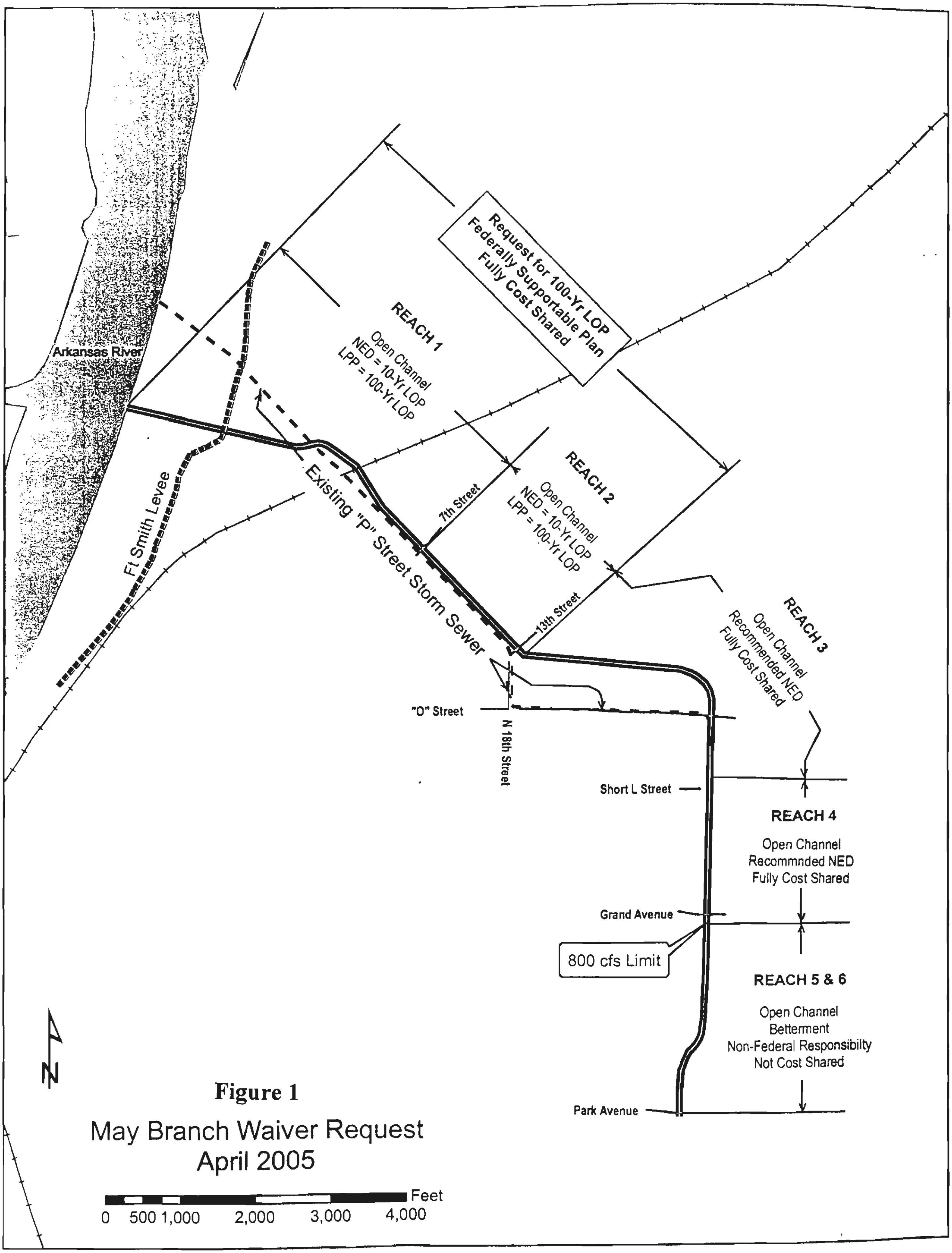


Figure 1

May Branch Waiver Request
April 2005

Description of Potential Impacts

Since May Branch and the area adjacent to it are already converted to urban development and the fish and wildlife resource values are very low, the proposed alternative would not result in significant adverse impacts to these resources. Although, a wetland determination of the area within the right-of-way has not been made, it is likely that some disturbed wetlands adjacent to the Arkansas River would be impacted by the proposed channel construction. It does not appear that any other wetlands would be impacted by the proposed project. A wetland determination will be completed as the study progresses. If wetlands are impacted, a plan to mitigate for the loss of wetland habitat and functions would need to be developed and implemented. In addition, the location of the disposal sites for the material excavated from the channel has not been determined. However, it is anticipated that the material would be hauled out of the project area for disposal. Whether the material excavated from the channel is disposed of within or outside of the May Branch area, it should be placed in previously cleared uplands, not in wetlands.

The Arkansas River does support high value aquatic resources, including both sport and commercial fisheries. During the construction period, there would be an increase in sediment and turbidity in May Branch which could in turn be transported to the Arkansas River. High levels of sediment and turbidity can cover gills and interfere with respiration of aquatic species. Further, sediments can cover and smother eggs and larvae of aquatic species and can reduce light penetration, interfering with photosynthesis. Therefore, measures to control sediment and turbidity should be instituted during the construction period in order to reduce the levels of sediments that are carried into the Arkansas River. Any areas disturbed by construction activities which are suitable should be seeded with native plant species to reduce erosion and provide some food and cover for urban wildlife species.

Recommendations and Service Position

The Service has no objection to the proposed modifications to May Branch provided the following recommendations are incorporated into project plans.

1. During the construction period, measures to reduce the amount of sediment entering the adjacent Arkansas River should be implemented.

2. As soon as possible after construction, all disturbed areas which are suitable should be seeded to establish a vegetative cover to minimize the amount of sediment in run-off from the site.

3. Material excavated from the channel should be placed in previously cleared upland sites.

4. If any wetlands will be converted to project purposes, a plan to mitigate for the loss of wetland function and habitat will need to be developed and implemented.

We appreciate the opportunity to work with your staff and the opportunity to provide these comments.

Sincerely,

Margaret Harney

Margaret Harney
Acting Field Supervisor

cc:
Arkansas Game and Fish Commission, Little Rock, Arkansas
    Attn: Craig Uyeda
Arkansas Natural Heritage Commission, Little Rock, Arkansas
    Attn: Cindy Osborne
Environmental Protection Agency, Dallas, TX

Arkansas Game and Fish Commission
2 Natural Resources Drive Little Rock, Arkansas 72205

Scott Henderson
Director

Mike Gibson
Deputy Director

David Goad
Deputy Director

Loren Hitchcock
Deputy Director

February 17, 2006

Margaret Harney
USFWS
110 South Amity Road, Suite 300
Conway, AR 72032

Dear Ms. Harney:

Our agency is in receipt of your Draft Fish and Wildlife Coordination Act Report that references the proposed May Branch project Located in Sebastian County, Arkansas.

Biologists from our agency have reviewed this report and concur with the recommendations in this report and agree with the locally preferred plan (LPP). Our agency would recommend constructing baffles in the runoff area to increase dissolved oxygen in the water and trash racks to collect trash before entering into the river. We would also suggest placing fabric and rip-rap at the outlet to control erosion. Our fisheries biologist feel that the storm water runoff should be separated from the P street sewage system to avoid impacts to fisheries habitat

Our agency appreciates the opportunity to review these comments and looks forward to working cooperatively with your agency in the future.

Sincerely,

Robert K. Leonard

Robert K. Leonard, Biologist
River Basins Division

Cc: Doyle Shook
Mike Armstrong

Phone: 501-223-6300 Fax: 501-223-6448 Website: www.agfc.com

The mission of the Arkansas Game and Fish Commission is to wisely manage all the fish and wildlife resources of Arkansas while providing maximum enjoyment for the people.

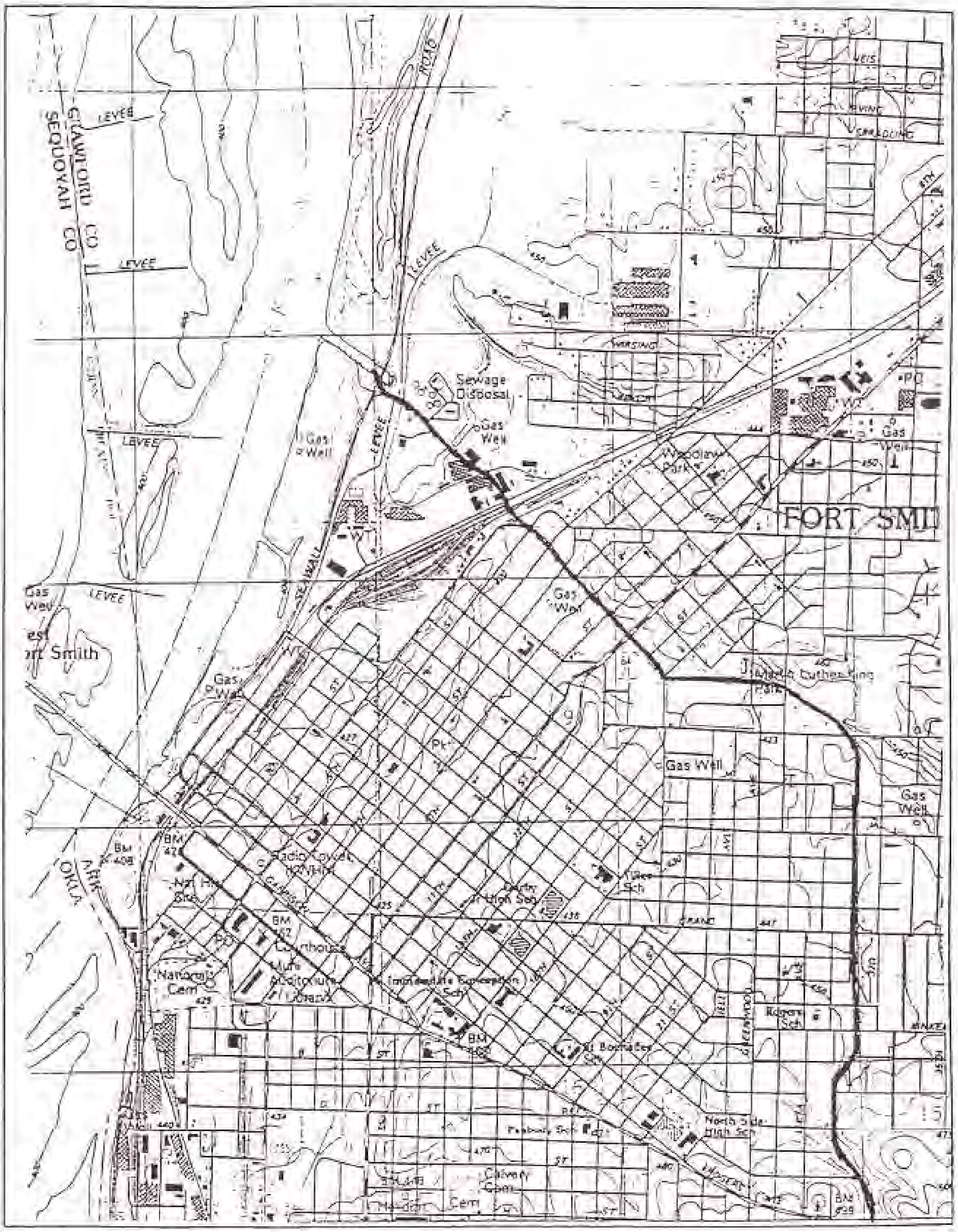


FIGURE 1 Alternatives corridor of proposed May Branch Flood Control Project, Fort Smith, Sebastian County, Arkansas. Map based on USGS topographic quadrangle map, 7.5 minute series, Fort Smith, ARK-OKL, 1987.

LIST OF ACRONYMS AND ABBREVIATIONS

ADEQ — Arkansas Department of Environmental Quality
ANHC — Arkansas Natural Heritage Commission
cfs — cubic feet per second
Corps — US Army Corps of Engineers
EPA — Environmental Protection Agency
FEMA — Federal Emergency Management Agency
FPPA — Farmland Protection Policy Act
FWS — US Fish and Wildlife Service
GLO — Government Land Office
NEPA — National Environmental Policy Act
sq miles — square miles
T&E species — threatened and endangered species

APPENDIX B
ECONOMICS

ECONOMIC EVALUATION
May Branch, Fort Smith, Arkansas

SCOPE

This documentation presents economic analysis of a 10-yr channel plan (Plan C-10), which is the NED plan that provides the greatest excess benefits over cost of the project. Also designated is the selected or locally preferred plan (LPP) which is a combination of the 100-yr channel plan (Plan C-100) for Reaches 1 and 2, and the 10-yr plan (Plan C-10) for Reaches 3 and 4. Benefits for Reaches 3 and 4 are the same for both the 10-yr and 100-yr plans; since cost for the 10-yr plan is lower than for the 100-yr, it is preferable to recommend a 10-yr plan for these two reaches. Although there is increased cost with the 100-yr plan, the City prefers this option with higher benefits for Reaches 1 & 2. The LLP, in the opinion of the sponsor, best meets the needs of the local community, and provides the greatest reduction in flood damages while remaining economically feasible. The LPP removes 127 structures out of the 100-yr flood plain, 40 more structures than removed with the NED plan.

Evaluation began with field reconnaissance to record the number, types, and value of structures in the flood plain. Annualized damages were computed for the without project condition and for alternative flood reduction plans. Total annualized benefits were compared with annualized costs of implementing proposed flood reduction plans.

SOURCES OF DATA

Much of the information collected for the economic analysis was provided by the county tax assessor’s office. It included types of businesses, as well as floor elevations, structure values, and type of construction for both residential and business structures. OMB-approved questionnaires were sent out by the City of Fort Smith to obtain additional economic data including values for automobiles, equipment and contents of structures. In addition, a local contractor gathered data from business owners in the May Branch flood plain to establish estimates of content values and start-of-damage points.

In this study, depth-damage functions for residential properties were obtained from Economic Guidance Memorandum (EGM) 01-03 (4 December 2000). These functions were developed from information obtained by the Flood Damage Data Collection Program and are based on actual losses from flood events that occurred in various parts of the United States in 1996, 1997, and 1998. The purpose of this program is to provide standardized relationships for estimating flood damage and other costs of flooding.

Damages to commercial structures and contents were estimated using depth-damage relationships appropriate for the particular type of establishment and were developed from information obtained from extensive field surveys conducted during current and previous studies in the area.

The May Branch flood plain area was delineated into four damage reaches, sectioned by beginning and ending stations along the stream. These reaches were used to define data for plan evaluations and to aggregate structure and other flood damage information by flood frequencies. A total of 136 structures were identified in the 500-yr flood plain for existing conditions (see Table 1), and the total value of these structures, including contents, was estimated at $44,196,700.

Table 1
Number Of Structures In 500-Yr Flood Plain By Category
May Branch, Fort Smith, Arkansas

	Damage Category		
	Residential	Commercial	Total
Existing Conditions			
Reach 1	8	22	30
Reach 2	25	11	36
Reach 3	2	16	18
Reach 4	37	15	52
Totals	72	64	136
10yr Channel Plan			
Reach 1	7	11	18
Reach 2	22	4	28
Reach 3	0	0	0
Reach 4	0	0	0
Totals	29	15	46
Locally-Preferred Plan			
Reach 1	7	10	17
Reach 2	21	2	23
Reach 3	0	0	0
Reach 4	0	0	0
Totals	28	12	40

Table 2
Number Of Structures In Floodplain By Plan
May Branch, Fort Smith, Arkansas

	Existing Conditions		10-yr Plan		50-yr Plan		100-yr Plan		200-yr Plan		LPP Plan	
Floodplain	100yr	500yr	100yr	500yr	100yr	500yr	100yr	500yr	100yr	500yr	100yr	500yr
Reach 1	25	30	15	18	1	18	0	17	0	17	0	17
Reach 2	36	36	25	28	1	28	0	23	0	23	0	23
Reach 3	15	18	0	0	0	0	0	0	0	0	0	0
Reach 4	51	52	0	0	0	0	0	0	0	0	0	0
Totals	127	136	40	46	2	46	0	40	0	40	0	40

SINGLE EVENT DAMAGES

Table 3 provides without and with-project estimates of single-event damages in each of the reaches in the study area for specified frequency events; the damages shown are at current price levels.

Table 3
Single Event Damages
May Branch, Fort Smith, Arkansas

	Recurrence Interval (Years)					
	2-Year	5-Year	10-Year	50-Year	100-Year	500-Year
Existing Conditions						
Reach 1 damage	$254	$3,489	$223,258	$969,475	$1,515,917	$3,115,681
[structures]	[1]	[4]	[16]	[24]	[25]	[30]
Reach 2 damage	$673	$702,995	$595,622	$944,707	$1,365,874	$2,232,190
[structures]	[3]	[23]	[33]	[36]	[36]	[36]
Reach 3	$261,353	$984,625	$1,250,187	$1,730,943	$2,038,308	$2,136,092
[structures]	[9]	[12]	[13]	[15]	[15]	[18]
Reach 4	$5,711	$473,548	$680,029	$1,932,410	$2,306,520	$2,629,920
[structures]	[13]	[43]	[44]	[51]	[51]	[52]
10yr Channel Plan						
Reach 1	0	0	0	$10,878	$123,970	$336,400
[structures]				[9]	[15]	[18]
Reach 2	0	0	0	$3,354	$213,467	$554,738
[structures]				[9]	[25]	[28]
Reach 3	0	0	0	0	0	0
Reach 4	0	0	0	0	0	0
Locally - Preferred Plan						
Reach 1	0	0	0	0	0	$233,596
[structures]						[17]
Reach 2	0	0	0	0	0	$121,785
[structures]						[23]
Reach 3	0	0	0	0	0	0
Reach 4	0	0	0	0	0	0

ANNUALIZED DAMAGES

The HEC-FDA computer program was used to estimate flood damages in the study area for the without-project and with-project plans. This program provides for the evaluation of flood-damage reductions plans using risk-based analytical methods. The program essentially correlates the depth-damage relationship for each structure and first floor elevation with water-surface profiles from HEC-RAS output to estimate damages for each frequency event. Thus, for each reach, a stage-damage function is developed providing estimates of damages by damage category for a range of frequency events. These frequencies cover probabilities ranging from .500 through .002. The HEC-FDA Flood Damage Reduction Model (HEC-FDA) was used for computing annualized damages. Once a plan and analysis year has been specified, the FDA program computes stage-damage functions for each of the damage reach index locations by damage category. In this study, damage categories included residential and commercial structures and automobile damages, and other flood-related costs including emergency costs, utility damages, and nonphysical losses.

Flood insurance benefits were calculated based on the Fiscal Year 2004 Economic Guidance Memorandum current operating cost per policy of $161. From FEMA, the City of Fort Smith obtained a list of 380 current flood insurance policies within the city; based on the addresses of the policies, there are 81 within the floodplain area of the May Branch study.

Numbers and values of vehicles were obtained from OMB questionnaires, field visits, and interviews with structure owners, as well as stage-damage data that was also derived from information from car dealerships in the Fort Smith area and from other Little Rock District studies. Auto damages were computed with FDA analysis.

Emergency costs are incurred by government agencies in the aftermath of the flood events and are determined using procedures developed in a study by the U.S. Army Engineer District, Louisville, Kentucky. This study, titled Flood Damage Report for Frankfort, Kentucky, July 1981, provides a basis for estimating these types of costs. Emergency costs were computed using a unit cost for each structure based on the number of structures flooded by frequency in the FDA program and relative duration of flooding. Unit costs are expected to remain constant from the Frankfort report. Changes in duration compensate for differences for the long single event in Frankfort and the short, flashy events that occur on May Branch. Flood events may create adverse socioeconomic effects that vary in duration from a few days to several months or even years following the particular event. Data from the Frankfort report was used to estimate costs associated with flood events in the May Branch study area. Emergency cost items include protection of life, health, and property; evacuation and reoccupation; emergency care; emergency preparedness; and administrative costs. The Frankfort data was adjusted for price changes as well as being modified to reflect local area conditions with regard to flood durations.

Emergency costs were calculated for the 0.02, 0.01, 0.004, and 0.002 events. Table 4 and Table 5 provide an example of calculating emergency costs and additional living expenses. The tables are taken from the C-10/C-100 Locally Preferred Plan for the 0.002 event.

Table 4
Estimated Emergency Costs
0.002 Event, Locally Preferred Plan
May Branch - Ft. Smith, AR
(March 2004)

	Unit Cost	No. of Units Affected		Average Duration(days)		Total Costs	
Cost Item	Per day (dollars) (1)	Without Project (2)	With Project (2)	Without Project	With Project	Without Project	With Project
R-1							
Protection of life, health & property (3)	$67	30	17	5	3	$10,107	$3,436
Evacuation, transition & reoccupation (4)	$67	8	7	30	20	$16,172	$9,434
Emergency & mass care (4)	$150	8	7	10	6	$12,025	$6,313
Emergency Preparedness	$83	30	17	5	3	$12,440	$4,230
Administrative Costs	$135	30	17	30	20	$121,288	$45,820
Emergency Costs by Project Condition R-1						$172,032	$69,233
Average Annual Emergency Costs R-1						$344	$138
R-2							
Protection of life, health & property (3)	$67	36	23	5	3	$12,129	$4,649
Evacuation, transition & reoccupation (4)	$67	25	21	30	20	$50,537	$28,301
Emergency & mass care (4)	$150	25	21	10	6	$37,579	$18,940
Emergency Preparedness	$83	36	23	5	3	$14,928	$5,722
Administrative Costs	$135	36	23	30	20	$145,546	$61,992
Emergency Costs by Project Condition R-2						$260,717	$119,603
Average Annual Emergency Costs R-2						$521	$239
R-3							
Protection of life, health & property (3)	$67	18	0	5	3	$6,064	$0
Evacuation, transition & reoccupation (4)	$67	2	0	30	20	$4,043	$0
Emergency & mass care (4)	$150	2	0	10	6	$3,006	$0
Emergency Preparedness	$83	18	0	5	3	$7,464	$0
Administrative Costs	$135	18	0	30	20	$72,773	$0
Emergency Costs by Project Condition R-3						$93,350	$0
Average Annual Emergency Costs R-3						$187	$0
R-4							
Protection of life, health & property (3)	$67	52	0	5	3	$17,519	$0
Evacuation, transition & reoccupation (4)	$67	37	0	30	20	$74,794	$0
Emergency & mass care (4)	$150	37	0	10	6	$55,616	$0
Emergency Preparedness	$83	52	0	5	3	$21,562	$0
Administrative Costs	$135	52	0	30	20	$210,233	$0
Emergency Costs by Project Condition R-4						$379,725	$0
Average Annual Emergency Costs R-4						$759	$0
Total Emergency Costs by Project Condition						**$905,825**	**$188,836**
Average Annual Emergency Costs						**$1,812**	**$378**

(1) Data from 1981 Report, Flood Damage Report for Frankfort, Kentucky, July 1981. Dollar values adjusted for price level changes and locality conditions. (2) Numbers of units with damages from FDA Model runs. (3) includes commercial and residential units (4) residential units

Examples of nonphysical losses are additional living expenses for individuals and families while in temporary housing, increased costs of eating out, laundering, caring for children and pets, and other miscellaneous expenses incurred by residents while displaced from their homes. Lodging expense was a calculated average nightly rate for a room with two double beds from three local hotels. Increased living expense based on per-diem rate for meals, adjusted for miscellaneous expenses and price levels.

Table 5
Additional Living Expenses
0.002 Event, Locally Preferred Plan
May Branch - Ft. Smith, AR
(Mar 2004)

Cost Item	Unit Cost Per day (dollars)	No. of Units Affected		Average Duration(days)		Total Costs	
		Without Project (2)	With Project (2)	Without Project	With Project	Without Project	With Project
R-1							
Lodging	$91	8	7	30	20	$21,958	$12,809
Increased Living Expense (1)	$137	8	7	30	20	$32,802	$19,135
Total Living Expense Costs R-1						$54,760	$31,943
Average Annual Living Expense Costs R-1						$110	$64
R-2							
Lodging	$91	25	21	30	20	$68,618	$38,426
Increased Living Expense (1)	$137	25	21	30	20	$102,507	$57,404
Total Living Expense Costs R-2						$171,125	$95,830
Average Annual Living Expense Costs R-2						$342	$192
R-3							
Lodging	$91	2	0	30	20	$5,489	$0
Increased Living Expense (1)	$137	2	0	30	20	$8,201	$0
Total Living Expense Costs R-3						$13,690	$0
Average Annual Living Expense Costs R-3						$27	$0
R-4							
Lodging	$91	37	0	30	20	$101,554	$0
Increased Living Expense (1)	$137	37	0	30	20	$151,710	$0
Total Living Expense Costs R-4						$253,264	$0
Average Annual Living Expense Costs R-4						$507	$0
Total Living Expense Costs						$492,839	$127,773
Average Annual Living Expenses (Non-Physical Losses)						**$986**	**$256**

(1) $54.89 expense/per person/per day X 2.49 persons per house hold
(2) Numbers of units with damages from FDA Model runs

Damages to utilities include telephone and electric transmission lines and sewerage systems; utility damages were estimated by applying a percentage factor of 15.6% to total physical losses from the FDA model. The percentage factor was determined from actual experienced losses resulting from historical floods in local areas.

Table 6
Utilities Benefits
May Branch - Ft. Smith, AR
(Mar 2004)

Reach	Structural Without Project	Structural With Project	Utility (1) Without Project	Utility (1) With Project	Utility Benefits
1	$98,430	$585	$15,355	$910	$15,264
2	$341,207	$0	$53,228	$0	$53,228
3	$467,320	$0	$72,902	$0	$72,902
4	$257,829	$0	$40,221	$0	$40,221
Total			$181,707	$91	$181,615
Average Annual Utilities Benefits					**$181,615**

(1) 15.6% of total structural damages from actual experienced losses from historical floods in local area

For this study, the future without-project condition was assumed to be similar to the existing condition, since additional development in the flood plain is not expected. There has been very little new residential development in recent years, and the same is true for the commercial category. Furthermore, current flood plain management policy limits development within flood plain areas.

Annualized damages and benefits for the 10-yr, 50-yr, 100-yr and 200-yr plans are shown by reach and by damage category in Table 7. Economic Analysis by Plan with B/C ratios is shown in Table 8. Included with the benefits in this table are the P Street Sewer repair savings. For Reach 4, the new channel will replace the storm sewer, thereby saving the repair and maintenance costs of the sewer. The storm sewer will remain in Reaches 1 – 3.

Table 9 displays the Economic Analysis by Reach for the Locally Preferred Plan, and Table 10 presents the plan’s Cost Apportionment. The Economic Analysis for the total of Reaches 1-4 with the LPP is shown in Table 11.

Table 7
Average Annual Project Benefits
May Branch - Ft. Smith, AR

Reach 1	Existing	10-yr Plan		50-yr Plan		100-yr & LPP		200-yr Plan	
Category	Damage	Damage	Benefits	Damage	Benefits	Damage	Benefits	Damage	Benefits
Structure	98,430	4,527	93,903	2,345	96,085	585	97,845	476	97,954
Other	22,355	2,656	19,699	764	21,591	373	21,982	300	22,055
Auto	3,770	209	3,561	88	3,682	13	3,757	9	3,761
Flood Ins.	3,059	1,771	1,288	161	2,898	161	2,898	161	2,898
Totals	127,614	9,163	118,451	3,358	124,256	1,132	126,482	946	126,668

Reach 2	Existing	10-yr Plan		50-yr Plan		100-yr & LPP		200-yr Plan	
Category	Damage	Damage	Benefits	Damage	Benefits	Damage	Benefits	Damage	Benefits
Structure	341,207	7,349	333,858	861	340,346	0	341,207	0	341,207
Other	68,775	5,400	63,375	1465	67,310	471	68,304	451	68,324
Auto	13,368	742	12,626	315	13,053	0	13,368	0	13,368
Flood Ins.	3,703	2,576	1,127	161	3,542	0	3,703	0	3,703
Totals	427,053	16,067	410,986	2,802	424,251	471	426,582	451	426,602

Reach 3	Existing	10-yr Plan		50-yr Plan		100-yr & LPP		200-yr Plan	
Category	Damage	Damage	Benefits	Damage	Benefits	Damage	Benefits	Damage	Benefits
Structure	467,320	0	467,320	0	467,320	0	467,320	0	467,320
Other	76,286	0	76,286	0	76,286	0	76,286	0	76,286
Auto	11,140	0	11,140	0	11,140	0	11,140	0	11,140
Flood Ins.	2,093	0	2,093	0	2,093	0	2,093	0	2,093
Totals	556,839	0	556,839	0	556,839	0	556,839	0	556,839

Reach 4	Existing	10-yr Plan		50-yr Plan		100-yr & LPP		200-yr Plan	
Category	Damage	Damage	Benefits	Damage	Benefits	Damage	Benefits	Damage	Benefits
Structure	257,829	0	257,829	0	257,829	0	257,829	0	257,829
Other	62,873	0	62,873	0	62,873	0	62,873	0	62,873
Auto	22,155	0	22,155	0	22,155	0	22,155	0	22,155
Flood Ins.	4,186	0	4,186	0	4,186	0	4,186	0	4,186
P-St Sewer	11,100	0	11,100	0	11,100	0	11,100	0	11,100
Totals	358,143	0	358,143	0	358,143	0	358,143	0	358,143

Total R.1-4	Existing	10-yr Plan		50-yr Plan		100-yr & LPP		200-yr Plan	
Category	Damage	Damage	Benefits	Damage	Benefits	Damage	Benefits	Damage	Benefits
Structure	1,164,786	11,876	1,152,910	3,206	1,161,580	585	1,164,201	476	1,164,310
Other	230,288	8,056	222,233	2,229	228,059	844	229,444	751	229,537
Auto	50,433	951	49,482	403	50,030	13	50,420	9	50,424
Flood Ins.	13,041	4,347	8,694	322	12,719	161	12,880	161	12,880
P-St Sewer	11,100	0	11,100	0	11,100	0	11,100	0	11,100
Totals	1,469,648	25,230	1,444,419	6,160	1,463,488	1,603	1,468,045	1,397	1,468,251

Note: “Other” includes Emergency, Nonphysical, and Utilities benefits.

Note: Reach 2 Other Damages for the LPP and the 200-yr plan, are greater than zero. Although average annual numbers for structural damage are so small that they are eventually rounded down to zero, emergency costs still exist for the .004 and .002 events.

Table 8
Economic Analysis By Plan
May Branch - Ft. Smith, AR

	Plan C-10, NED	Plan C-50	Plan C-100	Plan C-200
Interest Rate, %	5.125	5.125	5.125	5.125
Construction Period, years	3.4	3.8	3.8	3.9
Period of Analysis, years	50	50	50	50
Average Annual Benefits				
Flood damage	$1,152,900	$1,161,600	1,164,200	$1,164,300
Emergency, Non Phys,& Utility	$222,200	$228,100	229,500	$229,500
Auto damages	$49,500	$50,000	50,400	$50,500
Flood Insurance	$8,700	$12,700	12,900	$12,900
P St Sewer repair savings	$11,100	$11,100	11,100	$11,100
Total Annual Benefits	$1,444,400	$1,463,500	1,468,100	$1,468,300
Total Project Constr. Costs	$19,725,800	$21,058,400	$21,482,600	$21,963,900
Interest During Construction	1,730,200	2,084,300	2,126,300	2,236,300
Total Investment Costs	$21,456,000	$23,142,700	$23,608,900	$24,200,200
Average Annual Costs				
Interest	$1,099,500	$1,186,100	$1,210,000	$1,240,300
Amortization	98,500	106,200	108,300	111,000
OMRR&R	47,000	55,500	56,600	56,800
Total Annual Costs	$1,245,000	$1,347,800	$1,374,900	$1,408,100
Excess Benefits over Cost	$199,400	$115,600	$93,200	$60,200
Benefit/Cost Ratio	1.16	1.09	1.07	1.04

* Project cost includes $5,000 for a wingwall at the upstream end of Reach 4.

Table 9
LPP’s Economic Analysis By Reach, Plan C-100/C-10
May Branch - Ft. Smith, AR
(Interest Rate, 5.125 %)

Reach	Reach 1	Reach 2	Reach 3	Reach 4	Reaches 1 – 4
Upstream Limit	7th Street	Midland Ave	Short L St	Grand Avenue	Total
Annualized Benefits:					
Flood damage	$97,900	$341,200	$467,300	$257,800	$1,164,200
Emergency, Non Phys, & Utility	22,000	68,300	76,300	62,900	229,500
Auto damages	3,700	13,400	11,200	22,100	50,400
Flood Insurance	2,900	3,700	2,100	4,200	12,900
P St Sewer repair savings	0	0	0	11,100	11,100
Total Annualized Benefits	$126,500	$426,600	$556,900	$358,100	$1,468,100
Construction Costs:					
Project Construction Costs	$10,412,100	$4,077,500	3,752,200	2,894,600	$21,136,400
Interest During Construction	1,030,600	403,600	371,400	286,500	2,092,100
Total Investment Cost	$11,442,700	$4,481,100	$4,123,600	$3,181,100	$23,228,500
Annualized Costs:					
Interest	586,400	229,700	211,300	163,000	1,190,500
Amortization	52,500	20,600	18,900	14,600	106,600
OMRR&R	27,500	8,000	12,000	8,000	55,500
Total Annualized Costs	$666,400	$258,300	$242,200	$185,600	$1,352,600
Excess Benefits over Cost	($539,900)	$168,300	$314,700	$172,500	$115,500
Benefit/Cost Ratio	0.19	1.7	2.3	1.9	1.09

Table 10
Cost Apportionment LPP
May Branch - Ft. Smith, AR

REACHES 1- 4	FEDERAL	NON-FEDERAL	TOTAL
Lands and Damages	$ 137,000	$ 3,140,600	$ 3,277,600
Structures		2,639,300	2,639,300
Roads	759,100	1,261,200	2,020,300
Railroads	2,410,400	334,500	2,744,900
Channel	7,611,900	-	7,611,900
Control Structure	542,600	-	542,600
Subtotal	11,324,000	4,235,000	15,559,000
E&D	1,096,200	409,900	1,506,100
S&A	986,500	369,000	1,355,500
Subtotal	13,543,700	8,154,500	21,698,200
5% Cash	(1,084,900)	1,084,900	-
Subtotal	$ 12,458,800	$ 9,239,400	$ 21,698,200
Adjustments	-	-	-
Subtotal	$ 12,458,800	$ 9,239,400	$ 21,698,200
Percent of First Cost	57%	43%	100%
REACHES 5 & 6	FEDERAL	NON-FEDERAL	TOTAL
Lands and Damages	-	$ 1,905,000	$ 1,905,000
Construction	-	$ 2,421,700	$ 2,421,700
Total, Reaches 5 & 6	-	$4,326,700	$ 4,326,700
	FEDERAL	NON-FEDERAL	TOTAL
TOTAL FIRST COST	$ 12,458,800	$ 13,566,100	$ 26,024,900
Percent of Total	48%	52%	100%

With full Federal participation in the LPP cost sharing for reaches 1 – 4.
Land costs include relocation assistance costs that are a financial cost but not an economic cost. Extension channel cost, reaches 5&6, is reduced by $5K and reaches 1-4 cost is increased by $5K for the cost of the wing walls. Federal cost shown for roads and railroads is the cost of covered channel sections at crossings.

ECONOMIC JUSTIFICATION

Annualized benefits and costs, and a benefit-to-cost ratio for the proposed plan of improvement are shown in Table 11. These estimates are based on a project life of 50 years, a construction period of 3.8 years, and the current Federal discount rate of 5.125 percent. Annualized flood reduction benefits total $1,468,100; annualized costs of the project, including O&M charges, are estimated at $1,352,600, resulting in a 1.09 benefit-to-cost ratio.

Table 11
Economic Analysis LLP
May Branch - Ft. Smith, AR

Item	Amount
Economic Life (Years)	50
Construction Period (Years)	3.8
Interest Rate (Percent)	5.125%
Estimated Construction Cost	$21,136,400
Interest During Construction	2,092,100
Total Investment Cost	$23,228,500
Annualized Costs:	
Interest	$1,190,500
Amortization	106,600
Operation & Maintenance	55,500
Total Annual Cost	$1,352,600
Annualized Benefits:	$1,468,100
Benefit-to-Cost Ratio	1.09
Net Benefits	$115,500

RISK AND UNCERTAINTY

The HEC-FDA Flood Damage Reduction Model includes risk-based analysis methods that follow Federal and Corps of Engineers regulations ER 1105-2-100 and ER 1105-2-101. The program quantifies uncertainty in discharge-exceedance probability, stage discharge, and stage-damage functions and thus incorporates uncertainty into the economic analysis. In addition, uncertainty error factors are incorporated into the depth-damage functions associated with residential and commercial structures.

In Tables 12 and 13, FDA risk analysis is shown for total benefits that include other and auto, as well as structural and content categories for the NED (10-yr) Plan and for the LPP. Annual exceedance probabilities (AEP) associated with the various alternative plans are shown in Table 14.

Table 12
Annualized Damage Reduced and Distributed
for the 10-yr (10-yr Fully Modified) Plan and
Analysis Year 2002
Plan was calculated with Uncertainty
May Branch - Ft. Smith, AR

Damage Reach Name	Damage Reach Description	Annualized Damage			Probability Damage Reduced Exceeds Indicated Values		
		Total Without Project	Total With Project	Damage Reduced	.75	.50	.25
1	May Branch Reach 1	128,685	7,584	121,101	53,022	99,631	166,964
2	May Branch Reach 2	439,485	12,416	427,069	321,152	411,616	517,146
3	May Branch Reach 3	591,775	0	591,775	452,825	577,742	716,530
4	May Branch Reach 4	356,633	0	356,633	265,534	341,260	431,945
		1,516,578	20,000	1,496,578	1,092,533	1,430,249	1,832,585

* FDA includes Structure, Auto, Emergency, Nonphysical, Utilities, and Flood Insurance benefits.

Table 13
Annualized Damage Reduced and Distributed
for the LPP (Locally-Preferred Plan) and
Analysis Year 2002, (Damage in $1,000’s)
Plan was calculated with Uncertainty
May Branch - Ft. Smith, AR

Damage Reach Name	Damage Reach Description	Annualized Damage			Probability Damage Reduced Exceeds Indicated Values		
		Total Without Project	Total With Project	Damage Reduced	.75	.50	.25
1	May Branch Reach 1	128,685	898	127,787	55,473	104,548	175,787
2	May Branch Reach 2	439,485	0	439,485	327,088	421,322	532,893
3	May Branch Reach 3	591,775	0	591,775	452,826	577,742	716,530
4	May Branch Reach 4	356,633	0	356,633	265,534	341,260	431,944
		1,516,578	898	1,515,680	1,100,921	1,444,872	1,857,154

* FDA includes Structure, Auto, Emergency, Nonphysical, Utilities, and Flood Insurance benefits.

Table 14

May Branch Project Performance
by Plans and Damage Reaches by Analysis Year 2002
(Stages in ft.)

Without Project Base Year Performance Target Criteria:
Event Exceedance Probablility = 0.01
Residual Damage = 5.00 %

Plan Name	Stream Name	Damage Reach Name	Damage Reach Description	Target Stage	Target Stage Annual Exceedance Probability		Long-Term Risk (years)			Conditional Non-Exceedance Probability by Events					
					Median	Expected	10	25	50	10%	4%	2%	1%	.4%	.2%
Without	May Branch	1-Pump	Reach 1-Pump Station	404.50	0.9990	0.9980	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		1	May Branch Reach 1	415.38	0.1550	0.1530	0.8092	0.9841	0.9997	0.1857	0.0261	0.0148	0.0114	0.0099	0.0088
		2	May Branch Reach 2	417.06	0.3840	0.3890	0.9927	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		3A	May Branch Reach 3A	422.00	0.0250	0.0420	0.3481	0.6569	0.8823	0.9034	0.6358	0.4054	0.2240	0.0867	0.0405
		3B	May Branch Reach 3B	422.58	0.5300	0.5270	0.9994	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		4	May Branch Reach 4	435.12	0.2940	0.2990	0.9712	0.9999	1.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
10-yr	May Branch	1-Pump	Reach 1-Pump Station	404.50	0.0010	0.0020	0.0169	0.0418	0.0818	1.0000	1.0000	1.0000	0.9998	0.9983	0.9966
		1	May Branch Reach 1	415.38	0.0100	0.0120	0.1156	0.2643	0.4588	0.9999	0.9719	0.8170	0.5386	0.2365	0.1186
		2	May Branch Reach 2	417.06	0.0120	0.0150	0.1420	0.3181	0.5350	0.9998	0.9546	0.7412	0.4145	0.1278	0.0425
		3A	May Branch Reach 3A	422.00	0.0010	0.0020	0.0153	0.0379	0.0743	1.0000	1.0000	0.9999	0.9998	0.9995	0.9992
		3B	May Branch Reach 3B	levee	0.0010	0.0020	0.0169	0.0417	0.0816	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
		4	May Branch Reach 4	435.12	0.0010	0.0020	0.0159	0.0394	0.0772	1.0000	0.9999	0.9997	0.9988	0.9974	0.9969
50-yr	May Branch	1-Pump	Reach 1-Pump Station	404.50	0.0010	0.0010	0.0100	0.0247	0.0488	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		1	May Branch Reach 1	415.38	0.0040	0.0040	0.0424	0.1026	0.1947	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		2	May Branch Reach 2	416.35	0.0040	0.0040	0.0408	0.0989	0.1881	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		3A	May Branch Reach 3A	422.00	0.0010	0.0010	0.0100	0.0247	0.0488	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		3B	May Branch Reach 3B	levee	0.0010	0.0010	0.0100	0.0247	0.0488	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		4	May Branch Reach 4	435.12	0.0010	0.0010	0.0100	0.0247	0.0488	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
100-yr	May Branch	+1-Pump	Reach 1-Pump Station	404.50	0.0010	0.0020	0.0169	0.0417	0.0816	1.0000	1.0000	1.0000	0.9998	0.9992	0.9984
		+1	May Branch Reach 1	415.38	0.0010	0.0020	0.0209	0.0514	0.1002	1.0000	0.9999	0.9975	0.9552	0.8690	0.7205
		+2	May Branch Reach 2	416.35	0.0010	0.0010	0.0140	0.0347	0.0681	1.0000	1.0000	0.9998	0.9953	0.9846	0.9666
		+3A	May Branch Reach 3A	422.00	0.0010	0.0010	0.0063	0.0156	0.0309	1.0000	1.0000	1.0000	1.0000	1.0000	0.9999
		+3B	May Branch Reach 3B	levee	0.0010	0.0020	0.0169	0.0417	0.0816	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
		+4	May Branch Reach 4	435.12	0.0010	0.0010	0.0130	0.0321	0.0632	1.0000	1.0000	0.9998	0.9987	0.9977	0.9967
200-yr	May Branch	+1-Pump	Reach 1-Pump Station	404.50	0.0010	0.0020	0.0169	0.0417	0.0816	1.0000	1.0000	1.0000	0.9998	0.9992	0.9984
		+1	May Branch Reach 1	415.38	0.0010	0.0020	0.0178	0.0438	0.0857	1.0000	0.9999	0.9977	0.9622	0.8840	0.7386
		+2	May Branch Reach 2	416.35	0.0010	0.0010	0.0138	0.0340	0.0669	1.0000	1.0000	1.0000	0.9996	0.9993	0.9984
		+3A	May Branch Reach 3A	422.00	0.0010	0.0020	0.0169	0.0417	0.0816	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
		+3B	May Branch Reach 3B	levee	0.0010	0.0020	0.0169	0.0417	0.0816	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
		+4	May Branch Reach 4	435.12	0.0010	0.0010	0.0130	0.0321	0.0632	1.0000	1.0000	0.9998	0.9988	0.9978	0.9968

RAILROAD FLOOD IMPACT ANALYSIS

There are four railroad lines within the May Branch study area. Three different companies: the Kansas City Southern railroad, the Arkansas-Missouri railroad, and the Union Pacific railroad own these lines. Two companies, the Fort Smith Railroad and the Arkansas Missouri Railroad operate and maintain these railroads. Hydraulic analysis determined that there are five railroad crossings subject to flooding from May Branch.

It was determined based on discussions with railroad experts that the beginning damage elevation for railroads would be 1-foot below top of rail. It was assumed that once water reaches this elevation that railroad traffic would be suspended until a track inspection could be conducted. Traffic would continue only after a visual inspection could be conducted for the section of track impacted by flooding. For four of the sites, the damage elevation was determined to be 412.5’ MSL, and 413.0’ MSL for the fifth site. Discussions with railroad officials and companies serviced by these lines indicated that to-date over the last 20 years no interruption of rail service had been experienced from flooding. All companies interviewed indicated that there would be no impact to their businesses unless the interruption of service was for a period longer than 48 hours. Damages to tracks and roadbeds from flooding were assumed to begin after water has stood against the track for 48 hours.

For the reasons mentioned above it was essential that a flood duration analysis be conducted for the five sites identified in the project area. The duration analysis conducted (Table 15) revealed that under existing conditions the 500-year flood event would reach the damage elevation point for 23 hours for sites 2, 3, 4, and 5 and 19 hours for site 1. Under with-project conditions, the 500-year duration was reduced to 5 hours for sites 1 and 2 and 6 hours for sites 3, 4, and 5 (Table 16).

Table 15
Existing Conditions
Duration Analysis By Flood Frequency
By Railroad Site
May Branch - Ft. Smith, AR

		FLOOD FREQUENCY							
Site	Damage Elevation	2	5	10	25	50	100	200	500
	MSL	HOURS							
1	412.5	0	0	0	0	4	11	15	19
2	412.5	0	0	2	5	9	16	20	23
3	412.5	0	0	2	5	9	16	20	23
4	412.5	0	0	2	5	9	16	20	23
5	413.0	0	0	2	5	9	16	20	23

Table 16
With-Project Conditions
Duration Analysis By Flood Frequency
By Railroad Site
May Branch - Ft. Smith, AR

		FLOOD FREQUENCY							
Site	Damage Elevation	2	5	10	25	50	100	200	500
	MSL	HOURS							
1	412.5	0	0	0	2	3	3	4	5
2	412.5	0	0	0	2	3	4	5	5
3	412.5	0	0	0	3	4	4	5	6
4	412.5	0	0	3	4	4	5	6	6
5	413.0	0	0	3	4	4	5	6	6

Inspection Cost

As previously mentioned, based on railroad guidance, track that has water to within 1-foot of the rail must be inspected prior to opening the track up to traffic. This is a cost and would be incurred regardless of the duration of the flood event. It was assumed that all of the five sites could be visually inspected in 1 day at a cost of $1,000 per day. Under both existing and with-project conditions these inspections would be necessary since all sites evaluated would continue to flood but with shorter durations under with-project conditions.

Summary of Findings for Railroad Flood Impact Analysis

Based on the assumptions identified above and the duration analysis in Tables 8 and 9, it was determined that there would be no significant flood losses from traffic rerouting or business losses from the flood events analyzed. Track inspection will be required for both without and with-project conditions. It should be noted that damages to railroad track and roadbeds are expected to be minimal since these structures are designed to withstand years of heavy traffic load without major repairs or rehabilitation. It is acknowledged that there would be minor flood damages/costs from the flood events evaluated, but without longer durations (longer than 48 hours); significant damages are not expected to be incurred.

ABILITY-TO-PAY (Ref: EGM02 03 Able2Pay Memo)

The ability-to pay test is applied to all flood control projects. As a result of the application of the test, some projects will be cost shared at a lower level than the standard non-Federal share, which is the share that would apply to the project before any ability-to- pay consideration.

Step 1, the Benefits Test:

The B/C ratio for the selected Channel Plan, the LPP, is 1.09; when the ratio is divided by four, the result is 0.273, which is the BBF ("benefits based floor"). The standard level of cost sharing (the non-Federal share of total first cost) is 0.43 (ref. Cost Apportionment Table). Therefore, the BBF is less than the standard level, and the project may be eligible for either a reduction or partial reduction in the non-Federal share.

Step 2, the Income Test:

The form of the EF ("Eligibility Factor") is:

EF = a - b1 x (state income index) - b2 x (county income index)

The state's per capita personal income as an index number in comparison to the national average (U.S.=100) is 75.1; it is the average over three years (2000 –2002) of Arkansas' per capita personal income index (state per capita personal income divided by national per capita personal income). And the Sebastian County income index is 87.6, which is the average over three years (2000 –2002) of the county per capita personal income index (= county per capita personal income divided by national per capita personal income). Per capita personal income data is from the Bureau of Economic Analysis (BEA) publication, dated June 2004.

The parameters a, b1, and b2 have been determined using the state and county per capita index data and the condition that a certain fraction of the counties are to have eligibility factors greater than zero. The values of the parameters are:

a = 17.90057
b1 = 0.077461
b2 = 0.154922

If EF is one or more, the project is eligible for the full reduction in cost-share to the benefits-based floor. If EF is zero or less, the project is not eligible for a reduction. If EF is between zero and one, the non-Federal cost-share will be reduced proportionately to an amount that is greater than the BBF but less than the standard non-Federal cost-share.

Using the state income index for Arkansas, 75.1, the income index for Sebastian County, 87.6, and the values in the above EGM formula,

EF = 17.90057 - (0.077461)(75.1) - (0.154922)(87.6)
= 17.90057 – 5.817 – 13.571 = **-1.488**

The EF is less than zero; therefore, the project is not eligible for a reduction in the standard Non-Federal cost-share.

APPENDIX C
ENGINEERING APPENDIX

ENGINEERING APPENDIX

C-1. General

This appendix documents the engineering analysis. In this appendix are attached separate reports for the Hydrology and Hydraulics and the Hazardous and Toxic Materials. Attached are the MCACES cost estimates, construction schedule, plan views, typical channel sections, typical culvert sections and plan, hydraulic control structure, and boring logs.

C-2. Hydrology and Hydraulics

Hydraulic modeling was performed during this study; information obtained from the model was used in developing channel dimensions. Four variations of the selected channel layout were evaluated; they are the 10, 50, 100 and 200-year plans, which are referred to as C-10, C-50, C-100 and C-200. Each plan provides different levels of flood reduction. Refer to the Hydrology and Hydraulics report for complete details and the dimensions of each plan.

C-3. Surveying, Mapping, and Other Geospatial Data Requirements

No surveys were performed for this phase of study, however, an aerial based GIS map was provided by the sponsor. The map was generated at one inch to 100 feet with two-foot contours. The map also showed buildings, streets and railroad tracks. A more recent and comprehensive topographic survey will be required in order to develop plans and specifications.

C-4. Geotechnical

C-4.1.1. Regional and site geology

Fort Smith is located on the southern flank of the McAlester Basin, in the Arkansas Valley section of the Ouachita physiographic province. Three geologic formations, which are all Pennsylvanian age, crop out in the area. In ascending order, they are the Hartshorne sandstone, the Spadra shale and the Fort Smith formation, which consists of sandstone and sandy shale. Faulting is present in the area as is folding of the beds. These features increase in intensity southward. Groundwater generally follows the surface contours and may be found in small to moderate amounts in the residual and alluvial materials in the area. A layer of residual soil ranging up to 14 feet in thickness mantles the area; alluvial materials of varying thicknesses can be expected along major drainages of the area.

C-4.1.2. Completed exploration

In June 1999, there were a total of 23 borings drilled in the vicinity of the proposed channel alignment. Continuous standard penetration tests (SPT) were performed on the majority of the holes in accordance with procedures outlined in the Department of the Army, Engineer Manual (EM) 1110-2-1907, dated 31 Mar 72. The depth of the continuous SPTs ranged from 12 feet to 21 feet; an SPT was then performed at 3-foot intervals. Samples were obtained from each SPT for HTRW and soil classification tests. Auger borings were performed at other locations and samples were taken at 3-foot intervals for soil classification testing. When rock was encountered during the drilling operation, the hole was core drilled into the rock for 8 feet; the boring was then terminated. Rock was not encountered on all holes, however the holes where rock was encountered ranged from 3.5 feet to 20 feet. The total depth of the holes ranged from 11.5 feet to 39 feet. A total of seven borings were drilled (MB25 – MB31) in October 1999 and monitoring wells were installed to obtain water samples for Hazardous Toxicological Radioactive Waste (HTRW) testing. See Geotechnical plates G1 – G15 for location and details on all of the boring logs.

The equipment used for the drilling operation included a Mobile B-56 drill rig, 8" outside diameter (OD) augers, 2" OD standard split spoon samplers; 3.5" OD HQ core barrels were used for rock samples. The drill operation was performed by a contract drilling company.

A local engineering firm tested the soil samples; tests included natural water contents, liquid limits and plastic limits. The soils were also visually classified in accordance with ASTM D 2487. In general the overburden consists of CL, ML, SP, SM, and CH, with clays being the most common soil type and silts being the next most common. Sands and gravels were encountered somewhat infrequently. All samples were tested for the natural moisture content, the results ranged from 7% to 37% for sands, 3% to 63% for clays and 17% to 45% for silts. Atterburg limits were performed on a total of 37 samples of the cohesive material; the plasticity indexes ranged from 5 to 59.

C-4.1.3. Preliminary stability analysis.

Based on the given soil types in the area and engineering judgment, it was determined that the excavated channel side slopes should be 1V:3H and plated with 2 feet of riprap, except where vertical walls or concrete paved slopes are to be constructed.

C-4.1.4. Excavatability analysis

The soils encountered during drilling operations will be excavated by using typical earth excavation equipment. The rock that was encountered was primarily shale with some sandstone. The rock will likely have to be removed by using continuous systematic chiseling, edging or other appropriate rock excavation methods in order to efficiently remove the material.

C-4.1.5. Potential disposal sites.

No potential disposal areas have been identified at this time. Upon project approval, the specifications will likely direct the contractor to be responsible for locating appropriate disposal areas, unless the sponsor expresses a desired location for the disposal.

C-5. Civil Design

C-5.1. Site selection and project development

Site visits and preliminary cost comparisons were performed by the Project Delivery Team (PDT) in order to help facilitate selection of the most feasible channel layout. Consideration was given to existing bridges, buildings, utilities and roads that would be impacted by the selected plan. Other plans were not selected because they required excavation through an existing landfill and wetland mitigation. Other concerns were, the channels were longer, less hydraulically efficient and posed a greater negative impact to local businesses. The alternate channel routes are presented on plates G1-G3. Also, the possibility of constructing a covered channel was discussed but not thoroughly evaluated due to the feasibility of constructing an open channel and additional costs associated with construction of a covered channel. The National Economic Development (NED) plan, C-10, is an excavated channel, which flows through the city of Fort Smith, Arkansas, which will drain into the Arkansas River; the plan is presented on plates C-1 through C-3. The federal interest limit of the proposed channel is approximately 2.3 miles long with varying depths and a portion of it is located along an old railroad easement. The majority of the channel will have a trapezoidal cross-section with 1V:3H side slopes plated with riprap. The riprap will be placed at an elevation, which is consistent with a 2-year flood event. The channel was laid out in a manner that was hydraulically functional while minimizing the need to remove or relocate existing homes, businesses and other structures. However, at various locations along the proposed channel, it will not be feasible to construct a trapezoidal channel due to real estate limitations. At these locations, a vertical concrete wall will be used and a concrete paved trapezoidal channel will be used. A combination of the 100yr and 10yr plans, C-100/C-10, is presented on plates C-4 through C-6.

The proposed channel alignment will cross several existing streets thereby creating the need for covered channel sections and bridges. The alignment will also require five railroad crossings over a covered channel section. Traffic at each bridge or box culvert location will be rerouted until it is deemed feasible to use the newly constructed crossing. Based on information obtained by the contract A-E firm, one of the impacted railroads will not require temporary access during the construction of the new crossing. However, temporary access will be required for the three main line railroad tracks during the construction of the new crossings. The fifty-foot right-of-way along either side of the traffic is sufficient to construct a temporary shoofly. Although, the involved railroad companies have provided concurrence on our initial proposal, a formal agreement with all involved entities will be established upon project approval.

There are also several existing storm drains including the P Street storm sewer that will intersect the proposed channel alignment. This sewer and collector drains will collect water independently of the proposed channel in reaches 1-3. Where the proposed channel alignment crosses the main sewer line or the collector drains, the existing line will be cut in order to daylight to the new channel. These lines will remain in operation after completion of the channel by flowing into the completed channel. This will allow some of the runoff to continue to be collected by the existing drains. New headwalls and pipe extensions will also be used as required.   Plates C-1 and C-2 show the location of the storm sewer in relation to the proposed channel. The storm sewer is made of concrete and ranges in size from 105" to 138" in diameter with varying sizes of collector drains which tie into the sewer line at various locations within reaches 1-3. If the project goes to construction, the plans and specifications will clearly identify the location of the sewer line and will also instruct contractors to implement procedures that will avoid damage to the existing sewer line during excavation procedures.

During the initial stages of the study, it was believed that the existing pump station located near the Arkansas River would need to be upgraded to increase its capacity to handle coincident flooding. An A-E firm performed a study to determine the most practical methods of increasing the capacity of the flood control pump station. However, after further review by Hydraulic engineers, it was determined that coincident flooding will not be a problem, therefore a new/upgraded pump station would not be necessary for this project.

The upstream Federal interest limit of the project is at the upstream end of reach 4. However the two upstream reaches (reaches 5 and 6) will be constructed. A cost estimate is required for the Federal interest portion of the project (reaches 1 - 4). Thus, this portion includes the estimated cost of a wing wall that would have been constructed where the existing storm sewer would have transitioned into the open channel. Since an open channel will be constructed though all of the reaches, this headwall will not actually be required although its cost will reduce the sponsor's share of costs for reaches 5 & 6.

The project location is in an urban area with sparse vegetative cover; therefore no significant amount of clearing is anticipated.

C-5.2. Real Estate.

This project will require the acquisition of real estate in order to construct the flood reduction channel, which includes construction right of way. Also, real estate acquisition is required for permanent road relocation and temporary railroad access during construction. Where possible, a construction easement width of 25 feet will be used. The sponsor identified city owned land that would be available for use as a temporary lay down area during construction. This land was previously credited for the construction of the Fort Smith Levee. Refer to Plate C-1 for the location of this area.

C-5.3. Relocations.

Utilities located in the vicinity of the project were identified, by using existing as-built drawings that were provided by the sponsor. Sanitary sewer, potable water, gas and telephone lines will have to be removed and relocated in order to construct the channel.

C-6. Structural Requirements.

C-6.1 General.

Work includes the 15% preliminary structural design for highway, city street, and railroad crossings of the proposed May Branch drainage channel for C-10, C-50, C-100, and C-200. Preliminary designs were also done for the concrete retaining walls and bottom in the restricted width section of the channel and the hydraulic control structure. For safety purposes, a 6' chain link fence will be installed along the top of the retaining wall. The work also includes the type and extent of repairs required to restore the "P" Street storm water sewer to a good condition.

C-6.2 Design Items.

C-6.2.1 Highway, Street, and Railroad Crossings.

Clayton Expressway (State Highway 225) – bridge
Kansas City Southern RR at Sta. 13+75 - box culvert
  (used by Arkansas and Missouri Railroad)
Kansas City Southern RR at Sta. 28+25 – box culvert
  (used by Arkansas and Missouri Railroad)
Union Pacific RR at Sta. 33+70 – box culvert
  (leased to Fort Smith Railroad which is a subsidiary of Pioneer Railroad)
Arkansas and Missouri RR at Sta. 34+75 – box culvert
Union Pacific RR at Sta. 36+50 – box culvert
  (leased to Fort Smith Railroad)
6th Street at Sta. 41+45 – bridge
Midland at Sta. 58+00 – box culvert
Greenwood at Sta. 76+75 – box culvert
Concrete Retaining Walls and Channel Bottom from Sta. 82+30 to Sta. 86+35
  (17-feet height)
Arkhola Service Entrance at Sta. 86+10 – bridge
"O" Street at Sta. 92+00 – box culvert
Grand at Sta. 119+05 – box culvert
Kinkead Avenue at Sta 132+30 – box culvert
Park Avenue at Sta 146+14 – box culvert

C-6.2.2 Hydraulic Control Structure.
This design includes one type of channel hydraulic control structure: a slide gate control structure with motor operators and concrete box culvert through the Arkansas River levee. Refer to plates C-10 and C-11.

C-6.2.3 Repair of "P" Street Storm Water Sewer.
An inspection of the entire length of the North "P" Street storm sewer was performed. It included digital still pictures with station numbering of typical conditions and damaged areas. The type and extent of repairs required to restore the sewer to good condition include replacing the flow line for the entire length of the pipe, replacing mortar, repairing exposed aggregate, patching spalled areas and sealing roof and wall cracks.

C-6.3 Waterway Opening at Structures.
Waterway openings were determined by hydraulic modeling for C-10, C-50, C-100, and C-200 as presented in the Hydrology and Hydraulics Report.

C-6.4 Design Parameters/Specifications.

Highway and Street Crossings. Design of highway and street crossings are in accordance with the latest edition of "Standard Specifications for Highway Bridges" of the American Association of State Highway and Transportation Officials (AASHTO) with HS20 traffic loading for highway bridges and H20 traffic loading for city streets and 0.05G seismic acceleration. Geometric design will be in accordance with the AASHTO Green Book "A Policy on Geometric Design of Highways and Streets". In lieu of design, Arkansas State Highway and Transportation Department (AHTD) standard designs were used.

Railroad Crossings. Design of railroad crossings were to be in accordance with the latest edition of the American Railway Engineering Association "Manual for Railway Engineering" for Cooper E80 live loading. In lieu of design, Union Pacific railroad standard Designs were used. The railroads, which were contacted, Arkansas-Missouri, Kansas City Southern, and Fort Smith Railroad (Union Pacific) all agreed that the design parameters for the railroads should conform to the standards for Union Pacific crossings.

Channel Hydraulic Control Structure. Design of the channel hydraulic control structure was done in accordance with Corps of Engineers policies and procedures including EM 1110-2-2705, Structural Design for Closure Structures for Local Flood Protection Projects, 31 March 1994 and EM 1110-2-2105, Design of Hydraulic Steel Structures, 31 May 1994.

Roadway Width of Crossings. Clayton Expressway - 44 feet plus 8 foot bicycle path, other bridges 36 feet plus 1'-7" sidewalks on both sides. Covered channel section street crossings 27 feet minimum width plus 7 feet each side to guard rail, wider street crossings according to city master street plan. Side slopes at covered channel section crossings 4 foot horizontal to 1 foot vertical.

C-6.5. Alternatives Considered.

Bridge or Culvert. A comparative analysis based on cost and recommendations of the owners was made in order to determine whether to use a bridge or culvert at typical road crossings. Bridges were selected at Clayton Expressway, 6th Street, and service access to Arkhola storage area. Covered channel sections constructed of concrete box culverts were selected at all other locations. Railroad crossings were designed to railroad standards, which are covered channel sections constructed of concrete box culverts.

Cast-in-Place or Pre-cast Concrete. A cost analysis made between cast-in-place and pre-cast concrete showed cast-in-place concrete construction to be more economical.

Substructure. Steel H-pile bents with concrete cap were compared with concrete bents with spread footings on the basis of cost and resistance to scour and steel H-pile bents with concrete cap were selected.

C-7. Electrical and Mechanical Requirements.

The feasibility study includes functional design requirements, technical design criteria and engineering services for relocation of all utilities above ground and underground within the project boundary that will interfere with the new channel system. It also includes a hydraulic control structure with motorized slide gates and all the utility connections required to operate the slide gates. Gates will be locally controlled from a motor control panel or remotely from a remote control station located in the city engineering office on Garrison Avenue.

Technical design criteria for relocating utilities and constructing motorized gate structures shall at a minimum comply with the requirements of the following criteria, latest edition.

1. NFPA 70: National Electric Codes
2. ANSI C2: National Electrical Safety Codes
3. IES Reference and Application: Lighting Handbook

C-8. Hazardous and Toxic Materials.

Subsurface explorations were performed in the project location to assist in determining the most feasible channel layout. No significant HTRW concerns were identified in the proposed channel location. Refer to plates G1, G14-G15 and the HTRW report for details on the subsurface exploration results.

C-9. Construction Procedures and Water Control Plan

The construction of the covered channel sections/box culverts will be sequenced in order to minimize the impact on the local traffic patterns. Some streets along the "P" street drainage channel may be required to be temporarily closed during construction or permanently closed. Sequencing the installation of the box culverts will allow vehicular traffic to be rerouted around the local and collector streets during construction. Also, barriers will be installed near the edge of the excavated channel at locations where the channel intersects an existing road. The major arterial and/or collector streets, including Clayton Expressway, Greenwood Avenue, Grand Avenue, and Midland Avenue will require the box culverts to be installed in sections and traffic detoured around construction or that traffic be rerouted to parallel streets during construction.

It is anticipated that the bridges, hydraulic control structure, and covered channel sections will be constructed by using the adjacent in-place soil as a natural cofferdam. Groundwater and rainwater will have to be considered during construction of these features. A combination of ditches, well points, sumps or pumps will need to be used for removal of water from the excavations for satisfactory completion of the work. Erosion control measures will also be put in place to minimize the erosion on the excavated slopes and all adjacent land that may have been stripped of vegetation.

C-10. Operation and Maintenance

The sponsor will need to be responsible for annually traversing the entire length of the channel and looking at the condition of the channel bottom and side slopes and concrete structures. The sponsor will also need to semi-annually examine the slide gate for damages. The gate stem and operating mechanism will be lubricated and the gate will be opened and closed several times to distribute the lubrication and confirm that the gates will operate as designed. Debris and plant growth that interfere with gate operation will be removed. The sponsor will need to ensure that the earthen side slopes are mowed four times per year; undesirable weeds and woody growth will be removed by herbicides or cutting. The concrete structures will also need to be inspected annually for damage and deterioration and repaired immediately to prevent further damage to the structure. The sponsor will need to be responsible for repair to any damaged sections of the riprap. Removal of plant growth within the riprap will also be the responsibility of the sponsor.

C-11. Access Roads

This project is located within the city of Fort Smith and in most cases it will be feasible to use the existing public city streets for transporting of miscellaneous construction equipment and hauling of excavated material, debris and miscellaneous construction materials. Additionally, a substantial portion of the project site will have sufficient construction easements along the top banks of the excavated channel. It is likely that these temporary access roads can remain functional after completion of the project, provided that periodic maintenance is performed.

C-12. Cost Estimates

The baseline cost estimate (C-100/C-10) for the selected plan, reaches 1 through 4, was developed using MCACES in the Civil Works Work Breakdown Structure format. The estimate reflected the recent steel and petroleum products price increases to the month of March 2004. Quantities were calculated and provided by the Designers in the District. The cost estimate for each feature was escalated to the mid point of construction using the most current indices for Civil Works Construction Cost Index System (CWCCIS) EM 1110-2-1304 dated September 30, 2003. Contingencies in the range of 10% to 20% depending on the risk and uncertainties were applied to the estimate. The cost estimate for 10-year plan was developed in the similar manner. An estimate for reaches 5 and 6 was costed. For specific cost information refer to the MCACES cost estimates.

C-13. Schedule for Design and Construction

The schedule for construction is attached at the end of the engineering appendix. The design schedule has not been developed, but will be completed prior to completion of the Feasibility Phase.

C-14. Plates, Figures, and Drawings

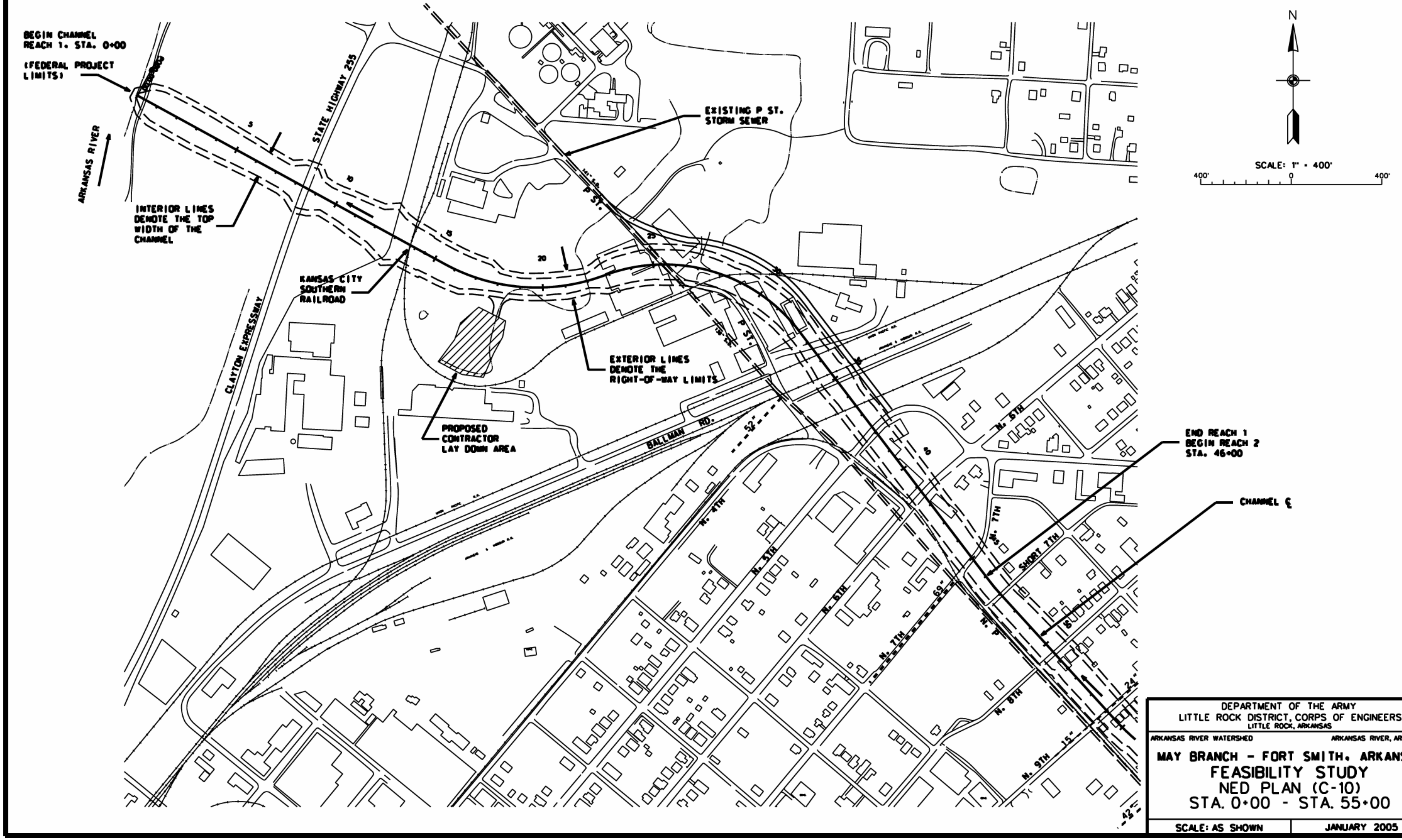
Plates included in the engineering appendix include the plan view of the selected channel, typical cross sections of the channel, typical culvert plan and details, hydraulic control structure details, plan of borings, boring logs, and other structural details.

C-15. Data Management.

During the feasibility study, data was compiled and maintained in project folders for each discipline involved.

C-16. Use of Metric System Measurements.

The city requested that the project be designed in English units and that Little Rock District obtain any required waivers. The city did the site surveys in English units and provided them to the district as part of their work in-kind cost share. Converting these survey drawings from English to Metric would have created an extra work effort for the design team resulting in a higher cost for the customer and lower customer satisfaction. The waiver request was approved by Headquarters, U.S. Army Corps of Engineers.



DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED

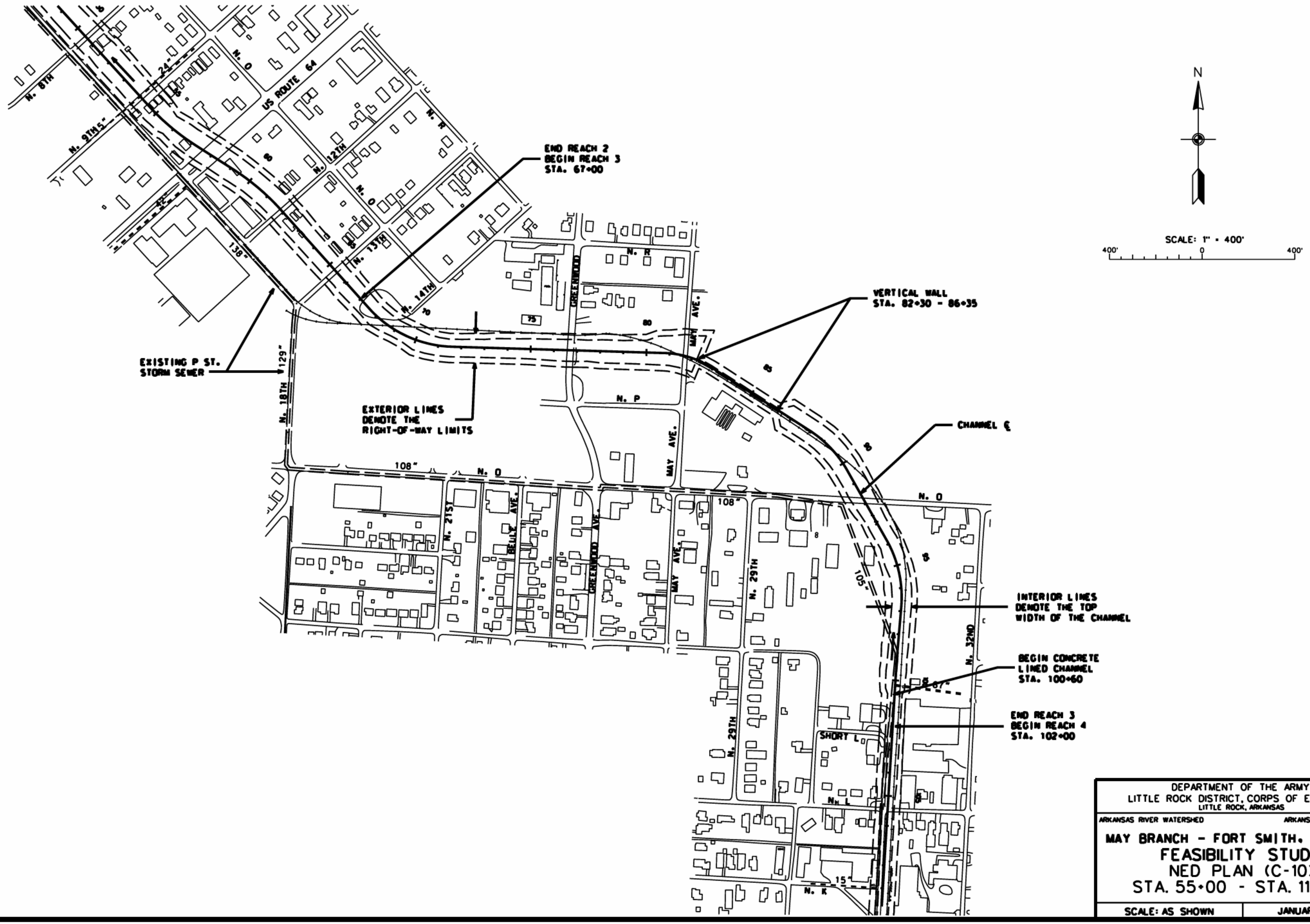
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
NED PLAN (C-10)
STA. 0+00 - STA. 55+00

SCALE: AS SHOWN

JANUARY 2005

PLATE C-1



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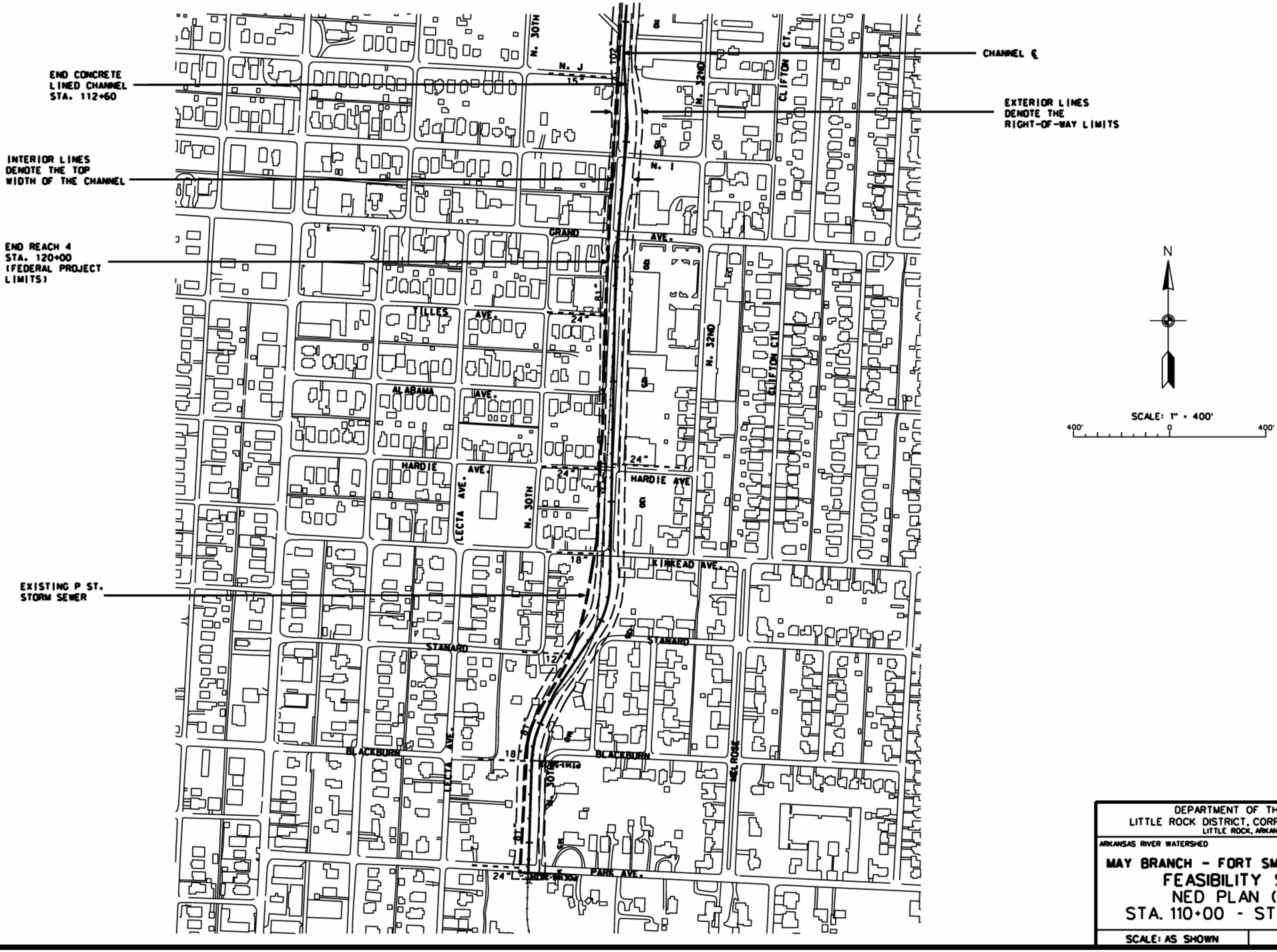
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED | ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
NED PLAN (C-10)
STA. 55+00 - STA. 110+00

SCALE: AS SHOWN | JANUARY 2005

PLATE C-2



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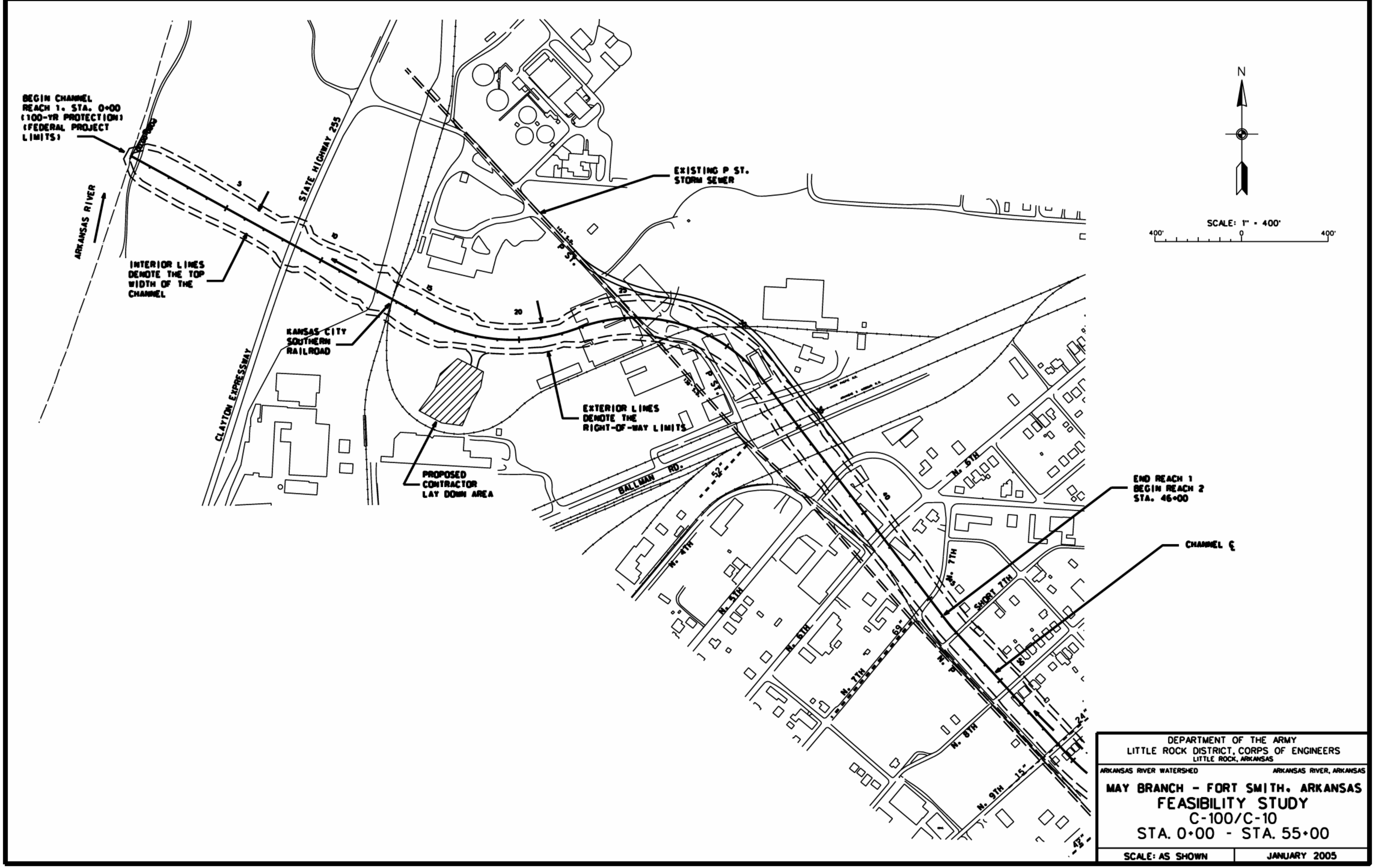
MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
NED PLAN (C-10)
STA. 110+00 - STA. 120+00

SCALE: AS SHOWN | JANUARY 2005

PLATE C-3



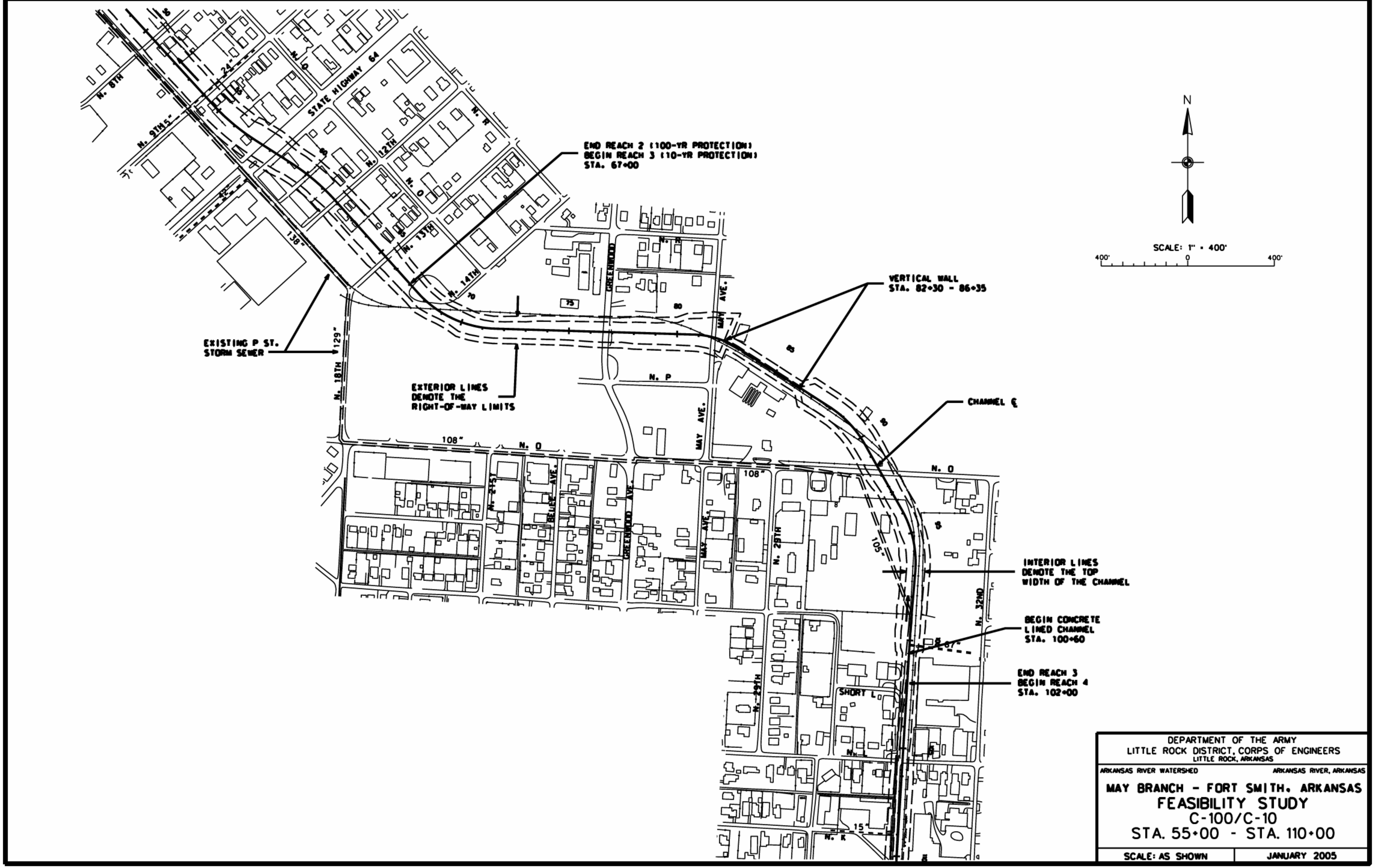
DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
C-100/C-10
STA. 0+00 - STA. 55+00

SCALE: AS SHOWN
JANUARY 2005

PLATE C-4



DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED | ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
C-100/C-10
STA. 55+00 - STA. 110+00

SCALE: AS SHOWN | JANUARY 2005

PLATE C-5

END CONCRETE
LINED CHANNEL
STA. 112+60

CHANNEL ℄

EXTERIOR LINES
DENOTE THE
RIGHT-OF-WAY LIMITS

INTERIOR LINES
DENOTE THE TOP
WIDTH OF THE CHANNEL

END REACH 4
STA. 120+00
(FEDERAL PROJECT
LIMITS)

BEGIN REACH 5

END REACH 5
BEGIN REACH 6
STA. 133+00

EXISTING P ST.
STORM SEWER

END CHANNEL
(10-YR PROTECTION)
REACH 6, STA. 146+28

N

SCALE: 1" = 400'
400' 0 400'

NOTE:

CONSTRUCTION OF REACHES 5 AND 6 WAS REQUESTED BY THE CITY OF FT. SMITH AND IS CONSIDERED A BETTERMENT. THE CITY OF FT. SMITH WILL BE RESPONSIBLE FOR ALL CONSTRUCTION COSTS ASSOCIATED WITH REACHES 5 AND 6.

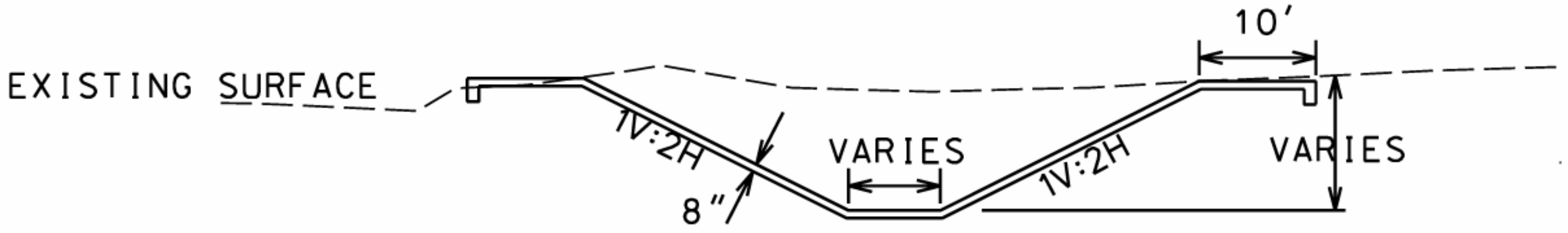
DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

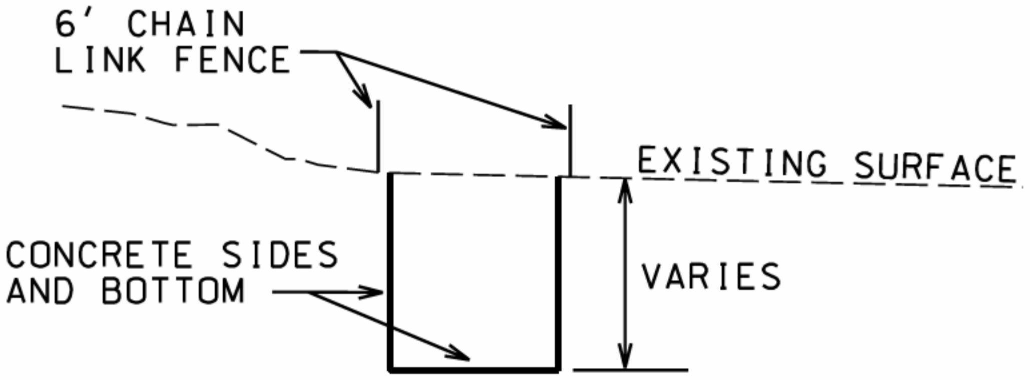
MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
C-100/C-10
STA. 110+00 - STA. 146+28

SCALE: AS SHOWN
JANUARY 2005

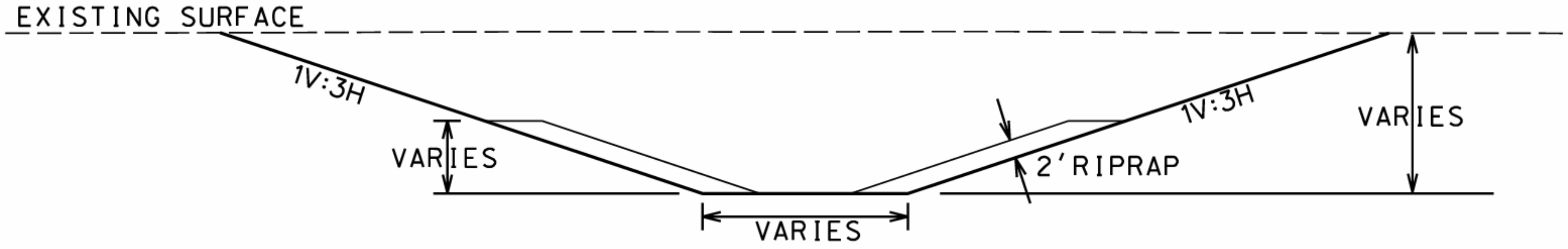
PLATE C-6



A TYPICAL SECTION N.T.S.
CONCRETE LINED CHANNEL
STA. 100+60 - STA. 112+60



B TYPICAL SECTION N.T.S.
VERTICAL CONCRETE WALL
STA. 82+30 - STA. 86+35



C TYPICAL SECTION N.T.S.
RIPRAP CHANNEL

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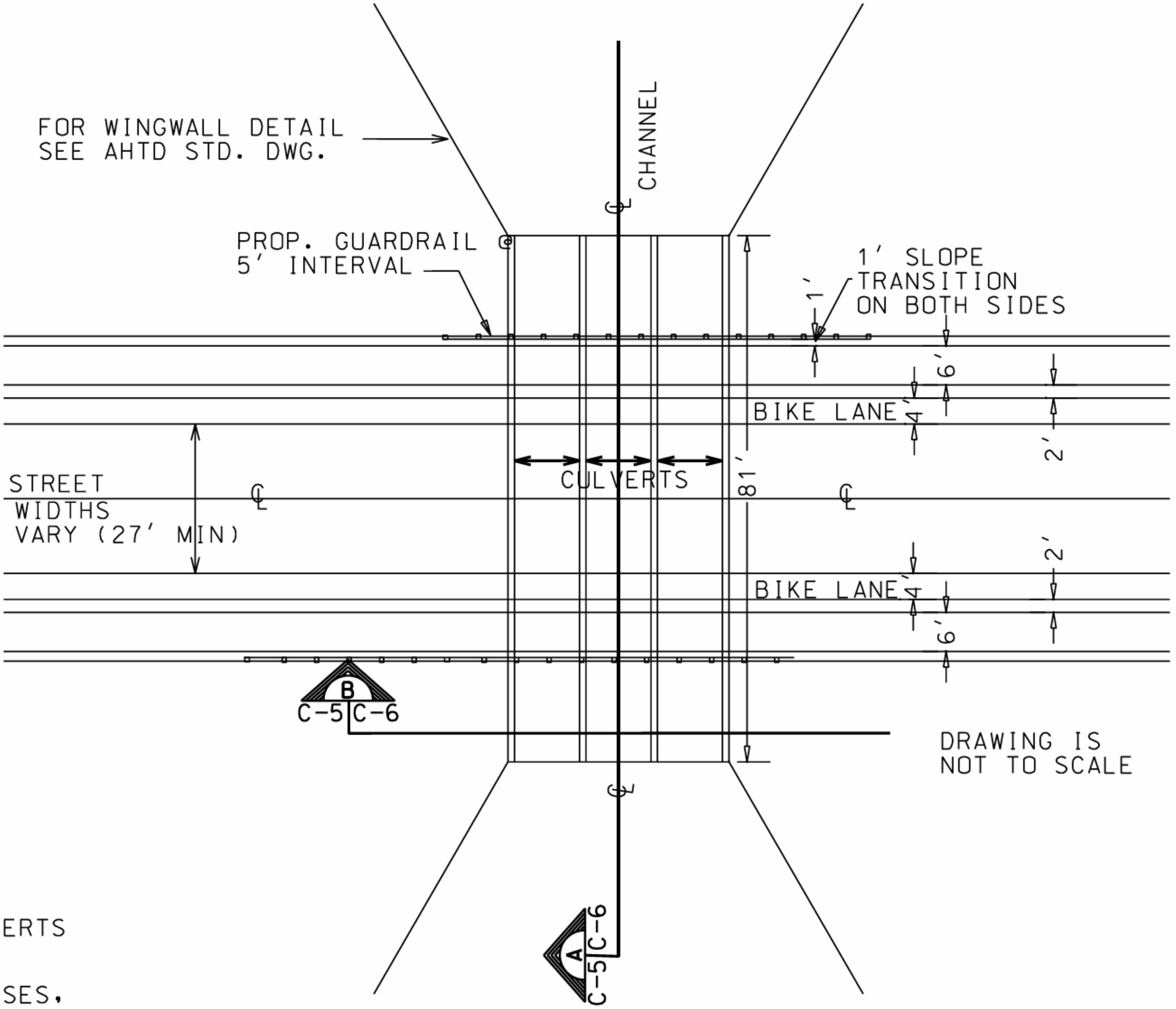
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
TYPICAL CHANNEL
SECTIONS

SCALE: AS SHOWN JANUARY 2005



DRAWING IS
NOT TO SCALE

NOTES:

1. THE NUMBER, SIZE AND LENGTH OF THE CULVERTS VARY AT DIFFERENT LOCATIONS.

2. CULVERT SLAB THICKNESSES, WALL THICKNESSES, INVERT ELEVATIONS AND DEPTH OF COVER VARY AT DIFFERENT LOCATIONS

3. CULVERT AND HEADWALL DESIGNS ARE IN ACCORDANCE WITH THE ARKANSAS HIGHWAY AND TRANSPORTATION DEPARTMENT STANDARD DRAWINGS:

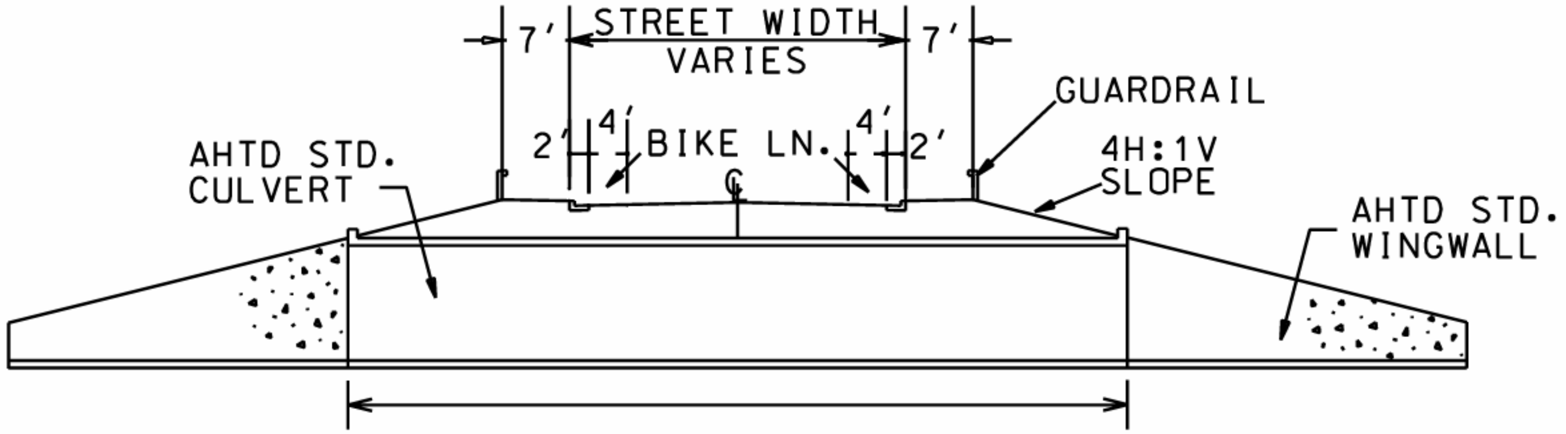
DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

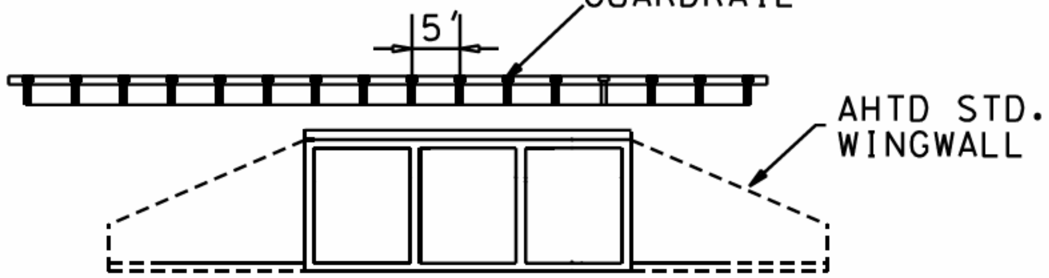
MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
TYPICAL CULVERT
PLAN

SCALE: AS SHOWN
JANUARY 2005

PLATE C-8



A
C-5|C-6
TYPICAL SECTION
CULVERTS
N.T.S.



B
C-5|C-6
TYPICAL SECTION
CULVERTS
N.T.S.

NOTE:

1. AHTD INDICATES ARKANSAS HIGHWAY AND TRANSPORTATION DEPARTMENT.

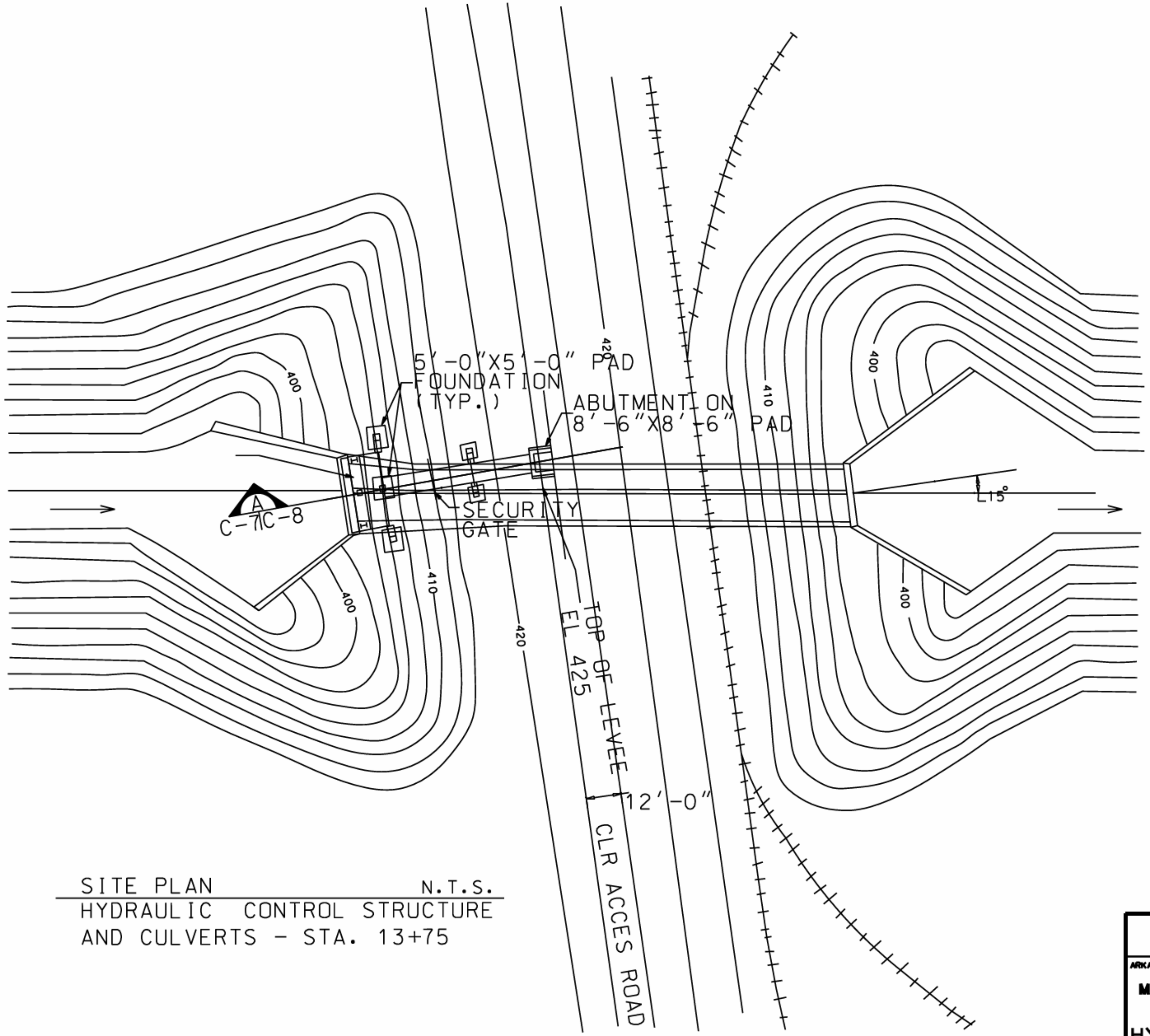
DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
TYPICAL CULVERT
SECTIONS

SCALE: AS SHOWN
JANUARY 2005

PLATE C-9



SITE PLAN N.T.S.

HYDRAULIC CONTROL STRUCTURE
AND CULVERTS - STA. 13+75

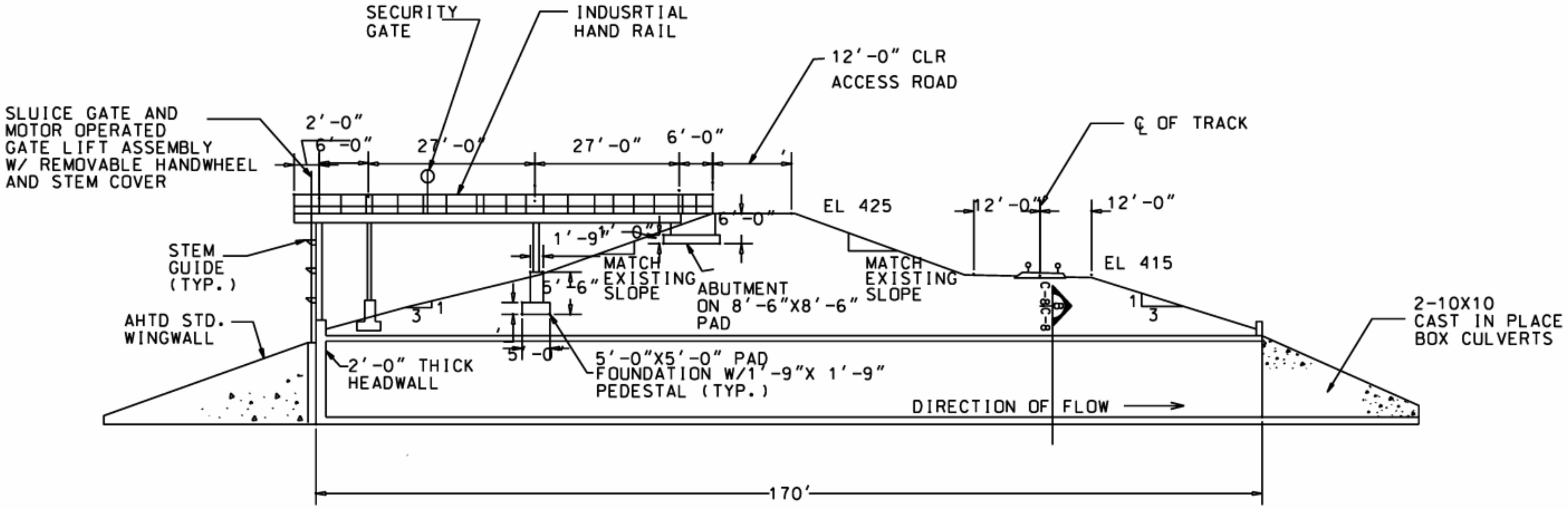
DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED | ARKANSAS RIVER, ARKANSAS

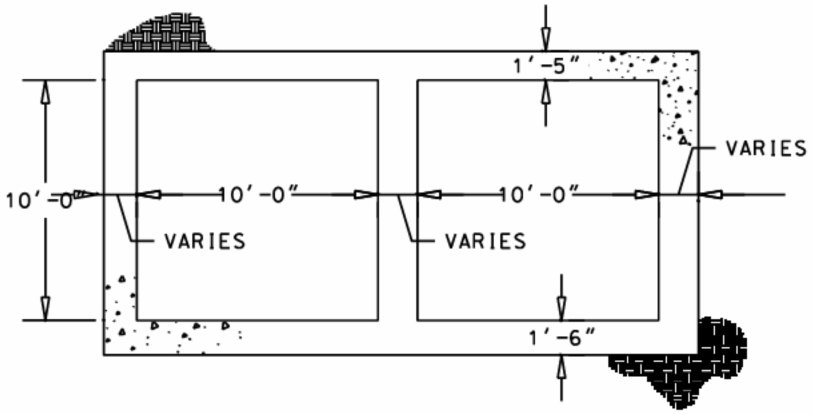
MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
HYDRAULIC CONTROL STRUCTURE

SCALE: AS SHOWN | JANUARY 2005

PLATE C-10



A SECTION NTS
C-7|C-8 HYDRAULIC CONTROL STRUCTURE



B SECTION NTS
C-8|C-8 CULVERTS THROUGH LEVEE

NOTE:

1. AHTD INDICATES ARKANSAS HIGHWAY AND TRANSPORTATION DEPARTMENT.

DEPARTMENT OF THE ARMY
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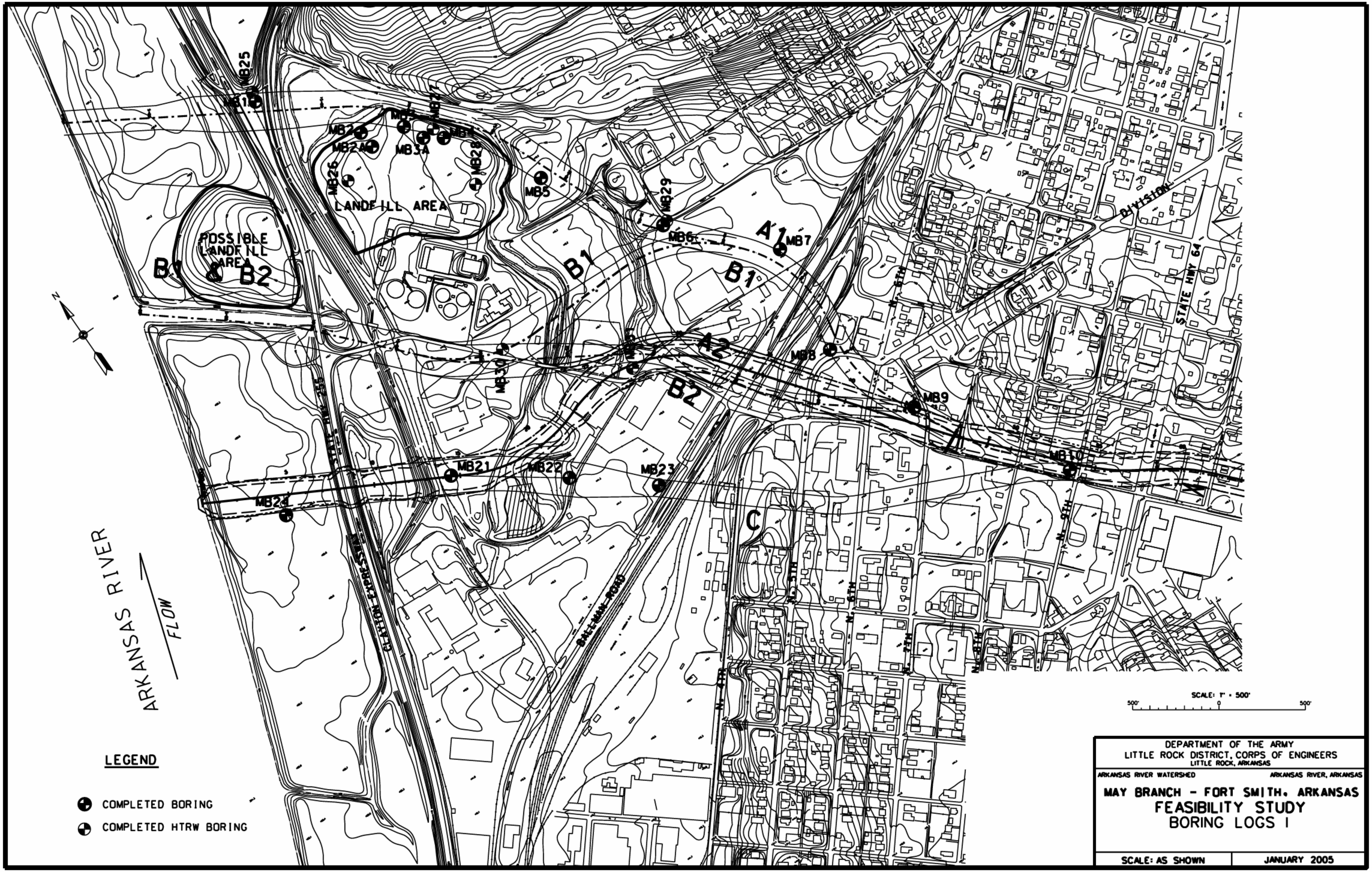
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
HYDRAULIC CONTROL STRUCTURE DETAILS

SCALE: AS SHOWN
JANUARY 2005

PLATE C-11



LEGEND

- ● COMPLETED BORING
- ● COMPLETED HTRW BORING

SCALE: 1" = 500'
500' 0 500'

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LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS I

SCALE: AS SHOWN
JANUARY 2005

PLATE G-1

SCALE: 1" = 500'

500' 0 500'

LEGEND

- ● COMPLETED BORING
- ⊕ PROPOSED BORING

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS II

SCALE: AS SHOWN
JANUARY 2005

PLATE G-2

FEDERAL LIMITS OF
PROJECT. STA. 120+00

LEGEND

● COMPLETED BORING

⊗ PROPOSED BORING

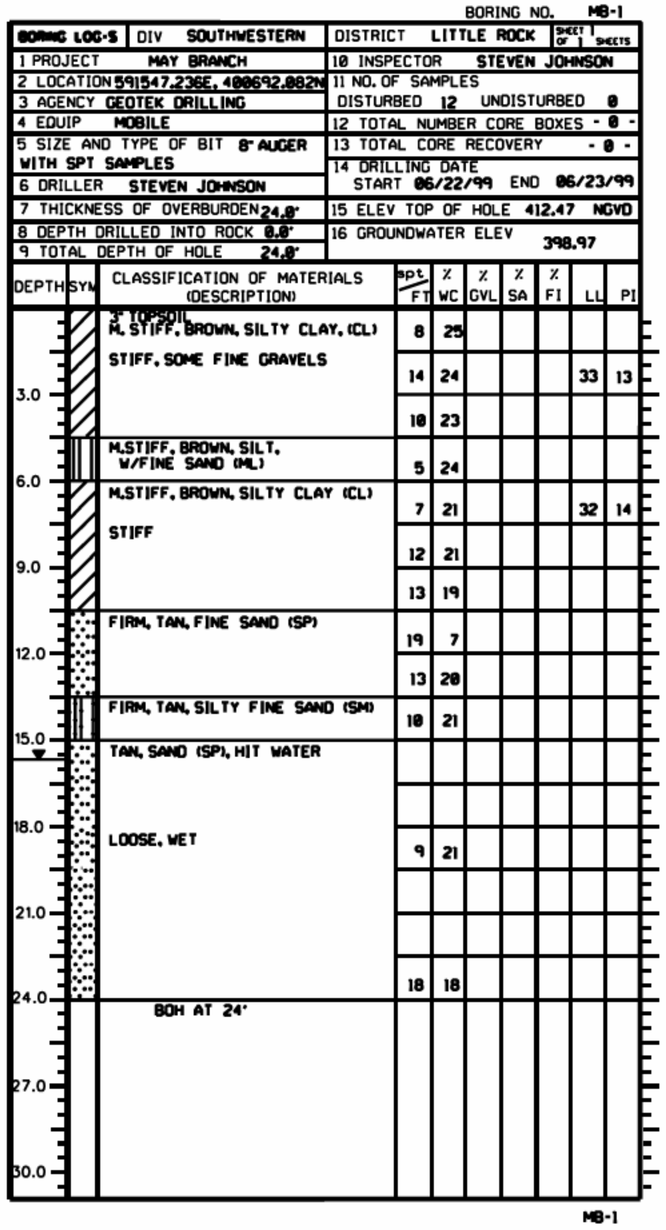
DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS III

SCALE: AS SHOWN	JANUARY 2005

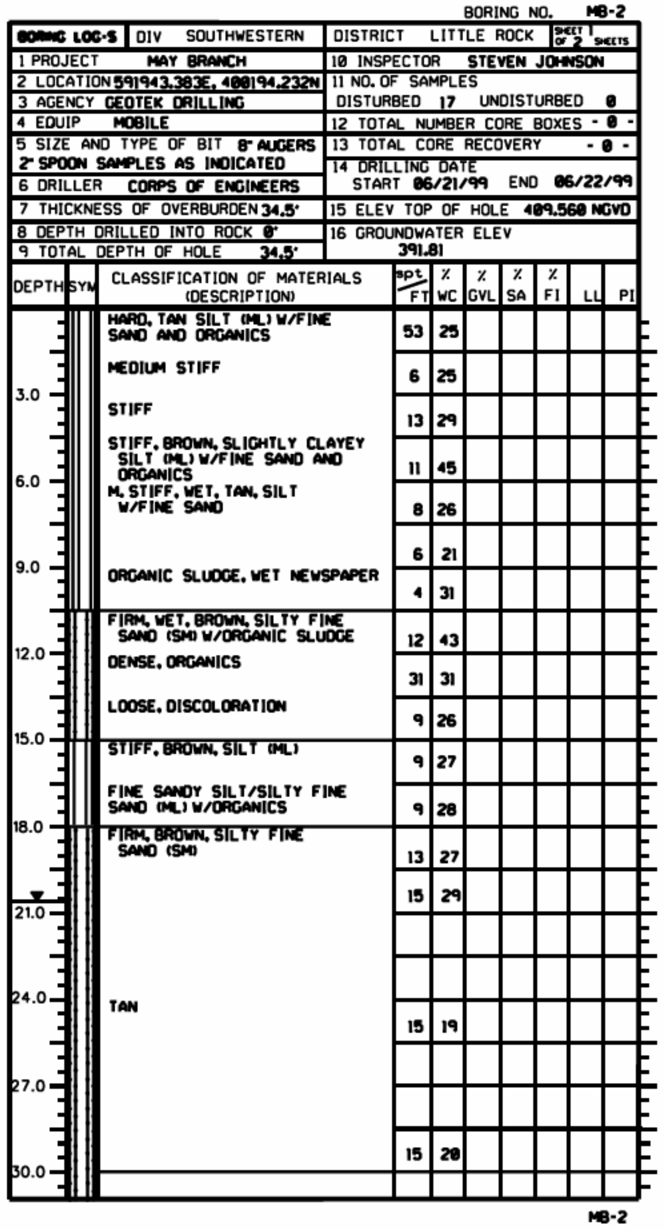
PLATE G-3



BORING NO. MB-1

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 1 SHEETS
1 PROJECT MAY BRANCH
2 LOCATION 591547.236E, 400692.082N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGER WITH SPT SAMPLES
6 DRILLER STEVEN JOHNSON
7 THICKNESS OF OVERBURDEN 24.0'
8 DEPTH DRILLED INTO ROCK 0.0'
9 TOTAL DEPTH OF HOLE 24.0'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 12 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/22/99 END 06/23/99
15 ELEV TOP OF HOLE 412.47 NGVD
16 GROUNDWATER ELEV 398.97

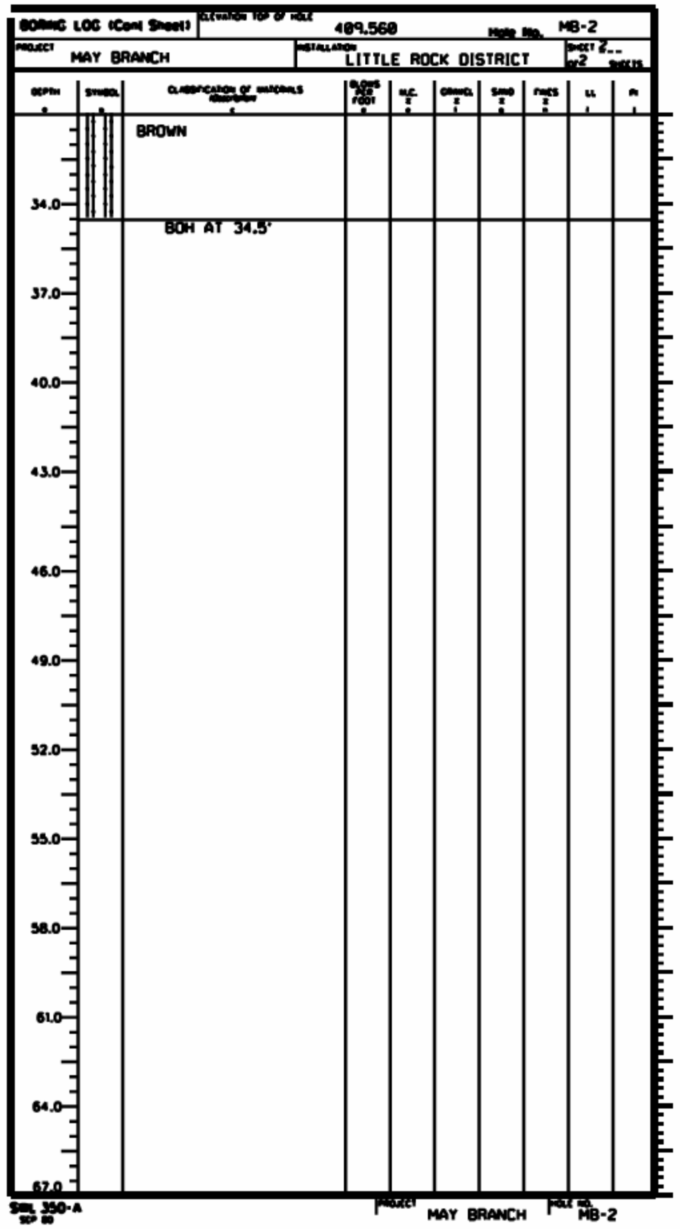
CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
3" TOPSOIL M. STIFF, BROWN, SILTY CLAY, (CL)	8	25					
STIFF, SOME FINE GRAVELS	14	24				33	13
	10	23					
M.STIFF, BROWN, SILT, W/FINE SAND (ML)	5	24					
M.STIFF, BROWN, SILTY CLAY (CL)	7	21				32	14
STIFF	12	21					
	13	19					
FIRM, TAN, FINE SAND (SP)	19	7					
	13	20					
FIRM, TAN, SILTY FINE SAND (SM)	10	21					
TAN, SAND (SP), HIT WATER							
LOOSE, WET	9	21					
	18	18					
BOH AT 24'							



BORING NO. MB-2

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 2 SHEETS
1 PROJECT MAY BRANCH
2 LOCATION 591943.383E, 400194.232N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 34.5'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 34.5'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 17 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/21/99 END 06/22/99
15 ELEV TOP OF HOLE 409.560 NGVD
16 GROUNDWATER ELEV 391.81

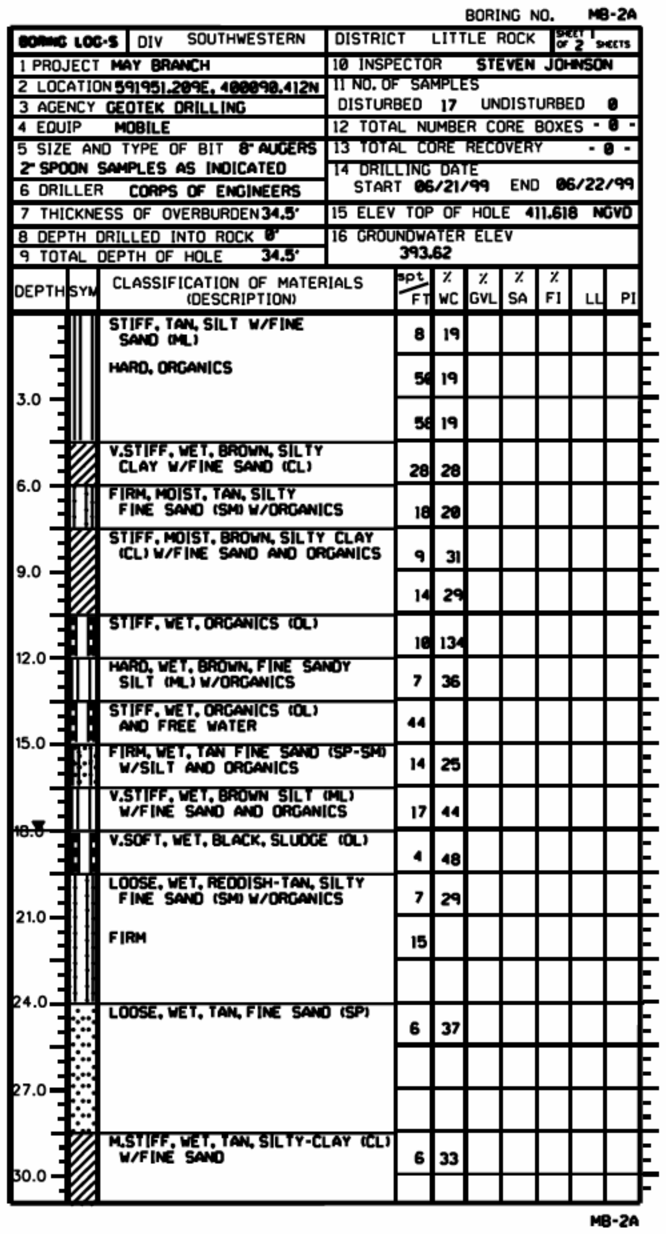
CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
HARD, TAN SILT (ML) W/FINE SAND AND ORGANICS	53	25					
MEDIUM STIFF	6	25					
STIFF	13	29					
STIFF, BROWN, SLIGHTLY CLAYEY SILT (ML) W/FINE SAND AND ORGANICS	11	45					
M. STIFF, WET, TAN, SILT W/FINE SAND	8	26					
	6	21					
ORGANIC SLUDGE, WET NEWSPAPER	4	31					
FIRM, WET, BROWN, SILTY FINE SAND (SM) W/ORGANIC SLUDGE	12	43					
DENSE, ORGANICS	31	31					
LOOSE, DISCOLORATION	9	26					
STIFF, BROWN, SILT (ML)	9	27					
FINE SANDY SILT/SILTY FINE SAND (ML) W/ORGANICS	9	28					
FIRM, BROWN, SILTY FINE SAND (SM)	13	27					
	15	29					
TAN	15	19					
	15	20					



BORING LOG (Cont Sheet) | ELEVATION TOP OF HOLE 409.560 | Hole No. MB-2
PROJECT MAY BRANCH | INSTALLATION LITTLE ROCK DISTRICT | SHEET 2 OF 2 SHEETS

DEPTH	SYMBOL	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FOOT	W.C. %	GRAVEL %	SAND %	FINES %	LL	PI
		BROWN							
		BOH AT 34.5'							

SWL 350-A
SEP 88
PROJECT MAY BRANCH
HOLE NO. MB-2



BORING NO. MB-2A

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 2 SHEETS
1 PROJECT MAY BRANCH
2 LOCATION 591951.209E, 400090.412N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 34.5'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 34.5'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 17 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/21/99 END 06/22/99
15 ELEV TOP OF HOLE 411.618 NGVD
16 GROUNDWATER ELEV 393.62

CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
STIFF, TAN, SILT W/FINE SAND (ML)	8	19					
HARD, ORGANICS	50	19					
	58	19					
V.STIFF, WET, BROWN, SILTY CLAY W/FINE SAND (CL)	28	28					
FIRM, MOIST, TAN, SILTY FINE SAND (SM) W/ORGANICS	18	20					
STIFF, MOIST, BROWN, SILTY CLAY (CL) W/FINE SAND AND ORGANICS	9	31					
	14	29					
STIFF, WET, ORGANICS (OL)	10	134					
HARD, WET, BROWN, FINE SANDY SILT (ML) W/ORGANICS	7	36					
STIFF, WET, ORGANICS (OL) AND FREE WATER	44						
FIRM, WET, TAN FINE SAND (SP-SM) W/SILT AND ORGANICS	14	25					
V.STIFF, WET, BROWN SILT (ML) W/FINE SAND AND ORGANICS	17	44					
V.SOFT, WET, BLACK, SLUDGE (OL)	4	48					
LOOSE, WET, REDDISH-TAN, SILTY FINE SAND (SM) W/ORGANICS	7	29					
FIRM	15						
LOOSE, WET, TAN, FINE SAND (SP)	6	37					
M.STIFF, WET, TAN, SILTY-CLAY (CL) W/FINE SAND	6	33					

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS MB1-MB2A

SCALE: AS SHOWN
JANUARY 2005

PLATE G-4

BORING LOG (Cont Sheet)
ELEVATION TOP OF HOLE 411.618
Hole No. MB-2A
PROJECT MAY BRANCH
INSTALLATION LITTLE ROCK DISTRICT
SHEET 2 of 2 SHEETS

DEPTH	SYMBOL	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FOOT	M.C. %	GRAVEL %	SAND %	FINES %	LL	PI
34.0		M.STIFF, BROWN, SLIGHTLY CLAYEY SILT (ML) W/FINE SAND	8	28	21				
		BOH AT 34.5'							
37.0									
40.0									
43.0									
46.0									
49.0									
52.0									
55.0									
58.0									
61.0									
64.0									
67.0									

SWL 350-A
SEP 00
PROJECT MAY BRANCH
HOLE NO. MB-2A

BORING NO. MB-3

BORING LOG-S DIV SOUTHWESTERN
DISTRICT LITTLE ROCK
SHEET 1 OF 1 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 592167.703E, 400079.876N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS
2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 39'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 39'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES
DISTURBED 18 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE
START 06/17/99 END 06/18/99
15 ELEV TOP OF HOLE 416.807 NGVD
16 GROUNDWATER ELEV
397.81

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		5" TOPSOIL STIFF, TAN/BROWN, SILT (ML) W/FINE SAND	13	17				26	5
		STIFF, BROWN, SILTY CLAY (CL) W/FINE SAND	10	19					
3.0		DARK BROWN	10	21					
		M.STIFF, BROWN, SILT (ML) W/FINE SAND	7	23				26	5
6.0		M.STIFF, DARK BROWN, SILTY CLAY (CL) W/FINE SAND	8	24					
			7	22				28	7
9.0		M.STIFF, TAN, SILT (ML) W/FINE SAND	7	24					
		STIFF	12	24					
12.0		FIRM, TAN, SILTY FINE SAND (SM)	11	20					
		M.STIFF, BROWN, SILT (ML) W/FINE SAND	7	20					
15.0		LOOSE, TAN, SILTY FINE SAND (SM)	6	30					
		M.STIFF, TAN, FINE SANDY SILT/ SILTY FINE SAND (ML)	6	30					
18.0 ▼		V.LOOSE, TAN, SILTY FINE SAND (SM)	4	32					
		M.STIFF, TAN, FINE SANDY SILT (ML)	7	32					
21.0									
24.0		LOOSE, TAN, SILTY FINE SAND (SM)	6	30					
27.0									
			4	32					
30.0									

MB-3

BORING LOG (Cont Sheet)
ELEVATION TOP OF HOLE 416.807
Hole No. MB-3
PROJECT MAY BRANCH
INSTALLATION LITTLE ROCK DISTRICT
SHEET 2 of 2 SHEETS

DEPTH	SYMBOL	CLASSIFICATION OF MATERIALS (DESCRIPTION)	BLOWS PER FOOT	M.C. %	GRAVEL %	SAND %	FINES %	LL	PI
34.0		SOFT, GRAYISH BROWN, FINE SANDY SILT (ML)	3	27					
37.0									
			2	33					
		BOH AT 39'							
40.0									
43.0									
46.0									
49.0									
52.0									
55.0									
58.0									
61.0									
64.0									
67.0									

SWL 350-A
SEP 00
PROJECT MAY BRANCH
HOLE NO. MB-3

BORING NO. MB-3A

BORING LOG-S DIV SOUTHWESTERN
DISTRICT LITTLE ROCK
SHEET 1 OF 2 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 592223.461E, 399961.923N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS
2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 34.5'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 34.5'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES
DISTURBED 17 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE
START 06/17/99 END 06/18/99
15 ELEV TOP OF HOLE 417.990 NGVD
16 GROUNDWATER ELEV
400.49

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		2" TOPSOIL STIFF, BROWN, SILTY CLAY (CL) W/FINE SAND	13	19					
		V.STIFF, TAN, SILTY FINE SAND (ML) AND OCCASIONAL SILTY CLAY LAYERS	16	18					
3.0		STIFF, TAN, FINE SANDY SILT (ML-CL) W/BROWN SILTY CLAY PARTING AND ORGANICS	10	20					
		V.LOOSE, TAN, FINE SAND (SP) W/ORGANICS	4	21					
6.0		V.LOOSE, TAN, SILTY FINE SAND (SM) W/DARK BROWN CLAYEY SILT AND ORGANICS	4	22					
		M.STIFF, TAN, SILT W/FINE SAND (ML) AND ORGANICS	5	24					
9.0		STIFF	8	20					
		MOIST	10	22					
12.0		STIFF, TAN, SILTY FINE SAND, (SM)	13	24					
		STIFF, WET, TAN, FINE SANDY SILT (ML) W/FINE SAND	9	27					
15.0		M. STIFF	6	31					
▼		SOFT, SILT W/FINE SAND	3	32					
18.0		M. STIFF	8	28					
		STIFF	12	29					
21.0									
24.0		LOOSE, TAN, SILTY FINE SAND (SM)	6	31					
27.0									
		BROWN	5	27					
30.0									

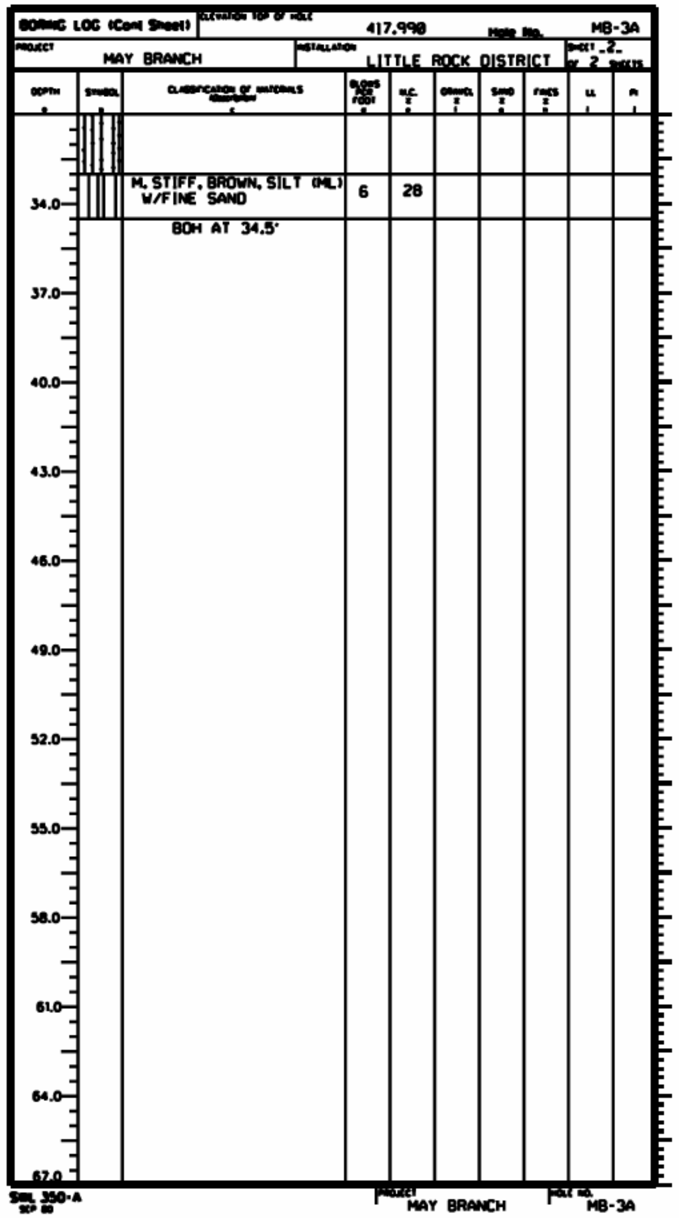
MB-3A

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS MB2A-MB3A

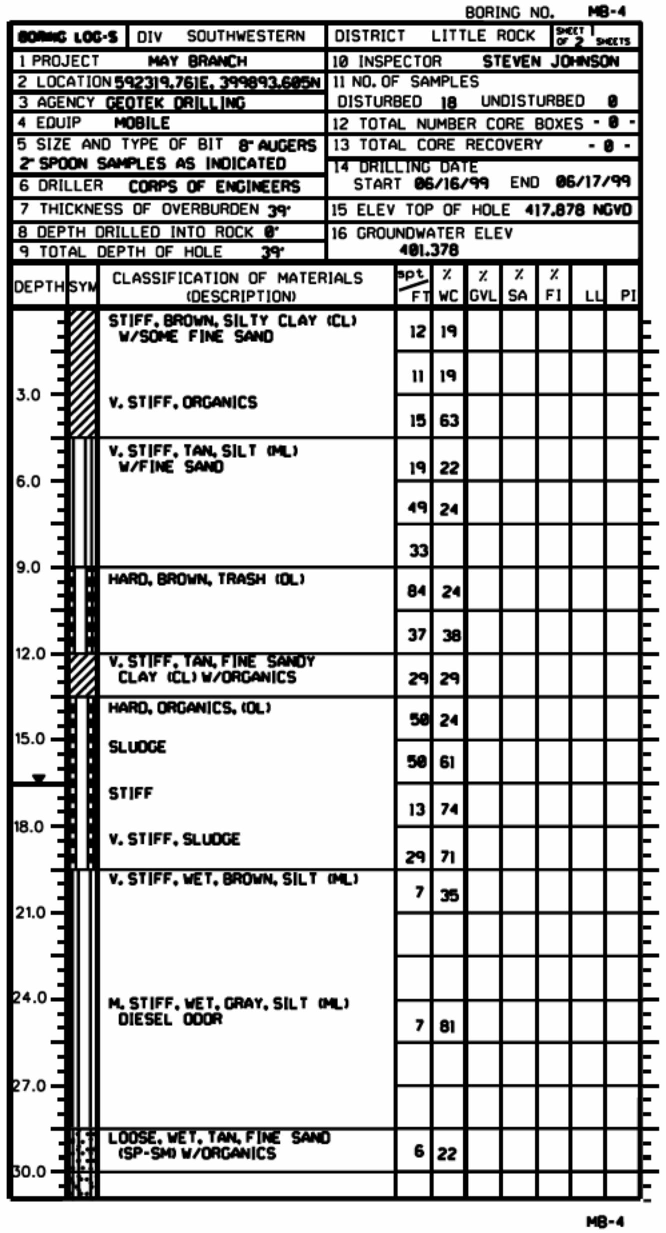
SCALE: AS SHOWN
JANUARY 2005



BORING LOG (Cont Sheet)
ELEVATION TOP OF HOLE 417.990
Hole No. MB-3A
PROJECT MAY BRANCH
INSTALLATION LITTLE ROCK DISTRICT
SHEET 2 OF 2 SHEETS

DEPTH	SYMBOL	CLASSIFICATION OF MATERIALS (Description)	BLOWS PER FOOT	W.C. %	GRAVEL %	SAND %	FINES %	LL	PI
34.0		M. STIFF, BROWN, SILT (ML) W/FINE SAND	6	28					
		BOH AT 34.5'							

SWL 350-A
SEP 80
PROJECT MAY BRANCH
HOLE NO. MB-3A



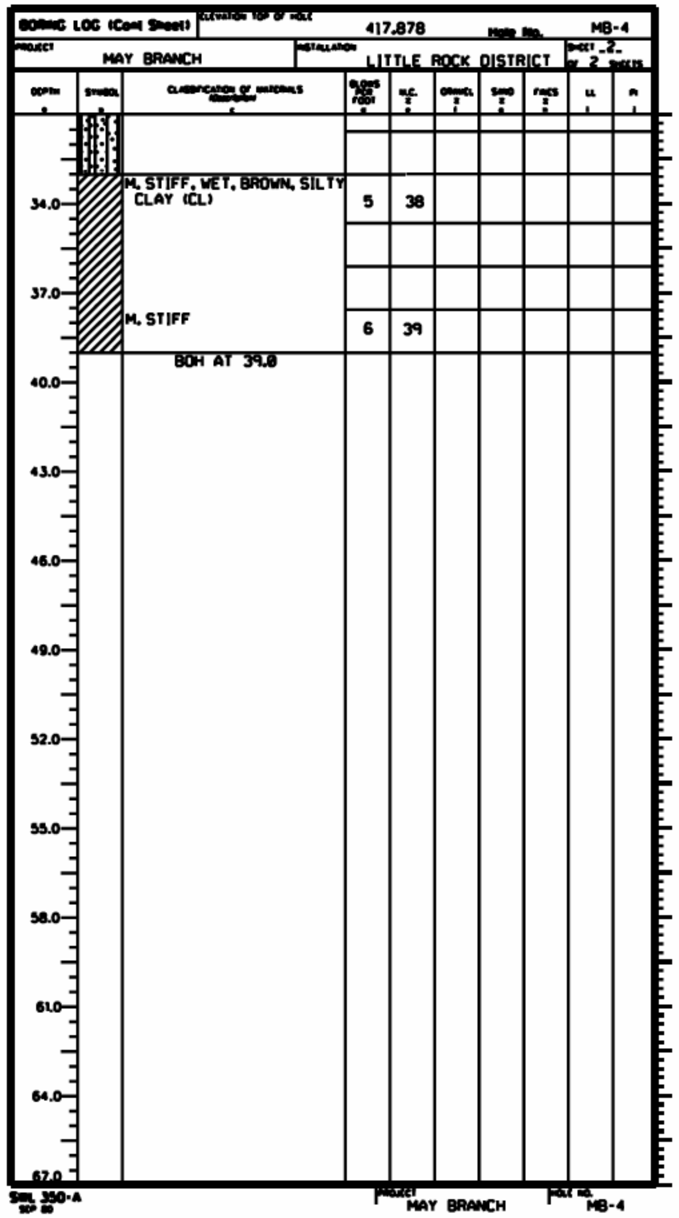
BORING NO. MB-4

BORING LOG-S DIV SOUTHWESTERN DISTRICT LITTLE ROCK SHEET 1 OF 2 SHEETS

1 PROJECT MAY BRANCH	10 INSPECTOR STEVEN JOHNSON
2 LOCATION 592319.761E, 399893.605N	11 NO. OF SAMPLES
3 AGENCY GEOTEK DRILLING	DISTURBED 18 UNDISTURBED 0
4 EQUIP MOBILE	12 TOTAL NUMBER CORE BOXES - 0 -
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED	13 TOTAL CORE RECOVERY - 0 -
6 DRILLER CORPS OF ENGINEERS	14 DRILLING DATE START 06/16/99 END 06/17/99
7 THICKNESS OF OVERBURDEN 39'	15 ELEV TOP OF HOLE 417.878 NGVD
8 DEPTH DRILLED INTO ROCK 0'	16 GROUNDWATER ELEV
9 TOTAL DEPTH OF HOLE 39'	401.378

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		STIFF, BROWN, SILTY CLAY (CL) W/SOME FINE SAND	12	19					
			11	19					
3.0		V. STIFF, ORGANICS	15	63					
		V. STIFF, TAN, SILT (ML) W/FINE SAND	19	22					
6.0			49	24					
			33						
9.0		HARD, BROWN, TRASH (OL)	84	24					
			37	38					
12.0		V. STIFF, TAN, FINE SANDY CLAY (CL) W/ORGANICS	29	29					
		HARD, ORGANICS, (OL)	50	24					
15.0		SLUDGE	50	61					
		STIFF	13	74					
18.0		V. STIFF, SLUDGE	29	71					
		V. STIFF, WET, BROWN, SILT (ML)	7	35					
21.0									
24.0		M. STIFF, WET, GRAY, SILT (ML) DIESEL ODOR	7	81					
27.0									
		LOOSE, WET, TAN, FINE SAND (SP-SM) W/ORGANICS	6	22					
30.0									

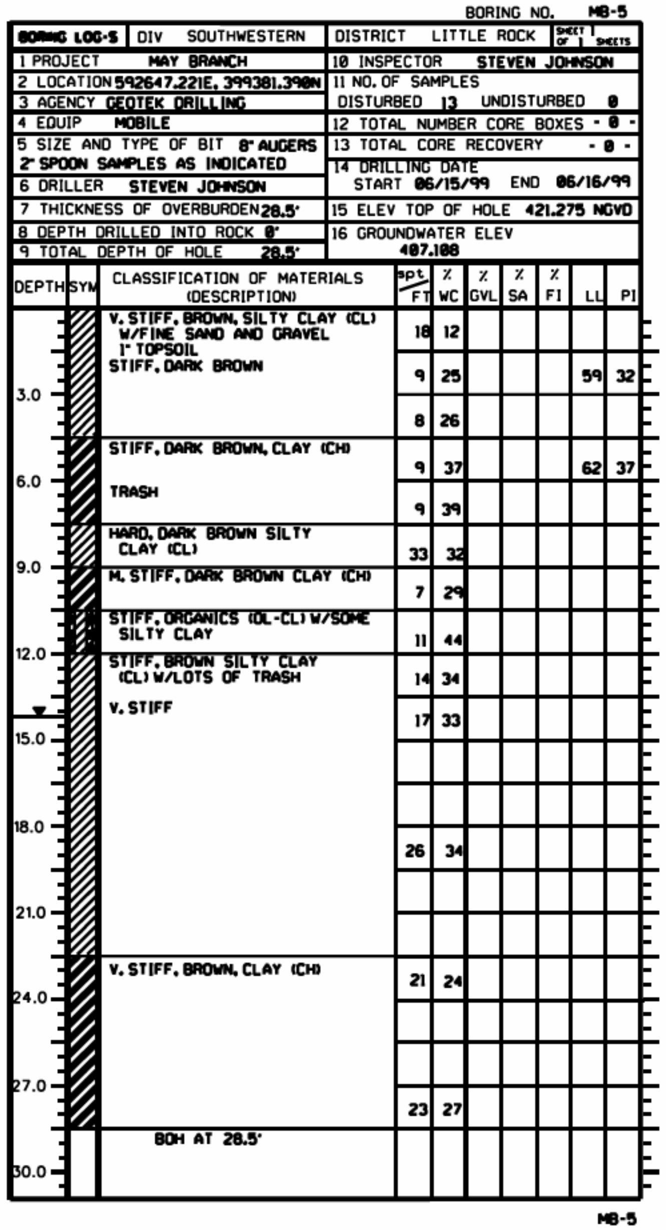
MB-4



BORING LOG (Cont Sheet)
ELEVATION TOP OF HOLE 417.878
Hole No. MB-4
PROJECT MAY BRANCH
INSTALLATION LITTLE ROCK DISTRICT
SHEET 2 OF 2 SHEETS

DEPTH	SYMBOL	CLASSIFICATION OF MATERIALS (Description)	BLOWS PER FOOT	W.C. %	GRAVEL %	SAND %	FINES %	LL	PI
34.0		M. STIFF, WET, BROWN, SILTY CLAY (CL)	5	38					
37.0									
		M. STIFF	6	39					
		BOH AT 39.0							

SWL 350-A
SEP 80
PROJECT MAY BRANCH
HOLE NO. MB-4



BORING NO. MB-5

BORING LOG-S DIV SOUTHWESTERN DISTRICT LITTLE ROCK SHEET 1 OF 1 SHEETS

1 PROJECT MAY BRANCH	10 INSPECTOR STEVEN JOHNSON
2 LOCATION 592647.221E, 399381.390N	11 NO. OF SAMPLES
3 AGENCY GEOTEK DRILLING	DISTURBED 13 UNDISTURBED 0
4 EQUIP MOBILE	12 TOTAL NUMBER CORE BOXES - 0 -
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED	13 TOTAL CORE RECOVERY - 0 -
6 DRILLER STEVEN JOHNSON	14 DRILLING DATE START 06/15/99 END 06/16/99
7 THICKNESS OF OVERBURDEN 28.5'	15 ELEV TOP OF HOLE 421.275 NGVD
8 DEPTH DRILLED INTO ROCK 0'	16 GROUNDWATER ELEV
9 TOTAL DEPTH OF HOLE 28.5'	407.108

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		V. STIFF, BROWN, SILTY CLAY (CL) W/FINE SAND AND GRAVEL 1" TOPSOIL	18	12					
		STIFF, DARK BROWN	9	25				59	32
3.0			8	26					
		STIFF, DARK BROWN, CLAY (CH)	9	37				62	37
6.0		TRASH	9	39					
		HARD, DARK BROWN SILTY CLAY (CL)	33	32					
9.0		M. STIFF, DARK BROWN CLAY (CH)	7	29					
		STIFF, ORGANICS (OL-CL) W/SOME SILTY CLAY	11	44					
12.0		STIFF, BROWN SILTY CLAY (CL) W/LOTS OF TRASH	14	34					
		V. STIFF	17	33					
15.0									
18.0			26	34					
21.0									
		V. STIFF, BROWN, CLAY (CH)	21	24					
24.0									
27.0			23	27					
30.0		BOH AT 28.5'							

MB-5

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS MB3A-MB5

SCALE: AS SHOWN
JANUARY 2005

BORING NO. MB-6

BORING LOG'S DIV SOUTHWESTERN	DISTRICT LITTLE ROCK SHEET 1 OF 1 SHEETS
1 PROJECT MAY BRANCH	10 INSPECTOR STEVEN JOHNSON
2 LOCATION 593070.006E, 398751.318N	11 NO. OF SAMPLES
3 AGENCY GEOTEK DRILLING	DISTURBED 13 UNDISTURBED 0
4 EQUIP MOBILE	12 TOTAL NUMBER CORE BOXES - 0 -
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED	13 TOTAL CORE RECOVERY - 0 -
6 DRILLER CORPS OF ENGINEERS	14 DRILLING DATE START 06/14/99 END 06/15/99
7 THICKNESS OF OVERBURDEN 28.5'	15 ELEV TOP OF HOLE 413.778 NGVD
8 DEPTH DRILLED INTO ROCK 0'	16 GROUNDWATER ELEV 405.028
9 TOTAL DEPTH OF HOLE 28.5'	

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		M. STIFF, DARK BROWN, CLAY (CH) 1" TOPSOIL	5	31					
			10						
3.0		STIFF	12	32				63	37
		STIFF, DARK BROWN, SILTY CLAY (CL) W/SOME FINE SAND	13	28					
6.0		STIFF, DARK BROWN, CLAY (CH) W/CALCAREOUS INCLUSIONS	14	25				73	47
▼			11	35					
9.0		CALCAREOUS DEPOSITS	14	27				91	59
		V. STIFF	17	31					
12.0			21	30					
			18	32					
15.0									
18.0		STIFF, BROWN, SILTY CLAY (CL)	12	31				44	24
21.0				30					
		V. STIFF	21						
24.0									
27.0		V. STIFF, BROWN, CLAY (CH)	16	32					
		BOH AT 28.5'							
30.0									

MB-6

BORING NO. MB-7

BORING LOG'S DIV SOUTHWESTERN	DISTRICT LITTLE ROCK SHEET 1 OF 1 SHEETS
1 PROJECT MAY BRANCH	10 INSPECTOR STEVEN JOHNSON
2 LOCATION 593544.386E, 398249.654N	11 NO. OF SAMPLES
3 AGENCY GEOTEK DRILLING	DISTURBED 13 UNDISTURBED 0
4 EQUIP MOBILE	12 TOTAL NUMBER CORE BOXES - 0 -
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED	13 TOTAL CORE RECOVERY - 0 -
6 DRILLER CORPS OF ENGINEERS	14 DRILLING DATE START 06/14/99 END 06/15/99
7 THICKNESS OF OVERBURDEN 28.5'	15 ELEV TOP OF HOLE 420.992 NGVD
8 DEPTH DRILLED INTO ROCK 0'	16 GROUNDWATER ELEV 406.492
9 TOTAL DEPTH OF HOLE 28.5'	

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		M. STIFF, BROWN, SILTY CLAY (CL) W/FINE TO COARSE GRAVEL	6	13					
			6						
3.0		TAN	6	26					
		SOFT	3	19				41	21
6.0			3	28					
		M. STIFF, DARK BROWN TO DARK GRAY, CLAY (CH)	7	36					
9.0		DARK GRAY	9	34					
		STIFF	12	33				74	44
12.0			14	22					
▼		V. STIFF	18	29					
15.0									
18.0			15						
21.0		DARK BROWN, SILTY CLAY (CL), W/MOLD		27					
			18						
24.0									
27.0		V. STIFF, DARK GRAYISH BROWN, CLAY (CH)	15	26					
		BOH AT 28.5'							
30.0									

MB-7

BORING NO. MB-8

BORING LOG'S DIV SOUTHWESTERN	DISTRICT LITTLE ROCK SHEET 1 OF 1 SHEETS
1 PROJECT MAY BRANCH	10 INSPECTOR STEVEN JOHNSON
2 LOCATION 593448.401E, 397606.984N	11 NO. OF SAMPLES
3 AGENCY GEOTEK DRILLING	DISTURBED 13 UNDISTURBED 0
4 EQUIP MOBILE	12 TOTAL NUMBER CORE BOXES - 0 -
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED	13 TOTAL CORE RECOVERY - 0 -
6 DRILLER CORPS OF ENGINEERS	14 DRILLING DATE START 06/14/99 END 06/15/99
7 THICKNESS OF OVERBURDEN 28.5'	15 ELEV TOP OF HOLE 416.032 NGVD
8 DEPTH DRILLED INTO ROCK 0'	16 GROUNDWATER ELEV 407.532
9 TOTAL DEPTH OF HOLE 28.5'	

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		FIRM, FINE TO COARSE GRAVEL (GM) W/DARK GRAY SILT	24	5					
		M. STIFF, GRAY, SILTY CLAY (CL) W/FINE GRAVEL	6	16					
3.0		STIFF, GRAY	13	32				41	18
		MOLD	14	30					
6.0		V. STIFF	17	29					
▼		V. STIFF, BROWN, SILTY CLAY (CH) W/CALCAREOUS INCLUSIONS	15	24				65	40
9.0		V. STIFF, BROWN, SILTY CLAY (CL) W/CALCAREOUS INCLUSIONS	16	29					
		LIGHT BROWN		28					
12.0		TAN		27				33	12
		BROWN		34					
15.0									
18.0			19	26					
21.0				31					
			23						
24.0									
27.0			21	24					
		BOH AT 28.5'							
30.0									

MB-8

BORING NO. MB-9

BORING LOG'S DIV SOUTHWESTERN	DISTRICT LITTLE ROCK SHEET 1 OF 1 SHEETS
1 PROJECT MAY BRANCH	10 INSPECTOR STEVEN JOHNSON
2 LOCATION 593654.830E, 397055.097N	11 NO. OF SAMPLES
3 AGENCY GEOTEK DRILLING	DISTURBED 8 UNDISTURBED 0
4 EQUIP MOBILE	12 TOTAL NUMBER CORE BOXES - 0 -
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED	13 TOTAL CORE RECOVERY - 0 -
6 DRILLER CORPS OF ENGINEERS	14 DRILLING DATE START 06/03/99 END 06/04/99
7 THICKNESS OF OVERBURDEN 24'	15 ELEV TOP OF HOLE 416.469 NGVD
8 DEPTH DRILLED INTO ROCK 0'	16 GROUNDWATER ELEV 411.219
9 TOTAL DEPTH OF HOLE 24'	

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		4" TOPSOIL, LOOSE ROCKS AND BRICKS 9" TO 1'9" BROWN, FINE SANDY CLAY (CL) W/FINE GRAVEL							
3.0				24				39	19
▼									
6.0		DARK BROWN, CLAY (CH)							
9.0				28				61	37
12.0		LIGHT BROWN, SILTY CLAY (CL) W/FINE SAND							
15.0		BROWN							
18.0		GRAYISH BROWN							
21.0									
24.0		BOH AT 24'							
27.0									
30.0									

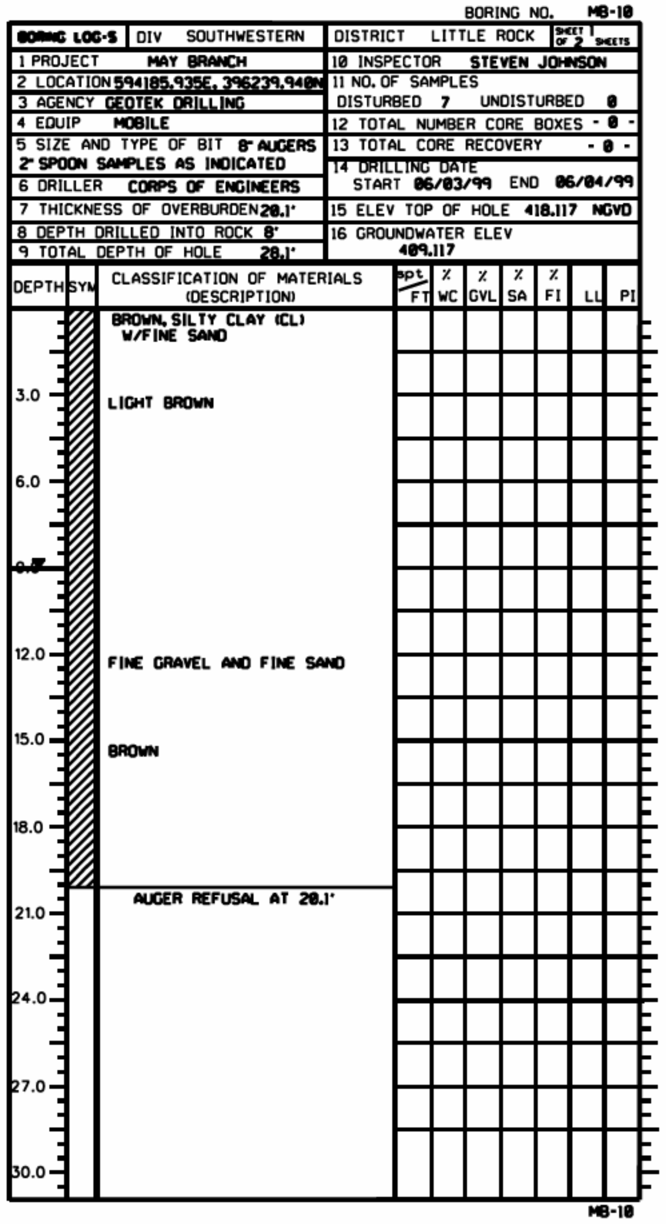
MB-9

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS MB6-MB9

SCALE: AS SHOWN
JANUARY 2005



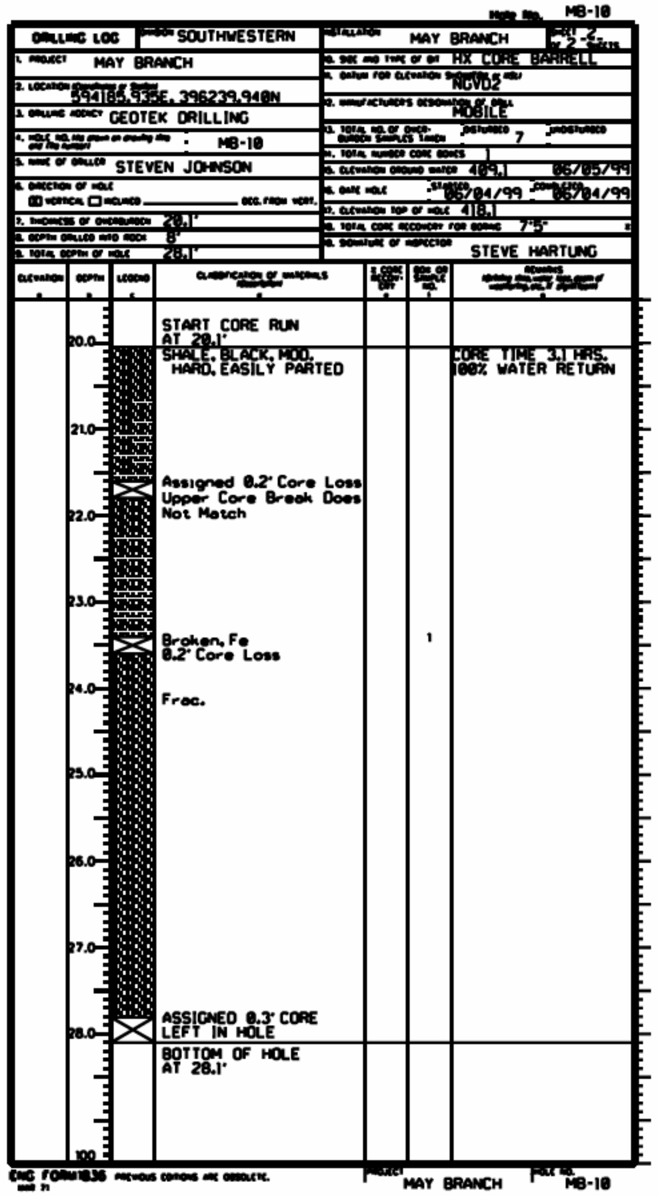
BORING NO. MB-10

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 2 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 594185.935E, 396239.940N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 20.1'
8 DEPTH DRILLED INTO ROCK 8'
9 TOTAL DEPTH OF HOLE 28.1'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 7 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/03/99 END 06/04/99
15 ELEV TOP OF HOLE 418.117 NGVD
16 GROUNDWATER ELEV 409.117

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		BROWN, SILTY CLAY (CL) W/FINE SAND							
3.0		LIGHT BROWN							
12.0		FINE GRAVEL AND FINE SAND							
15.0		BROWN							
		AUGER REFUSAL AT 20.1'							

MB-10



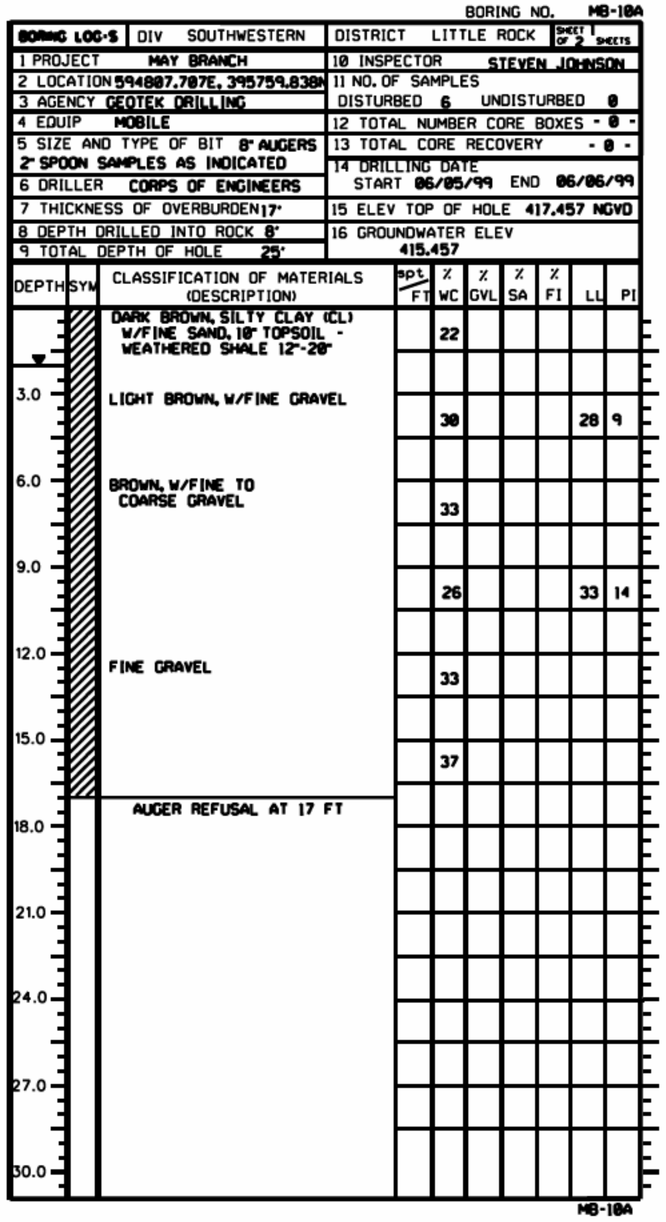
Hole No. MB-10

DRILLING LOG | DIVISION SOUTHWESTERN | INSTALLATION MAY BRANCH | SHEET 2 OF 2 SHEETS

1. PROJECT MAY BRANCH
2. LOCATION (Coordinates or Station) 594185.935E, 396239.940N
3. DRILLING AGENCY GEOTEK DRILLING
4. HOLE NO. (As shown on drawing title and file number) MB-10
5. NAME OF DRILLER STEVEN JOHNSON
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN 20.1'
8. DEPTH DRILLED INTO ROCK 8'
9. TOTAL DEPTH OF HOLE 28.1'
10. SIZE AND TYPE OF BIT HX CORE BARRELL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD2
12. MANUFACTURER'S DESIGNATION OF DRILL MOBILE
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 7 UNDISTURBED
14. TOTAL NUMBER CORE BOXES 1
15. ELEVATION GROUND WATER 409.1 06/05/99
16. DATE HOLE STARTED 06/04/99 COMPLETED 06/04/99
17. ELEVATION TOP OF HOLE 418.1
18. TOTAL CORE RECOVERY FOR BORING 7'5"
19. SIGNATURE OF INSPECTOR STEVE HARTUNG

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
			START CORE RUN AT 20.1'			
	20.0		SHALE, BLACK, MOD. HARD, EASILY PARTED			CORE TIME 3.1 HRS. 100% WATER RETURN
			Assigned 0.2' Core Loss Upper Core Break Does Not Match			
			Broken, Fe 0.2' Core Loss		1	
	24.0		Frac.			
			ASSIGNED 0.3' CORE LEFT IN HOLE			
	28.0		BOTTOM OF HOLE AT 28.1'			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.
PROJECT MAY BRANCH
HOLE NO. MB-10



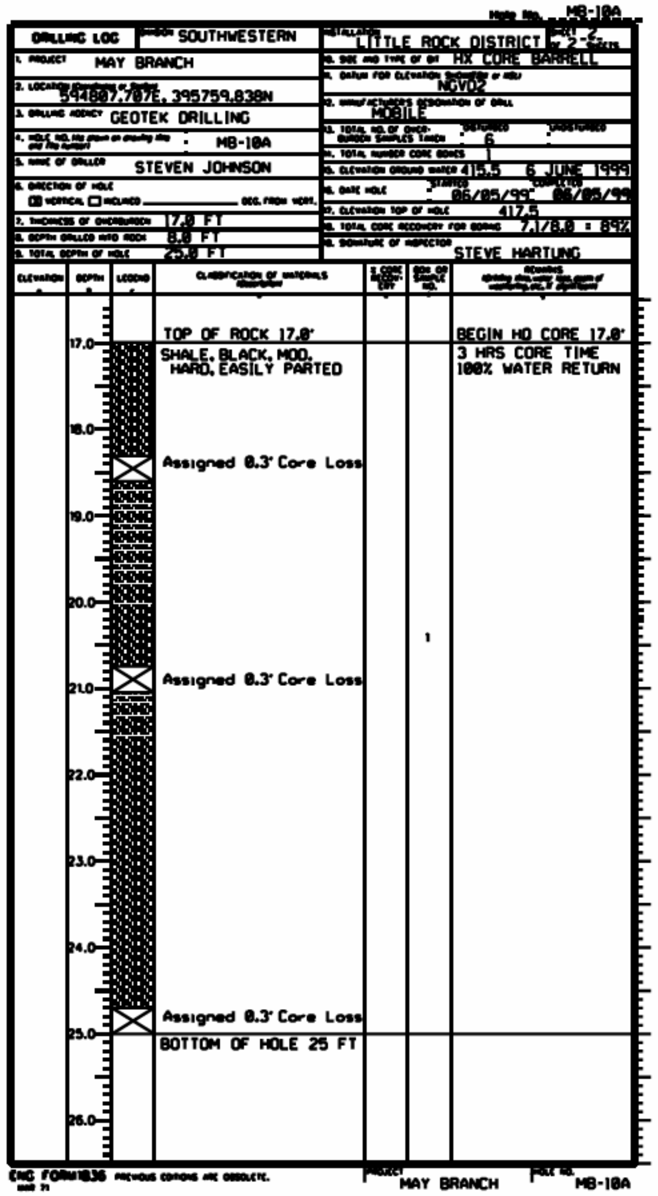
BORING NO. MB-10A

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 2 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 594807.707E, 395759.838N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 17'
8 DEPTH DRILLED INTO ROCK 8'
9 TOTAL DEPTH OF HOLE 25'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 6 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/05/99 END 06/06/99
15 ELEV TOP OF HOLE 417.457 NGVD
16 GROUNDWATER ELEV 415.457

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		DARK BROWN, SILTY CLAY (CL) W/FINE SAND, 10" TOPSOIL - WEATHERED SHALE 12"-20"		22					
3.0		LIGHT BROWN, W/FINE GRAVEL		30				28	9
6.0		BROWN, W/FINE TO COARSE GRAVEL		33					
9.0				26				33	14
12.0		FINE GRAVEL		33					
15.0				37					
		AUGER REFUSAL AT 17 FT							

MB-10A



Hole No. MB-10A

DRILLING LOG | DIVISION SOUTHWESTERN | INSTALLATION LITTLE ROCK DISTRICT | SHEET 2 OF 2 SHEETS

1. PROJECT MAY BRANCH
2. LOCATION (Coordinates or Station) 594807.707E, 395759.838N
3. DRILLING AGENCY GEOTEK DRILLING
4. HOLE NO. (As shown on drawing title and file number) MB-10A
5. NAME OF DRILLER STEVEN JOHNSON
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN 17.0 FT
8. DEPTH DRILLED INTO ROCK 8.0 FT
9. TOTAL DEPTH OF HOLE 25.0 FT
10. SIZE AND TYPE OF BIT HX CORE BARRELL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD2
12. MANUFACTURER'S DESIGNATION OF DRILL MOBILE
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 6 UNDISTURBED
14. TOTAL NUMBER CORE BOXES 1
15. ELEVATION GROUND WATER 415.5 6 JUNE 1999
16. DATE HOLE STARTED 06/05/99 COMPLETED 06/05/99
17. ELEVATION TOP OF HOLE 417.5
18. TOTAL CORE RECOVERY FOR BORING 7.1/8.0 = 89%
19. SIGNATURE OF INSPECTOR STEVE HARTUNG

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
			TOP OF ROCK 17.0'			BEGIN HQ CORE 17.0'
	17.0		SHALE, BLACK, MOD. HARD, EASILY PARTED			3 HRS CORE TIME 100% WATER RETURN
			Assigned 0.3' Core Loss			
					1	
	21.0		Assigned 0.3' Core Loss			
			Assigned 0.3' Core Loss			
	25.0		BOTTOM OF HOLE 25 FT			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.
PROJECT MAY BRANCH
HOLE NO. MB-10A

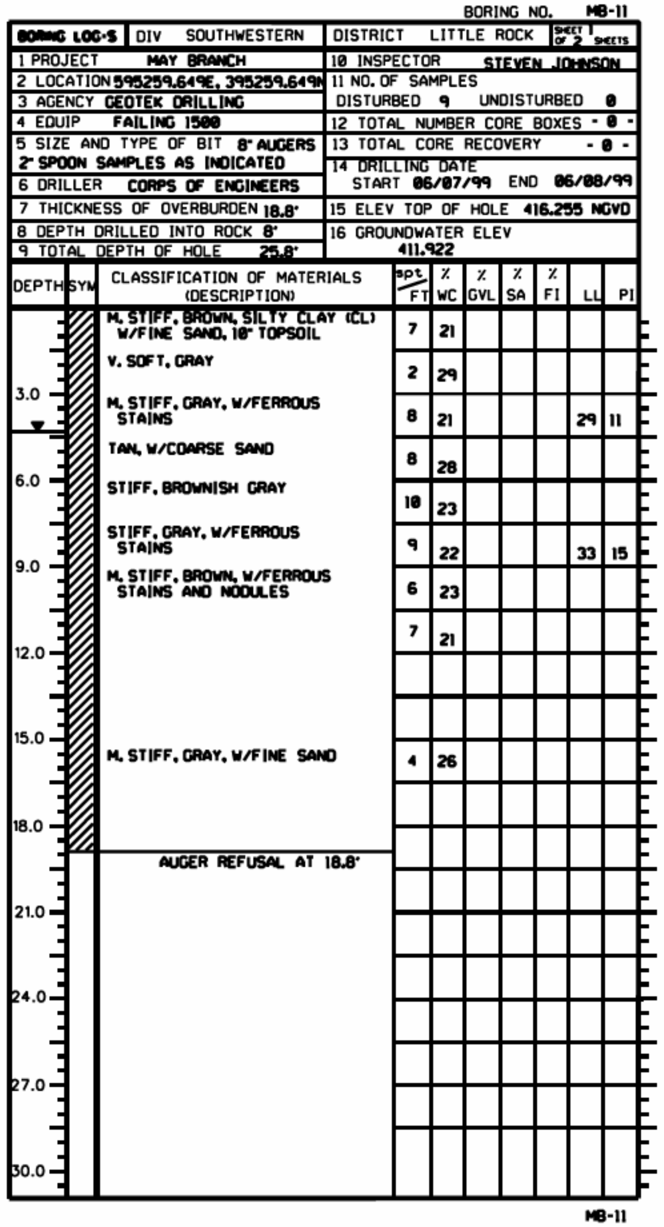
DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS MB10-MB10A

SCALE: AS SHOWN
JANUARY 2005

PLATE G-8

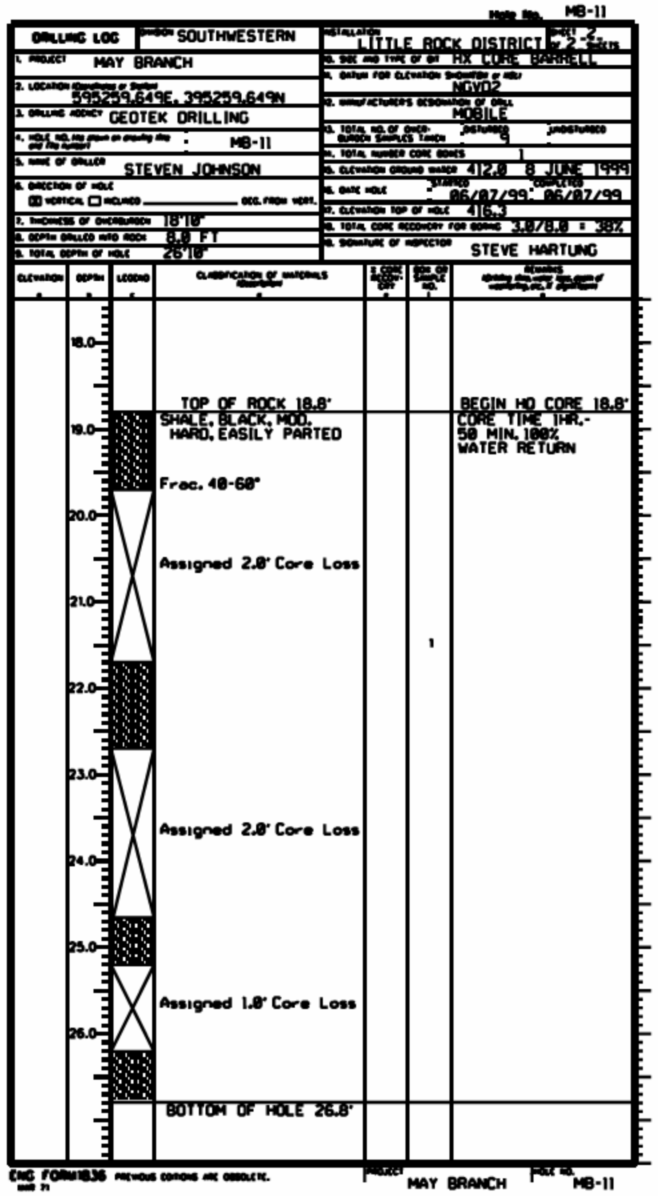


BORING NO. MB-11

BORING LOG'S	DIV SOUTHWESTERN
DISTRICT LITTLE ROCK	SHEET 1 OF 2 SHEETS
1 PROJECT MAY BRANCH	10 INSPECTOR STEVEN JOHNSON
2 LOCATION 595259.649E, 395259.649N	11 NO. OF SAMPLES DISTURBED 9 UNDISTURBED 0
3 AGENCY GEOTEK DRILLING	12 TOTAL NUMBER CORE BOXES - 0 -
4 EQUIP FAILING 1500	13 TOTAL CORE RECOVERY - 0 -
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED	14 DRILLING DATE START 06/07/99 END 06/08/99
6 DRILLER CORPS OF ENGINEERS	
7 THICKNESS OF OVERBURDEN 18.8'	15 ELEV TOP OF HOLE 416.255 NGVD
8 DEPTH DRILLED INTO ROCK 8'	16 GROUNDWATER ELEV 411.922
9 TOTAL DEPTH OF HOLE 25.8'	

CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
M. STIFF, BROWN, SILTY CLAY (CL) W/FINE SAND, 10" TOPSOIL	7	21					
V. SOFT, GRAY	2	29					
M. STIFF, GRAY, W/FERROUS STAINS	8	21				29	11
TAN, W/COARSE SAND	8	28					
STIFF, BROWNISH GRAY	10	23					
STIFF, GRAY, W/FERROUS STAINS	9	22				33	15
M. STIFF, BROWN, W/FERROUS STAINS AND NODULES	6	23					
	7	21					
M. STIFF, GRAY, W/FINE SAND	4	26					
AUGER REFUSAL AT 18.8'							

MB-11

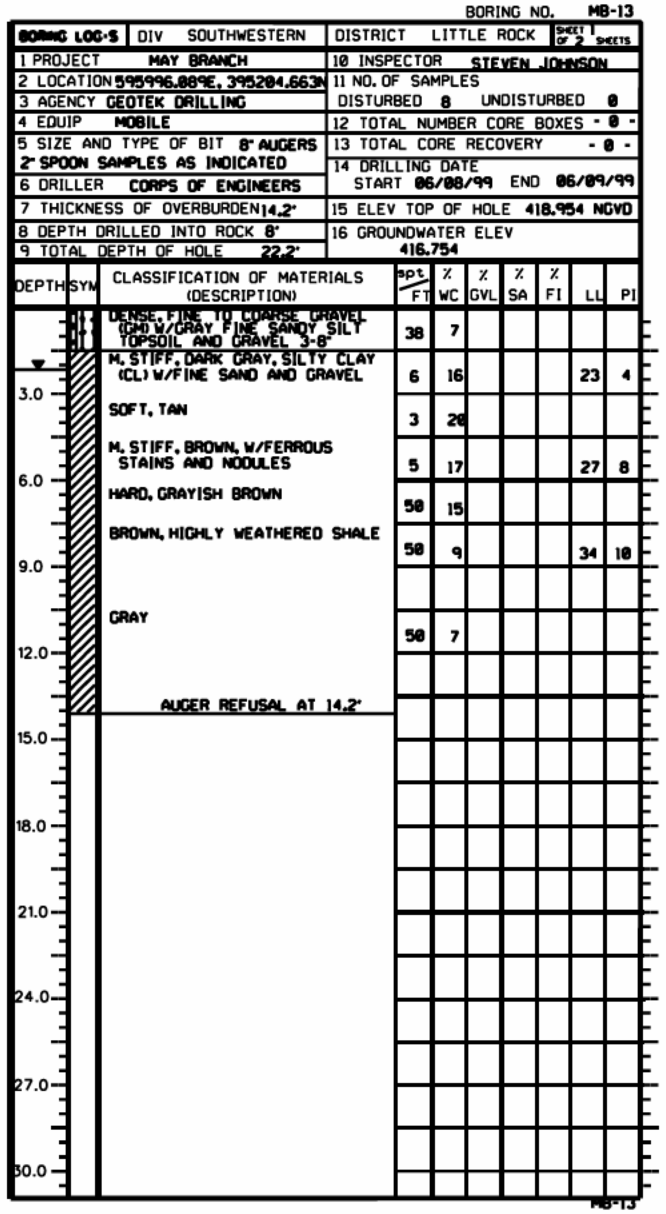


Hole No. MB-11

DRILLING LOG	DIVISION SOUTHWESTERN
INSTALLATION LITTLE ROCK DISTRICT	SHEET 2 OF 2 SHEETS
1. PROJECT MAY BRANCH	10. SIZE AND TYPE OF BIT HX CORE BARRELL
2. LOCATION 595259.649E, 395259.649N	11. DATUM FOR ELEVATION SHOWN NGVD2
3. DRILLING AGENCY GEOTEK DRILLING	12. MANUFACTURER'S DESIGNATION OF DRILL MOBILE
4. HOLE NO. MB-11	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED 9 UNDISTURBED
5. NAME OF DRILLER STEVEN JOHNSON	14. TOTAL NUMBER CORE BOXES 1
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 412.0 8 JUNE 1999
	16. DATE HOLE STARTED 06/07/99 COMPLETED 06/07/99
7. THICKNESS OF OVERBURDEN 18'10"	17. ELEVATION TOP OF HOLE 416.3
8. DEPTH DRILLED INTO ROCK 8.0 FT	18. TOTAL CORE RECOVERY FOR BORING 3.0/8.0 = 38%
9. TOTAL DEPTH OF HOLE 26'10"	19. SIGNATURE OF INSPECTOR STEVE HARTUNG

CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
TOP OF ROCK 18.8'			BEGIN HQ CORE 18.8'
SHALE, BLACK, MOD. HARD, EASILY PARTED			CORE TIME 1HR.- 50 MIN. 100% WATER RETURN
Frac. 40-60°			
Assigned 2.0' Core Loss		1	
Assigned 2.0' Core Loss			
Assigned 1.0' Core Loss			
BOTTOM OF HOLE 26.8'			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT MAY BRANCH HOLE NO. MB-11

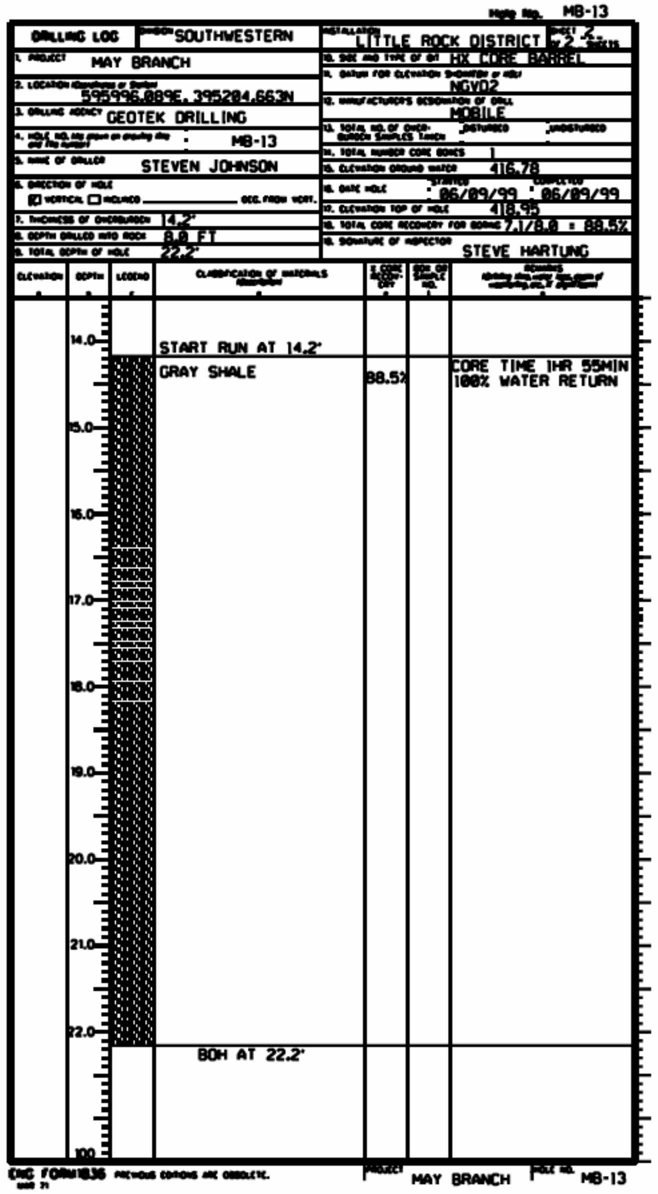


BORING NO. MB-13

BORING LOG'S	DIV SOUTHWESTERN
DISTRICT LITTLE ROCK	SHEET 1 OF 2 SHEETS
1 PROJECT MAY BRANCH	10 INSPECTOR STEVEN JOHNSON
2 LOCATION 595996.089E, 395204.663N	11 NO. OF SAMPLES DISTURBED 8 UNDISTURBED 0
3 AGENCY GEOTEK DRILLING	12 TOTAL NUMBER CORE BOXES - 0 -
4 EQUIP MOBILE	13 TOTAL CORE RECOVERY - 0 -
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED	14 DRILLING DATE START 06/08/99 END 06/09/99
6 DRILLER CORPS OF ENGINEERS	
7 THICKNESS OF OVERBURDEN 14.2'	15 ELEV TOP OF HOLE 418.954 NGVD
8 DEPTH DRILLED INTO ROCK 8'	16 GROUNDWATER ELEV 416.754
9 TOTAL DEPTH OF HOLE 22.2'	

CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
DENSE, FINE TO COARSE GRAVEL (GM) W/GRAY FINE SANDY SILT TOPSOIL AND GRAVEL 3-8"	38	7					
M. STIFF, DARK GRAY, SILTY CLAY (CL) W/FINE SAND AND GRAVEL	6	16				23	4
SOFT, TAN	3	20					
M. STIFF, BROWN, W/FERROUS STAINS AND NODULES	5	17				27	8
HARD, GRAYISH BROWN	50	15					
BROWN, HIGHLY WEATHERED SHALE	50	9				34	10
GRAY	50	7					
AUGER REFUSAL AT 14.2'							

MB-13



Hole No. MB-13

DRILLING LOG	DIVISION SOUTHWESTERN
INSTALLATION LITTLE ROCK DISTRICT	SHEET 2 OF 2 SHEETS
1. PROJECT MAY BRANCH	10. SIZE AND TYPE OF BIT HX CORE BARREL
2. LOCATION 595996.089E, 395204.663N	11. DATUM FOR ELEVATION SHOWN NGVD2
3. DRILLING AGENCY GEOTEK DRILLING	12. MANUFACTURER'S DESIGNATION OF DRILL MOBILE
4. HOLE NO. MB-13	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN DISTURBED UNDISTURBED
5. NAME OF DRILLER STEVEN JOHNSON	14. TOTAL NUMBER CORE BOXES 1
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER 416.78
	16. DATE HOLE STARTED 06/09/99 COMPLETED 06/09/99
7. THICKNESS OF OVERBURDEN 14.2'	17. ELEVATION TOP OF HOLE 418.95
8. DEPTH DRILLED INTO ROCK 8.0 FT	18. TOTAL CORE RECOVERY FOR BORING 7.1/8.0 = 88.5%
9. TOTAL DEPTH OF HOLE 22.2'	19. SIGNATURE OF INSPECTOR STEVE HARTUNG

CLASSIFICATION OF MATERIALS	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
START RUN AT 14.2'			
GRAY SHALE	88.5%		CORE TIME 1HR 55MIN 100% WATER RETURN
BOH AT 22.2'			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT MAY BRANCH HOLE NO. MB-13

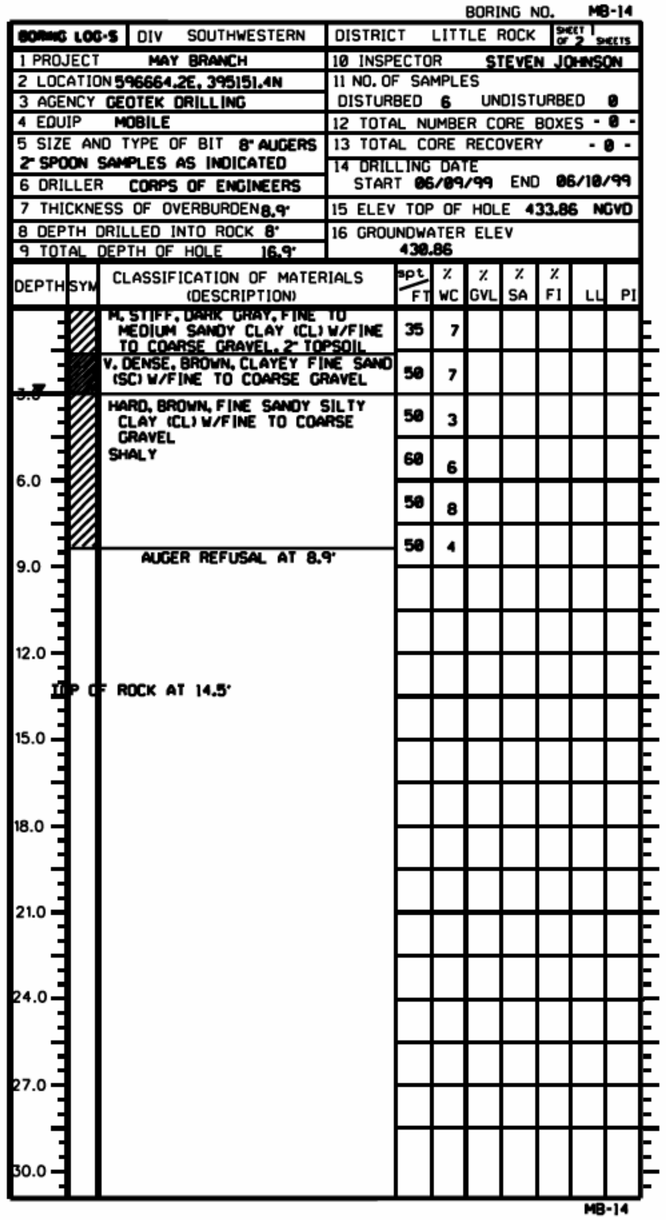
DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED | ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS MB11, MB13

SCALE: AS SHOWN | JANUARY 2005

PLATE G-9



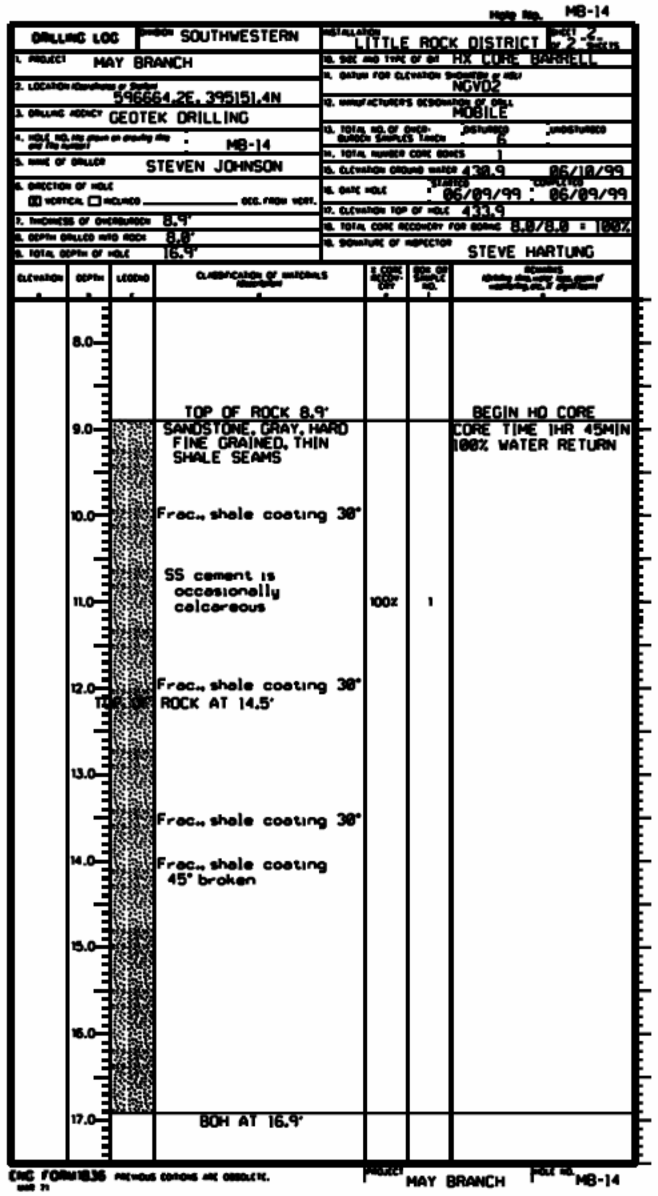
BORING NO. MB-14

BORING LOG-S	DIV SOUTHWESTERN	DISTRICT LITTLE ROCK	SHEET 1 OF 2 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 596664.2E, 395151.4N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 8.9'
8 DEPTH DRILLED INTO ROCK 8'
9 TOTAL DEPTH OF HOLE 16.9'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 6 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/09/99 END 06/10/99
15 ELEV TOP OF HOLE 433.86 NGVD
16 GROUNDWATER ELEV 430.86

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		M. STIFF, DARK GRAY, FINE TO MEDIUM SANDY CLAY (CL) W/FINE TO COARSE GRAVEL, 2" TOPSOIL	35	7					
		V. DENSE, BROWN, CLAYEY FINE SAND (SC) W/FINE TO COARSE GRAVEL	50	7					
3.0		HARD, BROWN, FINE SANDY SILTY CLAY (CL) W/FINE TO COARSE GRAVEL	50	3					
		SHALY	60	6					
6.0			50	8					
			50	4					
9.0		AUGER REFUSAL AT 8.9'							
12.0		TOP OF ROCK AT 14.5'							

MB-14



Hole No. MB-14

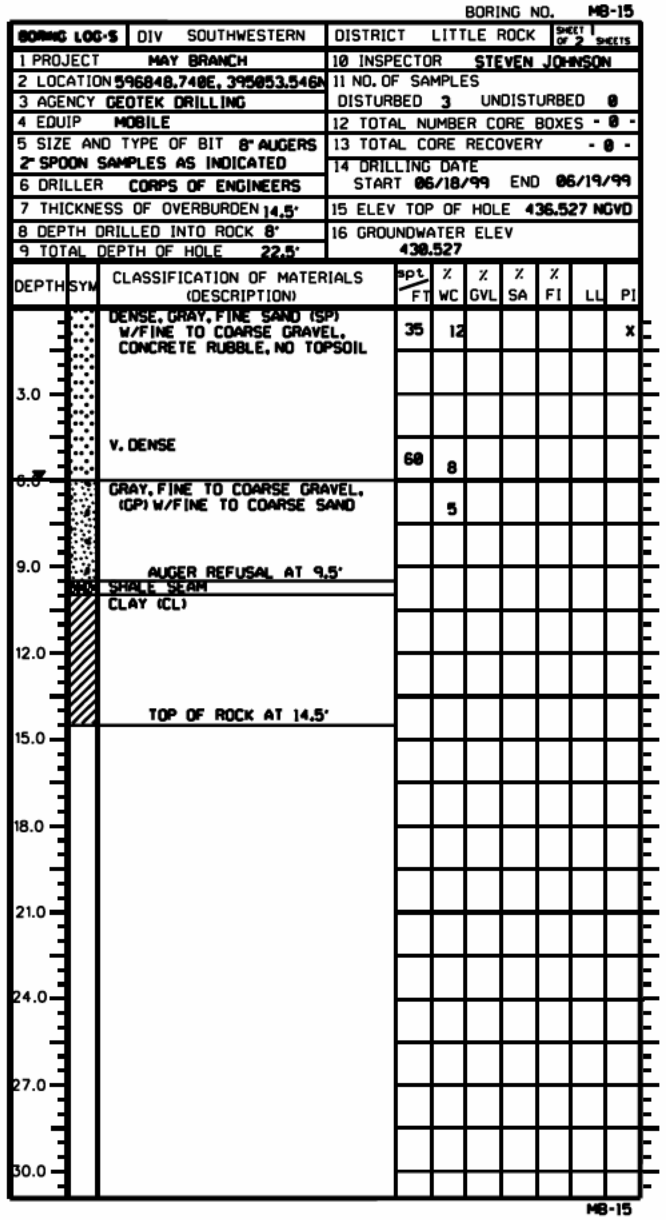
DRILLING LOG	DIVISION SOUTHWESTERN	INSTALLATION LITTLE ROCK DISTRICT	SHEET 2 OF 2 SHEETS

1. PROJECT MAY BRANCH
2. LOCATION (Coordinates or Station) 596664.2E, 395151.4N
3. DRILLING AGENCY GEOTEK DRILLING
4. HOLE NO. (As shown on drawing title and file number) MB-14
5. NAME OF DRILLER STEVEN JOHNSON
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN 8.9'
8. DEPTH DRILLED INTO ROCK 8.0'
9. TOTAL DEPTH OF HOLE 16.9'
10. SIZE AND TYPE OF BIT HX CORE BARRELL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD2
12. MANUFACTURER'S DESIGNATION OF DRILL MOBILE
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 6 UNDISTURBED
14. TOTAL NUMBER CORE BOXES 1
15. ELEVATION GROUND WATER 430.9 06/10/99
16. DATE HOLE STARTED 06/09/99 COMPLETED 06/09/99
17. ELEVATION TOP OF HOLE 433.9
18. TOTAL CORE RECOVERY FOR BORING 8.0/8.0 = 100%
19. SIGNATURE OF INSPECTOR STEVE HARTUNG

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	8.0					
			TOP OF ROCK 8.9'			BEGIN HQ CORE
	9.0		SANDSTONE, GRAY, HARD FINE GRAINED, THIN SHALE SEAMS			CORE TIME 1HR 45MIN 100% WATER RETURN
	10.0		Frac., shale coating 30°			
	11.0		SS cement is occasionally calcareous	100%	1	
	12.0		Frac., shale coating 30° TOP OF ROCK AT 14.5'			
	13.0		Frac., shale coating 30°			
	14.0		Frac., shale coating 45° broken			
	15.0					
	16.0					
	17.0		BOH AT 16.9'			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.
MAR 71

PROJECT MAY BRANCH HOLE NO. MB-14



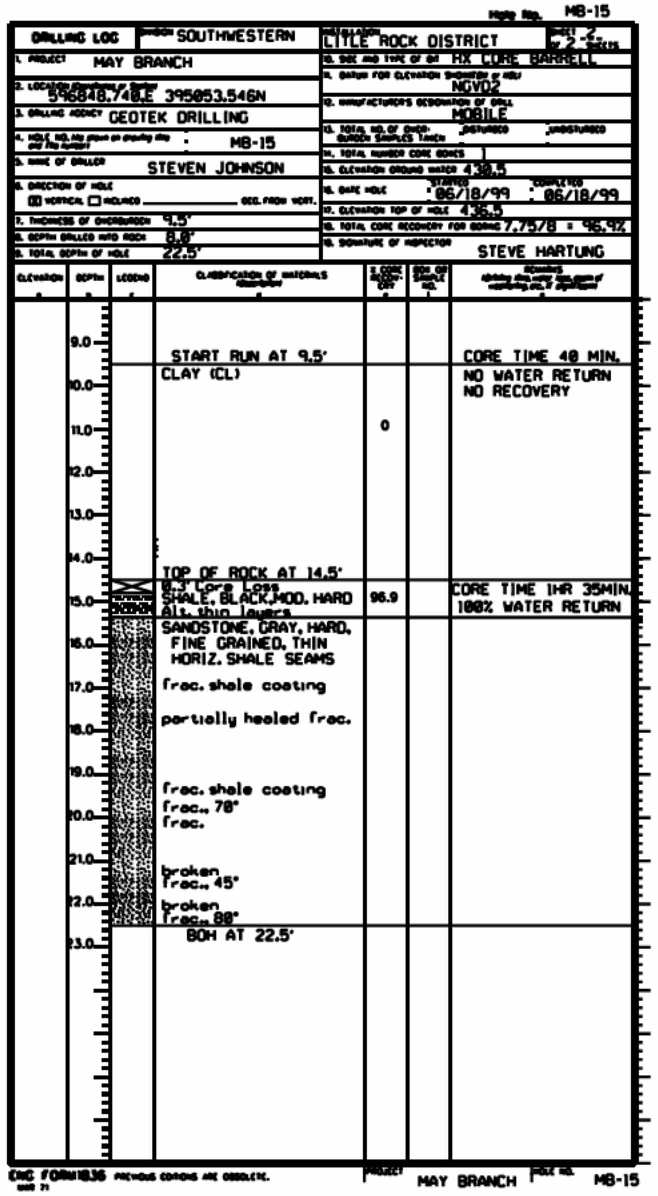
BORING NO. MB-15

BORING LOG-S	DIV SOUTHWESTERN	DISTRICT LITTLE ROCK	SHEET 1 OF 2 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 596848.740E, 395053.546N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 14.5'
8 DEPTH DRILLED INTO ROCK 8'
9 TOTAL DEPTH OF HOLE 22.5'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 3 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/18/99 END 06/19/99
15 ELEV TOP OF HOLE 436.527 NGVD
16 GROUNDWATER ELEV 430.527

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		DENSE, GRAY, FINE SAND (SP) W/FINE TO COARSE GRAVEL, CONCRETE RUBBLE, NO TOPSOIL	35	12					X
3.0		V. DENSE	60	8					
6.0		GRAY, FINE TO COARSE GRAVEL, (GP) W/FINE TO COARSE SAND		5					
9.0		AUGER REFUSAL AT 9.5'							
		SHALE SEAM							
		CLAY (CL)							
12.0		TOP OF ROCK AT 14.5'							

MB-15



Hole No. MB-15

DRILLING LOG	DIVISION SOUTHWESTERN	INSTALLATION LITLE ROCK DISTRICT	SHEET 2 OF 2 SHEETS

1. PROJECT MAY BRANCH
2. LOCATION (Coordinates or Station) 596848.740E 395053.546N
3. DRILLING AGENCY GEOTEK DRILLING
4. HOLE NO. (As shown on drawing title and file number) MB-15
5. NAME OF DRILLER STEVEN JOHNSON
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN 9.5'
8. DEPTH DRILLED INTO ROCK 8.0'
9. TOTAL DEPTH OF HOLE 22.5'
10. SIZE AND TYPE OF BIT HX CORE BARRELL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD2
12. MANUFACTURER'S DESIGNATION OF DRILL MOBILE
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED
14. TOTAL NUMBER CORE BOXES 1
15. ELEVATION GROUND WATER 430.5
16. DATE HOLE STARTED 06/18/99 COMPLETED 06/18/99
17. ELEVATION TOP OF HOLE 436.5
18. TOTAL CORE RECOVERY FOR BORING 7.75/8 = 96.9%
19. SIGNATURE OF INSPECTOR STEVE HARTUNG

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant)
	9.0		START RUN AT 9.5'			CORE TIME 40 MIN.
	10.0		CLAY (CL)			NO WATER RETURN NO RECOVERY
	11.0			0		
	14.0		TOP OF ROCK AT 14.5'			
	15.0		0.3' Core Loss SHALE, BLACK, MOD. HARD Alt. thin layers	96.9		CORE TIME 1HR 35MIN. 100% WATER RETURN
	16.0		SANDSTONE, GRAY, HARD, FINE GRAINED, THIN HORIZ. SHALE SEAMS			
	17.0		frac. shale coating			
	18.0		partially healed frac.			
	19.0		frac. shale coating frac., 70° frac.			
	21.0		broken frac., 45°			
	22.0		broken frac., 80°			
	23.0		BOH AT 22.5'			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.
MAR 71

PROJECT MAY BRANCH HOLE NO. MB-15

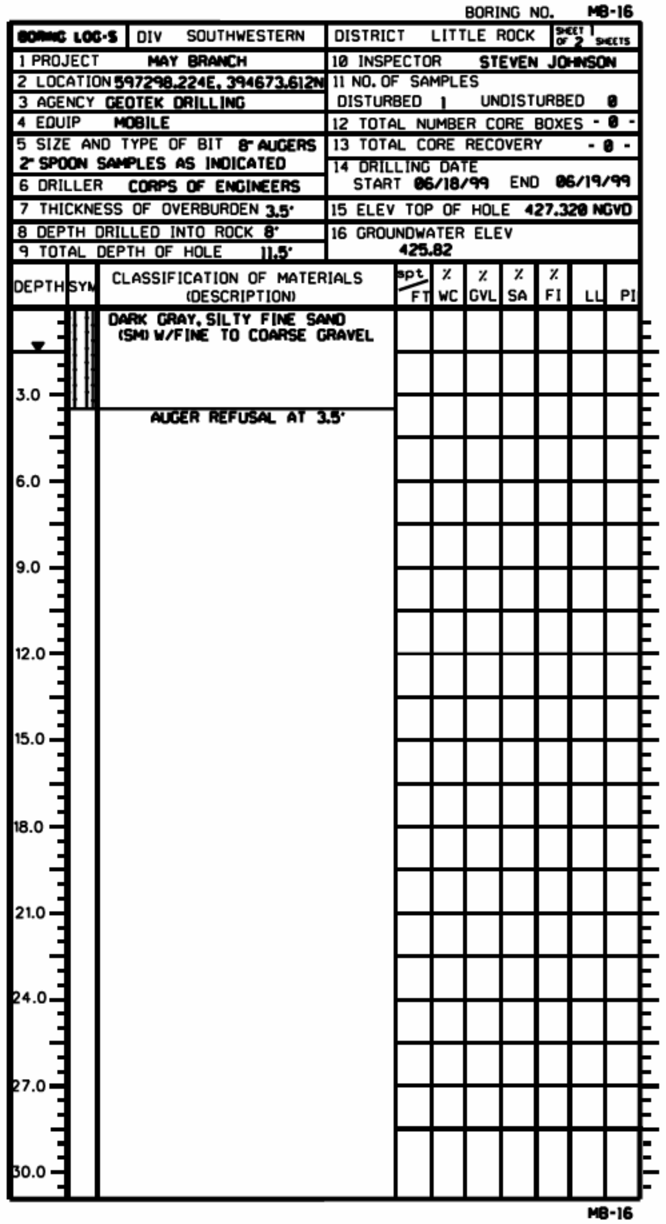
DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS MB14-MB15

SCALE: AS SHOWN
JANUARY 2005

PLATE G-10



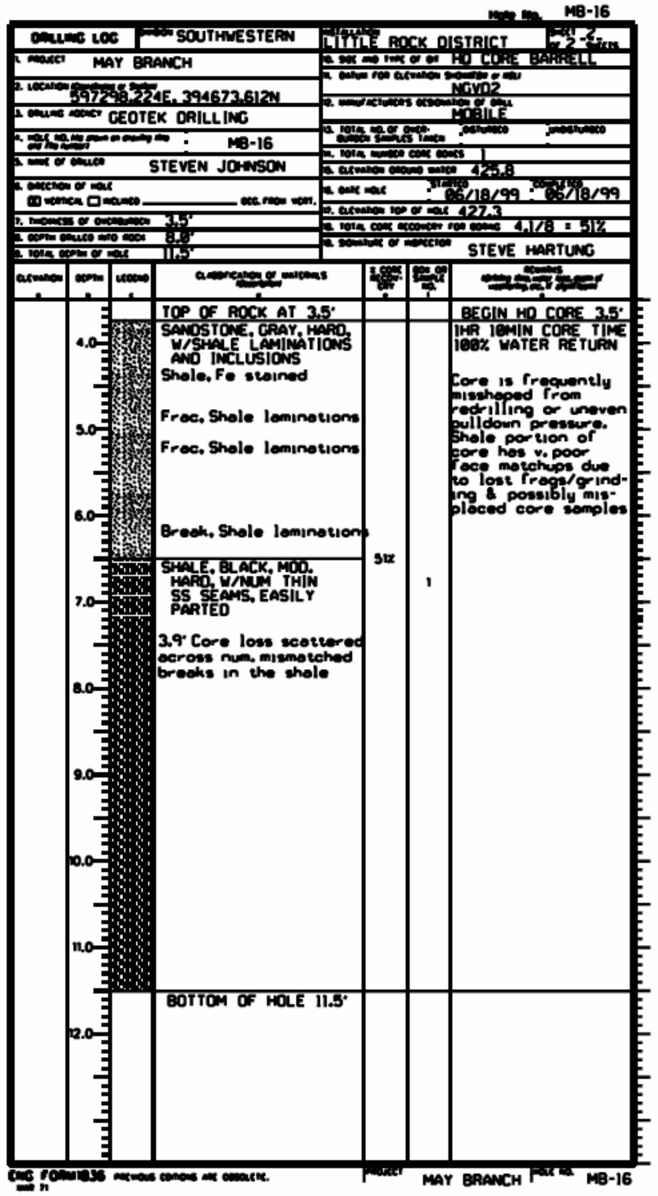
BORING NO. MB-16

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 2 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 597298.224E, 394673.612N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 3.5'
8 DEPTH DRILLED INTO ROCK 8'
9 TOTAL DEPTH OF HOLE 11.5'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 1 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/18/99 END 06/19/99
15 ELEV TOP OF HOLE 427.320 NGVD
16 GROUNDWATER ELEV 425.82

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		DARK GRAY, SILTY FINE SAND (SM) W/FINE TO COARSE GRAVEL							
		AUGER REFUSAL AT 3.5'							

MB-16



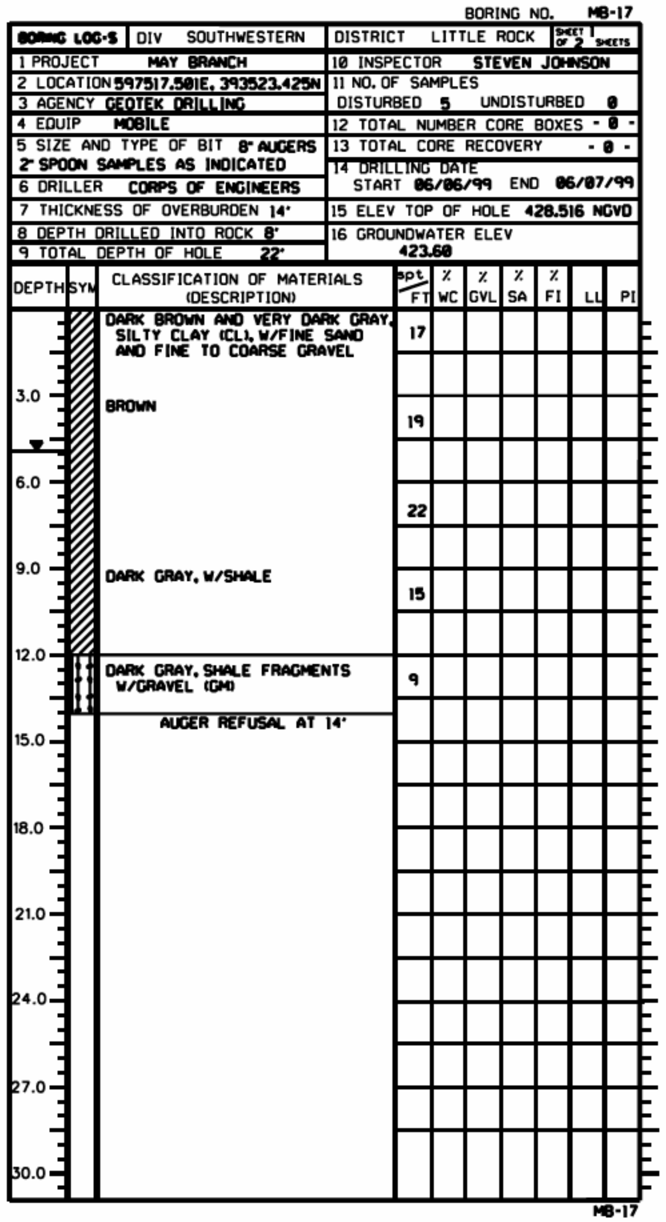
Hole No. MB-16

DRILLING LOG | DIVISION SOUTHWESTERN | INSTALLATION LITTLE ROCK DISTRICT | SHEET 2 OF 2 SHEETS

1. PROJECT MAY BRANCH
2. LOCATION (Coordinates or Station) 597298.224E, 394673.612N
3. DRILLING AGENCY GEOTEK DRILLING
4. HOLE NO. (As shown on drawing title and file number) MB-16
5. NAME OF DRILLER STEVEN JOHNSON
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN 3.5'
8. DEPTH DRILLED INTO ROCK 8.0'
9. TOTAL DEPTH OF HOLE 11.5'
10. SIZE AND TYPE OF BIT HQ CORE BARRELL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD2
12. MANUFACTURER'S DESIGNATION OF DRILL MOBILE
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED UNDISTURBED
14. TOTAL NUMBER CORE BOXES 1
15. ELEVATION GROUND WATER 425.8
16. DATE HOLE STARTED 06/18/99 COMPLETED 06/18/99
17. ELEVATION TOP OF HOLE 427.3
18. TOTAL CORE RECOVERY FOR BORING 4.1/8 = 51%
19. SIGNATURE OF INSPECTOR STEVE HARTUNG

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
			TOP OF ROCK AT 3.5'			BEGIN HQ CORE 3.5'
			SANDSTONE, GRAY, HARD, W/SHALE LAMINATIONS AND INCLUSIONS Shale, Fe stained Frac, Shale laminations Frac, Shale laminations Break, Shale laminations			1HR 10MIN CORE TIME 100% WATER RETURN Core is frequently misshaped from redrilling or uneven pulldown pressure. Shale portion of core has v. poor face matchups due to lost frags/grinding & possibly misplaced core samples
			SHALE, BLACK, MOD. HARD, W/NUM THIN SS SEAMS, EASILY PARTED 3.9' Core loss scattered across num. mismatched breaks in the shale	51%	1	
			BOTTOM OF HOLE 11.5'			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT MAY BRANCH | HOLE NO. MB-16



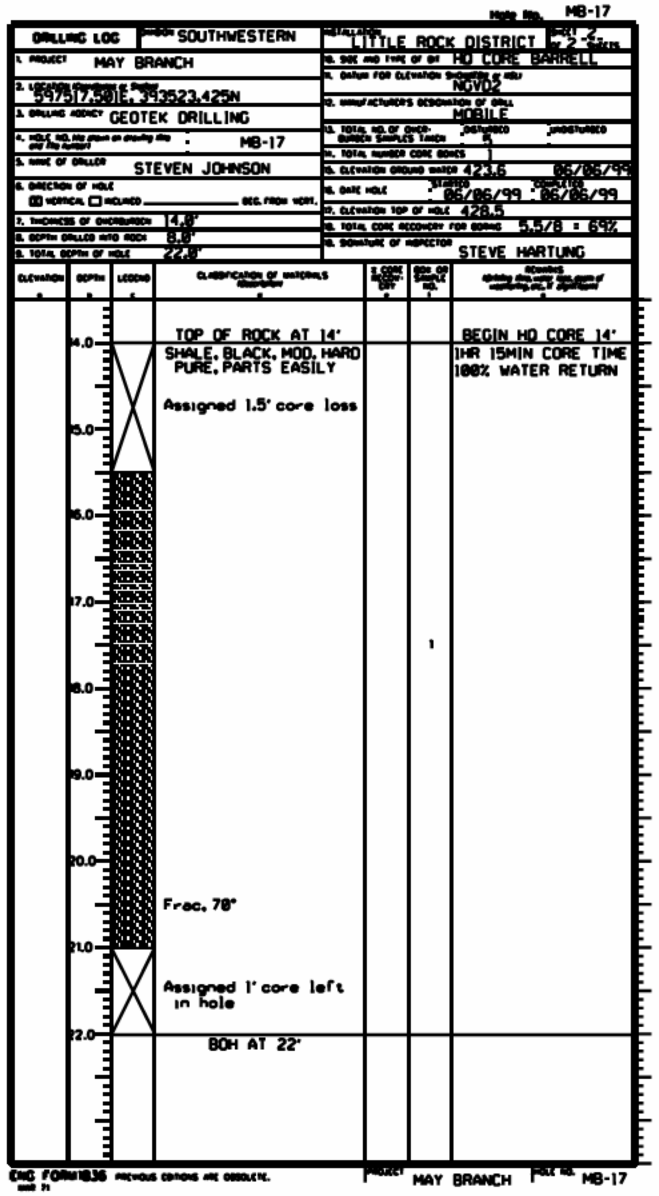
BORING NO. MB-17

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 2 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 597517.501E, 393523.425N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 14'
8 DEPTH DRILLED INTO ROCK 8'
9 TOTAL DEPTH OF HOLE 22'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 5 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/06/99 END 06/07/99
15 ELEV TOP OF HOLE 428.516 NGVD
16 GROUNDWATER ELEV 423.60

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		DARK BROWN AND VERY DARK GRAY, SILTY CLAY (CL), W/FINE SAND AND FINE TO COARSE GRAVEL	17						
3.0		BROWN	19						
6.0			22						
9.0		DARK GRAY, W/SHALE	15						
12.0		DARK GRAY, SHALE FRAGMENTS W/GRAVEL (GM)	9						
		AUGER REFUSAL AT 14'							

MB-17



Hole No. MB-17

DRILLING LOG | DIVISION SOUTHWESTERN | INSTALLATION LITTLE ROCK DISTRICT | SHEET 2 OF 2 SHEETS

1. PROJECT MAY BRANCH
2. LOCATION (Coordinates or Station) 597517.501E, 393523.425N
3. DRILLING AGENCY GEOTEK DRILLING
4. HOLE NO. (As shown on drawing title and file number) MB-17
5. NAME OF DRILLER STEVEN JOHNSON
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN 14.0'
8. DEPTH DRILLED INTO ROCK 8.0'
9. TOTAL DEPTH OF HOLE 22.0'
10. SIZE AND TYPE OF BIT HQ CORE BARRELL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD2
12. MANUFACTURER'S DESIGNATION OF DRILL MOBILE
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 5 UNDISTURBED
14. TOTAL NUMBER CORE BOXES 1
15. ELEVATION GROUND WATER 423.6 06/06/99
16. DATE HOLE STARTED 06/06/99 COMPLETED 06/06/99
17. ELEVATION TOP OF HOLE 428.5
18. TOTAL CORE RECOVERY FOR BORING 5.5/8 = 69%
19. SIGNATURE OF INSPECTOR STEVE HARTUNG

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
			TOP OF ROCK AT 14'			BEGIN HQ CORE 14'
			SHALE, BLACK, MOD. HARD PURE, PARTS EASILY Assigned 1.5' core loss Frac, 70° Assigned 1' core left in hole		1	1HR 15MIN CORE TIME 100% WATER RETURN
			BOH AT 22'			

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. | PROJECT MAY BRANCH | HOLE NO. MB-17

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED | ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS MB16-MB17

SCALE: AS SHOWN | JANUARY 2005

PLATE G-11

BORING NO. MB-18

BORING LOG·S	DIV SOUTHWESTERN	DISTRICT LITTLE ROCK	SHEET 1 OF 1 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 597438.739E, 392201.045N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 21'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 21'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 7 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/06/99 END 06/07/99
15 ELEV TOP OF HOLE 433.243 NGVD
16 GROUNDWATER ELEV 426.243

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		BROWN, SILTY CLAY (CL), W/FINE SAND AND FINE GRAVEL		23					
3.0				19				34	13
6.0		SHALE FRAGMENTS		17					
9.0		GRAY, CLAYEY SHALE-SHALY CLAY		11					
12.0				7					
15.0				8					
18.0		SHALE INCLUSIONS		23					
21.0		BOH AT 21'							
24.0									
27.0									
30.0									

MB-18

BORING NO. MB-19

BORING LOG·S	DIV SOUTHWESTERN	DISTRICT LITTLE ROCK	SHEET 1 OF 2 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 597376.423E, 390896.688N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 14.4'
8 DEPTH DRILLED INTO ROCK 8'
9 TOTAL DEPTH OF HOLE 22.4'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 5 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/19/99 END 06/20/99
15 ELEV TOP OF HOLE 441.314 NGVD
16 GROUNDWATER ELEV 436.814

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		BROWN, SILTY CLAY (CL) W/FINE SAND, 10" GRAVEL FILL		21					
3.0				23					
6.0		BROWN, SILTY CLAY (CL-ML) W/FINE SAND		26				24	6
9.0									
12.0		WEATHERED SHALE FRAGMENTS							
15.0		AUGER REFUSAL AT 14.4'							
18.0									
21.0									
24.0									
27.0									
30.0									

MB-19

Hole No. MB-19

DRILLING LOG	DIVISION SOUTHWESTERN	INSTALLATION LITTLE ROCK DISTRICT	SHEET 2 OF 2 SHEETS

1. PROJECT MAY BRANCH
2. LOCATION (Coordinates or Station) 597376.423E, 390896.688N
3. DRILLING AGENCY GEOTEK DRILLING
4. HOLE NO. (As shown on drawing title and file number) MB-19
5. NAME OF DRILLER STEVEN JOHNSON
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN 14'5"
8. DEPTH DRILLED INTO ROCK 8.0'
9. TOTAL DEPTH OF HOLE 22'5"
10. SIZE AND TYPE OF BIT HX CORE BARRELL
11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD2
12. MANUFACTURER'S DESIGNATION OF DRILL MOBILE
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN DISTURBED 5 UNDISTURBED
14. TOTAL NUMBER CORE BOXES 1
15. ELEVATION GROUND WATER 436.8 06/20/99
16. DATE HOLE STARTED 06/19/99 COMPLETED 06/19/99
17. ELEVATION TOP OF HOLE 441.3
18. TOTAL CORE RECOVERY FOR BORING 7.7/8 = 96%
19. SIGNATURE OF INSPECTOR STEVE HARTUNG

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	14.0		TOP OF ROCK AT 14.5'			BEGIN HD CORE 14.5'
			Assigned 0.3' core loss SHALE, MOD. HARD, W/NUM ALTERNATING HORIZ. THIN SS SEAMS, COMPRISING 40% OF CORE			1.5HR CORE TIME 100% WATER RETURN
	15.0		Thicker SS seams are hard, gray, all breaks have poorly matching faces			
	16.0		Break			
	17.0		Break Break			
	18.0		Break Broken Break	96%	1	
	19.0		Breaks			
	20.0		Break			
	21.0		Break			
	22.0		Break			
			BOH AT 22.5'			
	23.0					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71
PROJECT MAY BRANCH
HOLE NO. MB-19

BORING NO. MB-20

BORING LOG·S	DIV SOUTHWESTERN	DISTRICT LITTLE ROCK	SHEET 1 OF 2 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 597053.668E, 389485.243N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 12.2'
8 DEPTH DRILLED INTO ROCK 8'
9 TOTAL DEPTH OF HOLE 20.2'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 4 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/19/99 END 06/20/99
15 ELEV TOP OF HOLE 454.129 NGVD
16 GROUNDWATER ELEV 451.129'

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
		BROWN, FINE SANDY SILTY CLAY (CL) W/FINE TO COARSE GRAVEL 3" TOPSOIL		9					
3.0		FINE TO COARSE GRAVEL (GM) W/BROWN SILT		5					
6.0				6					
9.0		SHALE FRAGMENTS		3					
12.0		AUGER REFUSAL AT 12.2'							
15.0									
18.0									
21.0									
24.0									
27.0									
30.0									

MB-20

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS MB18-MB20

SCALE: AS SHOWN
JANUARY 2005

Hole No. MB-20

DRILLING LOG	DIVISION SOUTHWESTERN	INSTALLATION LITTLE ROCK DISTRICT	SHEET 2 OF 2 SHEETS
1. PROJECT MAY BRANCH		10. SIZE AND TYPE OF BIT HD CORE BARRELL	
2. LOCATION (Coordinates or Station) 597053.668E, 389485.243N		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) NGVD2	
3. DRILLING AGENCY GEOTEK DRILLING		12. MANUFACTURER'S DESIGNATION OF DRILL MOBILE	
4. HOLE NO. (As shown on drawing title and file number) MB-20		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED 4 UNDISTURBED
5. NAME OF DRILLER STEVEN JOHNSON		14. TOTAL NUMBER CORE BOXES 1	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER 451.2	06/19/99
7. THICKNESS OF OVERBURDEN 12.2'		16. DATE HOLE STARTED 06/19/99	COMPLETED 06/19/99
8. DEPTH DRILLED INTO ROCK 8.0'		17. ELEVATION TOP OF HOLE 454.2	
9. TOTAL DEPTH OF HOLE 20.2'		18. TOTAL CORE RECOVERY FOR BORING 7.5/8 94%	
		19. SIGNATURE OF INSPECTOR STEVE HARTUNG	

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	BOX OR SAMPLE NO.	REMARKS
	12.0		TOP OF ROCK AT 12.2'			BEGIN HD CORE AT 12.2'
		▒	0.3' Core loss SANDSTONE, GRAY, V.HARD OCCASIONAL SHALE INCLUSIONS			1HR 15MIN CORE TIME 100% WATER RETURN
	13.0	▒	Frac., shale coated			
	14.0	▒	Frac., shale coated	94%		
		⊠	0.2' core loss			
	15.0	▩	SHALE, BLACK, MOD. HARD, NUM. THIN SS SEAMS = 30% OF CORE		1	
		▩	Break			
	16.0	▩				
		▩	Break			
	17.0	▩	Break			
		▩	Break			
	18.0	▩	Break			
		▩	Break			
	19.0	▩				
	20.0	▒	SANDSTONE, GRAY, HARD, W/NUM. SHALE SEAMS			
			BOH AT 20.2'			
	21.0					

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE.
MAR 71

PROJECT MAY BRANCH | HOLE NO. MB-20

BORING NO. MB-21

BORING LOG-S	DIV SOUTHWESTERN	DISTRICT LITTLE ROCK	SHEET 1 OF 1 SHEETS
1 PROJECT MAY BRANCH		10 INSPECTOR STEVEN JOHNSON	
2 LOCATION 591232.400E, 398268.345N		11 NO. OF SAMPLES DISTURBED 13 UNDISTURBED 0	
3 AGENCY GEOTEK DRILLING			
4 EQUIP MOBILE		12 TOTAL NUMBER CORE BOXES - 0 -	
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED		13 TOTAL CORE RECOVERY - 0 -	
6 DRILLER STEVEN JOHNSON		14 DRILLING DATE START 06/19/99 END 06/20/99	
7 THICKNESS OF OVERBURDEN 28.5'		15 ELEV TOP OF HOLE 415.131 NGVD	
8 DEPTH DRILLED INTO ROCK 0'		16 GROUNDWATER ELEV 398.431'	
9 TOTAL DEPTH OF HOLE 28.5'			

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
	▨	M.STIFF, BROWN SILTY CLAY (CL), W/FINE SAND, 3" TOPSOIL	8	19					
	▨	DARK BROWN	9	22				28	9
3.0	▨	SOFT	4	21					
	▨	STIFF	11	23				36	17
6.0	▨	V. STIFF	19	23					
	▨		24	29				54	30
9.0	▨		21	31					
	▥	STIFF, LT. BROWN SILT (ML), SLIGHTLY CLAYEY W/FINE SAND	13	24					
12.0	▥		10	27					
	▥	M. STIFF, BROWN	7	27					
15.0	▥								
▼	▥								
18.0	▥	SOFT	4	30					
	▥								
21.0	▥								
	▨	SOFT, BROWN SILTY CLAY (CL), W/SOME FINE SAND	4	34					
24.0	▨								
	▨								
27.0	▨	DARK BROWN	26	30					
		BOH AT 28.5'							
30.0									

MB-21

BORING NO. MB-22

BORING LOG-S	DIV SOUTHWESTERN	DISTRICT LITTLE ROCK	SHEET 1 OF 1 SHEETS
1 PROJECT MAY BRANCH		10 INSPECTOR STEVEN JOHNSON	
2 LOCATION 591786.191E, 397864.225N		11 NO. OF SAMPLES DISTURBED 13 UNDISTURBED 0	
3 AGENCY GEOTEK DRILLING			
4 EQUIP MOBILE		12 TOTAL NUMBER CORE BOXES - 0 -	
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED		13 TOTAL CORE RECOVERY - 0 -	
6 DRILLER STEVEN JOHNSON		14 DRILLING DATE START 06/15/99 END 06/16/99	
7 THICKNESS OF OVERBURDEN 28.5'		15 ELEV TOP OF HOLE 410.531 NGVD	
8 DEPTH DRILLED INTO ROCK 0'		16 GROUNDWATER ELEV 397.78	
9 TOTAL DEPTH OF HOLE 28.5'			

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
	▨	STIFF, DARK BROWN, SILTY CLAY (CL) W/FINE SAND	13	23					
	▨		18	23					
3.0	▥	STIFF, BROWN, CLAYEY SILT (ML) W/FINE SAND	11	22					
	▨	STIFF, DARK BROWN, CLAY (CH)	12	35				72	41
6.0	▨	V. STIFF	17	32					
	▨	BROWN, SLIGHTLY BLOCKY	13	33					
9.0	▨	DARK BROWN, FERROUS STAINS	10	31				51	29
	▨	STIFF, BROWN, SILTY CLAY (CL) W/FERROUS NODULES	10	28					
12.0 ▼	▨	M. STIFF, LT. BROWN, CLAY (CH)	8	31					
	▨	V. STIFF, BROWN, SILTY CLAY (CL)	15	26					
15.0	▨								
	▨								
18.0	▨	V. STIFF, BROWN, CLAY (CH) W/CALCAREOUS INCLUSIONS	18	28					
	▨								
21.0	▨								
	▨	STIFF	13	33					
24.0	▨								
	▨								
27.0	▨		12	32					
		BOH AT 28.5'							
30.0									

MB-22

BORING NO. MB-23

BORING LOG-S	DIV SOUTHWESTERN	DISTRICT LITTLE ROCK	SHEET 1 OF 1 SHEETS
1 PROJECT MAY BRANCH		10 INSPECTOR STEVEN JOHNSON	
2 LOCATION 592168.565E, 397530.776N		11 NO. OF SAMPLES DISTURBED 13 UNDISTURBED 0	
3 AGENCY GEOTEK DRILLING			
4 EQUIP MOBILE		12 TOTAL NUMBER CORE BOXES - 0 -	
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED		13 TOTAL CORE RECOVERY - 0 -	
6 DRILLER CORPS OF ENGINEERS		14 DRILLING DATE START 06/15/99 END 06/16/99	
7 THICKNESS OF OVERBURDEN 28.5'		15 ELEV TOP OF HOLE 414.295 NGVD	
8 DEPTH DRILLED INTO ROCK 0'		16 GROUNDWATER ELEV 403.795	
9 TOTAL DEPTH OF HOLE 28.5'			

DEPTH	SYM	CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
	▒	V. DENSE, FINE TO COARSE GRAVEL (GP-GM) W/DARK GRAY SILTY SAND 3" TOPSOIL	61	7					
	▩	V. DENSE, BROWN, SILTY CLAY (GC) AND FINE TO COARSE GRAVEL	50	19					
3.0	▨	STIFF, DARK GRAY, SILTY CLAY (CL) W/FINE SAND	11	25				40	19
	▨	V. STIFF	19	24					
6.0	▨	V. STIFF, DARK BROWN, CLAY (CH)	16	31				63	36
	▨		17	20					
9.0	▨	BROWN	18	31				74	43
▼	▨	BLOCKY, W/FINE TO COARSE GRAVEL	17	34					
12.0	▨	STIFF, BROWN, SILTY CLAY (CL)	14	25					
	▨		10	25					
15.0	▨								
	▨								
18.0	▨	LT. BROWN, CLAY (CH) W/FINE GRAVEL		32					
	▨								
21.0	▨								
	▨	BROWN, SILTY CLAY (CL) W/FINE GRAVEL		28					
24.0	▨								
	▨								
27.0	▨	BROWN, CLAY (CH)		29					
		BOH AT 28.5'							
30.0									

MB-23

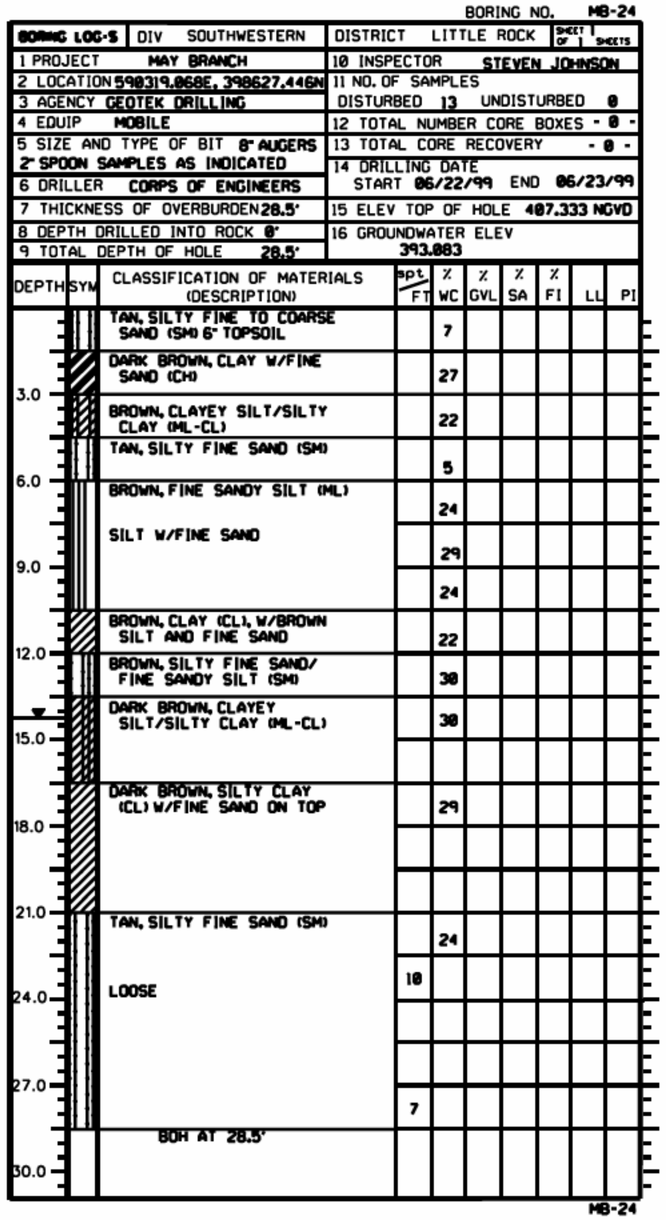
DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED | ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS MB20-MB23

SCALE: AS SHOWN | JANUARY 2005

PLATE G-13

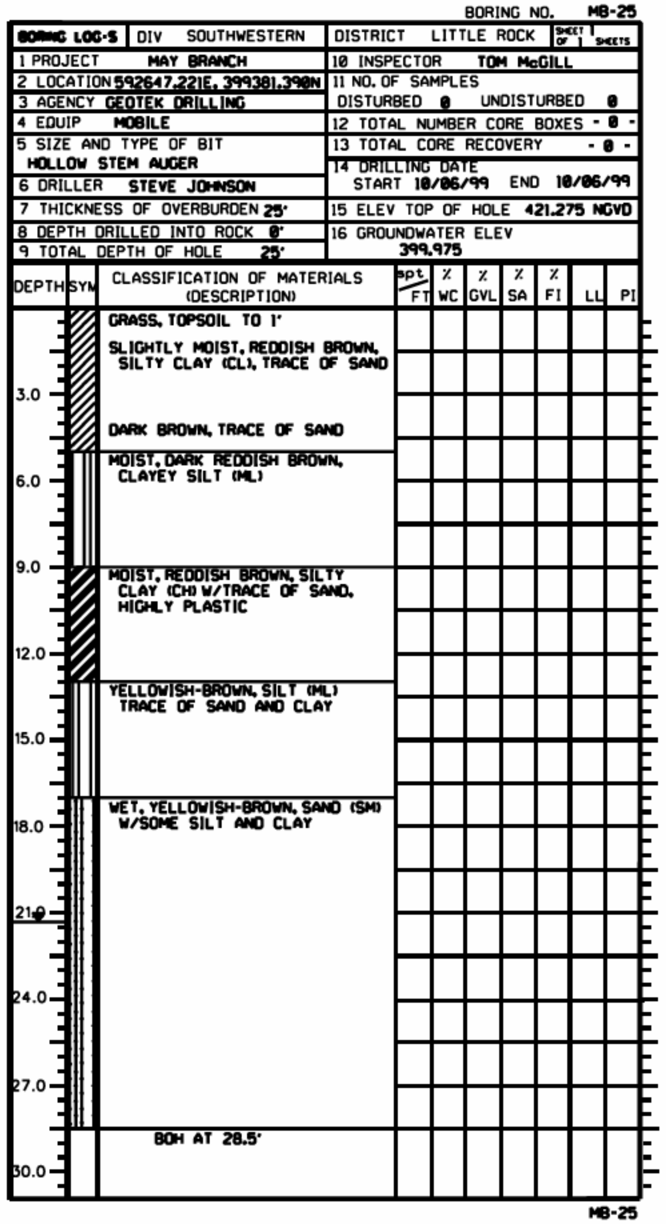


BORING NO. MB-24

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 1 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 590319.068E, 398627.446N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT 8" AUGERS 2" SPOON SAMPLES AS INDICATED
6 DRILLER CORPS OF ENGINEERS
7 THICKNESS OF OVERBURDEN 28.5'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 28.5'
10 INSPECTOR STEVEN JOHNSON
11 NO. OF SAMPLES DISTURBED 13 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 06/22/99 END 06/23/99
15 ELEV TOP OF HOLE 407.333 NGVD
16 GROUNDWATER ELEV 393.083

CLASSIFICATION OF MATERIALS (DESCRIPTION)	spt/FT	% WC	% GVL	% SA	% FI	LL	PI
TAN, SILTY FINE TO COARSE SAND (SM) 6" TOPSOIL		7					
DARK BROWN, CLAY W/FINE SAND (CH)		27					
BROWN, CLAYEY SILT/SILTY CLAY (ML-CL)		22					
TAN, SILTY FINE SAND (SM)		5					
BROWN, FINE SANDY SILT (ML)		24					
SILT W/FINE SAND		29					
		24					
BROWN, CLAY (CL), W/BROWN SILT AND FINE SAND		22					
BROWN, SILTY FINE SAND/ FINE SANDY SILT (SM)		30					
DARK BROWN, CLAYEY SILT/SILTY CLAY (ML-CL)		30					
DARK BROWN, SILTY CLAY (CL) W/FINE SAND ON TOP		29					
TAN, SILTY FINE SAND (SM)		24					
LOOSE	10						
	7						
BOH AT 28.5'							



BORING NO. MB-25

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 1 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 592647.221E, 399381.390N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE
5 SIZE AND TYPE OF BIT HOLLOW STEM AUGER
6 DRILLER STEVE JOHNSON
7 THICKNESS OF OVERBURDEN 25'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 25'
10 INSPECTOR TOM McGILL
11 NO. OF SAMPLES DISTURBED 0 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 10/06/99 END 10/06/99
15 ELEV TOP OF HOLE 421.275 NGVD
16 GROUNDWATER ELEV 399.975

DEPTH | SYM | CLASSIFICATION OF MATERIALS (DESCRIPTION) | spt/FT | % WC | % GVL | % SA | % FI | LL | PI

GRASS, TOPSOIL TO 1'

SLIGHTLY MOIST, REDDISH BROWN, SILTY CLAY (CL), TRACE OF SAND

DARK BROWN, TRACE OF SAND

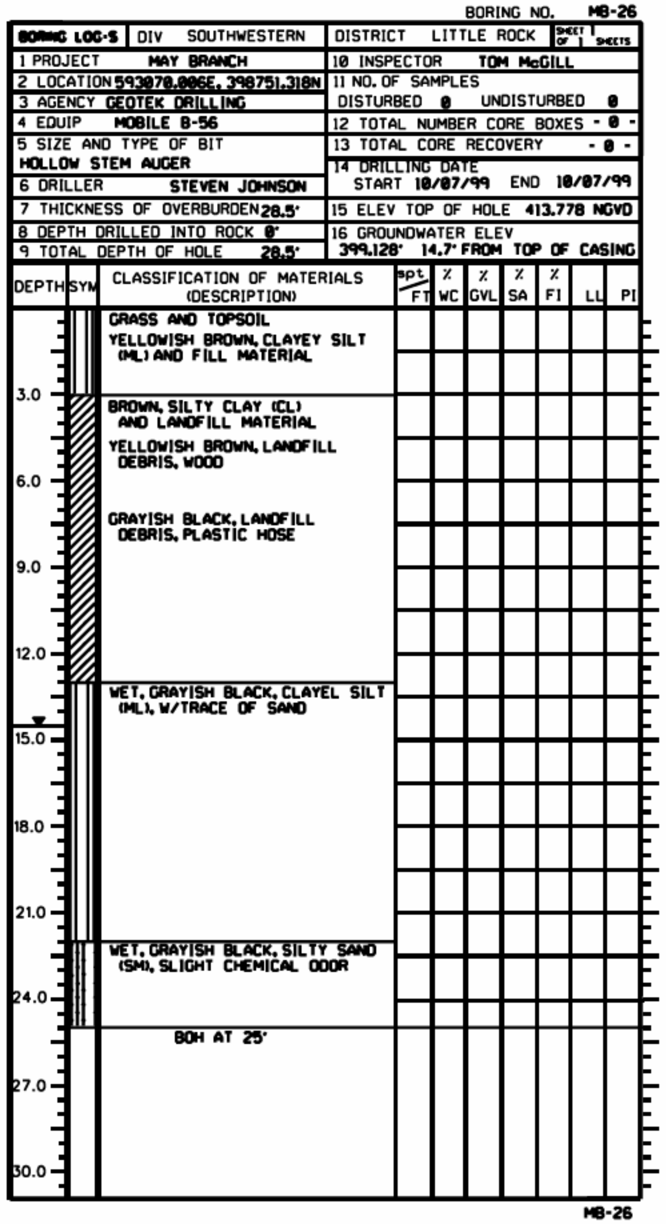
MOIST, DARK REDDISH BROWN, CLAYEY SILT (ML)

MOIST, REDDISH BROWN, SILTY CLAY (CH) W/TRACE OF SAND, HIGHLY PLASTIC

YELLOWISH-BROWN, SILT (ML) TRACE OF SAND AND CLAY

WET, YELLOWISH-BROWN, SAND (SM) W/SOME SILT AND CLAY

BOH AT 28.5'



BORING NO. MB-26

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 1 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 593070.006E, 398751.318N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE B-56
5 SIZE AND TYPE OF BIT HOLLOW STEM AUGER
6 DRILLER STEVEN JOHNSON
7 THICKNESS OF OVERBURDEN 28.5'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 28.5'
10 INSPECTOR TOM McGILL
11 NO. OF SAMPLES DISTURBED 0 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 10/07/99 END 10/07/99
15 ELEV TOP OF HOLE 413.778 NGVD
16 GROUNDWATER ELEV 399.128' 14.7' FROM TOP OF CASING

DEPTH | SYM | CLASSIFICATION OF MATERIALS (DESCRIPTION) | spt/FT | % WC | % GVL | % SA | % FI | LL | PI

GRASS AND TOPSOIL

YELLOWISH BROWN, CLAYEY SILT (ML) AND FILL MATERIAL

BROWN, SILTY CLAY (CL) AND LANDFILL MATERIAL

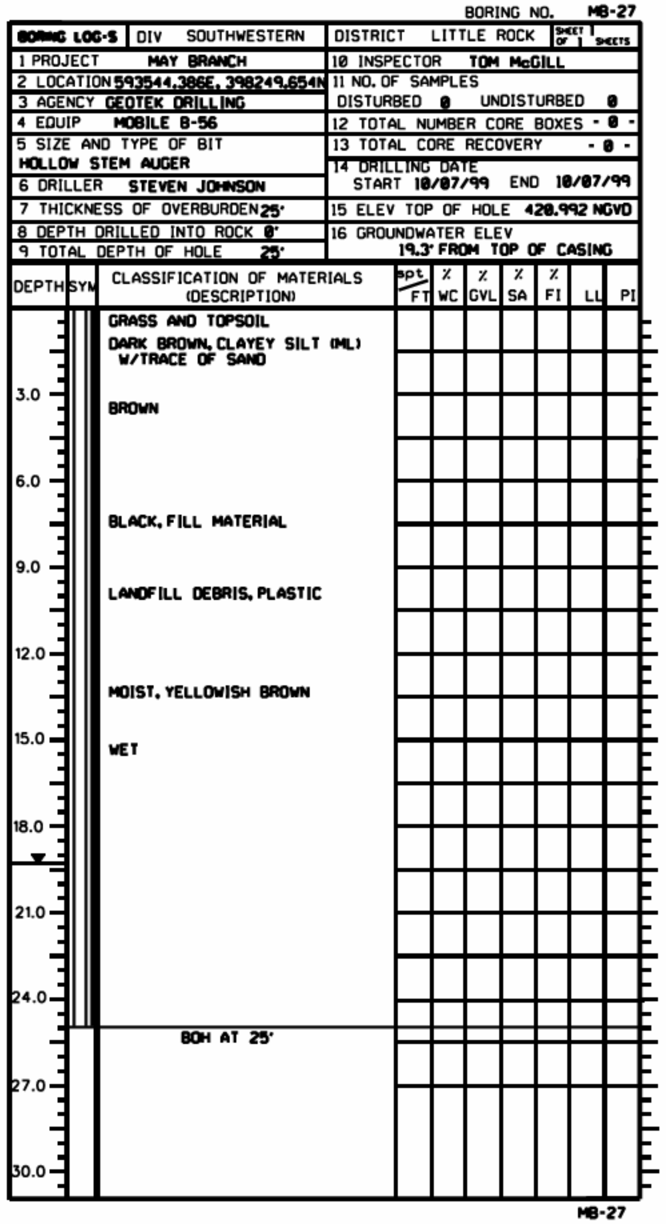
YELLOWISH BROWN, LANDFILL DEBRIS, WOOD

GRAYISH BLACK, LANDFILL DEBRIS, PLASTIC HOSE

WET, GRAYISH BLACK, CLAYEL SILT (ML), W/TRACE OF SAND

WET, GRAYISH BLACK, SILTY SAND (SM), SLIGHT CHEMICAL ODOR

BOH AT 25'



BORING NO. MB-27

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 1 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 593544.386E, 398249.654N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE B-56
5 SIZE AND TYPE OF BIT HOLLOW STEM AUGER
6 DRILLER STEVEN JOHNSON
7 THICKNESS OF OVERBURDEN 25'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 25'
10 INSPECTOR TOM McGILL
11 NO. OF SAMPLES DISTURBED 0 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 10/07/99 END 10/07/99
15 ELEV TOP OF HOLE 420.992 NGVD
16 GROUNDWATER ELEV 19.3' FROM TOP OF CASING

DEPTH | SYM | CLASSIFICATION OF MATERIALS (DESCRIPTION) | spt/FT | % WC | % GVL | % SA | % FI | LL | PI

GRASS AND TOPSOIL

DARK BROWN, CLAYEY SILT (ML) W/TRACE OF SAND

BROWN

BLACK, FILL MATERIAL

LANDFILL DEBRIS, PLASTIC

MOIST, YELLOWISH BROWN

WET

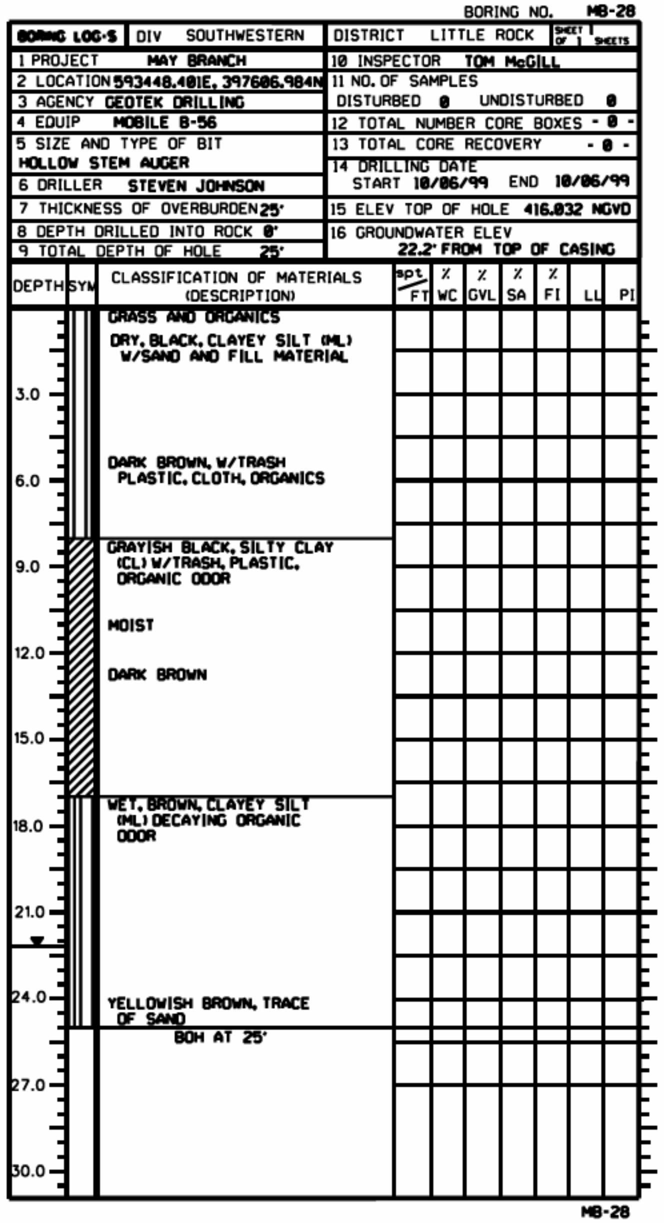
BOH AT 25'

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED | ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS MB24-MB27

SCALE: AS SHOWN | JANUARY 2005



BORING NO. MB-28

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 1 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 593448.401E, 397606.984N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE B-56
5 SIZE AND TYPE OF BIT HOLLOW STEM AUGER
6 DRILLER STEVEN JOHNSON
7 THICKNESS OF OVERBURDEN 25'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 25'
10 INSPECTOR TOM McGILL
11 NO. OF SAMPLES DISTURBED 0 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 10/06/99 END 10/06/99
15 ELEV TOP OF HOLE 416.032 NGVD
16 GROUNDWATER ELEV 22.2' FROM TOP OF CASING

CLASSIFICATION OF MATERIALS (DESCRIPTION)

GRASS AND ORGANICS

DRY, BLACK, CLAYEY SILT (ML) W/SAND AND FILL MATERIAL

DARK BROWN, W/TRASH PLASTIC, CLOTH, ORGANICS

GRAYISH BLACK, SILTY CLAY (CL) W/TRASH, PLASTIC, ORGANIC ODOR

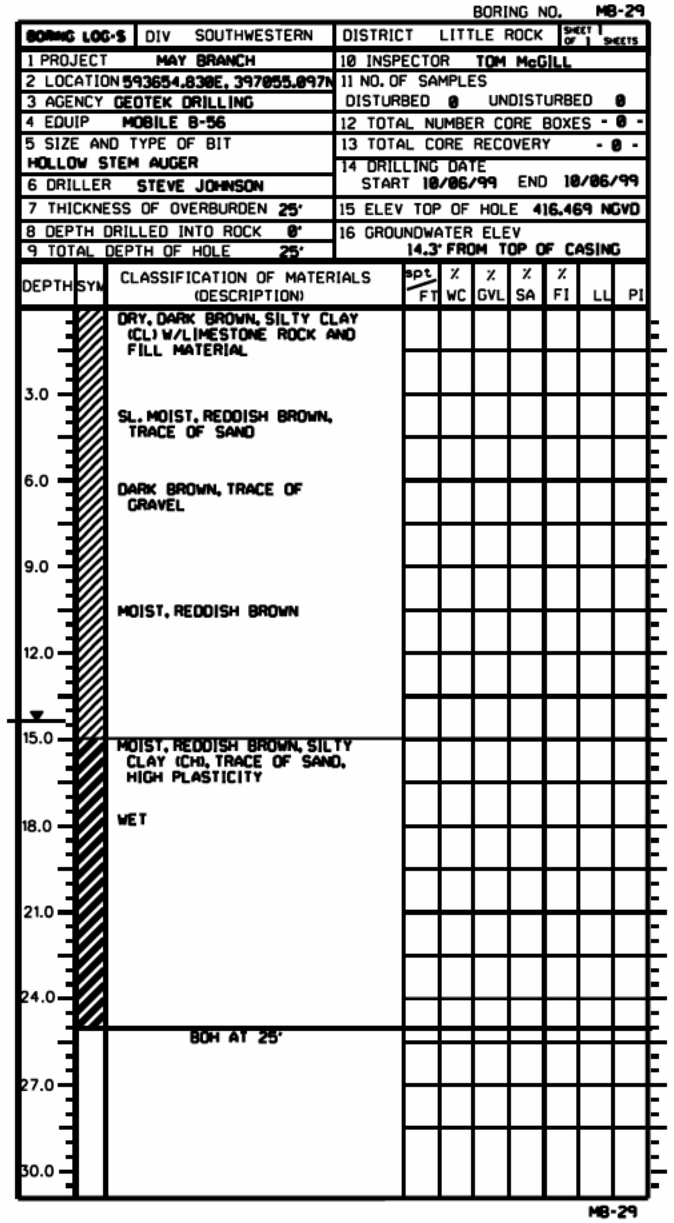
MOIST

DARK BROWN

WET, BROWN, CLAYEY SILT (ML) DECAYING ORGANIC ODOR

YELLOWISH BROWN, TRACE OF SAND

BOH AT 25'



BORING NO. MB-29

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 1 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION 593654.830E, 397055.097N
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE B-56
5 SIZE AND TYPE OF BIT HOLLOW STEM AUGER
6 DRILLER STEVE JOHNSON
7 THICKNESS OF OVERBURDEN 25'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 25'
10 INSPECTOR TOM McGILL
11 NO. OF SAMPLES DISTURBED 0 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 10/06/99 END 10/06/99
15 ELEV TOP OF HOLE 416.469 NGVD
16 GROUNDWATER ELEV 14.3' FROM TOP OF CASING

CLASSIFICATION OF MATERIALS (DESCRIPTION)

DRY, DARK BROWN, SILTY CLAY (CL) W/LIMESTONE ROCK AND FILL MATERIAL

SL. MOIST, REDDISH BROWN, TRACE OF SAND

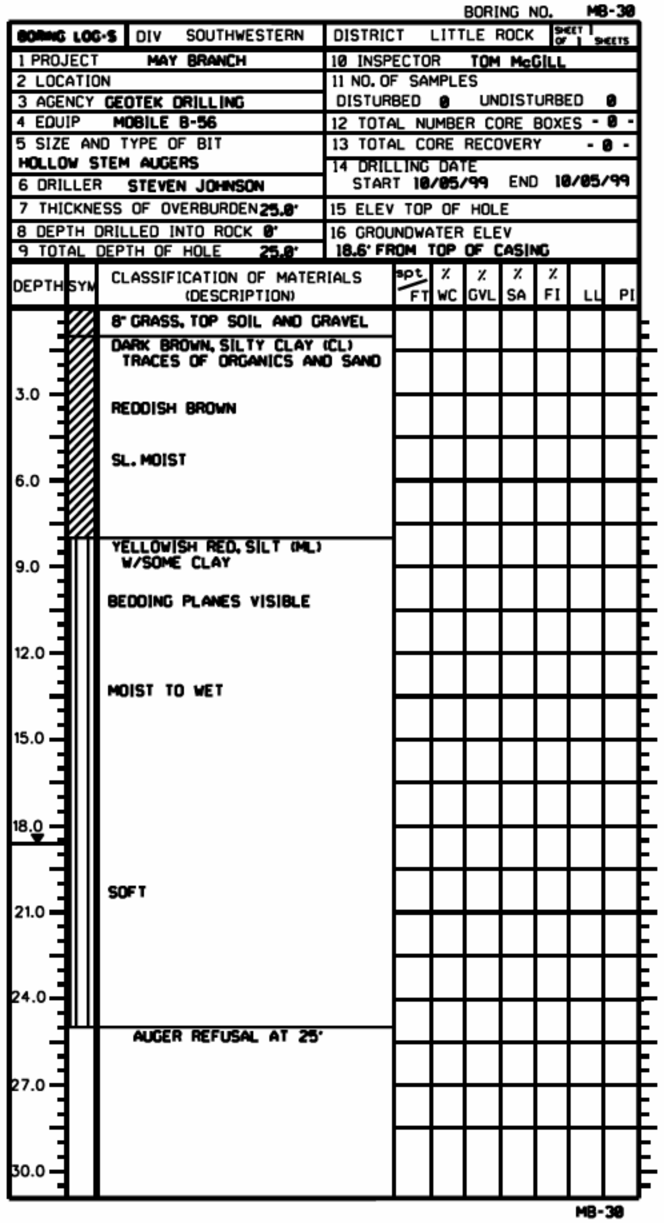
DARK BROWN, TRACE OF GRAVEL

MOIST, REDDISH BROWN

MOIST, REDDISH BROWN, SILTY CLAY (CH), TRACE OF SAND, HIGH PLASTICITY

WET

BOH AT 25'



BORING NO. MB-30

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 1 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE B-56
5 SIZE AND TYPE OF BIT HOLLOW STEM AUGERS
6 DRILLER STEVEN JOHNSON
7 THICKNESS OF OVERBURDEN 25.0'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 25.0'
10 INSPECTOR TOM McGILL
11 NO. OF SAMPLES DISTURBED 0 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 10/05/99 END 10/05/99
15 ELEV TOP OF HOLE
16 GROUNDWATER ELEV 18.6' FROM TOP OF CASING

CLASSIFICATION OF MATERIALS (DESCRIPTION)

8" GRASS, TOP SOIL AND GRAVEL

DARK BROWN, SILTY CLAY (CL) TRACES OF ORGANICS AND SAND

REDDISH BROWN

SL. MOIST

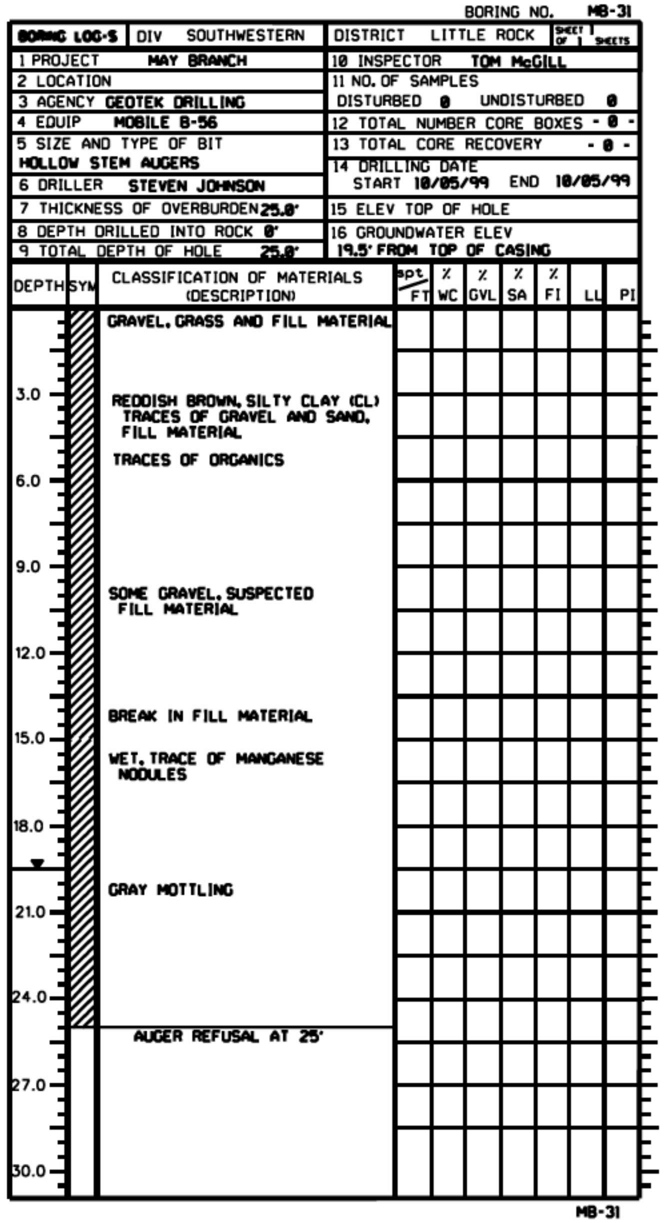
YELLOWISH RED, SILT (ML) W/SOME CLAY

BEDDING PLANES VISIBLE

MOIST TO WET

SOFT

AUGER REFUSAL AT 25'



BORING NO. MB-31

BORING LOG-S | DIV SOUTHWESTERN | DISTRICT LITTLE ROCK | SHEET 1 OF 1 SHEETS

1 PROJECT MAY BRANCH
2 LOCATION
3 AGENCY GEOTEK DRILLING
4 EQUIP MOBILE B-56
5 SIZE AND TYPE OF BIT HOLLOW STEM AUGERS
6 DRILLER STEVEN JOHNSON
7 THICKNESS OF OVERBURDEN 25.0'
8 DEPTH DRILLED INTO ROCK 0'
9 TOTAL DEPTH OF HOLE 25.0'
10 INSPECTOR TOM McGILL
11 NO. OF SAMPLES DISTURBED 0 UNDISTURBED 0
12 TOTAL NUMBER CORE BOXES - 0 -
13 TOTAL CORE RECOVERY - 0 -
14 DRILLING DATE START 10/05/99 END 10/05/99
15 ELEV TOP OF HOLE
16 GROUNDWATER ELEV 19.5' FROM TOP OF CASING

CLASSIFICATION OF MATERIALS (DESCRIPTION)

GRAVEL, GRASS AND FILL MATERIAL

REDDISH BROWN, SILTY CLAY (CL) TRACES OF GRAVEL AND SAND, FILL MATERIAL

TRACES OF ORGANICS

SOME GRAVEL, SUSPECTED FILL MATERIAL

BREAK IN FILL MATERIAL

WET, TRACE OF MANGANESE NODULES

GRAY MOTTLING

AUGER REFUSAL AT 25'

DEPARTMENT OF THE ARMY
LITTLE ROCK DISTRICT, CORPS OF ENGINEERS
LITTLE ROCK, ARKANSAS

ARKANSAS RIVER WATERSHED
ARKANSAS RIVER, ARKANSAS

MAY BRANCH - FORT SMITH, ARKANSAS
FEASIBILITY STUDY
BORING LOGS MB28-MB31

SCALE: AS SHOWN
JANUARY 2005

PLATE G-15

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                                                                                QUANTITY UOM    CONTRACT  CONTINGN  ESCALATN  TOTAL COST  UNIT COST
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                                                01  Lands and Damages                1.00 EA   2,616,700   523,340   471,006   3,611,046 3611046.00
                                                02  Relocations                      1.00 EA   2,406,218   240,622   413,717   3,060,557 3060556.89
                                                08  Roads, Railroads, and Bridges    1.00 EA   3,561,317   534,198   640,153   4,735,668 4735668.04
                                                09  Channels and Canals              1.00 EA   6,259,533   938,930 1,125,016   8,323,480 8323479.53
                                                15  Floodway Control-Diversion Struc 1.00 EA     471,618    70,743    84,771     627,132  627132.03
                                                30  Planning, Engineering & Design   1.00 EA   1,272,451   127,245   263,143   1,662,839 1662838.97
                                                31  Supervision and Administration   1.00 EA   1,145,207   114,521   288,478   1,548,205 1548205.34
                                                                                              ----------- --------- --------- -----------
                                              TOTAL MAY BRANCH - FEASI. STUDY - C-10         1.00 EA  17,733,045 2,549,598 3,286,284  23,568,927 23568926.80
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	QUANTITY UOM	CONTRACT	CONTINGN	ESCALATN	TOTAL COST	UNIT COST
01 Lands and Damages						
01.01 Reach 1	1.00 EA	423,800	84,760	76,284	584,844	584844.00
01.02 Reach 2	1.00 EA	1,097,600	219,520	197,568	1,514,688	1514688.00
01.03 Reach 3	1.00 EA	303,000	60,600	54,540	418,140	418140.00
01.04 Reach 4	1.00 EA	792,300	158,460	142,614	1,093,374	1093374.00
TOTAL Lands and Damages	1.00 EA	2,616,700	523,340	471,006	3,611,046	3611046.00
02 Relocations						
02.03 Cementeries, Utilities & Str.	1.00 EA	2,406,218	240,622	413,717	3,060,557	3060556.89
TOTAL Relocations	1.00 EA	2,406,218	240,622	413,717	3,060,557	3060556.89
08 Roads, Railroads, and Bridges						
08.01 Roads	1.00 EA	1,567,677	235,152	281,793	2,084,621	2084621.18
08.02 Railroads	1.00 EA	1,993,640	299,046	358,360	2,651,047	2651046.86
TOTAL Roads, Railroads, and Bridges	1.00 EA	3,561,317	534,198	640,153	4,735,668	4735668.04
09 Channels and Canals						
09.01 Channels	1.00 EA	6,259,533	938,930	1,125,016	8,323,480	8323479.53
TOTAL Channels and Canals	1.00 EA	6,259,533	938,930	1,125,016	8,323,480	8323479.53
15 Floodway Control-Diversion Struc						
15.01 Hydraulic Control Structure	1.00 EA	471,618	70,743	84,771	627,132	627132.03
TOTAL Floodway Control-Diversion Struc	1.00 EA	471,618	70,743	84,771	627,132	627132.03
30 Planning, Engineering & Design						
30.10 Planning, Engineering & Design	1.00 EA	1,272,451	127,245	263,143	1,662,839	1662838.97
TOTAL Planning, Engineering & Design	1.00 EA	1,272,451	127,245	263,143	1,662,839	1662838.97
31 Supervision and Administration						
31.10 Supervision and Administration	1.00 EA	1,145,207	114,521	288,478	1,548,205	1548205.34

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                                                                               QUANTITY UOM    CONTRACT  CONTINGN  ESCALATN  TOTAL COST   UNIT COST
------------------------------------------------------------------------------------------------------------------------------------------------------------------------

                                            TOTAL Supervision and Administration          1.00 EA   1,145,207   114,521   288,478   1,548,205  1548205.34
                                                                                                  ----------- --------- --------- -----------
                                            TOTAL MAY BRANCH - FEASI. STUDY - C-10        1.00 EA  17,733,045 2,549,598 3,286,284  23,568,927 23568926.80
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ue 03 Aug 2004                                         U.S. Army Corps of Engineers                                         TIME 10:04:20
ff. Date  08/01/04              PROJECT 10OMMR:   MAY BRANCH-FEASI. STUDY-O&M Est. - Operation and Maintenance Cost
                                                   Preliminary Feasibility Cost Estimate - O&M                           SUMMARY PAGE    1
                                                     ** PROJECT OWNER SUMMARY - Feature **

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                                                                                QUANTITY UOM    CONTRACT  CONTINGY  ESCALATN  TOTAL COST   UNIT COST
-----------------------------------------------------------------------------------------------------------------------------------------

                                           15  Floodway Control and Div Str.            1.00 EA      47,021         0         0      47,021    47021.22
                                                                                              ----------- --------- --------- -----------
                                          TOTAL MAY BRANCH-FEASI. STUDY-O&M Est.        1.00 EA      47,021         0         0      47,021    47021.22
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ABOR ID: 03A2R0    EQUIP ID: RG3299                          Currency in DOLLARS                              CREW ID: NAT01A   UPB ID: U01EAR
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U.S. Army Corps of Engineers
PROJECT LPPLAN: MAY BRANCH-FEASI. STUDY-C100-C10 - LOCALLY PREFERRED PLAN (LPP)
LPP Cost Estimate - C-10(Rch 3&4) & C-100 (1&2)
** PROJECT OWNER SUMMARY - Feature **

		QUANTITY	UOM	CONTRACT	CONTINGN	ESCALATN	TOTAL COST	UNIT COST
01	Lands and Damages	1.00	EA	2,731,300	546,260	491,634	3,769,194	3,769,194.00
02	Relocations	1.00	EA	2,399,395	239,940	437,815	3,077,150	3,077,149.57
08	Roads, Railroads, and Bridges	1.00	EA	4,143,623	621,543	790,450	5,555,616	5,555,616.00
09	Channels and Canals	1.00	EA	6,614,677	992,202	1,261,729	8,868,607	8,868,607.31
15	Floodway Control-Diversion Struc	1.00	EA	471,753	70,763	89,995	632,511	632,510.81
30	Planning, Engineering & Design	1.00	EA	1,369,249	136,925	283,161	1,789,335	1,789,334.59
31	Supervision and Administration	1.00	EA	1,232,324	123,232	310,422	1,665,979	1,665,978.82
TOTAL	MAY BRANCH-FEASI. STUDY-C100-C10	1.00	EA	18,962,321	2,730,865	3,665,206	25,358,391	25358391.11

25,358,400 Total cost
-3,665,200 Escalation
21,693,200 Total w/o escalation
+5,000 wingwalls
21,698,200 LPP cost w/o escalation

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                                  ** PROJECT OWNER SUMMARY - Feature **

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                                                         QUANTITY UOM    CONTRACT  CONTINGY  ESCALATN  TOTAL COST   UNIT COST
---------------------------------------------------------------------------------------------------------------------------

                          15  Floodway Control and Div Str.      1.00 EA      56,665         0         0      56,665    56664.72
                                                                          ----------- --------- --------- -----------
                        TOTAL MAY BR-FEASI STUDY-100YR O&M Est   1.00 EA      56,665         0         0      56,665    56664.72
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U.S. Army Corps of Engineers
PROJECT 10YEAR: MAY BRANCH - FEASIBILITY STUDY - 10-Year Channel Alternative
Feasibility Cost Estimate - 10 YEAR, Reach 5 & 6
** PROJECT OWNER SUMMARY - Feature **

		QUANTITY	UOM	CONTRACT	CONTINGN	ESCALATN	TOTAL COST	UNIT COST
02	Relocations	1.00	EA	694,172	69,417	154,198	917,787	917787.28
08	Roads, Railroads, and Bridges	1.00	EA	223,467	33,520	71,767	328,754	328753.81
09	Channels and Canals	1.00	EA	1,127,260	169,089	261,781	1,558,129	1558129.24
30	Planning, Engineering & Design	1.00	EA	204,490	20,449	9,204	234,143	234142.84
31	Supervision and Administration	1.00	EA	184,041	18,404	44,176	246,621	246620.95
TOTAL	MAY BRANCH - FEASIBILITY STUDY	1.00	EA	2,433,429	310,879	541,126	3,285,434	3285434.12

SCHEDULE

MAY BRANCH - FEASI. STUDY - C-10	1225.13d	1/2/08 8:00 AM	11/16/12 9:00 AM	
Contract Performance Time	1225.13d	1/2/08 8:00 AM	11/16/12 9:00 AM	
Submittals	22d	1/2/08 8:00 AM	2/1/08 5:00 PM	
Notice to Proceed	1d	2/4/08 8:00 AM	2/4/08 5:00 PM	3
Mobilization	10d	2/5/08 8:00 AM	2/19/08 5:00 PM	4
Relocations	158.75d	2/20/08 8:00 AM	10/2/08 3:00 PM	
"Cementeries, Utilities & Str."	158.75d	2/20/08 8:00 AM	10/2/08 3:00 PM	
Utilities	158.75d	2/20/08 8:00 AM	10/2/08 3:00 PM	
Reach 1	23.38d	2/20/08 8:00 AM	3/24/08 11:00 AM	
Sanitary Sewer	10.88d	2/20/08 8:00 AM	3/5/08 4:00 PM	
"Remove 10"" Sanitary Sewer (SS)"	11h	2/20/08 8:00 AM	2/21/08 11:00 AM	5
"Remove 48"" SS Line"	18h	2/21/08 11:00 AM	2/25/08 2:00 PM	11
Remove Manhole	2h	2/25/08 2:00 PM	2/25/08 4:00 PM	12
"Install New 10"" SS Line"	22h	2/27/08 1:00 PM	3/3/08 10:00 AM	21
"Install New 48"" SS Line"	10h	3/3/08 10:00 AM	3/4/08 12:00 PM	14
"Install New 30"" SS Line"	7h	3/4/08 1:00 PM	3/5/08 11:00 AM	15
Install New Manhole	4h	3/5/08 11:00 AM	3/5/08 4:00 PM	16
Potable Water	9.63d	2/25/08 4:00 PM	3/10/08 12:00 PM	
"Remove 2"" Waterline"	1h	2/25/08 4:00 PM	2/25/08 5:00 PM	13
"Remove 6"" Waterline"	8h	2/26/08 8:00 AM	2/26/08 5:00 PM	19
"Remove 20"" Waterline"	4h	2/27/08 8:00 AM	2/27/08 12:00 PM	20
"Rebuild 2"" Waterline"	1h	3/5/08 4:00 PM	3/5/08 5:00 PM	17
"Rebuild 6"" Waterline"	7h	3/6/08 8:00 AM	3/6/08 4:00 PM	22
"Rebuild 10"" Waterline"	13h	3/6/08 4:00 PM	3/10/08 12:00 PM	23
Gas	9.88d	3/10/08 1:00 PM	3/24/08 11:00 AM	
"Relocate 2"" LP Gas Line"	12h	3/10/08 1:00 PM	3/11/08 5:00 PM	24
"Relocate 4"" LP Gas Line"	12h	3/12/08 8:00 AM	3/13/08 12:00 PM	26
"Relocate 4"" HP Gas Line"	8h	3/13/08 1:00 PM	3/14/08 12:00 PM	27
"Relocate 4"" HP Gas Line"	16h	3/14/08 1:00 PM	3/18/08 12:00 PM	28
"Relocate 10"" HP Gas Line"	31h	3/18/08 1:00 PM	3/24/08 11:00 AM	29
Reach 2	100.38d	3/24/08 11:00 AM	8/13/08 3:00 PM	
Sanitary Sewer	40.5d	3/24/08 11:00 AM	5/19/08 4:00 PM	
"Remove 24"" Sanitary Sewer (SS)"	56h	3/24/08 11:00 AM	4/2/08 11:00 AM	30
"Remove 8"" Sanitary Sewer (SS)"	8h	4/2/08 11:00 AM	4/3/08 11:00 AM	33
"Remove 20"" Sanitary Sewer (SS)"	100h	4/3/08 11:00 AM	4/21/08 4:00 PM	34
Remove Manhole	22h	4/21/08 4:00 PM	4/24/08 2:00 PM	35
"Install New 24"" SS Line"	82h	4/24/08 2:00 PM	5/8/08 4:00 PM	36
"Install New 8"" SS Line"	4h	5/8/08 4:00 PM	5/9/08 11:00 AM	37
"Install New 18"" SS Line"	8h	5/9/08 11:00 AM	5/12/08 11:00 AM	38
Install New Manhole	44h	5/12/08 11:00 AM	5/19/08 4:00 PM	39
Potable Water	2.63d	5/19/08 4:00 PM	5/22/08 12:00 PM	
"Remove 6"" Waterline"	13h	5/19/08 4:00 PM	5/21/08 12:00 PM	40
"Rebuild 6"" Waterline"	8h	5/21/08 1:00 PM	5/22/08 12:00 PM	42
Gas	14.75d	5/22/08 1:00 PM	6/13/08 10:00 AM	
"Relocate 2"" LP Gas Line"	55h	5/22/08 1:00 PM	6/3/08 11:00 AM	43
"Relocate 4"" LP Gas Line"	13h	6/3/08 11:00 AM	6/4/08 5:00 PM	45
"Relocate 6"" LP Gas Line"	18h	6/5/08 8:00 AM	6/9/08 10:00 AM	46
"Relocate 10"" HP Gas Line"	32h	6/9/08 10:00 AM	6/13/08 10:00 AM	47
Telephone	42.5d	6/13/08 10:00 AM	8/13/08 3:00 PM	
Underground Fiber Optic Cable	32h	6/13/08 10:00 AM	6/19/08 10:00 AM	48
UG Twisted Pair Telecom Cables	288h	6/19/08 10:00 AM	8/11/08 10:00 AM	50
FO Splice Connectors	1h	8/11/08 10:00 AM	8/11/08 11:00 AM	51
FO Splice Closure-WP	1h	8/11/08 11:00 AM	8/11/08 12:00 PM	52
Manholes	6h	8/11/08 1:00 PM	8/12/08 10:00 AM	53
Boring	10h	8/12/08 10:00 AM	8/13/08 12:00 PM	54
Trench Excavation	1h	8/13/08 1:00 PM	8/13/08 2:00 PM	55
Trench Backfill & Compaction	1h	8/13/08 2:00 PM	8/13/08 3:00 PM	56
Reach 3	30.75d	2/20/08 8:00 AM	4/2/08 3:00 PM	
Sanitary Sewer (none)	13.75d	2/20/08 8:00 AM	3/10/08 3:00 PM	
"Remove 6"" Sanitary Sewer (SS)"	8h	2/20/08 8:00 AM	2/20/08 5:00 PM	5
"Remove 8"" SS Line"	8h	2/21/08 8:00 AM	2/21/08 5:00 PM	60
"Remove 15"" SS Line"	8h	2/22/08 8:00 AM	2/22/08 5:00 PM	61
Remove Manhole	4h	2/25/08 8:00 AM	2/25/08 12:00 PM	62
"Install New 6"" SS Line"	16h	2/27/08 3:00 PM	2/29/08 3:00 PM	74
"Install New 8"" SS Line"	20h	2/29/08 3:00 PM	3/5/08 10:00 AM	64
"Install New 18"" SS Line"	20h	3/5/08 10:00 AM	3/7/08 3:00 PM	65
Install New Manhole	8h	3/7/08 3:00 PM	3/10/08 3:00 PM	66
Potable Water	2.25d	2/25/08 1:00 PM	2/27/08 3:00 PM	
"Remove 2"" Waterline"	1h	2/25/08 1:00 PM	2/25/08 2:00 PM	63
"Remove 8"" Waterline"	2h	2/25/08 2:00 PM	2/25/08 4:00 PM	69

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"Remove 22"" Waterline"	3h	2/25/08 4:00 PM	2/26/08 10:00 AM	70
"Rebuild 2"" Waterline"	1h	2/26/08 10:00 AM	2/26/08 11:00 AM	71
"Rebuild 8"" Waterline"	1h	2/26/08 11:00 AM	2/26/08 12:00 PM	72
"Rebuild 22"" Waterline"	10h	2/26/08 1:00 PM	2/27/08 3:00 PM	73
Gas	17d	3/10/08 3:00 PM	4/2/08 3:00 PM	
"Relocate 2"" LP Gas Line"	9h	3/10/08 3:00 PM	3/11/08 4:00 PM	67
"Relocate 4"" LP Gas Line"	17h	3/11/08 4:00 PM	3/13/08 5:00 PM	76
"Relocate 10"" HP Gas Line"	110h	3/14/08 8:00 AM	4/2/08 3:00 PM	77
Reach 4	128d	4/2/08 3:00 PM	10/2/08 3:00 PM	
Sanitary Sewer	56.13d	4/2/08 3:00 PM	6/20/08 4:00 PM	
"Remove 20"" Sanitary Sewer (SS)"	168h	4/2/08 3:00 PM	5/1/08 3:00 PM	78
"Remove 8"" Sanitary Sewer (SS)"	23h	5/1/08 3:00 PM	5/6/08 2:00 PM	81
"Remove 21"" Sanitary Sewer (SS)"	4h	5/6/08 2:00 PM	5/7/08 9:00 AM	82
Remove Manholes (All in reach)	28h	5/7/08 9:00 AM	5/12/08 2:00 PM	83
"Install New 24"" SS Line"	90h	5/20/08 11:00 AM	6/5/08 2:00 PM	97
"Install New 8"" SS Line"	27h	6/5/08 2:00 PM	6/10/08 5:00 PM	85
"Install New 18"" SS Line"	8h	6/11/08 8:00 AM	6/11/08 5:00 PM	86
Install New Manhole	55h	6/12/08 8:00 AM	6/20/08 4:00 PM	87
Potable Water	5.75d	5/12/08 2:00 PM	5/20/08 11:00 AM	
"Remove 6"" Waterline"	18h	5/12/08 2:00 PM	5/14/08 4:00 PM	84
"Remove 10"" Waterline"	2h	5/14/08 4:00 PM	5/15/08 9:00 AM	90
"Rebuild 6"" Waterline"	11h	5/15/08 9:00 AM	5/16/08 12:00 PM	91
"Rebuild 10"" Waterline"	11h	5/16/08 1:00 PM	5/19/08 4:00 PM	92
"Install 6"" Valves"	1h	5/19/08 4:00 PM	5/19/08 5:00 PM	93
"Install 4"" Valves"	1h	5/20/08 8:00 AM	5/20/08 9:00 AM	94
Install Fire Hydrants	1h	5/20/08 9:00 AM	5/20/08 10:00 AM	95
"Install 6"" to 4"" reducer"	1h	5/20/08 10:00 AM	5/20/08 11:00 AM	96
Gas	44.25d	6/20/08 4:00 PM	8/25/08 9:00 AM	
"Relocate 2"" LP Gas Line"	24h	6/20/08 4:00 PM	6/25/08 4:00 PM	88
"Relocate 4"" LP Gas Line"	28h	6/25/08 4:00 PM	7/1/08 11:00 AM	99
"Relocate 10"" HP Gas Line"	78h	7/1/08 11:00 AM	7/16/08 9:00 AM	100
"Relocate 6"" LP Gas Line"	14h	7/16/08 9:00 AM	7/17/08 4:00 PM	101
"Relocate 8"" MP Gas Line"	14h	7/17/08 4:00 PM	7/21/08 2:00 PM	102
"Relocate 12"" HP Gas Line"	196h	7/21/08 2:00 PM	8/25/08 9:00 AM	103
Telephone	27.63d	8/25/08 9:00 AM	10/2/08 3:00 PM	
UG Twisted Pair Telecom Cables	202h	8/25/08 9:00 AM	9/30/08 11:00 AM	104
Manholes	6h	9/30/08 11:00 AM	10/1/08 9:00 AM	106
Boring (2 runs)	11h	10/1/08 9:00 AM	10/2/08 12:00 PM	107
Trench Excavation	1h	10/2/08 1:00 PM	10/2/08 2:00 PM	108
Trench Backfill & Compaction	1h	10/2/08 2:00 PM	10/2/08 3:00 PM	109
Structures	87.25d	2/20/08 8:00 AM	6/23/08 10:00 AM	
Reach 1	75.25d	2/20/08 8:00 AM	6/5/08 10:00 AM	
Slab @ Sta 23	14.5d	2/20/08 8:00 AM	3/11/08 12:00 PM	
Slab Break-up & Haul-off	116h	2/20/08 8:00 AM	3/11/08 12:00 PM	5
Metal Bldg @ Sta. 26+00	18.75d	3/11/08 1:00 PM	4/7/08 10:00 AM	
Demolish Steel Comm. Bldg.	65h	3/11/08 1:00 PM	3/21/08 2:00 PM	114
Remove Steel Debris	50h	3/21/08 2:00 PM	3/31/08 4:00 PM	116
Slab Break-up & Haul-off	35h	3/31/08 4:00 PM	4/7/08 10:00 AM	117
Metal Bldg @ Sta. 40+00	37.5d	4/7/08 10:00 AM	5/29/08 3:00 PM	
Demolish Steel Comm. Bldg.	130h	4/7/08 10:00 AM	4/29/08 12:00 PM	118
Remove Steel Debris	100h	4/29/08 1:00 PM	5/15/08 5:00 PM	120
Slab Break-up & Haul-off	70h	5/16/08 8:00 AM	5/29/08 3:00 PM	121
Metal Bldg @ Sta. 42+00	4.5d	5/29/08 3:00 PM	6/5/08 10:00 AM	
Demolish Steel Comm. Bldg.	16h	5/29/08 3:00 PM	6/2/08 3:00 PM	122
Remove Steel Debris	12h	6/2/08 3:00 PM	6/4/08 10:00 AM	124
Slab Break-up & Haul-off	8h	6/4/08 10:00 AM	6/5/08 10:00 AM	125
Reach 2	12d	6/5/08 10:00 AM	6/23/08 10:00 AM	
House @ 47+50	1d	6/5/08 10:00 AM	6/6/08 10:00 AM	
Demolition	8h	6/5/08 10:00 AM	6/6/08 10:00 AM	126
House @ 51+05	1d	6/6/08 10:00 AM	6/9/08 10:00 AM	
Demolition	8h	6/6/08 10:00 AM	6/9/08 10:00 AM	129
House @ 51+05	0.5d	6/9/08 10:00 AM	6/9/08 3:00 PM	
Demolition	4h	6/9/08 10:00 AM	6/9/08 3:00 PM	131
Slab @ Sta 54+50	0.63d	6/9/08 3:00 PM	6/10/08 11:00 AM	
Slab Break-up & Haul-off	5h	6/9/08 3:00 PM	6/10/08 11:00 AM	133
House @ 54+50	1d	6/10/08 11:00 AM	6/11/08 11:00 AM	
Demolition	8h	6/10/08 11:00 AM	6/11/08 11:00 AM	135
House @ 54+50	1d	6/11/08 11:00 AM	6/12/08 11:00 AM	
Demolition	8h	6/11/08 11:00 AM	6/12/08 11:00 AM	137

House @ 54+50	1d	6/12/08 11:00 AM	6/13/08 11:00 AM	
Demolition	8h	6/12/08 11:00 AM	6/13/08 11:00 AM	139
Brick Building @ 57+00	0.88d	6/13/08 11:00 AM	6/16/08 10:00 AM	
Demolition	7h	6/13/08 11:00 AM	6/16/08 10:00 AM	141
House @ 57+00	1d	6/16/08 10:00 AM	6/17/08 10:00 AM	
Demolition	8h	6/16/08 10:00 AM	6/17/08 10:00 AM	143
House @ 62+50 (3)	1d	6/17/08 10:00 AM	6/18/08 10:00 AM	
Demolition	8h	6/17/08 10:00 AM	6/18/08 10:00 AM	145
House @ 62+50 (3)	1d	6/18/08 10:00 AM	6/19/08 10:00 AM	
Demolition	8h	6/18/08 10:00 AM	6/19/08 10:00 AM	147
House @ 62+50 (5)	1d	6/19/08 10:00 AM	6/20/08 10:00 AM	
Demolition	8h	6/19/08 10:00 AM	6/20/08 10:00 AM	149
House @ 63+10	1d	6/20/08 10:00 AM	6/23/08 10:00 AM	
Demolition	8h	6/20/08 10:00 AM	6/23/08 10:00 AM	151
"Roads, Railroads, and Bridges"	485.88d	6/23/08 10:00 AM	6/1/10 9:00 AM	
Roads	200.25d	6/23/08 10:00 AM	4/10/09 12:00 PM	
Demolition	7.75d	6/23/08 10:00 AM	7/2/08 5:00 PM	
Reach 1	1.5d	6/23/08 10:00 AM	6/24/08 3:00 PM	
Demolition - Pavement Removal	1.5d	6/23/08 10:00 AM	6/24/08 3:00 PM	
Remove Pavement @ Sta. 45+00	4h	6/23/08 10:00 AM	6/23/08 3:00 PM	153
Remove Pavement @ Sta. 25+45	8h	6/23/08 3:00 PM	6/24/08 3:00 PM	159
Reach 2	3.38d	6/24/08 3:00 PM	6/30/08 9:00 AM	
Demolition	3.38d	6/24/08 3:00 PM	6/30/08 9:00 AM	
Demolition Roadway @ 47+05	4h	6/24/08 3:00 PM	6/25/08 10:00 AM	160
Remove Pavement @ Sta. 50+60	4h	6/25/08 10:00 AM	6/25/08 3:00 PM	163
Demolition Roadway @ 61+90	3h	6/25/08 3:00 PM	6/26/08 9:00 AM	164
Demolition Roadway @ 54+10	3h	6/26/08 9:00 AM	6/26/08 12:00 PM	165
Remove Pavement @ Sta. 58+00	10h	6/26/08 1:00 PM	6/27/08 3:00 PM	166
Remove Pavement @ Sta. 65+40	3h	6/27/08 3:00 PM	6/30/08 9:00 AM	167
Reach 3	2d	6/23/08 10:00 AM	6/25/08 10:00 AM	
Demolition	2d	6/23/08 10:00 AM	6/25/08 10:00 AM	
Remove Pavement @ Sta. 76+75	7h	6/23/08 10:00 AM	6/24/08 9:00 AM	153
Remove Pavement @ Sta. 81+70	4h	6/24/08 9:00 AM	6/24/08 2:00 PM	171
Remove Pavement @ Sta. 92+00	5h	6/24/08 2:00 PM	6/25/08 10:00 AM	172
Reach 4	5.75d	6/25/08 10:00 AM	7/2/08 5:00 PM	
Demolition	5.75d	6/25/08 10:00 AM	7/2/08 5:00 PM	
Demolition Roadway @ 102+20 +	37h	6/25/08 10:00 AM	7/1/08 4:00 PM	173
Remove Pavement @ Sta. 105+75	3h	7/1/08 4:00 PM	7/2/08 10:00 AM	176
Remove Pavement @ Sta. 119+05	6h	7/2/08 10:00 AM	7/2/08 5:00 PM	177
Drainage - Box Culverts (NEW)	147.88d	6/30/08 9:00 AM	2/2/09 5:00 PM	
Reach 2	92.38d	6/30/08 9:00 AM	11/10/08 12:00 PM	
Midland Blvd (Sta 58+00)	92.38d	6/30/08 9:00 AM	11/10/08 12:00 PM	
Earthwork	128h	6/30/08 9:00 AM	7/23/08 9:00 AM	168
Formwork	220h	7/23/08 9:00 AM	8/29/08 2:00 PM	182
Steel Reinforcement	31h	8/29/08 2:00 PM	9/5/08 12:00 PM	183
Concrete Cast-in-place	348h	9/5/08 1:00 PM	11/6/08 5:00 PM	184
Concrete Curing	12h	11/7/08 8:00 AM	11/10/08 12:00 PM	185
Reach 3	128.75d	7/3/08 8:00 AM	1/8/09 3:00 PM	
Greenwood Ave. (Sta 76+75)	56.13d	7/3/08 8:00 AM	9/23/08 9:00 AM	
Earthwork	56h	7/3/08 8:00 AM	7/14/08 5:00 PM	178
Formwork	140h	7/15/08 8:00 AM	8/7/08 12:00 PM	189
Steel Reinforcement	17h	8/7/08 1:00 PM	8/11/08 2:00 PM	190
Concrete Cast-in-place	228h	8/11/08 2:00 PM	9/22/08 9:00 AM	191
Concrete Curing	8h	9/22/08 9:00 AM	9/23/08 9:00 AM	192
Arkhola (Sta 86+10)	3.25d	9/23/08 9:00 AM	9/26/08 11:00 AM	
Formwork	8h	9/23/08 9:00 AM	9/24/08 9:00 AM	193
Steel Reinforcement	8h	9/24/08 9:00 AM	9/25/08 9:00 AM	195
Concrete Cast-in-place	8h	9/25/08 9:00 AM	9/26/08 9:00 AM	196
Concrete Curing	2h	9/26/08 9:00 AM	9/26/08 11:00 AM	197
"N. ""O"" Street (Sta 92+00)"	69.38d	9/26/08 11:00 AM	1/8/09 3:00 PM	
Earthwork	111h	9/26/08 11:00 AM	10/17/08 10:00 AM	198
Formwork	161h	10/17/08 10:00 AM	11/17/08 11:00 AM	200
Steel Reinforcement	20h	11/17/08 11:00 AM	11/19/08 4:00 PM	201
Concrete Cast-in-place	255h	11/19/08 4:00 PM	1/7/09 3:00 PM	202
Concrete Curing	8h	1/7/09 3:00 PM	1/8/09 3:00 PM	203
Reach 4	55.5d	11/10/08 1:00 PM	2/2/09 5:00 PM	
Grand Ave. (Sta 119+05)	55.5d	11/10/08 1:00 PM	2/2/09 5:00 PM	
Earthwork	49h	11/10/08 1:00 PM	11/19/08 2:00 PM	186
Formwork	137h	11/19/08 2:00 PM	12/15/08 3:00 PM	207
Steel Reinforcement	18h	12/15/08 3:00 PM	12/17/08 5:00 PM	208

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Concrete Cast-in-place	232h	12/18/08 8:00 AM	1/30/09 5:00 PM	209
Concrete Curing	8h	2/2/09 8:00 AM	2/2/09 5:00 PM	210
"Bridges, Foundations"	19.63d	1/8/09 3:00 PM	2/6/09 11:00 AM	
Reach 1	19.63d	1/8/09 3:00 PM	2/6/09 11:00 AM	
Concrete - 6th Street	1.25d	2/3/09 8:00 AM	2/4/09 10:00 AM	
Piling Encasements	8h	2/3/09 8:00 AM	2/3/09 5:00 PM	211
Concrete for Wingwall	1h	2/4/09 8:00 AM	2/4/09 9:00 AM	215
Concrete for Wingwall Footings	1h	2/4/09 9:00 AM	2/4/09 10:00 AM	216
Piling - 6th Steet	2.13d	2/4/09 10:00 AM	2/6/09 11:00 AM	
End Bent	6h	2/4/09 10:00 AM	2/4/09 5:00 PM	217
Interior Bent	11h	2/5/09 8:00 AM	2/6/09 11:00 AM	219
Concrete - Clayton Expressway	2.88d	1/8/09 3:00 PM	1/13/09 2:00 PM	
Piling Encasements	21h	1/8/09 3:00 PM	1/13/09 11:00 AM	204
Concrete for Wingwall	1h	1/13/09 11:00 AM	1/13/09 12:00 PM	222
Concrete for Wingwall Footings	1h	1/13/09 1:00 PM	1/13/09 2:00 PM	223
Piling - Clayton Expressway	2.63d	1/13/09 2:00 PM	1/16/09 10:00 AM	
End Bent	5h	1/13/09 2:00 PM	1/14/09 10:00 AM	224
Interior Bent	16h	1/14/09 10:00 AM	1/16/09 10:00 AM	226
"Bridges, Abutments and Piers"	21.5d	1/16/09 10:00 AM	2/18/09 3:00 PM	
Reach 1	21.5d	1/16/09 10:00 AM	2/18/09 3:00 PM	
"6th St - Concrete, In Place"	2.5d	2/6/09 11:00 AM	2/10/09 4:00 PM	
Concrete for Interior Bent	3h	2/6/09 11:00 AM	2/6/09 3:00 PM	220
Concrete for End Bent	1h	2/6/09 3:00 PM	2/6/09 4:00 PM	231
Bents Finish	16h	2/6/09 4:00 PM	2/10/09 4:00 PM	232
6th St - Reinforcing Steel	1.5d	2/10/09 4:00 PM	2/12/09 11:00 AM	
Substructure Reinforcing	12h	2/10/09 4:00 PM	2/12/09 11:00 AM	233
6th St - Formwork	3.38d	2/12/09 11:00 AM	2/18/09 3:00 PM	
Bent Forms (sides)	23h	2/12/09 11:00 AM	2/18/09 10:00 AM	235
Bent Forms (ends)	1h	2/18/09 10:00 AM	2/18/09 11:00 AM	237
Wingwall Forms	3h	2/18/09 11:00 AM	2/18/09 3:00 PM	238
"Clayton Exp - Concrete, In Place"	2.5d	1/16/09 10:00 AM	1/21/09 3:00 PM	
Concrete for Interior Bent	4h	1/16/09 10:00 AM	1/16/09 3:00 PM	227
Concrete for End Bent	1h	1/16/09 3:00 PM	1/16/09 4:00 PM	241
Bents Finish	15h	1/16/09 4:00 PM	1/21/09 3:00 PM	242
Clayton Exp - Reinforcing Steel	2d	1/21/09 3:00 PM	1/23/09 3:00 PM	
Substructure Reinforcing	16h	1/21/09 3:00 PM	1/23/09 3:00 PM	243
Clayton Exp - Formwork	3d	1/23/09 3:00 PM	1/28/09 3:00 PM	
Bent Forms (sides)	21h	1/23/09 3:00 PM	1/28/09 11:00 AM	245
Bent Forms (ends)	1h	1/28/09 11:00 AM	1/28/09 12:00 PM	247
Wingwall Forms	2h	1/28/09 1:00 PM	1/28/09 3:00 PM	248
"Bridges, Superstructure & Deck"	44.63d	1/28/09 3:00 PM	4/2/09 11:00 AM	
Reach 1	44.63d	1/28/09 3:00 PM	4/2/09 11:00 AM	
Railings and Guards	0.25d	4/1/09 4:00 PM	4/2/09 9:00 AM	
Guardrails	2h	4/1/09 4:00 PM	4/2/09 9:00 AM	270
"6th St - Concrete, In Place"	6.25d	2/18/09 3:00 PM	2/26/09 5:00 PM	
Concrete for Slab - Class S(AE)	16h	2/18/09 3:00 PM	2/20/09 3:00 PM	239
Concrete for Parapet Wall	2h	2/20/09 3:00 PM	2/20/09 5:00 PM	255
Concrete for Sidewalks	2h	2/23/09 8:00 AM	2/23/09 10:00 AM	256
Bridge Deck Finish	20h	2/23/09 10:00 AM	2/25/09 3:00 PM	257
Sidewalk Finish	6h	2/25/09 3:00 PM	2/26/09 12:00 PM	258
Parapet Finish	4h	2/26/09 1:00 PM	2/26/09 5:00 PM	259
6th St - Reinforcing Steel	11d	2/27/09 8:00 AM	3/13/09 5:00 PM	
Slab-Epoxy Coated Reinforcing	76h	2/27/09 8:00 AM	3/12/09 12:00 PM	260
Parapet-Epoxy Coated Reinforcing	6h	3/12/09 1:00 PM	3/13/09 10:00 AM	262
Sidewalk-Epoxy Coated Reinforng	6h	3/13/09 10:00 AM	3/13/09 5:00 PM	263
6th St - Formwork	12.88d	3/16/09 8:00 AM	4/1/09 4:00 PM	
Forms Under Bridge Deck	54h	3/16/09 8:00 AM	3/24/09 3:00 PM	264
Side Forms - Bridge Deck	7h	3/24/09 3:00 PM	3/25/09 2:00 PM	266
End Forms - Bridge Deck	11h	3/25/09 2:00 PM	3/26/09 5:00 PM	267
Sidewalk Forms	7h	3/27/09 8:00 AM	3/27/09 4:00 PM	268
Parapet Forms	24h	3/27/09 4:00 PM	4/1/09 4:00 PM	269
6th St - Railings and Guards	0.25d	4/2/09 9:00 AM	4/2/09 11:00 AM	
Guardrails	2h	4/2/09 9:00 AM	4/2/09 11:00 AM	253
"Clayton Exp - Concrete, In Place"	7.13d	1/28/09 3:00 PM	2/6/09 4:00 PM	
Concrete for Slab - Class S(AE)	21h	1/28/09 3:00 PM	2/2/09 11:00 AM	249
Concrete for Parapet Wall	2h	2/2/09 11:00 AM	2/2/09 2:00 PM	274
Concrete for Traffic/Bike Parapt	1h	2/2/09 2:00 PM	2/2/09 3:00 PM	275
Concrete for B ke Path Parapet	1h	2/2/09 3:00 PM	2/2/09 4:00 PM	276
Bridge Deck Finish	26h	2/2/09 4:00 PM	2/6/09 9:00 AM	277
Parapet (traffic)	1h	2/6/09 9:00 AM	2/6/09 10:00 AM	278

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Parapet (traffic & bike)	2h	2/6/09 10:00 AM	2/6/09 12:00 PM	279
Parapet (bike)	3h	2/6/09 1:00 PM	2/6/09 4:00 PM	280
Clayton Exp - Reinforcing Steel	14.25d	2/6/09 4:00 PM	3/2/09 9:00 AM	
Slab-Epoxy Coated Reinforcing	103h	2/6/09 4:00 PM	2/26/09 3:00 PM	281
Parapet-Epoxy Coated Reinforcing	11h	2/26/09 3:00 PM	3/2/09 9:00 AM	283
Clayton Exp - Formwork	17.88d	3/2/09 9:00 AM	3/25/09 5:00 PM	
Forms Under Bridge Deck	72h	3/2/09 9:00 AM	3/13/09 9:00 AM	284
Side Forms - Bridge Deck	11h	3/13/09 9:00 AM	3/16/09 12:00 PM	286
End Forms - Bridge Deck	12h	3/16/09 1:00 PM	3/17/09 5:00 PM	287
Parapet (traffic)	20h	3/18/09 8:00 AM	3/20/09 12:00 PM	288
Parapet (traffic and bike)	14h	3/20/09 1:00 PM	3/24/09 10:00 AM	289
Parapet (bike)	14h	3/24/09 10:00 AM	3/25/09 5:00 PM	290
Clayton Exp -Railings and Guards	0.38d	3/26/09 8:00 AM	3/26/09 11:00 AM	
Guardrails	3h	3/26/09 8:00 AM	3/26/09 11:00 AM	291
Construct Road to Subgrade	9.88d	3/26/09 11:00 AM	4/9/09 10:00 AM	
Reach 1	3.25d	3/26/09 11:00 AM	3/31/09 2:00 PM	
P Street Relocation	2.75d	3/26/09 11:00 AM	3/31/09 9:00 AM	
Stripping & Subgrade Prep	22h	3/26/09 11:00 AM	3/31/09 9:00 AM	293
P Street Rebuild	0.5d	3/31/09 9:00 AM	3/31/09 2:00 PM	
Stripping & Subgrade Prep 2	4h	3/31/09 9:00 AM	3/31/09 2:00 PM	297
Reach 2	4.88d	3/31/09 2:00 PM	4/7/09 12:00 PM	
Midland Blvd Backfill	4.88d	3/31/09 2:00 PM	4/7/09 12:00 PM	
Fill	33h	3/31/09 2:00 PM	4/6/09 3:00 PM	299
Spread and Compact	6h	4/6/09 3:00 PM	4/7/09 12:00 PM	302
Reach 3	2.63d	4/2/09 11:00 AM	4/6/09 5:00 PM	
Greenwood Ave Backfill	1.88d	4/2/09 11:00 AM	4/6/09 10:00 AM	
Fill	12h	4/2/09 11:00 AM	4/3/09 4:00 PM	272
Spread and Compact	3h	4/3/09 4:00 PM	4/6/09 10:00 AM	306
Arkhola Plant Bridge Backfill	0.75d	4/6/09 10:00 AM	4/6/09 5:00 PM	
Fill	5h	4/6/09 10:00 AM	4/6/09 4:00 PM	307
Spread and Compact	1h	4/6/09 4:00 PM	4/6/09 5:00 PM	309
Reach 4	1.75d	4/7/09 1:00 PM	4/9/09 10:00 AM	
Grand Avenue Backfill	1.75d	4/7/09 1:00 PM	4/9/09 10:00 AM	
Fill	12h	4/7/09 1:00 PM	4/8/09 5:00 PM	303
Spread and Compact	2h	4/9/09 8:00 AM	4/9/09 10:00 AM	313
Road Surfacing	3.5d	4/7/09 8:00 AM	4/10/09 12:00 PM	
Reach 1	2d	4/7/09 8:00 AM	4/8/09 5:00 PM	
P Street Relocation	1.75d	4/7/09 8:00 AM	4/8/09 3:00 PM	
Base Course	7h	4/7/09 8:00 AM	4/7/09 4:00 PM	310
Wearing Course	5h	4/7/09 4:00 PM	4/8/09 12:00 PM	318
At Grade Railroad Crossing	2h	4/8/09 1:00 PM	4/8/09 3:00 PM	319
P Street Rebuild	0.25d	4/8/09 3:00 PM	4/8/09 5:00 PM	
Base Course	1h	4/8/09 3:00 PM	4/8/09 4:00 PM	320
Wearing Course	1h	4/8/09 4:00 PM	4/8/09 5:00 PM	322
Reach 2	0.38d	4/9/09 10:00 AM	4/9/09 2:00 PM	
Midland Blvd Paving	0.38d	4/9/09 10:00 AM	4/9/09 2:00 PM	
Base Course	2h	4/9/09 10:00 AM	4/9/09 12:00 PM	314
Wearing Course	1h	4/9/09 1:00 PM	4/9/09 2:00 PM	326
Reach 3	0.63d	4/9/09 2:00 PM	4/10/09 10:00 AM	
Greenwood Ave Paving	0.38d	4/9/09 2:00 PM	4/9/09 5:00 PM	
Base Course	2h	4/9/09 2:00 PM	4/9/09 4:00 PM	327
Wearing Course	1h	4/9/09 4:00 PM	4/9/09 5:00 PM	330
Arkhola Plant Bridge Paving	0.25d	4/10/09 8:00 AM	4/10/09 10:00 AM	
Base Course	1h	4/10/09 8:00 AM	4/10/09 9:00 AM	331
Wearing Course	1h	4/10/09 9:00 AM	4/10/09 10:00 AM	333
Reach 4	0.25d	4/10/09 10:00 AM	4/10/09 12:00 PM	
Grand Avenue Paving	0.25d	4/10/09 10:00 AM	4/10/09 12:00 PM	
Base Course	1h	4/10/09 10:00 AM	4/10/09 11:00 AM	334
Wearing Course	1h	4/10/09 11:00 AM	4/10/09 12:00 PM	337
Railroads	287.13d	4/9/09 8:00 AM	6/1/10 9:00 AM	
"Mob, Demob, & Preparatory Work"	47.25d	4/10/09 1:00 PM	6/17/09 3:00 PM	
Reach 1	47.25d	4/10/09 1:00 PM	6/17/09 3:00 PM	
Site Work - Track 3 Shoofly	14.38d	4/10/09 1:00 PM	4/30/09 4:00 PM	
Fine Grade Subrade	21h	4/10/09 1:00 PM	4/15/09 9:00 AM	338
Ballast	57h	4/15/09 9:00 AM	4/24/09 10:00 AM	343
Ties	14h	4/24/09 10:00 AM	4/27/09 5:00 PM	344
Rails and Accessories	23h	4/28/09 8:00 AM	4/30/09 4:00 PM	345
Site Work - Track 4 Shoofly	16.25d	4/30/09 4:00 PM	5/26/09 9:00 AM	
Fine Grade Subrade	8h	4/30/09 4:00 PM	5/1/09 4:00 PM	346
Ballast	74h	5/1/09 4:00 PM	5/15/09 9:00 AM	348

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Ties	18h	5/15/09 9:00 AM	5/19/09 11:00 AM	349
Rails and Accessories	30h	5/19/09 11:00 AM	5/26/09 9:00 AM	350
Site Work - Track 5 Shoofly	16.63d	5/26/09 9:00 AM	6/17/09 3:00 PM	
Fine Grade Subrade	8h	5/26/09 9:00 AM	5/27/09 9:00 AM	351
Ballast	75h	5/27/09 9:00 AM	6/9/09 12:00 PM	353
Ties	18h	6/9/09 1:00 PM	6/11/09 3:00 PM	354
Rails and Accessories	32h	6/11/09 3:00 PM	6/17/09 3:00 PM	355
Demolition	9.13d	4/9/09 8:00 AM	4/22/09 9:00 AM	
Reach 2	9.13d	4/9/09 8:00 AM	4/22/09 9:00 AM	
Demolition	9.13d	4/9/09 8:00 AM	4/22/09 9:00 AM	
Demolition RR Tracks @ 69+00	7h	4/9/09 8:00 AM	4/9/09 4:00 PM	323
Demolition RR Tracks @ 69+10	32h	4/9/09 4:00 PM	4/15/09 4:00 PM	360
Demolition RR Tracks @ 91+00	34h	4/15/09 4:00 PM	4/22/09 9:00 AM	361
"Bridges, Superstructure & Deck"	278d	4/22/09 9:00 AM	6/1/10 9:00 AM	
Reach 1	278d	4/22/09 9:00 AM	6/1/10 9:00 AM	
KC Southern Railroad - 13+75	136d	4/22/09 9:00 AM	11/4/09 9:00 AM	
Fine Grade Subgrade	13h	4/22/09 9:00 AM	4/23/09 3:00 PM	362
Ballast	124h	4/23/09 3:00 PM	5/15/09 10:00 AM	366
Ties	30h	5/15/09 10:00 AM	5/20/09 5:00 PM	367
Rails and Accessories	28h	5/21/09 8:00 AM	5/27/09 12:00 PM	368
Wellpoint System	228h	5/27/09 1:00 PM	7/7/09 5:00 PM	369
Earthwork	38h	7/8/09 8:00 AM	7/14/09 3:00 PM	370
Formwork	274h	7/14/09 3:00 PM	8/31/09 5:00 PM	371
Steel Reinforcement	96h	9/1/09 8:00 AM	9/17/09 5:00 PM	372
Concrete Cast-in-place	242h	9/18/09 8:00 AM	11/2/09 10:00 AM	373
Concrete Curing	15h	11/2/09 10:00 AM	11/4/09 9:00 AM	374
KC Southern (Sta. 28+25)	106.5d	6/17/09 3:00 PM	11/19/09 10:00 AM	
Remove/Install Rail @ Sta. 28+25	30h	6/17/09 3:00 PM	6/23/09 12:00 PM	356
Wellpoint System	183h	6/23/09 1:00 PM	7/27/09 11:00 AM	377
Earthwork	1h	7/27/09 11:00 AM	7/27/09 12:00 PM	378
Formwork	189h	7/27/09 1:00 PM	8/28/09 9:00 AM	379
Steel Reinforcement	84h	8/28/09 9:00 AM	9/14/09 2:00 PM	380
Concrete Cast-in-place	354h	9/14/09 2:00 PM	11/17/09 4:00 PM	381
Concrete Curing	11h	11/17/09 4:00 PM	11/19/09 10:00 AM	382
Union Pacific (Sta 33+20)	67.13d	11/4/09 9:00 AM	2/12/10 10:00 AM	
Remove/Install Rail @ Sta. 28+25	23h	11/4/09 9:00 AM	11/6/09 5:00 PM	375
Wellpoint System	96h	11/9/09 8:00 AM	11/25/09 5:00 PM	385
Earthwork	37h	11/27/09 8:00 AM	12/3/09 2:00 PM	386
Formwork	121h	12/3/09 2:00 PM	12/24/09 3:00 PM	387
Steel Reinforcement	46h	12/24/09 3:00 PM	1/5/10 12:00 PM	388
Concrete Cast-in-place	208h	1/5/10 1:00 PM	2/11/10 12:00 PM	389
Concrete Curing	6h	2/11/10 1:00 PM	2/12/10 10:00 AM	390
Ark MO Rail (Sta 34+75)	90.13d	11/19/09 10:00 AM	4/1/10 11:00 AM	
Remove/Install Rail @ Sta. 34+75	27h	11/19/09 10:00 AM	11/24/09 2:00 PM	383
Wellpoint System	160h	11/24/09 2:00 PM	12/23/09 2:00 PM	393
Earthwork	14h	12/23/09 2:00 PM	12/28/09 11:00 AM	394
Formwork	164h	12/28/09 11:00 AM	1/27/10 4:00 PM	395
Steel Reinforcement	68h	1/27/10 4:00 PM	2/9/10 11:00 AM	396
Concrete Cast-in-place	279h	2/9/10 11:00 AM	3/31/10 10:00 AM	397
Concrete Curing	9h	3/31/10 10:00 AM	4/1/10 11:00 AM	398
Union Pacific (Sta 36+50)	74.88d	2/12/10 10:00 AM	6/1/10 9:00 AM	
Remove/Install Rail @ Sta. 36+50	25h	2/12/10 10:00 AM	2/18/10 11:00 AM	391
Wellpoint System	103h	2/18/10 11:00 AM	3/9/10 10:00 AM	401
Earthwork	81h	3/9/10 10:00 AM	3/23/10 11:00 AM	402
Formwork	126h	3/23/10 11:00 AM	4/14/10 9:00 AM	403
Steel Reinforcement	48h	4/14/10 9:00 AM	4/22/10 9:00 AM	404
Concrete Cast-in-place	209h	4/22/10 9:00 AM	5/28/10 10:00 AM	405
Concrete Curing	7h	5/28/10 10:00 AM	6/1/10 9:00 AM	406
Channels and Canals	536.25d	4/1/10 11:00 AM	5/18/12 2:00 PM	
Channels	536.25d	4/1/10 11:00 AM	5/18/12 2:00 PM	
"Mob, Demob & Preparatory Work"	44.5d	4/1/10 11:00 AM	6/3/10 4:00 PM	
Reach 1	18.5d	4/1/10 11:00 AM	4/27/10 4:00 PM	
Clearing and Grubbing	18.5d	4/1/10 11:00 AM	4/27/10 4:00 PM	
Clearing and Grubbbing	132h	4/1/10 11:00 AM	4/23/10 4:00 PM	399
Haul-off of Debris	16h	4/23/10 4:00 PM	4/27/10 4:00 PM	413
Reach 2	18.5d	4/27/10 4:00 PM	5/24/10 11:00 AM	
Clearing and Grubbing	18.5d	4/27/10 4:00 PM	5/24/10 11:00 AM	
Clearing and Grubbbing	132h	4/27/10 4:00 PM	5/20/10 11:00 AM	414
Haul-off of Debris	16h	5/20/10 11:00 AM	5/24/10 11:00 AM	417
Reach 3	3.38d	5/24/10 11:00 AM	5/27/10 3:00 PM	

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Clearing and Grubbing	3.38d	5/24/10 11:00 AM	5/27/10 3:00 PM	
Clearing and Grubbbing	22h	5/24/10 11:00 AM	5/27/10 9:00 AM	418
Haul-off of Debris	5h	5/27/10 9:00 AM	5/27/10 3:00 PM	421
Reach 4	4.13d	5/27/10 3:00 PM	6/3/10 4:00 PM	
Clearing and Grubbing	4.13d	5/27/10 3:00 PM	6/3/10 4:00 PM	
Clearing and Grubbbing	27h	5/27/10 3:00 PM	6/3/10 9:00 AM	422
Haul-off of Debris	6h	6/3/10 9:00 AM	6/3/10 4:00 PM	425
Drainage	28.75d	6/1/10 9:00 AM	7/12/10 4:00 PM	
Reach 1	25.63d	6/1/10 9:00 AM	7/7/10 3:00 PM	
"Remove 138"" Dia. Storm Pipe&Plug"	162h	6/1/10 9:00 AM	6/29/10 11:00 AM	407
"Headwall for 138"" Dia Pipe"	32h	6/29/10 11:00 AM	7/6/10 11:00 AM	429
"Extend 72"" Dia. Pipe"	11h	7/6/10 11:00 AM	7/7/10 3:00 PM	430
Reach 2	3.13d	6/3/10 4:00 PM	6/8/10 5:00 PM	
"Remove 24"" Dia. Pipe & Plug"	5h	6/3/10 4:00 PM	6/4/10 12:00 PM	426
"Extend 42"" Dia. Storm Pipe"	6h	6/4/10 1:00 PM	6/7/10 10:00 AM	433
"Install 60"" Dia. Storm Pipe"	14h	6/7/10 10:00 AM	6/8/10 5:00 PM	434
Reach 3	5.25d	6/9/10 8:00 AM	6/16/10 10:00 AM	
"Remove 105"" Dia. Storm Pipe&Plug"	32h	6/9/10 8:00 AM	6/14/10 5:00 PM	435
"Remove 67"" Dia. Storm Pipe& Plug"	10h	6/15/10 8:00 AM	6/16/10 10:00 AM	437
Reach 4	17.63d	6/16/10 10:00 AM	7/12/10 4:00 PM	
"Remove 105"" Dia. Storm Pipe"	140h	6/16/10 10:00 AM	7/12/10 3:00 PM	438
"15"" Dia. Storm Pipe Headwall"	1h	7/12/10 3:00 PM	7/12/10 4:00 PM	440
Concrete	118.13d	7/7/10 3:00 PM	12/27/10 4:00 PM	
Reach 3	118.13d	7/7/10 3:00 PM	12/27/10 4:00 PM	
U-Channel at Arkhola	118.13d	7/7/10 3:00 PM	12/27/10 4:00 PM	
Base Preparation	12h	7/7/10 3:00 PM	7/9/10 10:00 AM	431
Formwork	614h	7/9/10 10:00 AM	10/27/10 5:00 PM	445
Concrete Reinforcement	82h	10/28/10 8:00 AM	11/11/10 10:00 AM	446
Concrete	215h	11/11/10 10:00 AM	12/22/10 9:00 AM	447
Chainlink Fence	22h	12/22/10 9:00 AM	12/27/10 4:00 PM	448
Concrete Channel Lining	95.13d	7/12/10 4:00 PM	11/26/10 5:00 PM	
Formwork	32h	7/12/10 4:00 PM	7/16/10 4:00 PM	441
Steel Reinforcement	75h	7/16/10 4:00 PM	7/30/10 10:00 AM	451
Concrete Cast-in-place	614h	7/30/10 10:00 AM	11/18/10 5:00 PM	452
Concrete Curing	40h	11/19/10 8:00 AM	11/26/10 5:00 PM	453
Reach 4	13.13d	11/29/10 8:00 AM	12/16/10 9:00 AM	
Concrete Channel Lining	13.13d	11/29/10 8:00 AM	12/16/10 9:00 AM	
Formwork	4h	11/29/10 8:00 AM	11/29/10 12:00 PM	454
Steel Reinforcement	11h	11/29/10 1:00 PM	11/30/10 4:00 PM	457
Concrete Cast-in-place	84h	11/30/10 4:00 PM	12/15/10 11:00 AM	458
Concrete Curing	6h	12/15/10 11:00 AM	12/16/10 9:00 AM	459
Earthwork	185.25d	12/9/10 10:00 AM	9/2/11 12:00 PM	
Reach 1	180.38d	12/16/10 9:00 AM	9/2/11 12:00 PM	
Topsoil Handling	8.25d	12/16/10 9:00 AM	12/29/10 11:00 AM	
Topsoil Removal & Stockpile	43h	12/16/10 9:00 AM	12/23/10 12:00 PM	460
Spread Topsoil from Stockpile	23h	12/23/10 1:00 PM	12/29/10 11:00 AM	464
Excavation	172.13d	12/29/10 11:00 AM	9/2/11 12:00 PM	
Prework Surveys	253h	12/29/10 11:00 AM	2/14/11 5:00 PM	465
Excavation	1337h	1/4/11 11:00 AM	8/31/11 12:00 PM	467SS+24h
Post-work Surveys & Computations	124h	8/12/11 8:00 AM	9/2/11 12:00 PM	468FF+16h
Haul-off & Disposal	1142h	2/10/11 3:00 PM	9/2/11 12:00 PM	468FF+16h
Material Disposal Management	1157h	2/8/11 4:00 PM	9/2/11 12:00 PM	470FF
Reach 2	72.75d	12/9/10 10:00 AM	3/25/11 5:00 PM	
Topsoil Handling	5.13d	12/27/10 4:00 PM	1/4/11 5:00 PM	
Topsoil Removal & Stockpile	17h	12/27/10 4:00 PM	12/29/10 5:00 PM	449
Spread Topsoil from Stockpile	24h	12/30/10 8:00 AM	1/4/11 5:00 PM	474
Reach Excavation	72.75d	12/9/10 10:00 AM	3/25/11 5:00 PM	
Prework Surveys	116h	1/5/11 8:00 AM	1/26/11 12:00 PM	475
Reach 1 Excavation	384h	1/10/11 8:00 AM	3/18/11 5:00 PM	477SS+24h
Post-work Surveys & Computations	180h	2/17/11 1:00 PM	3/22/11 5:00 PM	478FF+16h
Reach 1 Haul-off & Disposal	475h	12/23/10 2:00 PM	3/22/11 5:00 PM	478FF+16h
Material Disposal Management	558h	12/9/10 10:00 AM	3/22/11 5:00 PM	480FF
Fine Grading of Slopes	224h	2/15/11 8:00 AM	3/25/11 5:00 PM	480FF+24h
Reach 3	73.5d	3/24/11 2:00 PM	7/8/11 9:00 AM	
Topsoil Handling	4.88d	3/28/11 8:00 AM	4/1/11 4:00 PM	
Topsoil Removal & Stockpile	16h	3/28/11 8:00 AM	3/29/11 5:00 PM	482
Spread Topsoil from Stockpile	23h	3/30/11 8:00 AM	4/1/11 4:00 PM	485
Reach Excavation	58.25d	3/24/11 2:00 PM	6/15/11 4:00 PM	
Prework Surveys	124h	4/1/11 4:00 PM	4/25/11 11:00 AM	486
Excavation	376h	4/6/11 4:00 PM	6/13/11 4:00 PM	488SS+24h

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Post-work Surveys & Computations	150h	5/19/11 9:00 AM	6/15/11 4:00 PM	489FF+16h
Haul-off & Disposal	466h	3/24/11 2:00 PM	6/15/11 4:00 PM	489FF+16h
Material Disposal Management	430h	3/31/11 9:00 AM	6/15/11 4:00 PM	491FF
Fine Grading of Slopes	220h	5/6/11 11:00 AM	6/15/11 4:00 PM	489FF+16h
Extra Excavation - Vert. Walls	14.88d	6/15/11 4:00 PM	7/7/11 3:00 PM	
Excavation	27h	6/15/11 4:00 PM	6/21/11 10:00 AM	493
Backfill of Excvated Material	111h	6/16/11 4:00 PM	7/7/11 3:00 PM	495SS+8h
Exc. @ MLK Park - Environmental	0.38d	7/7/11 3:00 PM	7/8/11 9:00 AM	
Excavation	3h	7/7/11 3:00 PM	7/8/11 9:00 AM	496
Reach 4	23.38d	7/7/11 3:00 PM	8/10/11 9:00 AM	
Topsoil Handling	3.75d	7/8/11 9:00 AM	7/13/11 4:00 PM	
Topsoil Removal & Stockpile	6h	7/8/11 9:00 AM	7/8/11 4:00 PM	498
Topsoil Spreading on Slopes	24h	7/8/11 4:00 PM	7/13/11 4:00 PM	501
Reach Excavation	23.38d	7/7/11 3:00 PM	8/10/11 9:00 AM	
Prework Surveys	56h	7/13/11 4:00 PM	7/22/11 4:00 PM	502
Excavation	130h	7/14/11 4:00 PM	8/8/11 9:00 AM	504SS+8h
Post-work Surveys & Computations	68h	7/28/11 2:00 PM	8/10/11 9:00 AM	505FF+16h
Haul-off & Disposal	162h	7/12/11 4:00 PM	8/10/11 9:00 AM	505FF+16h
Material Disposal Management	187h	7/7/11 3:00 PM	8/10/11 9:00 AM	505FF+16h
Fine Grading of Slopes	76h	7/27/11 2:00 PM	8/10/11 9:00 AM	505FF+16h
Associated General Items	199.13d	8/3/11 1:00 PM	5/18/12 2:00 PM	
Reach 1	199.13d	8/3/11 1:00 PM	5/18/12 2:00 PM	
Riprap	177.13d	9/2/11 1:00 PM	5/18/12 2:00 PM	
Riprap	1417h	9/2/11 1:00 PM	5/18/12 2:00 PM	471
Turfing	8.13d	8/10/11 9:00 AM	8/22/11 10:00 AM	
Seedbed Preparation	4h	8/10/11 9:00 AM	8/10/11 2:00 PM	509
Fertilization	10h	8/10/11 2:00 PM	8/11/11 4:00 PM	515
Seeding	47h	8/11/11 4:00 PM	8/19/11 3:00 PM	516
Mulching/Temporary Soil Stabilz	4h	8/19/11 3:00 PM	8/22/11 10:00 AM	517
Temporary Erosion Control	102h	8/3/11 1:00 PM	8/22/11 10:00 AM	518FF
Reach 2	70.63d	8/22/11 10:00 AM	12/2/11 4:00 PM	
Riprap	66.5d	8/22/11 10:00 AM	11/28/11 3:00 PM	
Riprap	532h	8/22/11 10:00 AM	11/28/11 3:00 PM	519
Turfing	4.13d	11/28/11 3:00 PM	12/2/11 4:00 PM	
Seedbed Preparation	2h	11/28/11 3:00 PM	11/28/11 5:00 PM	522
Fertilization	5h	11/29/11 8:00 AM	11/29/11 2:00 PM	524
Seeding	24h	11/29/11 2:00 PM	12/2/11 2:00 PM	525
Mulching/Temporary Soil Stabilz	2h	12/2/11 2:00 PM	12/2/11 4:00 PM	526
Temporary Erosion Control	56h	11/22/11 4:00 PM	12/2/11 4:00 PM	527FF
Reach 3	67d	12/2/11 4:00 PM	3/12/12 4:00 PM	
Riprap	58.13d	12/2/11 4:00 PM	2/28/12 5:00 PM	
Riprap	465h	12/2/11 4:00 PM	2/28/12 5:00 PM	528
Turfing	5.25d	2/29/12 8:00 AM	3/7/12 10:00 AM	
Seedbed Preparation	3h	2/29/12 8:00 AM	2/29/12 11:00 AM	531
Fertilization	7h	2/29/12 11:00 AM	3/1/12 10:00 AM	533
Seeding	30h	3/1/12 10:00 AM	3/6/12 5:00 PM	534
Mulching/Temporary Soil Stabilz	2h	3/7/12 8:00 AM	3/7/12 10:00 AM	535
Temporary Erosion Control	44h	2/28/12 3:00 PM	3/7/12 10:00 AM	536FF
Gabions @ MLK Park - Environment	3.63d	3/7/12 10:00 AM	3/12/12 4:00 PM	
Gabions @ MLK Park - Environment	29h	3/7/12 10:00 AM	3/12/12 4:00 PM	537
Reach 4	3d	3/12/12 4:00 PM	3/15/12 4:00 PM	
Turfing	3d	3/12/12 4:00 PM	3/15/12 4:00 PM	
Seedbed Preparation	2h	3/12/12 4:00 PM	3/13/12 9:00 AM	539
Fertilization	4h	3/13/12 9:00 AM	3/13/12 2:00 PM	542
Seeding	16h	3/13/12 2:00 PM	3/15/12 2:00 PM	543
Mulching/Temporary Soil Stabilz	2h	3/15/12 2:00 PM	3/15/12 4:00 PM	544
Temporary Erosion Control	24h	3/12/12 4:00 PM	3/15/12 4:00 PM	545FF
Floodway Control-Diversion Struc	45.25d	3/15/12 4:00 PM	5/18/12 9:00 AM	
Hydraulic Control Structure	45.25d	3/15/12 4:00 PM	5/18/12 9:00 AM	
"Bridges, Foundations"	2.88d	3/15/12 4:00 PM	3/20/12 3:00 PM	
Reach 1	2.88d	3/15/12 4:00 PM	3/20/12 3:00 PM	
"Concrete, in Place"	2.63d	3/15/12 4:00 PM	3/20/12 12:00 PM	
Pads-Bents #1 and #2	1h	3/15/12 4:00 PM	3/15/12 5:00 PM	546
Pedestal - Bents #1 and #2	4h	3/16/12 8:00 AM	3/16/12 12:00 PM	552
End Bent Pad	4h	3/16/12 1:00 PM	3/16/12 5:00 PM	553
End Bent Side Walls	4h	3/19/12 8:00 AM	3/19/12 12:00 PM	554
End Bent Front Wall	4h	3/19/12 1:00 PM	3/19/12 5:00 PM	555
End Bent Slab	4h	3/20/12 8:00 AM	3/20/12 12:00 PM	556
Reinforcing Steel	0.25d	3/20/12 1:00 PM	3/20/12 3:00 PM	
Box and Headwall Reinforcing	2h	3/20/12 1:00 PM	3/20/12 3:00 PM	557

SCHEDULE

"Bridges, Abutments and Piers"	2.75d	3/20/12 3:00 PM	3/23/12 12:00 PM	
Reach 1	2.75d	3/20/12 3:00 PM	3/23/12 12:00 PM	
"Concrete, in Place"	0.63d	3/20/12 3:00 PM	3/21/12 11:00 AM	
Short Wingwall at Transition	1h	3/20/12 3:00 PM	3/20/12 4:00 PM	559
Long Wingwall at Transition	1h	3/20/12 4:00 PM	3/20/12 5:00 PM	563
Finish Top of Headwall/Transitin	1h	3/21/12 8:00 AM	3/21/12 9:00 AM	564
Finish Short Wingwall/Transition	1h	3/21/12 9:00 AM	3/21/12 10:00 AM	565
Finish Long Wingwall/Transition	1h	3/21/12 10:00 AM	3/21/12 11:00 AM	566
Reinforcing Steel	0.25d	3/21/12 11:00 AM	3/21/12 2:00 PM	
Short Wingwall at Transition	1h	3/21/12 11:00 AM	3/21/12 12:00 PM	567
Long Wingwall at Transition	1h	3/21/12 1:00 PM	3/21/12 2:00 PM	569
Formwork	1.88d	3/21/12 2:00 PM	3/23/12 12:00 PM	
Top of Headwall at Transition	4h	3/21/12 2:00 PM	3/22/12 9:00 AM	570
Short Wingwall at Transition	3h	3/22/12 9:00 AM	3/22/12 12:00 PM	572
Long Wingwall at Transition	8h	3/22/12 1:00 PM	3/23/12 12:00 PM	573
"Bridges, Superstructure and Deck"	24.13d	3/23/12 1:00 PM	4/26/12 2:00 PM	
Reach 1	24.13d	3/23/12 1:00 PM	4/26/12 2:00 PM	
"Concrete, in Place"	3.25d	4/17/12 3:00 PM	4/20/12 5:00 PM	
Top Slab of Transition	3h	4/17/12 3:00 PM	4/18/12 9:00 AM	593
Bottom Slab of Transition	3h	4/18/12 9:00 AM	4/18/12 12:00 PM	578
Side Slab of Transition	2h	4/18/12 1:00 PM	4/18/12 3:00 PM	579
Interior Slab of Transition	2h	4/18/12 3:00 PM	4/18/12 5:00 PM	580
Finish Top Slab of Transition	4h	4/19/12 8:00 AM	4/19/12 12:00 PM	581
Finish Bottom Slab of Transition	4h	4/19/12 1:00 PM	4/19/12 5:00 PM	582
Finish Side Walls of Transition	1h	4/20/12 8:00 AM	4/20/12 9:00 AM	583
Finish Inter Walls of Transition	1h	4/20/12 9:00 AM	4/20/12 10:00 AM	584
Finish Pad-Bents #1 and #2	1h	4/20/12 10:00 AM	4/20/12 11:00 AM	585
Finish Pedistal-Bents #1 and #2	1h	4/20/12 11:00 AM	4/20/12 12:00 PM	586
Finish End Bent Pad	1h	4/20/12 1:00 PM	4/20/12 2:00 PM	587
Finish End Bent Side Walls	1h	4/20/12 2:00 PM	4/20/12 3:00 PM	588
Finish End Bent Front Wall	1h	4/20/12 3:00 PM	4/20/12 4:00 PM	589
Finish End Bent Slab	1h	4/20/12 4:00 PM	4/20/12 5:00 PM	590
Reinforcing Steel	6.25d	4/9/12 1:00 PM	4/17/12 3:00 PM	
Box and Headwall Reinforcing	50h	4/9/12 1:00 PM	4/17/12 3:00 PM	605
Formwork	11d	3/23/12 1:00 PM	4/9/12 12:00 PM	
Sides of Top Slab of Transition	2h	3/23/12 1:00 PM	3/23/12 3:00 PM	574
Bottom of Top Slab - Transition	10h	3/23/12 3:00 PM	3/26/12 5:00 PM	595
Sides of Bottom Slab of Transitn	4h	3/27/12 8:00 AM	3/27/12 12:00 PM	596
Side Walls of Transition	30h	3/27/12 1:00 PM	4/2/12 10:00 AM	597
Interior Walls of Transition	34h	4/2/12 10:00 AM	4/6/12 12:00 PM	598
Pads - Bents #1 and #2	2h	4/6/12 1:00 PM	4/6/12 3:00 PM	599
Pedestal-Bents #1 and #2	1h	4/6/12 3:00 PM	4/6/12 4:00 PM	600
End Bent Pad	2h	4/6/12 4:00 PM	4/9/12 9:00 AM	601
End Bent Side Walls	1h	4/9/12 9:00 AM	4/9/12 10:00 AM	602
End Bent Front Wall	1h	4/9/12 10:00 AM	4/9/12 11:00 AM	603
End Bent Slab	1h	4/9/12 11:00 AM	4/9/12 12:00 PM	604
Steel Trusses	2d	4/23/12 8:00 AM	4/24/12 5:00 PM	
W14 Girders	2h	4/23/12 8:00 AM	4/23/12 10:00 AM	591
W14 Platform (front and back)	1h	4/23/12 10:00 AM	4/23/12 11:00 AM	607
W14 Platform (sides)	1h	4/23/12 11:00 AM	4/23/12 12:00 PM	608
C10- Wa kway Bracking	1h	4/23/12 1:00 PM	4/23/12 2:00 PM	609
C8 Platform Interior Members	2h	4/23/12 2:00 PM	4/23/12 4:00 PM	610
C8 Platform Interior Members	1h	4/23/12 4:00 PM	4/23/12 5:00 PM	611
C8 Platform Interior Members	1h	4/24/12 8:00 AM	4/24/12 9:00 AM	612
#1 Bent - W6 (2 Piers)	1h	4/24/12 9:00 AM	4/24/12 10:00 AM	613
#1 Bent (L3x3x3/8 Bracing)	1h	4/24/12 10:00 AM	4/24/12 11:00 AM	614
#1 Bent (C8 Cap)	1h	4/24/12 11:00 AM	4/24/12 12:00 PM	615
#2 Bent -W6 (3 Piers)	1h	4/24/12 1:00 PM	4/24/12 2:00 PM	616
#2 Bent (L3x3x3/8 Bracing)	1h	4/24/12 2:00 PM	4/24/12 3:00 PM	617
End Bent - W8 (3 Piers)	1h	4/24/12 3:00 PM	4/24/12 4:00 PM	618
End Bent (L3x3x3/8 Bracing)	1h	4/24/12 4:00 PM	4/24/12 5:00 PM	619
Floor Decking	1.63d	4/25/12 8:00 AM	4/26/12 2:00 PM	
"2.5"" x 9.5"" Non-Slip Planks"	13h	4/25/12 8:00 AM	4/26/12 2:00 PM	620
"Bridges, Associated General Item"	15.5d	4/26/12 2:00 PM	5/18/12 9:00 AM	
Reach 1	15.5d	4/26/12 2:00 PM	5/18/12 9:00 AM	
Handrails	1.88d	4/26/12 2:00 PM	4/30/12 12:00 PM	
Handrails (Wa kway)	9h	4/26/12 2:00 PM	4/27/12 3:00 PM	622
Handrails (Platform)	6h	4/27/12 3:00 PM	4/30/12 12:00 PM	626
Security Fence	0.25d	4/30/12 1:00 PM	4/30/12 3:00 PM	
Chain Link Fence	2h	4/30/12 1:00 PM	4/30/12 3:00 PM	627

SCHEDULE

Steel Trusses- Painting	6.75d	4/30/12 3:00 PM	5/9/12 12:00 PM	
Painting of Structural Steel	54h	4/30/12 3:00 PM	5/9/12 12:00 PM	629
Operating Machinery (Gates)	3.75d	5/9/12 1:00 PM	5/15/12 10:00 AM	
10' x 10' Hydro Gates	30h	5/9/12 1:00 PM	5/15/12 10:00 AM	631
Electrical	23h	5/15/12 10:00 AM	5/18/12 9:00 AM	633
Weather Delays	120d	5/18/12 9:00 AM	11/8/12 9:00 AM	634
Demobilization	5d	11/8/12 9:00 AM	11/16/12 9:00 AM	635
Contarct Closeout	44d	11/16/12 9:00 AM	1/23/13 9:00 AM	636

US Army Corps
of Engineers

Little Rock District

MAY BRANCH

FORT SMITH, ARKANSAS

FEASIBILITY STUDY

HYDROLOGIC AND HYDRAULIC ANALYSIS

AUGUST 2004

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HYDROLOGIC AND HYDRAULIC ANALYSIS
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1. Introduction

A hydrologic and hydraulic study of May Branch, a tributary of the Arkansas River, located within the city limits of Fort Smith, Arkansas was initiated in 1999. Historically, this basin has suffered numerous floods due to increased urbanization, insufficient storm sewer capacity, and an undersized levee outlet. The purpose of this study is to determine the feasibility of flood reduction alternatives for the May Branch watershed. This report presents a description of the analytical approach, analyses performed, and the results obtained for a detailed hydrologic and hydraulic study of an approximately 2.8 mile reach of May Branch that passes through the city and empties into the Arkansas River. Results of this study include water surface profiles for the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year return period flow events for without-project (existing) conditions and for three respective with-project alternative conditions.

2. General

2.1 Scope of Work

An interior flooding coincident frequency analysis was performed which was used for existing condition downstream ponding water surface elevation landward of the levee. For each respective flow event analyzed, 2-, 5-, 10-, 25-, 50-, 100-, and 500-year return period, the study entailed development of an existing condition hydrologic and hydraulic model using EPA Storm Water Management Model (SWMM) and a hydraulic model (HEC-RAS) for each respective with-project alternative condition analyzed.

2.2 Watershed Description

The entire drainage area of May Branch is within the city limits of Fort Smith, Arkansas. The basin is 100 percent urbanized. Development in the basin includes areas of low density housing, high density housing, commercial areas, and industrial areas. Basin slope ranges from relatively mild within the Arkansas River floodplain to fairly steep in the headwater areas.

2.3 Available Historical Data

No historical stream flow data was available for the stream reach and associated drainage basins addressed in this study. Data from several rainfall reporting stations in the area is available but was not used in this study. Synthetic rainfall for seven storms was developed and used.

2.4 Previous Studies

May Branch has been previously studied by both the Corps of Engineers and by private engineering firms. Previous studies are listed in Table 1.

TABLE 1

Select Previous Studies of May Branch

1. Fort Smith Flood Protection – April, 1947 – U.S. Army Corps of Engineers, LRD – Analysis of Design for Pumping Stations, Sewer Relief Structures, Levee, Walls, and Drainage Structures.
2. North “P” Street Combined Sewer – August, 1970 – Mickle Associates – Recommend additions to the “P” Street Drainage System.
3. Fort Smith, Arkansas, Flood Study – May, 1983 – U.S. Army Corps of Engineers, LRD – Hydrologic and Hydraulic Analysis.
4. Fort Smith, Arkansas, Type 19 Flood Insurance Study – August, 1986 – U.S. Army Corps of Engineers, LRD – Hydrologic and Hydraulic Analysis.
5. May Branch, Fort Smith, Arkansas, Section 205 – March 1992 – U.S. Army Corps of Engineers, LRD - Reconnaissance Report
6. Fort Smith Stormwater Management Plan – 1993 – Camp Dresser & McKee.
7. May Branch, Fort Smith, Arkansas – May 1996 - U.S. Army Corps of Engineers, LRD - Feasibility Study

3. Interior Flooding Analysis

3.1 Purpose

The purpose of these analyses is to develop coincident event stage-exceedance probability functions for the interior ponding area near the mouth of May Branch. The interior ponding elevations resulting from these analyses are dependent on the probability of Arkansas River stages, the probability of interior runoff, pond storage capacity, and outlet capacity. Stage-exceedance probability curves are developed for existing conditions and for two proposed project alternatives.

3.2 General

The May Branch interior ponding area is formed by the Fort Smith Levee and Floodwall that provide protection against backwater flooding from the Arkansas River. The interior ponding area is drained through the P-Street pumping station, which provides a 12 foot diameter pipe culvert gravity outlet and a peak pumping capacity of 400 cfs. The levee will overtop near the P-Street pumping station when the water surface elevation exceeds EL 419.5 feet (NGVD). At this elevation the interior ponding area has a surface area of approximately 350 acres and extends upstream (southeast) along the route of the P-Street storm sewer to the vicinity of 8th Street. Just below 4th Street the interior ponding area is bisected into an upper and lower pond by the Missouri-Pacific Railroad embankment. For ponding elevations below 415.0 feet the P-Street storm sewer provides the only flow connection between the upper and lower ponds. For ponding elevations above 415.0 feet the Missouri-Pacific Railroad embankment is overtopped.

3.3 Approach

Independence of hydrologic events implies that the physical and meteorological processes of the events are unrelated. The assumption of independence of interior and exterior events is generally valid for relatively small interior areas adjacent to large rivers, and is used here as the basis for application of coincident frequency methodology in the development of the interior ponding area stage-exceedance probability functions.

1) A stage-duration function for exterior (Arkansas River) stages at the mouth of May Branch was developed and divided into segments such that the middle value of each segment represents an exterior stage likely to affect interior ponding stages for either existing conditions or the proposed project alternatives. The segment interval, P(Bi), for each duration represents the probability of the interval and is associated with the middle value for that interval. The sum of the probabilities for all intervals equals 1, i.e., $\sum P(Bi) = 1$. The selected values are shown in Table 2.

Table 2
Arkansas River Stage/Probability

Arkansas River Stage [ft] (Bi)	392.4	394.6	396.0	397.8	400.1	403.0	410.7
Probability P(Bi)	0.7	0.1	0.05	0.05	0.08	0.015	0.005

Use of the stage-duration function as a method of assigning probabilities to exterior stages that might coincide with interior events is assumed to be more accurate than the use of a stage-frequency function because the coincident probability of peak exterior stage with peak interior runoff is very low. For example, the probability of the 100-yr. return period exterior stage coinciding with the 100-yr. return period interior event is (0.01*0.01) = 0.0001 (joint probability theorem). Equivalently stated, such coincidence of events would have a return period frequency of 10,000 years.

2) A series of hypothetical frequency precipitation events occurring over the interior area were modeled for each of the respective exterior stage conditions. An interior stage-frequency function, P(A/Bi) was then developed for each respective exterior stage condition. Implicit in this method of stage-frequency function development is the assumption that interior stage-frequency is directly related to precipitation event frequency (e.g., the 1% interior stage for a given exterior stage condition is the direct result of the 1% storm event over the interior area).

3) A coincident event, interior stage vs. exceedance probability function was then developed from this set of conditional probability functions using the total probability theorem,
$P(A) = \Sigma_{i=1,n} (P(A/Bi) \text{ x } P(Bi))$
where:
P(A) = probability of exceeding a given interior ponding elevation
P(Bi) = probability that the exterior (Arkansas River) is at the i^{th} specific stage interval, where "i" assumes the full range of "n" values that have an effect on pond elevation
P(A/Bi) = probability of exceeding a given interior pond elevation if the river stage is at the i^{th} stage interval

3. 4 Description of Analyses

The HEC-IFH computer model was used for the analyses, with the results of the computer runs providing the required data for development of the probability curves (P(A/Bi)) and (P(A)) previously described in paragraph 3.

The HEC-IFH computer program was not designed to directly model complex, multi-basin hydrologic systems. It provides hydrologic modeling capabilities for relatively simple systems consisting of a maximum of two sub-basins, an "upper" and a "lower", with one interior ponding area allowed in the lower sub-basin only. The modeling of pumps and gravity outlets is also restricted to the lower sub-basin only. More complex hydrologic systems may be modeled indirectly by importing previously computed hydrographs for routing through an interior ponding area. This capability was utilized to model the May Branch interior ponding area.

a) The SWMM computer model was used to model the hypothetical 2-, 5-, 10-, 25-, 50-, 100-, and 500-year precipitation events for the May Branch watershed. The resulting runoff hydrographs representing inflow to the interior ponding area were then imported into HEC-IFH to perform the reservoir routings through the interior pond. The inflow hydrographs for the existing condition analyses reflected routing through available storage upstream of the Missouri-Pacific Railroad embankment and were thus routed only through the portion of the interior pond lying below the railroad embankment. The inflow hydrographs for proposed project conditions reflected routing through available storage upstream of 7th Street and were routed through all available pond storage.

b) The HEC-IFH program used the average end-area method to calculate incremental interior pond storage volumes based on elevation-area data digitally planimetered from contour mapping provided by the City of Fort Smith, dated 1989. For the existing condition analyses the storage volumes were modified to reflect an estimate of fill material placed to the southwest of the P-Street sewer relief structure after the date of survey. For proposed project condition analyses the storage volumes were further modified to account for the increase in storage volume due to channel excavation.

c) The HEC-RAS hydraulic model was used to model the 12 feet diameter pipe culvert gravity outlet and develop discharge vs. interior pond elevation ratings for each of the respective exterior stage conditions. For existing conditions the ratings were developed based on the reach extending from the outlet to the sewer relief structure located about 1000 feet upstream from the P-Street pumping station at the low point of the interior pond. The sewer relief structure is a significant inlet that facilitates flow from the interior pond into the pipe culvert. For proposed project conditions, with interior pond elevations up to 408.0 feet, the ratings were based on the reach extending from the outlet to a point about 320 feet upstream of the sewer relief structure where the existing pipe culvert would tie in to the proposed project open channel. Above 408.0 feet, the sewer relief structure overflow weir elevation, the ratings were based on the reach extending from the outlet to the sewer relief structure.

d) The HEC-RAS hydraulic model was used to model the proposed project condition channel outlet and develop discharge vs. interior pond elevation ratings for each of the respective exterior stage conditions.

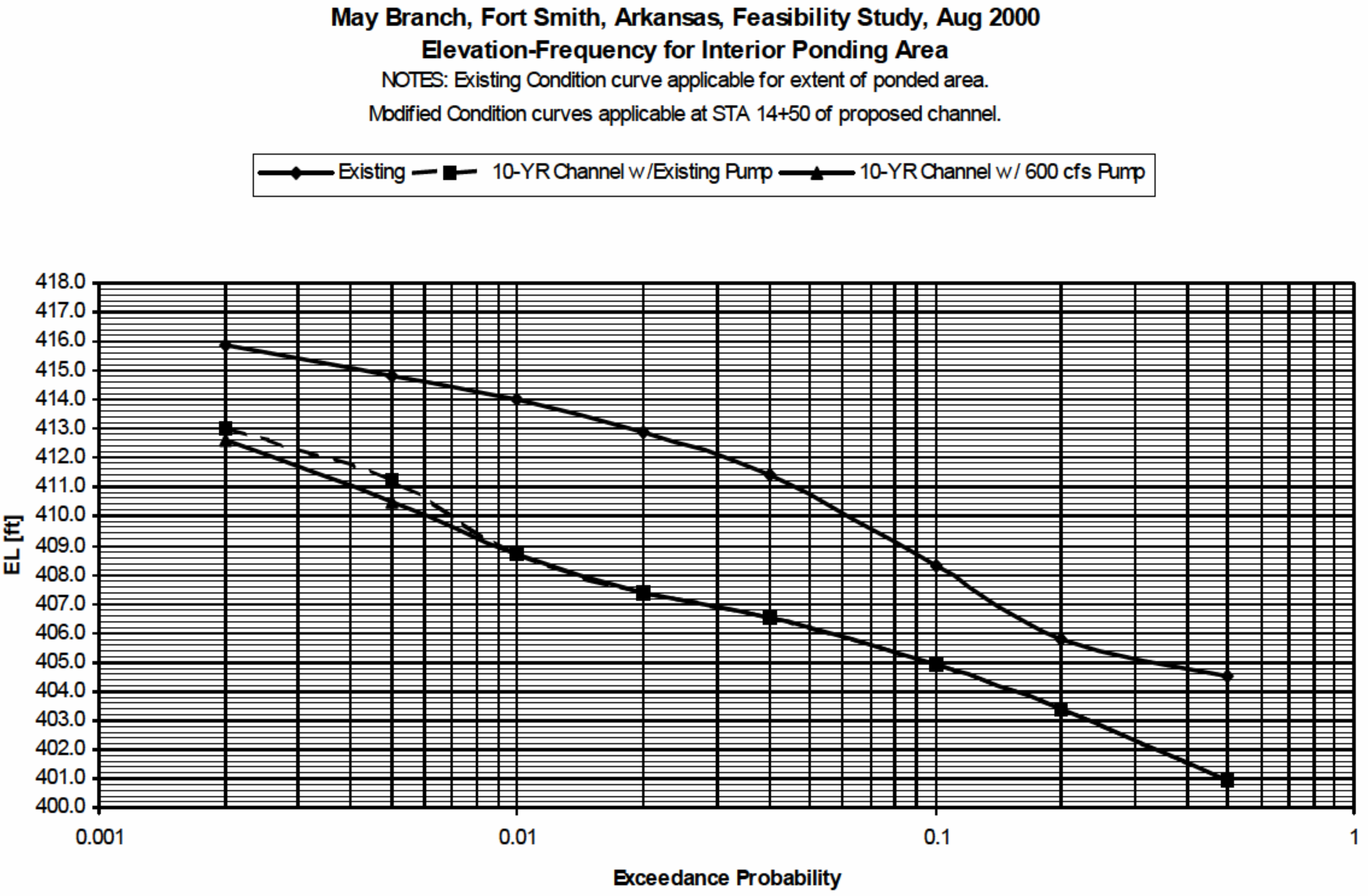
e) The P-Street pumping station was modeled as designed. Outflow is via the gravity outlet alone for exterior stages below 408.0 feet. For exterior stages at or above 408.0 feet, outflow is via either gravity outlet or pumping depending on the differential between interior pond water surface elevation (headwater) and exterior stage (tailwater). When the tailwater elevation exceeds the headwater elevation the outlet gate is closed and outflow is via pumping only. When the headwater minus tailwater differential is such that gravity outlet capacity exceeds available pumping capacity (about 1 feet for 400 cfs pump capacity) the outlet gate is opened and outflow is via gravity outlet only. The design of the P-Street pumping station is such that the pumps may not be operated simultaneously with the gravity outlet. Outlet gates for the proposed project channel were modeled consistent with the operation of the P-Street pumping station.

3.5 Results of Analysis

Summary results of the analyses are presented in Table 3 and shown graphically on the chart that follows, Plate 1.

Table 3
Interior Flooding Results

		Interior Pond Elevation [ft]		
Return Period [yrs]	**Exc. Prob.**	**Existing**	**10-YR Channel w/ 400 cfs Pump**	**10-YR Channel w/ 600 cfs Pump**
2	0.5	404.5	400.9	400.9
5	0.2	405.8	403.4	403.4
10	0.1	408.3	404.9	404.9
25	0.04	411.4	406.5	406.5
50	0.02	412.9	407.4	407.4
100	0.01	414.0	408.7	408.7
200	0.005	414.8	411.2	410.5
500	0.002	415.9	413.0	412.6



May Branch, Fort Smith, Arkansas, Feasibility Study, Aug 2000

Elevation-Frequency for Interior Ponding Area

NOTES: Existing Condition curve applicable for extent of ponded area.

Modified Condition curves applicable at STA 14+50 of proposed channel.

Plate 1

4. Existing Condition Analysis

4.1 Scope of Study

An existing SWMM model for the May Branch channel-culvert system was provided by the City of Fort Smith. Camp Dresser & McKee (CDM) developed the existing model for the City's Stormwater Management Plan published in 1993. The scope of the current study was:

- Determine if any modifications were necessary to the CDM model hydrology to reflect changes from the 1992 conditions to the current conditions;

- Replace the precipitation values used in the CDM study with values developed using HEC-1 for the target events (2-, 5-, 10-, 25-, 50-, 100-, and 500-year flood events);

- Run the City's SWMM model with these precipitation values; and

- Generate water surface elevations for the target events.

It was assumed that the City's SWMM model included the correct geometry for the current system (e.g., no physical or structural changes had been made by the City that would impact the geometry in the model).

4.2 Watershed Changes

Based on reconnaissance of the area on July 21 and August 17, 1999 and discussions with City personnel, it was determined that no modifications were necessary to the watershed characteristics used in the 1993 SWMM model developed by Camp Dresser & McKee (CDM) for the City's Stormwater Management Plan.

4.3 Precipitation Method Changes

In order to conform to the methodology for hypothetical precipitation used by the Corps of Engineers, new precipitation values and distributions were developed for the seven storms to be analyzed using HEC-1 and 24-hour frequency precipitation data from TP-40 (NWS 1961). Table 4 compares the total storm precipitation values used by CDM with those used in this study.

Table 4

Comparison of Precipitation Values

Recurrence Interval (yrs)	Event Frequency (%)	CDM Rainfall Depth* (inches)	FTN Rainfall Depth (inches)
2	50	N/A	3.66
5	20	N/A	5.11
10	10	6.30	6.29
25	4	7.38	7.35
50	2	8.24	8.19
100	1	9.17	9.09
500	0.2	11.70	11.11

* Taken from City of Fort Smith Stormwater Management Plan, Camp Dresser & McKee, December 22, 1993

4.4 Simulation Considerations

All simulations for this project were run using XP-SWMM, Version 6.3, 1999, by XP Software, Inc.

4.5 Backwater Effects

In order to take into account backwater effects from the Arkansas River, the downstream boundary conditions (starting water surface elevations) were set to the coincident frequency elevation values in Table 5 as agreed upon by the City and the Corps. These values are based on a coincident frequency analysis completed in 2000 (different from interior analysis discussed earlier and only used as starting conditions). The FIS elevations, shown for comparison, were taken from the July 1991, City of Fort Smith, Arkansas, Flood Insurance Study (FEMA 1991) profile at the May Branch confluence with the Arkansas River. Normal pool elevation for the Arkansas River at the confluence with May Branch is 392 feet (NGVD).

Table 5
Starting water surface elevation conditions

Recurrence Interval (yrs)	Event Frequency (%)	Coincident Arkansas River Elevation at 'P' Street Sewer Outfall	FIS Arkansas River Elevation (ft)
2	50	394.08	N/A
5	20	394.31	N/A
10	10	394.58	409.8
25	4	394.96	N/A
50	2	395.12	415.2
100	1	395.27	417.5
500	0.2	395.86	419.8

4.6 Pump Station Operation

A pump station exists at the downstream end of May Branch that is operated to control interior flooding during high stages on the Arkansas River. Under low Arkansas River flow conditions, the May Branch/'P' Street sewer drains to the Arkansas River through a 12 foot diameter pipe through the levee. When the Arkansas River reaches an elevation of 408 feet near the outlet of the May Branch, a gate is closed on the sewer to prevent additional backwater flooding upstream from the Arkansas River, and pumping is initiated to drain the interior areas. For these simulations, the coincident frequency elevation of the Arkansas River was lower than 408, therefore, the May Branch was considered as pipe flow to the Arkansas River, rather than a pumped condition.

4.7 Job Control

Based on recommendations from the SWMM software developers, several job control parameters were modified to smooth numerical oscillations.

4.8 Geometry Changes

During a review of the results a limited review of the hydraulics of the CDM SWMM model was conducted. During this review several connections and nodes were questioned. In addition, it was noted that the existing SWMM model did not include a pump station at the downstream end of the model. After discussing the conditions with City personnel, the following changes were made to the geometry file used for this analysis. A schematic diagram of the existing conditions system model is attached as Plate 2.

- Moved link 10151 from between nodes 1011n/1015n to between nodes 1013n/1015n. Renamed new link MUL510.

- Added link 10131 between nodes 1011n/1013n. Renamed new link MUL511. Link 10131 has the following parameters:
    - Trapezoidal channel section
    - Length = 1086’
    - Bottom Width = 200’
    - Side Slope = 1V:50H
    - Depth = 8’
    - Manning’s ‘n’ = 0.035
    - Upstream invert = 414.86
    - Downstream invert = 414.50

- Moved overland flow link 12301 from between nodes 1230n/1015n to between nodes 1230n/1013n. Renamed the new link MUL100. Changed downstream invert from 410.60 to 414.86 to match the overland flow elevation at node 1013n, as directed by City personnel.

- A weir diversion (link 1005) was added at node 9n. This weir diversion connects to a new node, 10n. With this change, the storage node data originally at node 9n was moved to node 10n. In addition, the pipe invert at node 9n was changed from 392.5 to 396 so that the weir crest elevation of 408 is at the same elevation as the pipe crown.

- Loss coefficients at Park Street were modified slightly to eliminate crossing water surface profiles just upstream of Park Avenue.

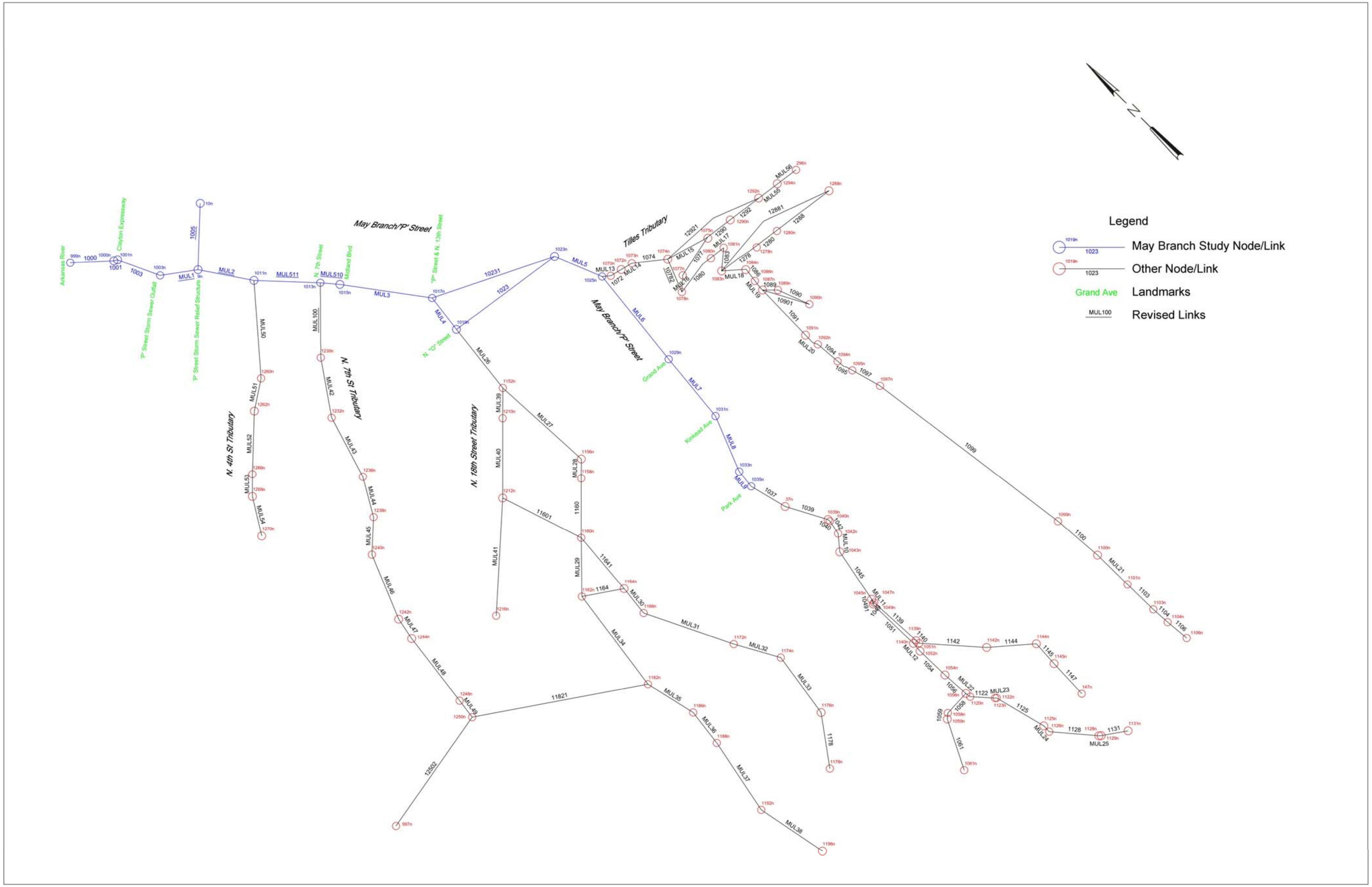
- Link 10782 was moved from between nodes 1042n & 1074n to between nodes 1078n & 1074n based on discussions with City of Fort Smith personnel.

- Node 1042n minimum node elevation was changed to 463.3 based on discussions with City of Fort Smith personnel.

4.9 Results

4.9.1 Hydrology

Table 6 presents the peak flows at various locations along May Branch for the seven frequency events modeled. The flows are not necessarily cumulative at confluences and junctions because SWMM allows for the variation of flow with time and therefore adds the hydrograph ordinates into the system at the time that they occur rather than adding peaks together as is commonly done with a steady state model. The SWMM model also includes several storage areas at nodes that serve to decrease the peak flow as it goes downstream. The flow in the pipe through the



N
Legend
1019n
1023
May Branch Study Node/Link
1019n
1023
Other Node/Link
Grand Ave
Landmarks
MUL100
Revised Links
May Branch/'P' Street
May Branch/'P' Street
Tilles Tributary
N. 4th St Tributary
N. 7th St Tributary
N. 18th Street Tributary
Arkansas River
Clayton Expressway
'P' Street Storm Sewer Outfall
'P' Street Storm Sewer Relief Structure
N. 7th Street
Midland Blvd
'P' Street & N. 13th Street
N. "O" Street
Grand Ave
Kinkead Ave
Park Ave
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1000n
1001
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1061n

levee downstream of the ‘P’ Street relief structure is larger than in previous studies due to SWMM modeling the pipe with pressure flow rather than a free flow condition. The area downstream of the relief structure is modeled as a storage area to represent the ponding that occurs in this area. The overland flow link in this area is configured only to have flow if the elevations are high enough to overtop the levee, which does not occur in any of these simulations.

Table 6.
Existing Conditions Peak Flow Summary

Event Frequency	Location (SWMM Link)	Mouth (Arkansas R – 1000)	P Street Sewer Relief Structure (MUL1 – 1009/10091)	N. 4th Street (MUL2 – 1011/10111)	N. 7th Street (MUL511 – 1013/10131)	Midland Blvd (MUL510 – 1015/10151)	Tilles Tributary (MUL5 – 1025/10251)	Grand Ave nue (MUL6 – 1029/10291)	Kinkead Avenue (MUL7 – 1031/10311)	Blackburn Avenue (MUL8 – 1033/10331)	Park Avenue (MUL9 – 1035/10351)
		Flow (cfs)									
50%	Pipe	1056	1046	942	920	685	422	448	341	322	322
	Overland	N/A	0	0	0	0	221	0	0	0	0
	Combined *	1056	1046	942	920	685	506	448	341	322	322
20%	Pipe	1207	1195	1063	989	738	400	519	427	439	473
	Overland	N/A	0	0	0	322	574	157	172	115	131
	Combined *	1207	1195	1063	989	912	868	672	580	554	572
10%	Pipe	1311	1311	1303	1001	733	400	538	426	441	473
	Overland	N/A	0	0	378	946	800	314	385	309	292
	Combined *	1311	1311	1303	1252	1429	1114	841	770	731	733
4%	Pipe	1501	1489	1460	1000	731	399	548	425	441	473
	Overland	N/A	0	136	1099	1438	1015	474	525	429	412
	Combined *	1501	1489	1513	1743	1850	1346	1021	899	852	853
2%	Pipe	1658	1656	1443	1000	580	399	551	424	440	473
	Overland	N/A	0	612	1553	1752	1207	598	634	541	525
	Combined *	1658	1656	1814	2166	2120	1553	1148	1006	965	967
1%	Pipe	1845	1845	1423	992	567	398	553	424	440	473
	Overland	N/A	0	1401	2006	2120	1456	722	813	726	655[⊥]
	Combined *	1845	1845	2168	2602	2475	1820	1274	1180	1152	1097
0.2%	Pipe	2058	2058	1291	833	577	394	558	424	440	473
	Overland	N/A	0	2562	2869	2853	1839	1052	974	822	824[⊥⊥]
	Combined *	2058	2058	3137	3425	3209	2224	1604	1333	1247	1296[⊥⊥]

* In some cases, the peaks in the storm sewer pipe and corresponding overland channel were not coincident. The combined peak was computed by taking the maximum of the coincident sum of flows.

[⊥] According to output, max flow = 1586 cfs, but considered a numerical anomaly.

[⊥⊥] Computed using average of max. total flow (1260) downstream with total max flow upstream (1332) = 1296 cfs, overland flow = 1296-473

4.9.2 Hydraulics

The results of the simulations are presented in profile form (Plate 3) showing the maximum hydraulic grade line elevations along May Branch or coincident ponding elevation, whichever is higher. The profiles also show the approximate invert and top of pipe for the ‘P’ Street Sewer and the natural ground profile for the 1991 City of Fort Smith FIS profile. Table 7 summarizes the maximum hydraulic grade line elevations along May Branch.

These SWMM “profiles” cannot be interpreted the same as HEC-2 or HEC-RAS water surface profiles because the SWMM model simulates pipe flow which includes pressure flow in pipes, not just open channel flow. The elevations output from the SWMM model represent the hydraulic grade line elevation and not necessarily the water surface elevation. For evaluation purposes, existing conditions hydraulic grade lines were used as water surface elevations.

Table 7

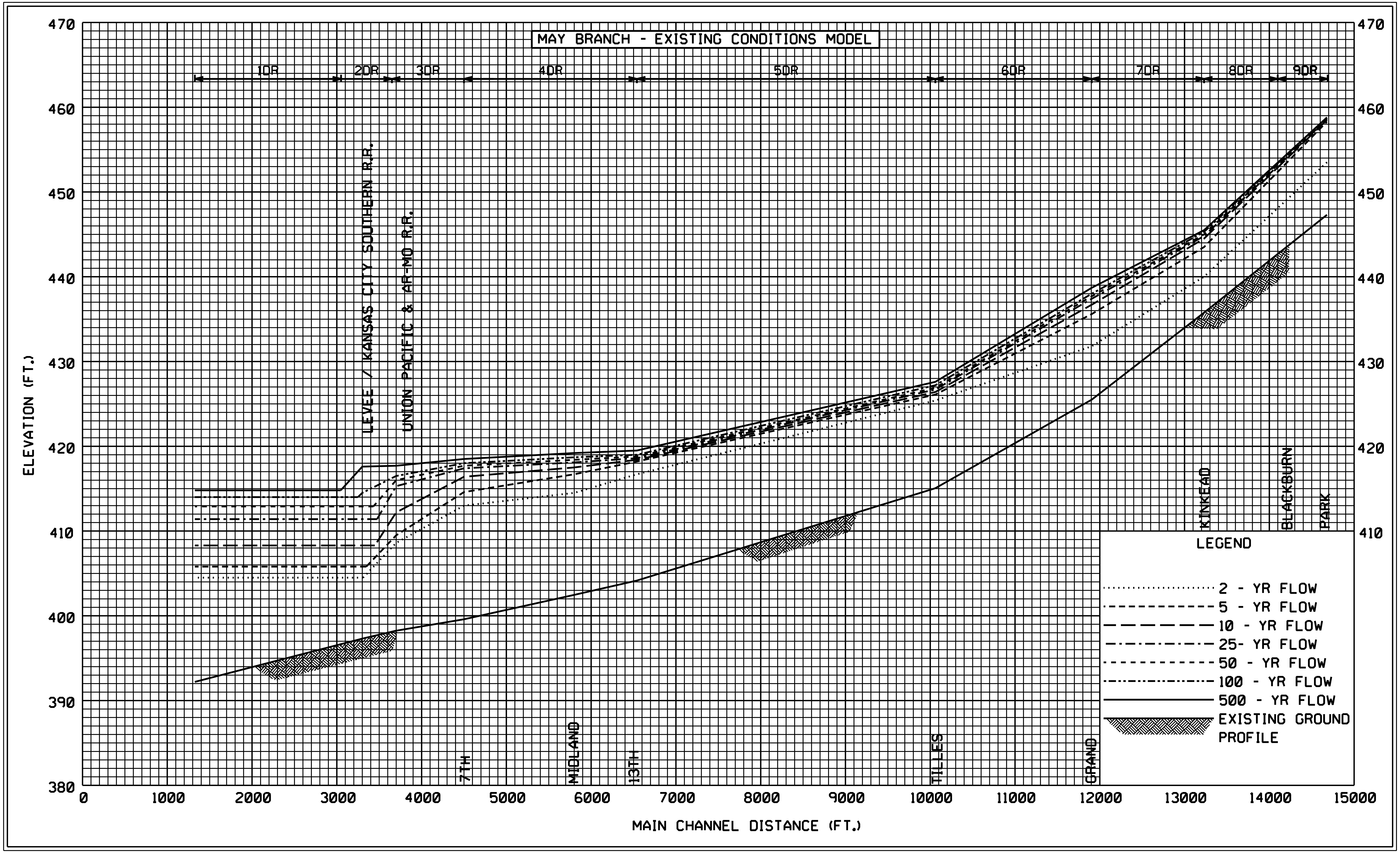
Maximum hydraulic grade line elevations (Existing Conditions)

May Branch	**SWMM Node**	**Event Frequency**						
		50%	**20%**	**10%**	**4%**	**2%**	**1%**	**0.2%**
Location		**Hydraulic Grade Line (ft)**						
Mouth (Arkansas R)	999n	394.1	394.3	394.6	395.0	395.1	395.3	395.9
P St. Sewer Relief Structure	9n	404.4	405.3	406.0	408.4	411.4	414.5	417.6
Just U/S of Missouri-Pacific/Union-Pacific RR	1011n	408.6	409.5	412.2	415.3	416.0	416.5	417.7
N. 7th Street	1013n	413.0	414.6	416.4	417.4	417.7	418.0	418.5
Midland Blvd	1015n	414.5	416.7	417.5	418.1	418.4	418.7	419.2
P St. & N. 13th	1017n	416.7	418.2	418.4	418.6	418.8	419.0	419.5
Tilles Tributary	1025n	425.4	426.1	426.4	426.7	426.9	427.2	427.6
Grand Avenue	1029n	431.8	435.6	436.7	437.4	437.7	438.0	438.7
Kinkead Avenue	1031n	440.0	443.5	444.5	444.8	445.0	445.3	445.5
Park Avenue	1035n	453.5	458.3	458.5	458.6	458.7	458.8	458.8

5 Analysis of Project Alternatives

5.1 General

The purpose of the analysis was to develop 10-, 50-, and 100-year design channels to maintain water elevations below “Start of Damages” elevations along the study reach. The study reach is from the confluence with the Arkansas River upstream to Park Avenue, approximately 3 miles. The upstream limit of Federal interest, the point where the 10-year flow equals 800 cfs, is just upstream of Grand Avenue, as shown in Table 6, Existing Conditions Peak Flow Summary. The downstream project limit is the confluence with the Arkansas River. Flood flow from May Branch is minimal compared to any condition of the Arkansas River and would be insignificant to any Arkansas River condition.



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5.2 Background

The City of Fort Smith (City) contracted with FTN Associates, Ltd. to develop the existing conditions profiles for the 2-, 5-, 10-, 25-, 50-, 100-, and 500-year events (with frequencies of 50%, 20%, 10%, 4%, 2%, 1%, and 0.2%, respectively) for the existing "P" Street storm sewer system. The City provided FTN with an existing SWMM model of the system that was developed by Camp, Dresser & McKee in 1993 for the City's Stormwater Management Plan. FTN applied the design rainfall, based on TP-40, to the existing SWMM model and prepared profiles for the existing condition.

5.3 Pre-Selected Channel

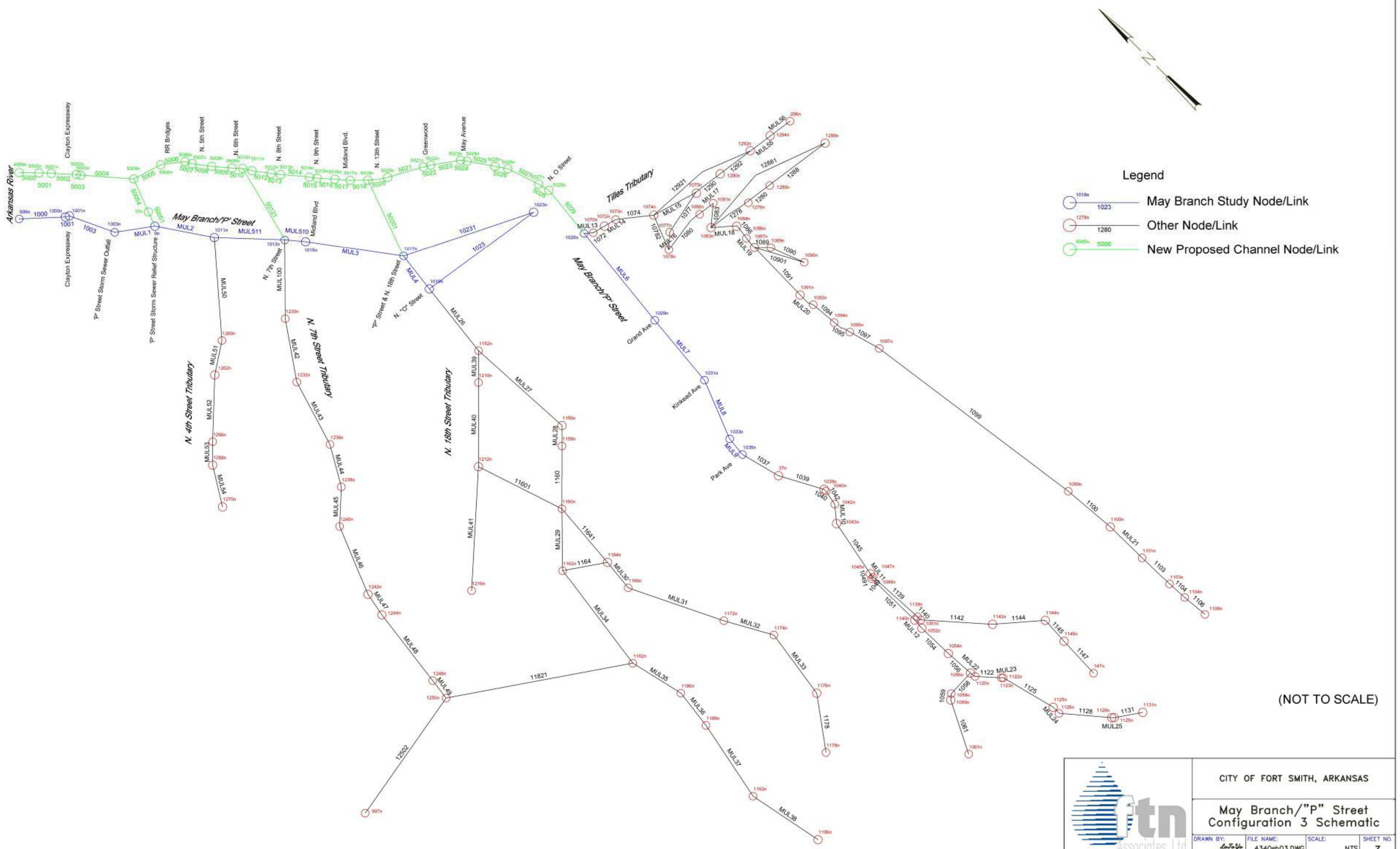
The existing conditions SWMM model was modified to develop a pre-selected design channel for the proposed May Branch improvement project. Assumptions made in the SWMM analysis included:

1. Allowing additional capacity in several of the downstream laterals that feed into the existing "P" Street system (assuming the City improves these laterals in the future);

2. Providing three lateral connections between the original "P" Street system and the new channel (at the oxbow just upstream of the existing pump station, near North 7th Street, and near the intersection of "P" Street and 13th Street); and

3. The existing "P" Street system would remain in place and fully functional from just upstream of the North "O" Street crossing downstream to the Arkansas River.

These assumptions were made to provide a conservative (high) estimate of the flow that the new channel would need to accommodate. This pre-selected design channel was used to establish design flows for use in preparing an HEC-RAS model of the proposed channel to determine preliminary design sizes for the channel, bridge openings, and culverts for the Little Rock District. The flow values used in the HEC-RAS models are presented in Table 8. The modified condition SWMM schematic is shown as Plate 4.



CITY OF FORT SMITH, ARKANSAS

May Branch/"P" Street
Configuration 3 Schematic

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APPROVED BY:	PROJECT NO.	DATE:	OF
	4340-123	03/19/01	3

ftn Associates Ltd.
water resources/environmental consultants

Plate 4

Table 8

Flow values (cfs) used in HEC-RAS design models (Modified Conditions)

Location	Station (ft)	50% (2-year)	20% (5-year)	10% (10-year)	4% (25-year)	2% (50-year)	1% (100-year)	0.2% (500-year)
U/S Limit	158+20	140	215	270	340	400	450	575
Kinkead Ave U/S Face	144+40	240	375	465	600	685	785	1000
Grand Ave U/S Face	131+30	390	600	750	955	1100	1250	1585
Just D/S of Tilles Trib	112+00	555	830	1140	1310	1460	1725	2415
Just D/S of N 18th St extension	75+90	910	1365	1680	2025	2280	2600	3550
Just D/S of N 7th St extension	53+30	1670	2475	3000	3565	3840	4090	5025

5.4 Design Channels

The basic parameters for determining the size of the new channels and structures included the following:

- The models would use starting water surface elevations from the coincident frequency analysis,
- No levee gate or pump station would be modeled in the system along the new channel,
- Trapezoidal channels would have 3H:1V side slopes stabilized with rip rap (Manning's 'n' value equals 0.040),
- Manning's 'n' values would not be modified from 0.040 based on velocities in the channels,
- Concrete vertical-walled channels would have a Manning's 'n' value of 0.013,
- Bridges would be used for structures from North 6th Street to the mouth,
- Box culverts would be used for all structures upstream of North 6th Street (box culverts would be standard highway type with 18 to 33 degree flared wingwalls),
- At least 1 foot between top of road and interior top of box culvert (crown) would be maintained at all crossings,
- The channel through Clayton Expressway to just upstream of the Fort Smith levee would have vertical sides and be made of concrete (Manning's 'n" equals 0.013), (changed to trapezoid channel through Clayton Expressway)

- The channel between May Avenue and North "O" Street would have vertical sides and be made of concrete (Manning's 'n' value equals 0.013) including the two structures and one access crossing at the Arkhola Plant, (changed to vertical sides from May Avenue to Arkhola Bridge behind plant)

- The channel invert and slope would approximate the existing invert and slope of the "P" Street system,

- The channels would be designed such that the water surface elevations are below the provided "Start of Damages" elevations (Table 9) and with minimal or no roadway inundation, and

- Overbank points would be obtained from a drawing provided by the District.

Manning's 'n' values were set to 0.04 for the overbank areas upstream of the Union Pacific Railway crossing at approximately station 48+00. Downstream of this crossing, the overbanks are wooded and a Manning's 'n' value of 0.10 was assumed for the overbank areas.

Table 9

Start of Damages station-elevation

Station	"Start of Damages" Elevation	Station	"Start of Damages" Elevation
14+50	416.8	82+50	422.0
28+00	413.0	88+00	422.2
33+00	412.5	93+50	424.4
38+00	416.8	105+00	424.2
42+50	412.8	110+00	424.7
48+00	413.2	115+00	426.8
52+00	413.9	120+00	428.4
56+00	414.4	122+50	430.5
62+00	415.4	127+50	432.2
65+00	413.2	133+00	436.3
70+00	415.9	138+00	440.4
74+00	419.0	149+00	446.4
77+00	416.1	157+00	453.9

5.5 RESULTS OF DESIGN ANALYSIS

Results of the design analyses are shown on profiles for the proposed May Branch channel as PLATES 4 - 7. The various plans were designed to maintain respective water surface elevations below the "start of damage" elevations as shown in Table 9.

5.5.1 10-Year Design

The bottom width of the 10-year design trapezoidal channel varies from 10 feet to 4 feet wide (Table 10). The channel bottom width from the mouth of May Branch to May Avenue is 10 feet. From May Avenue along the back of Arkhola the channel has vertical walls with a 12 foot bottom width. From Arkhola crossing to "L" Street the bottom width is 6 feet and from "L" Street to Park Street the bottom width is 4 feet. Box culvert sizes range from 3 - 10'Wx10'H to 2 - 6'Wx6'H (Table 11). The 10-year design channel profile is shown as Plate 5.

Table 10
10-year design channel data.

Section Type	Station*		10-Year Design Channel Data	
	Start Station	End Station	Bottom Width (ft)	Side Slope
Trapezoid	0+00	80+80	10	3H:1V
Rectangular	82+20	86+35	12	N/A
Trapezoid	86+80	90+80	6	3H:1V
Trapezoid	100+60	105+10	6	2H:1V
Trapezoid	106+30	112+60	4	2H:1V
Trapezoid	117+50	145+30	4	3H:1V

- Gaps in stationing are locations of transition sections and structures.

Table 11

10-year design structure data.

Structure Type	Location	Center line Station	10-Year Design Structure Data			
			Length (ft)	Number of Boxes	Bottom Width or Span (ft)	Rise (ft)
RCBC*	Clayton Expressway/Levee	13+25	140	2	10	10
RCBC	Missouri-Pacific RR	28+25	83	3	10	10
RCBC	Unnamed Railroad and Union Pacific Railroad	33+70	42	3	10	10
RCBC	Arkansas-Missouri RR	34+75	68	3	10	10
RCBC	Union Pacific RR	36+50	45	3	10	10
Bridge	North 6th Street	41+45	N/A	N/A	N/A	N/A
RCBC	Midland Blvd	58+00	120	2	8	12
RCBC	Greenwood Avenue	76+75	86	2	8	8
Bridge	Arkhola Crossing	86+10	N/A	N/A	N/A	N/A
RCBC	North 'O' Street	92+00	90	2	8	10
RCBC	Grand Avenue	119+05	102	3	6	6
RCBC	Kinkead Avenue	132+30	90	2	6	6
RCBC	Park Avenue	146+14	85	2	6	6

*Reinforced concrete box culvert

5.5.2 50-Year Design

The bottom width of the trapezoidal portion of the 50-year design channel varies from 24 feet to 4 feet wide (Table 12). The channel bottom width from the mouth of May Branch to the levee is 20 feet. In the reach between the levee and Midland Blvd., the channel bottom width increases to 24 feet. From Midland to May Avenue the bottom width is 16 feet. From May Avenue along the back of Arkhola the channel has vertical walls with a 14 foot bottom width. From Arkhola crossing to "L" Street the bottom width is 16 feet, from "L" Street to Grand Avenue 8 feet, and from Grand Avenue to Park Street the bottom width is 4 feet. Box culvert sizes range from 4 - 10'Wx10'H to 2 - 6'Wx6'H (Table 13). The 50-year design channel profile is shown as Plate 6.

Table 12

50-year design channel data.

Section Type	Station		50-Year Design Channel Data	
	Start Station	End Station	Bottom Width (ft)	Side Slope
Trapezoid	0+00	12+00	20	3H:1V
Trapezoid	14+50	56+55	24	3H:1V
Trapezoid	59+10	80+80	16	3H:1V
Rectangular	82+20	86+35	14	N/A
Trapezoid	86+80	90+80	16	3H:1V
Trapezoid	100+60	105+10	16	2H:1V
Trapezoid	106+30	112+60	8	2H:1V
Trapezoid	117+50	118+15	8	3H:1V
Trapezoid	119+75	145+30	4	3H:1V

Table 13
50-year design structure data.

Structure Type	Location	Center line Station	50-Year Design Structure Data			
			Length (ft)	Number of Boxes	Bottom Width or Span (ft)	Rise (ft)
RCBC*	Clayton Expressway/Levee	13+25	140	2	10	10
RCBC	Missouri-Pacific RR	28+25	83	4	10	10
RCBC	Unnamed Railroad and Union Pacific Railroad	33+70	42	4	10	10
RCBC	Arkansas-Missouri RR	34+75	68	4	10	10
RCBC	Union Pacific RR	36+50	45	4	10	10
Bridge	North 6th Street	41+45	N/A	N/A	N/A	N/A
RCBC	Midland Blvd	58+00	120	2	8	12
RCBC	Greenwood Avenue	76+75	86	2	8	10
Bridge	Arkhola Crossing	86+10	N/A	N/A	N/A	N/A
RCBC	North 'O' Street	92+00	90	2	8	10
RCBC	Grand Avenue	119+05	102	3	6	6
RCBC	Kinkead Avenue	132+30	90	3	6	6
RCBC	Park Avenue	146+14	85	2	6	6

5.5.3 100-Year Design

The bottom width of the trapezoidal portion of the 100-year design channel varies from 24 feet to 4 feet wide (Table 14). The channel bottom width from the mouth of May Branch to the levee is 20. In the reach between the Levee and Midland Blvd., the channel bottom width increases to 24 feet. From Midland to May Avenue the bottom width is 16 feet. From May Avenue along the back of Arkhola the channel has vertical walls with a 14 foot bottom width. From Arkhola crossing to "L" Street the bottom width is 16 feet, from "L" Street to Grand Avenue 8 feet, and from Grand Avenue to Park Street the bottom width is 4 feet. Box culvert sizes range from 5 - 10'Wx10'H to 3 - 6'Wx6'H (Table 15). The 100-year design channel profile is shown as Plate 7.

Table 14
100-year design channel data.

Section Type	Station*		100-Year Design Channel Data	
	Start Station	End Station	Bottom Width (ft)	Side Slope
Trapezoid	0+00	12+00	20	3H:1V
Trapezoid	14+50	56+55	24	3H:1V
Trapezoid	59+10	80+80	16	3H:1V
Rectangular	82+20	86+35	14	N/A
Trapezoid	86+80	90+80	16	3H:1V
Trapezoid	100+60	105+10	16	2H:1V
Trapezoid	106+30	112+60	8	2H:1V
Trapezoid	117+50	118+15	8	3H:1V
Trapezoid	119+75	145+30	4	3H:1V

*Gaps in stationing are locations of transition sections and structures.
**Several sections in this reach were modified to have vertical right banks to avoid buildings in the area. See plans tables for data.

Table 15
100-year design structure data.

Structure Type	Location	Center line Station	100-Year Design Structure Data			
			Length (ft)	Number of Boxes	Bottom Width or Span (ft)	Rise (ft)
RCBC*	Clayton Expressway/Levee	13+25	140	2	10	10
RCBC	Missouri-Pacific RR	28+25	83	5	10	10
RCBC	Unnamed Railroad and Union Pacific Railroad	33+70	42	5	10	10
RCBC	Arkansas-Missouri RR	34+75	68	5	10	10
RCBC	Union Pacific RR	36+50	45	5	10	10
Bridge	North 6th Street	41+45	N/A	N/A	N/A	N/A
RCBC	Midland Blvd	58+00	120	3	8	12
RCBC	Greenwood Avenue	76+75	86	2	8	10
Bridge	Arkhola Crossing	86+10	N/A	N/A	N/A	N/A
RCBC	North 'O' Street	92+00	90	2	8	10
RCBC	Grand Avenue	119+05	102	3	6	6
RCBC	Kinkead Avenue	132+30	90	3	6	6
RCBC	Park Avenue	146+14	85	3	6	6

5.5.4 200-Year Design

The bottom width of the trapezoidal portion of the 100-year design channel varies from 26 feet to 4 feet wide (Table 16). The channel bottom width from the mouth of May Branch to the levee is 20. In the reach between the Levee and Midland Blvd., the channel bottom width increases to 26 feet. From Midland to May Avenue the bottom width is 16 feet. From May Avenue along the back of Arkhola the channel has vertical walls with a 14 foot bottom width. From Arkhola crossing to "L" Street the bottom width is 16 feet, from "L" Street to Grand Avenue 8 feet, and from Grand Avenue to Park Street the bottom width is 4 feet. Box culvert sizes range from 6 - 10'Wx10'H to 3 - 6'Wx6'H (Table 17). The 200-year design channel profile is shown as Plate 8.

Table 16

200-year design channel data.

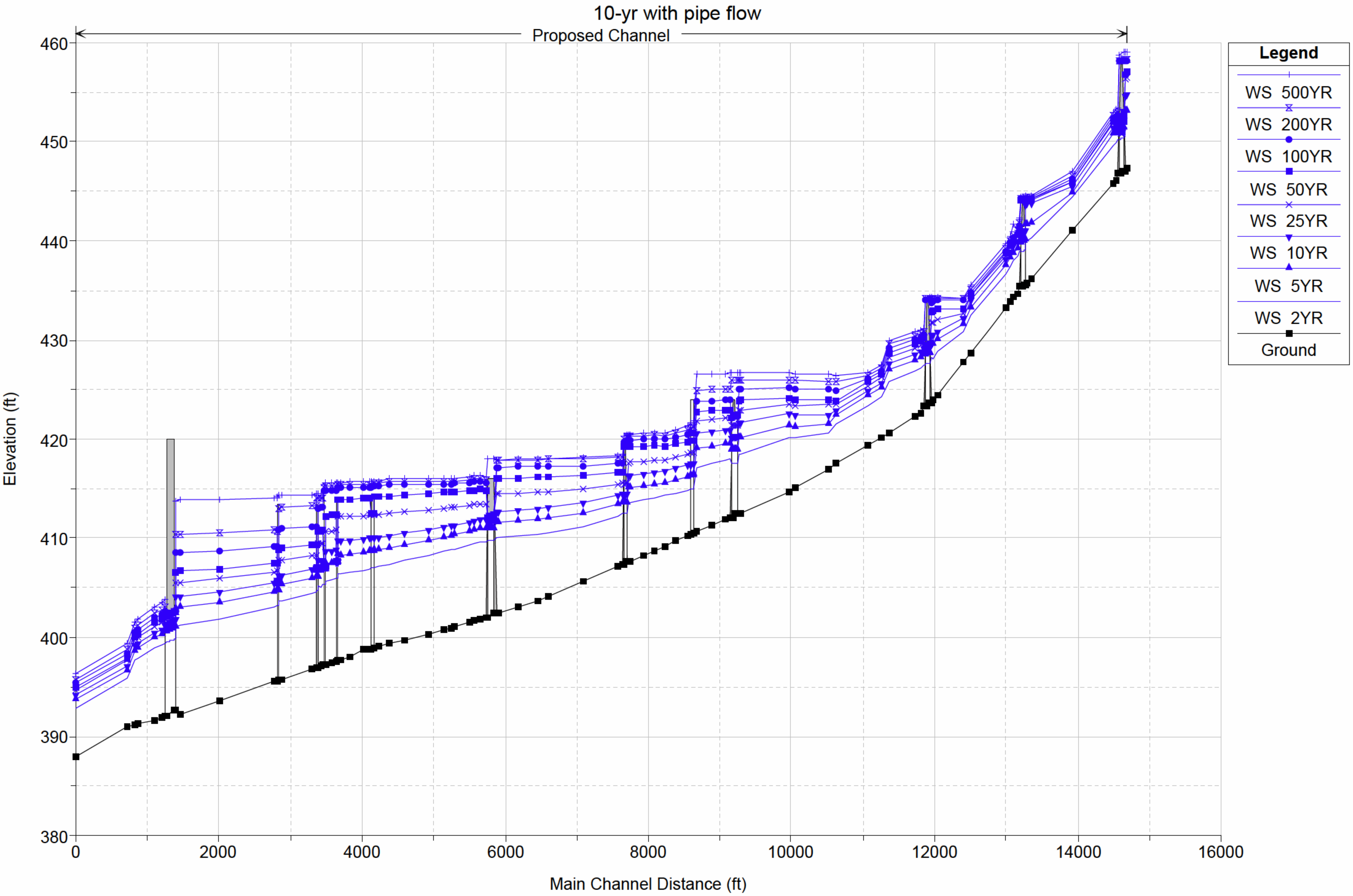
Section Type	Station*		200-Year Design Channel Data	
	Start Station	End Station	Bottom Width (ft)	Side Slope
Trapezoid	0+00	12+00	20	3H:1V
Trapezoid	14+50	56+55	26	3H:1V
Trapezoid	59+10	64+50	20	3H:1V
Trapezoid	66+05	80+80	16	3H:1V
Rectangular	82+20	86+35	14	N/A
Trapezoid	86+80	90+80	16	3H:1V
Trapezoid	100+60	105+10	16	2H:1V
Trapezoid	106+30	112+60	8	2H:1V
Trapezoid	117+50	118+15	8	3H:1V
Trapezoid	119+75	145+30	4	3H:1V

*Gaps in stationing are locations of transition sections and structures.

Table 17

200-year design structure data.

Structure Type	Location	Center line Station	200-Year Design Structure Data			
			Length (ft)	Number of Boxes	Bottom Width or Span (ft)	Rise (ft)
RCBC*	Clayton Expressway/Levee	13+25	140	2	10	10
RCBC	Missouri-Pacific RR	28+25	83	6	10	10
RCBC	Unnamed Railroad and Union Pacific Railroad	33+70	42	6	10	10
RCBC	Arkansas-Missouri RR	34+75	68	6	10	10
RCBC	Union Pacific RR	36+50	45	6	10	10
Bridge	North 6th Street	41+45	N/A	N/A	N/A	N/A
RCBC	Midland Blvd	58+00	120	3	8	12
RCBC	Greenwood Avenue	76+75	86	3	8	10
Bridge	Arkhola Crossing	86+10	N/A	N/A	N/A	N/A
RCBC	North 'O' Street	92+00	90	2	8	10
RCBC	Grand Avenue	119+05	102	3	6	6
RCBC	Kinkead Avenue	132+30	90	3	6	6
RCBC	Park Avenue	146+14	85	3	6	6


10-yr with pipe flow
Proposed Channel
Elevation (ft)
Main Channel Distance (ft)
460
450
440
430
420
410
400
390
380
0
2000
4000
6000
8000
10000
12000
14000
16000
Legend
WS 500YR
WS 200YR
WS 100YR
WS 50YR
WS 25YR
WS 10YR
WS 5YR
WS 2YR
Ground

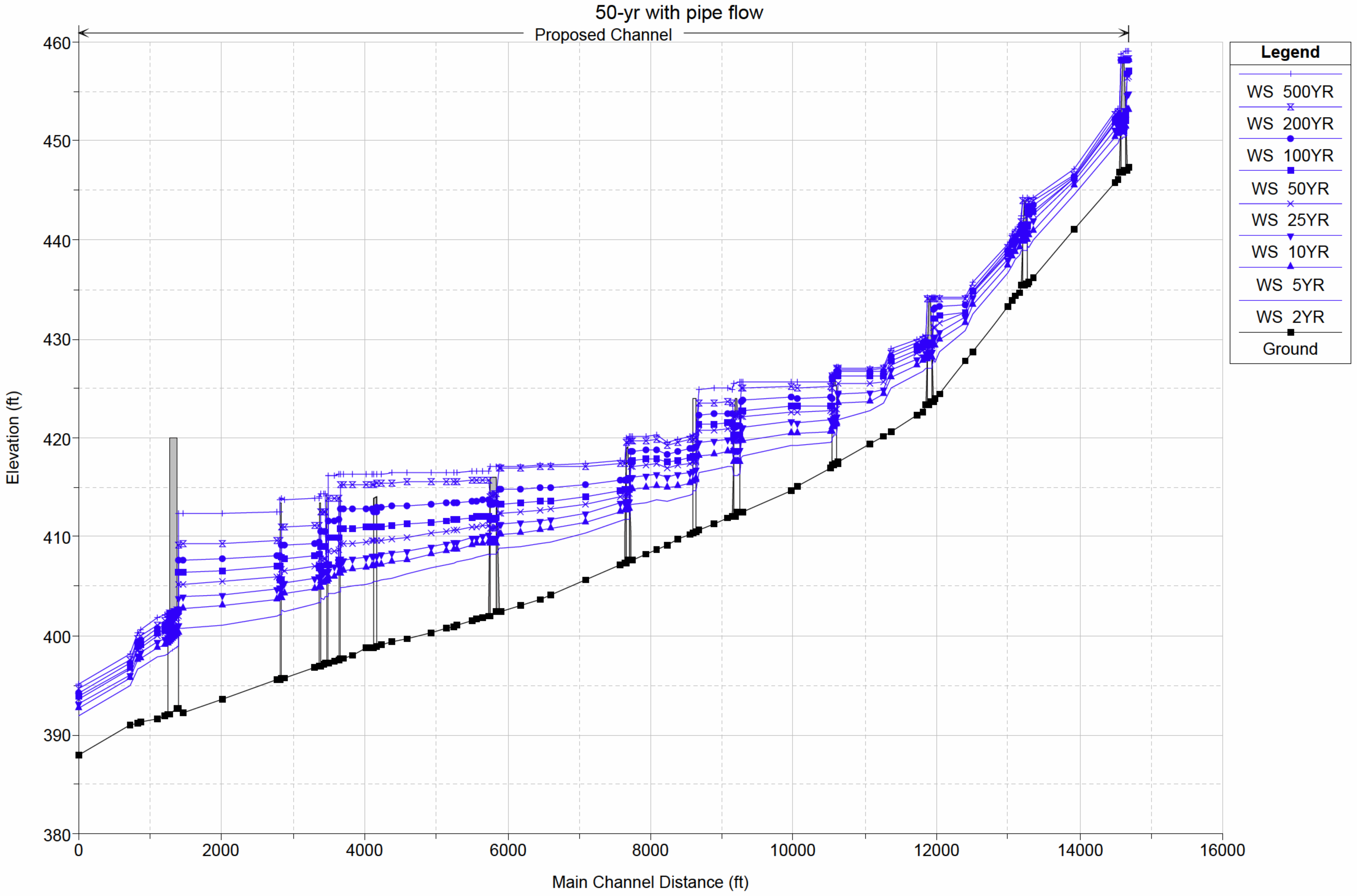

50-yr with pipe flow
Proposed Channel
Elevation (ft)
Main Channel Distance (ft)
460
450
440
430
420
410
400
390
380
0
2000
4000
6000
8000
10000
12000
14000
16000
Legend
WS 500YR
WS 200YR
WS 100YR
WS 50YR
WS 25YR
WS 10YR
WS 5YR
WS 2YR
Ground

Plate 6

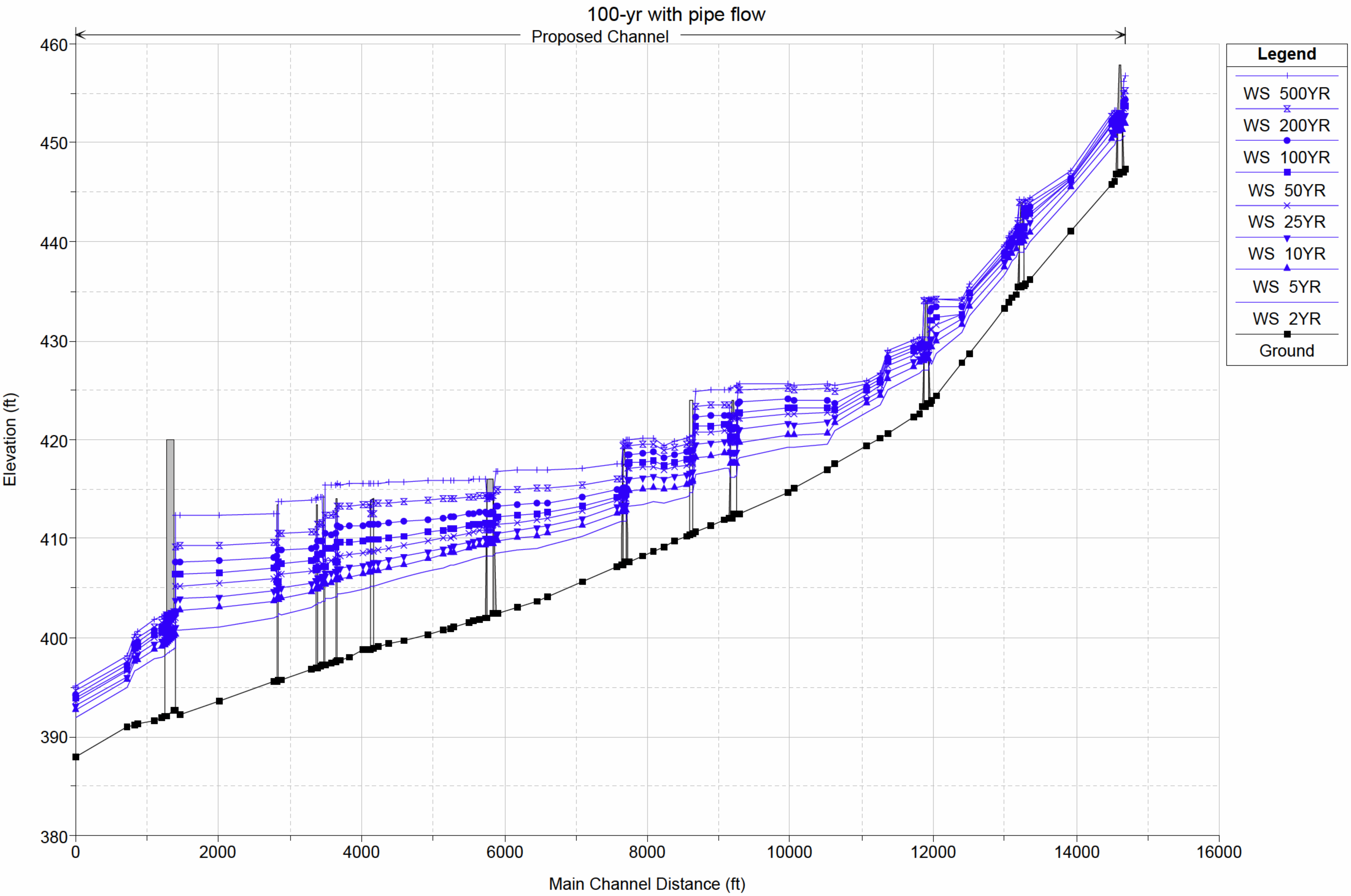
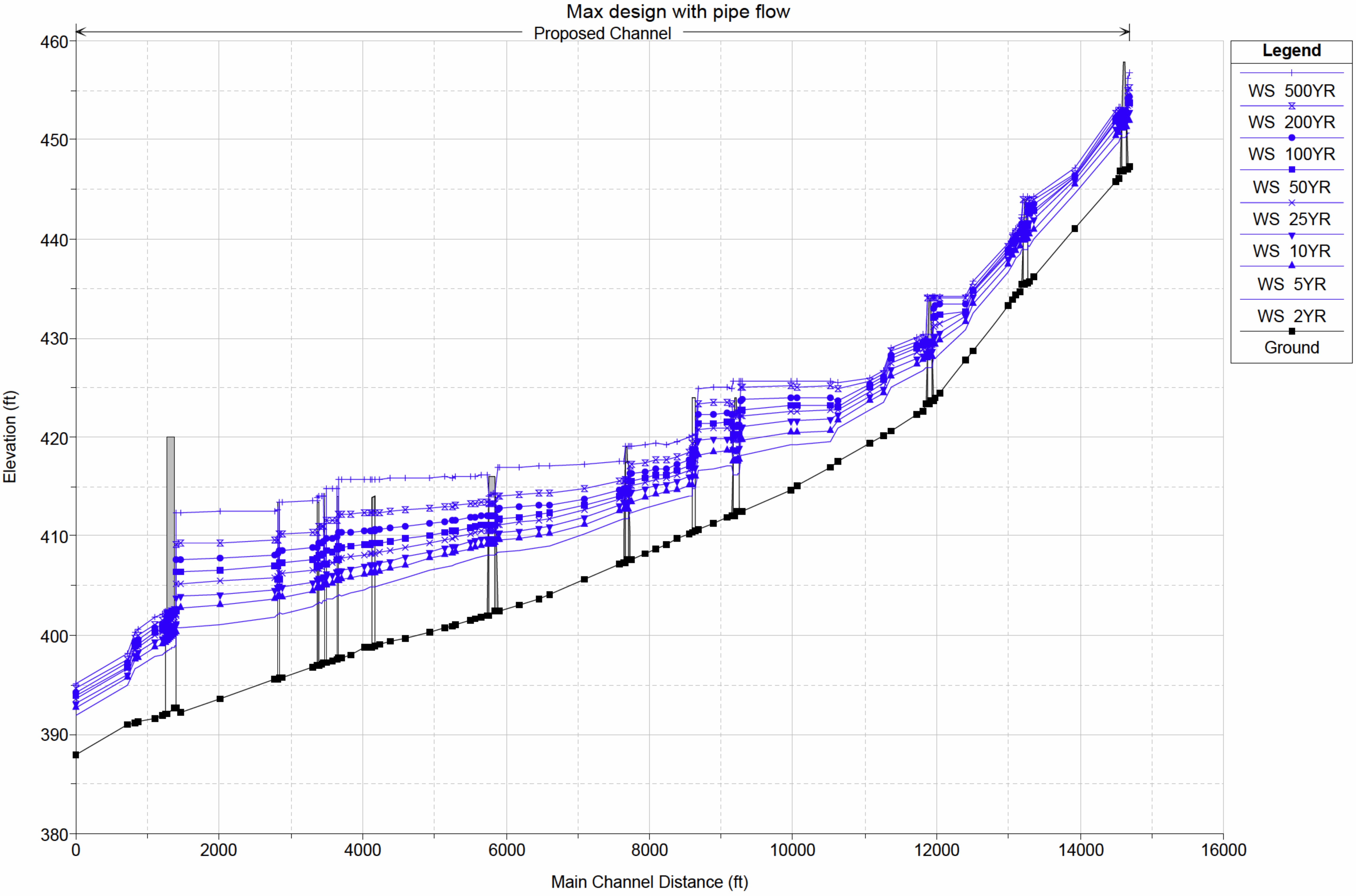

100-yr with pipe flow
Proposed Channel
Legend
WS 500YR
WS 200YR
WS 100YR
WS 50YR
WS 25YR
WS 10YR
WS 5YR
WS 2YR
Ground
Elevation (ft)
Main Channel Distance (ft)
380
390
400
410
420
430
440
450
460
0
2000
4000
6000
8000
10000
12000
14000
16000

Plate 8


Max design with pipe flow
Proposed Channel
Elevation (ft)
460
450
440
430
420
410
400
390
380
Main Channel Distance (ft)
0
2000
4000
6000
8000
10000
12000
14000
16000
Legend
WS 500YR
WS 200YR
WS 100YR
WS 50YR
WS 25YR
WS 10YR
WS 5YR
WS 2YR
Ground

MAY BRANCH
FT. SMITH, ARKANSAS

HTRW INVESTIGATIONS REPORT

FEBRUARY 2000

US ARMY CORPS OF ENGINEERS
LITTLE ROCK DISTRICT

1 Executive Summary:

Borings were made along the proposed channel alignments for the May Branch flood damage reduction project, which traverses the industrial area of Ft. Smith, Arkansas. Soil and water samples were analyzed for contaminants which could have originated from the industries in the area. The soil and water analyses showed that the suspected contamination exists. However, for the proposed route (C), contamination is minimal, and the Arkansas Department of Environmental Quality did not see any problems with the project.

2 1992 Site Inspection:

The May Branch Small Flood Control Project site at Ft. Smith, Arkansas was originally visually inspected, on 9 December 1992, for the surface evidence of the presence of Hazardous, Toxic, and Radioactive Waste HTRW). This investigation determined that the existing May Branch, the proposed channel alignments, and the proposed site of the deep bored tunnel encounter residential areas and light to moderate industrial areas. The initial site inspection revealed the potential for HTRW contamination in the industrialized area. This was taken into consideration for the selection of the most suitable route. See Attachment A: 1992 Inspection of May Branch.

3 1999 Site Inspection:

The industrial area of Ft. Smith, Arkansas was again inspected on 13-15 April 1999, since the channel must flow through a portion of the area to reach the Arkansas river. Historical documents were provided by the city of Ft. Smith on 13 April 1999. Data from existing maps and reports were combined to correlate historical data with present industry in the inspected area. Historical and aerial photos of the industrial area that were provided by some of the local industry representatives, the city of Ft. Smith, and Corps of Engineers were used to help characterize the area. Specific information on the individuals interviewed and businesses contacted is given in Attachment B: 1999 Site Inspection.

4 Subsurface Investigations – First Phase:

Subsurface investigations were performed to obtain geotechnical information and to obtain soil samples for hazardous waste analyses. Soil samples obtained during the subsurface investigations were analyzed to determine the presence of the suspected contaminants. The first phase of the subsurface investigation was performed starting 14 May 1999. During the first phase, the borings from which soil samples were obtained for chemical analysis were: MB-1, MB-2, MB-2A, MB-3, MB-3A, MB-4, MB-5, MB-6, MB-7, MB-8, MB-11, MB-13, MB-14, MB-21, MB-22, MB-23, MB-24.

The second phase of subsurface investigations was performed during 5-9 October 1999. The borings from which soil and water samples were obtained for chemical analysis were: MB-25, MB-26, MB-27, MB-28, MB-29, MB-30, MB-31. Surface water samples were also obtained from standing water around the landfill.

Refer to plate G-1 for locations. The data from the investigation is summarized in Attachment C: Table of May Branch HTRW Investigation Results. The analysis of the results is presented as Attachment D: Analysis of results.

5 ADEQ Review Meeting:

Representatives of the Corps of Engineers (Julia Smethurst & Max Frauenthal) met with representatives from the Arkansas Department of Environmental Quality (ADEQ) (Mike Bates, Tammy Hynum, & Dianna Kilburn) on 24 August 1999 to present the subsurface investigation findings and request advice from the ADEQ. The analytical results of the sub-surface samples and drawings showing the proposed channel pathways were presented. ADEQ also requested zoning maps of Ft. Smith, surface water and groundwater samples, the Chemical Data Assurance Report (CQAR), the sampling methodology, the Site Safety & Health Plan, the Chain of Custody form, and the Scope of Work. Zoning maps were obtained from the city of Ft. Smith and the ground water samples were obtained during the second phase of sampling. The CQAR was produced by Ft. Worth District Corps of Engineers. All requested items were transmitted to the ADEQ.

6 SWD Review Meeting:

On 25 August 1999 representatives from Little Rock District held an in-progress review meeting at Southwestern Division. The SWD representatives reiterated the importance of water samples and mentioned that the Chemical Quality Assurance Report should be produced. Details of the topics discussed are presented in Attachment E: Notes from SWD Meeting.

7 Subsurface Investigations – Second Phase:

Borings for the second phase of the HTRW investigations at May Branch, Ft. Smith soil were made 5-9 October 1999. The drilling/sampling contractor was GEOTEK Drilling company, Inc. from Nashville, TN (615) 331-2088. The geologist was Tom McGill and the driller was Steve Johnson. The driller's assistant was John Duncan. During the second phase, monitoring wells were installed at seven locations (MB-25, MB-26, MB-27, MB-28, MB-29, MB-30, and MB-31). Refer to plate G-1 for locations. Groundwater samples were analyzed from each monitoring well. Soil samples were analyzed from MB-30 and MB-31. Soil samples were not obtained from the other monitoring well locations since soil from these areas had been analyzed previously. Surface water samples were obtained from the old channel and the ponds by the pallet factory and the landfill. The data from the investigation is summarized in Attachment C: Table of May Branch HTRW Investigation Results.

The contract laboratory that analyzed the soil and water HTRW samples was: Environmental Testing and Consulting, Inc. (ETC), 2924 Walnut Grove Rd., Memphis, TN 38111. The point of contact at the lab was: Dr. Richard Medina or Randy Thomas. The telephone number was (800) 494-2750 or (817) 978-3221 ext. 1639.

8 Analysis of Investigation Results:

Expected contamination was confirmed in the landfill. The contaminant concentrations of several species exceeded the EPA screening levels. However, the concentrations of contaminants were below the industrial soil levels for surface contamination. If the channel were to be installed through the landfill, additional costs would be incurred for exposure monitoring, personnel protection, isolation of the landfill from the channel, and perhaps remediation. Ft. Worth District Corps of Engineers performed the Chemical Quality Assurance Report. The point of contact was Janet (Roxanne) Welch.

9 ADEQ Concurrence:

Per letters dated January 11, 2000 and June 18, 2004, ADEQ approved the selected route which does not intersect the landfill. (See Attachment F: ADEQ Memorandum) According to the ADEQ, the data available does not show cause for a hazardous waste concern. If further data becomes available in the future, this decision may require reconsideration.

Attachment A
1992 Inspection of May Branch

CESWL-ED-GH 15 December 1992

MEMORANDUM THRU
Acting Chief, HTRW Section
Chief, Geotechnical Branch
Chief, Engineering Division
FOR Chief, Planning Division

SUBJECT: Inspection of May Branch, Ft. Smith, Arkansas

1. Per Request from Planning Division by Ms. Julia Smethurst the May Branch Small Flood Control Project site at Ft. Smith, Arkansas was investigated, on 9 December 1992, for the presence of Hazardous, Toxic, and Radioactive Waste (HTRW). The existing May Branch, the proposed paths of channels, and the proposed site of the deep bored tunnel encounter residential and light to moderate industrial areas.

2. The P Street area between the Clayton Expressway and Highway 64 is moderately industrialized and HTRW contamination in this area is probable. The db Paper Company has barrels of corrosive material stored improperly and has a dump site near the channel. The Willard Mirrors company has a dump site on the edge of the channel. Contamination in the area of the db Paper Company and the Willard Mirror Company is probable.

3. The project area from Highway 64 to the beginning of the storm sewer consists of lightly industrialized and residential areas. Contamination is possible in this area from small industry, but unlikely.

4. The project area of the D Street Tunnel is residential except for the industrial area near the Clayton Expressway. Contamination in the residential area is not probable. The Clayton Expressway area has been discussed above.

5. Since the potential exists for HTRW contamination in the industrialized area, care should be taken in selecting the channel route in this area. If additional information is needed please contact Max Frauenthal in the Geotechnical Branch, Ext. 7133.

MAX FRAUENTHAL, P.E.
HTRW Section

Attachment B
1999 Site Inspection

Information on the following businesses was obtained:

1. Wastewater Treatment Plant

The City of Fort Smith, Arkansas
Wastewater Treatment Plant, Utility Department
Gerald Plank, Supervisor of Wastewater Operations
13 North “P” Street
Fort Smith, Arkansas 72904
(479) 784-2333

Wastewater treatment sludges are presently taken to a Class A landfill and this procedure has been followed since at least 1982.

2. Dave Brown Paper Company

The Dave Brown Paper Company formerly owned the rectangular building across the bridge, southeast, (toward town) from the wastewater treatment plant. He transferred ownership of the building to Chester Kerpovich of Butler & Cook. Across the street (southwest) was the location of the Riverside Furniture Company. The Riverside building was destroyed by the tornado in 1996. The building did not appear to be in use at the date of the inspection. The possibility of hazardous wastes emanating from this building could not be determined, but it appeared improbable.

3. Crawford County Pallets

Crawford County Pallets presently occupies the building southeast of the former Dave Brown Paper Company. (This is the long building across from Color Tex and the Bradley Machine Company.) Lynn Merechka owns Crawford County Pallets. The address is: 1701 Ballman Rd. Ft. Smith, AR 72901 (479) 783-5659. Or P.O. Box 1623, Van Buren, AR 72956 (479) 474-8810. The building now occupied by Crawford County Pallets was built by Hickory Springs Furniture. Hickory Springs sold the building to Crane. Crane (partner with Steve Bradley) bought and sold machinery. Crane sold to Dave Brown. Dave Brown leased to several businesses including Wisenfeld-Stampco Pallet Co, Industrial Linen Co., a cabinet shop, and a poultry industry tools & equipment supplier. The Crawford County Pallets Co. obtained the building in 1993.

4. Color Tex

Color Tex is across the street from Crawford County Pallets. ColorTex (479-783-2120) manufactures childrens furniture, such as bean bags, and they distribute foam cushions for furniture. ColorTex, at this location, is the end product manufacturer. No chemical processes are involved at this location. Therefore, the potential for hazardous waste generation is low. For information contact: The Jeffrey Smith Group, 101 N. Second Street, Ft. Smith; Mr. Smith or Mr. Joyce; Phone Number: 783-2120.

5. Bradley Machine Shop

The Bradley Machine Shop is across the street from Crawford County Pallets. Steve Bradley owns the business and has owned it since 1987. Steve Bradley has some historical photos. His photos show the historical location of ACME Spring & Mattress Co. (Riverside Furniture), Mitchell Manufacturing Co., Old Fort Line-Springs for the Furniture Industries, Williard Mirror, and the Ft. Smith Abattoir. Hickory Springs originally had operations in the building which is not the Bradley Machine Shop. Hickory Springs transferred ownership to Leggett & Platt, a steel hide-a-bed manufacturer. Steve Bradley's phone Number: 785-2925. Steve Bradley reported that Mr. Jay Gibson reported to him that the stormwater drainage tunnel runs under Bradley Machine Shop.

6. H.J. Baker & Bro., Inc.

H.J. Baker & Bro, Inc. is located behind (north) Crawford County Pallets. Tom Scott is the Plant Manager. The address is: H. J. Baker & Bro., Inc.; Pro-Pak Division, North First & P Streets, Fort Smith, Arkansas 72901. The phone number is: (479) 782-5705. Carnation Albers operated the site before H.J. Baker. H.J. Baker has operated the site since ~1970. The original processing plant burned and was replaced by H.J. Baker. H.J. Baker provides a protein mix that is used for feed by the poultry industries. Fish and chicken by-products comprise the mix, and an odor emanates from the plant.

The pond/swamp adjacent to H.J. Baker and Crawford County Pallets is increasing in area according to Tom Scott, Plant Manager for H.J. Baker. The water is getting higher and starting to infringe on the H.J. Baker property. It appears more debris is being dumped into the pond/swamp in addition to the tornado deposited debris. (Subsequent Note: It appeared that the scrap automobile lot operator has added fill to the low area through which this ponded area formerly discharged. This decrease in size of this local drainage storage area should not affect the proposed C May Branch channel alignment.

7. Williard Mirror Company

The Williard Mirror Company is in bankruptcy. The ownership is unknown and disputed. The mirror manufacturer went out of business in 1994. Although this facility had the potential to release heavy metals into the environment, high levels of heavy metals were not identified by the chemical analyses of soil near the site.

8. Arkansas Protein Company

The former Arkansas Protein Company passed ownership to Simmons and then to Mr. Jay Gibson.

9. Jeffrey Smith

Jeffrey Smith owns the land between the site of the former Williard Mirror Company and the Calvin Alley Cabinet Shop.

10. Calvin Alley Cabinet Shop

Calvin Alley of the Calvin Alley Cabinet Shop owns several historical photos which are labeled with the date. The October 1967 photo accurately depicts the location of the Ft. Smith landfill. Although the Calvin Alley Cabinet Shop was not in operation at the time, one of Calvin Alley's employees was formerly responsible for the disposal of wastes from the furniture manufacturing industry into the Ft. Smith landfill. Drums, or truck loads of the waste solvents were dumped onto the landfill, or into the water. This was the approved disposal method at the time providing it was ignited. The employee recalled one instance in which an unusually large load of the solvent had been dumped and ignited. The fire extended into the Arkansas river where the fire damaged a fisherman's nets.

11. Bailes Best Dog Food
Bailes Best Dog Food is across the railroad tracks form the area of the former Williard Mirror Company. Bailes Best is owned by Chick Borum.

12. Ft. Smith Wood Truss Company
Tom Moore owns Ft. Smith Wood Truss Company which is located next to Bailes Best Dog Food.

13. Hickory Springs Furniture
A Division of Hickory Springs Furniture out of Hickory Springs, North Carolina operates a fiber plant in the former Buster Brown Store in the building across the railroad tracks (southeast) from Crawford County Pallets. The plant manager is Betty Selph, phone number: 479-783-4440. Hickory Springs has operated the site since 1987.

14. Jack Grober
Jack Grober owns the property southwest of the Calvin Alley Cabinet Shop.

15. City Landfill
The city landfill was in operation until 1973. The Arkansas Department of Pollution Control & Ecology permitted the closing of the landfill. The landfill was closed in January 1974. Following ADPC&E's direction, the landfill was graded and covered with a two foot thick clay liner.

16. Arkansas Protein
The former Arkansas Protein production facility is now owned by Mr. Jay Gipson. He has done extensive landfilling. Suspect materials, such as sulfuric acid barrels, remain at the production facility.

17. Potential sources of HTRW contamination are companies such as United Refrigeration Services, tire dumps, Arkhola Concrete, Kraus Construction, an autobody paint shop, Sunbelt Chemical Company, and cleaners.

18. Other industries in the area such as Arkansas Proteins, H.J. Baker and Bro. Inc., and the sewage treatment plant may be contributing to the deterioration of air quality.

19. Contaminant Assessment
Because of the industries that exist or have existed in the area such as the city landfill, mirror manufacturing, metal plating, furniture manufacturing, and animal feed production, contamination in the industrial area is highly probable. Leachate from the landfill could flow into the branch. Heavy metal

contamination from the mirror manufacturing operation and from the coatings applied to furniture could pose a problem. Process chemicals could have been discharged from any of the industries. Sulfuric acid barrels were observed at the former Arkansas Protein facility. Automobiles and tires have been accumulated on or near the landfill area. Petroleum products could have leaked from the cars. Railroad cross ties have been dumped into a pond between the railroad tracks. Creosote contamination from the ties was considered possible.

Attachment C
Table of May Branch HTRW Investigation Results

May Branch HTRW Investigation Results

Nov-99

Boring Number										MB #1			MB #2			MB #2A			MB #3				MB #3A			MB #4				MB #5
Depth (ft.)	**Key : C=CANCER, N=NONCANCER, sat=SOIL SATURATION, max=CEILING LIMIT**									1.5	10	19	3	12	25	3	12	25	5	15	20	29	3	12	25	3.5	10	17	25	1.5
	Contaminants	**CAS No.**	**Screening Levels, Residential Soil(mg/Kg)**	**Key**	**Screening Levels Industrial Soil(mg/Kg)**	**Key**	**Screening Levels Tap Water (ug/l)**	**Key**	**Screening Levels DAF1 (mg/Kg)**	mg/Kg	mg/Kg	NS	mg/Kg	mg/Kg	mg/Kg	NS	mg/Kg	NS	mg/Kg	NS	mg/Kg	NS	NS	mg/Kg	NS	mg/Kg	NS	mg/Kg	NS	mg/Kg
Silver	Silver & Compounds	7440-22-4	370.00	N	9400.00	N	180.000	N	2.00																					
Arsenic	Arsenic (noncancer endpoint)	7440-38-2	21.00	N	480.00	N				4.28	2.34		2.54	1.49	0.446		2.3		4.11		1.67			2.49		2.13		3.01		3.49
	Arsenic (cancer endpoint)	7440-38-2	0.38	C	3.00	C	0.00045	C	1.00																					
Barium	Barium and compounds	7440-39-3	5200.00	N	100000.00	max	0.520	N	82.00	149	71		83.8	101	26.1		16.7		108		45.7			142		46.7		25.1		185
Cadmium	Cadmium and compounds	7440-43-9	37.00	N	930.00	N	0.0011	C	0.40					6.72																
Chromium	Total Chromium (1/6 ratio Cr V	n/a	210.00	C	450.00	C		C	2.00	18.7	11.2		40.9	17.6	5.36		2.22		13.3		7.39			14.2		5.64		8.15		15.6
Mercury	Mercury and compounds	7487-94-7	22.00	N	560.00	N	11.000	N		0.034			0.358				0.058							0.051				0.051		
Lead	Lead	7439-92-1	400.00		2000.00		15.000			51.2	5.25		48.1	3.96	1.6		55.9		15.5		5.87			114		4.74		10.5		27.8
Selenium	Selenium	7782-49-2	370.00	N	9400.00	N	180.000	N	0.30	0.378																				
VOAs/SVOAs										NS	ND	ND	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ug/Kg	ND	ug/Kg	ug/Kg	ND	ug/Kg	ND	ug/Kg	ND	ug/Kg	ug/Kg	ug/Kg	ug/Kg	NS
Acetone	Acetone	67-64-1	1400.00	N	6100.00	N	610.000	N	0.80								69.5							145			2440E			
Acetonitrile	Acetonitrile	75-05-8	200	N	1400	N	71	N																						
Benzene	Benzene	71-43-2	0.62	C	1.40	C	0.390	C	0.002								3.05										19.1			
Bromodichloromethane	Bromodichloromethane	75-27-4	0.98	C	2.3	C	0.18	C	0.03																					
n-Butylbenzene	n-Butylbenzene	104-51-8	130.00	N	240.00	sat	61.000	N																					20.3	
sec-Butylbenzene	sec-Butylbenzene	135-9-88	110.00	N	220.00	sat	61.000	N									10.7							0.656J						
tert-Butylbenzene	tert-Butylbenzene	104-5-18	120.00	N	390.00	sat	61.000	N																					19.8	
2-Butanone (MEK)	Methyl ethyl ketone	78-93-3	6900.00	N	27000.00	N	1000.000	N																			3550E			
Carbon Disulfide	Carbon disulfide	75-15-0	350.00	N	720.00	sat	1000.000	N	2.00								3.11													
Bis (2-etyhylhexyl) Phthalate	Bis(2-ethylhexyl)phthalate (DE	117-81-7	32.00	C	210.00	C	0.480	C					47400			446B								343B		834		2300		
Chlorobenzene	Chlorobenzene	108-90-7	54.00	N	180.00	N	39.000	N	0.07								9.23										17.4			
Chlorodibromomethane	Dibromochloromethane	124-48-1	5.3	C	36	C	0.8	C	0.02																					
Chloroform	Chloroform	67-66-3	0.24	C	0.52	C	0.16	C	0.03																					
2-Chlorotoluene	o-Chlorotoluene	95-49-8	150.00	N	510.00	sat	120.000	N																2.48						
1,2-Dichlorobenzene	1,2-Dichlorobenzene	95-50-1	370.00	sat	370.00	sat	370.000	N	0.90															3.9					33.7	
1,4-Dichlorobenzene	1,4-Dichlorobenzene	106-46-7	3.00	C	7.30	C	0.470	C	0.10					3.37			22							2.01					53.1	
1,1-Dichloroethane	1,1-Dichloroethane	75-34-3	570	N	2000	N	810	N	1																					
1,1-Dichloroethene	1,1-Dichloroethylene	75-35-4	0.53	C	1.2	C	0.46	C	0.003																					
cis-1,2-Dichloroethene	1,2-Dichloroethylene (cis)	156-59-2	42.00	N	150.00	N	61.000	N	0.02																		108			
trans-1,2-Dichloroethene	1,2-Dichloroethylene (trans)	156-60-5	62	N	210	N	120	N	0.03																					
Ethylbenzene	Ethylbenzene	100-41-4	230.00	sat	230.00	sat	1300.000	N	0.70					8.59	3.82									31.6			2730		136	
2-Hexanone (MBK)	SURROGATE	Cyclohexanon	100000	max	100000	max	180000	N																			438			
Isopropylbenzene	iso-Propylbenzene	104-5-18	120.00	N	390.00	sat	61.000	N									11.7							1.67J			122		14.9	
4-Isopropyltoluene	SURROGATE	Toluene	520.00	sat	520.00	sat	720.000	N									26.5										514		37.4	
Methylene Chloride	Methylene chloride	75-09-2	8.50	C	20.00	C	4.300	C	0.001																					
4-Methyl-2-pentanone (MIBK)	Methyl ethyl ketone	78-93-3	6900.00	N	27000.00	N	160.000	N																			1040		152	
Naphthalene	Naphthalene	91-20-3	55.00	N	190.00	N	6.200	N	4.00				1200				48							2.52			1220	65.9J	974	
n-Propylbenzene	n-Propylbenzene	104-51-8	130.00	N	240.00	sat	61.000	N									14.6							1.01J			298		18.5	
Styrene	Styrene	100-42-5	1700.00	sat	1700.00	sat	1600.000	N																			435		26.7	
Tetrachloroethene	Tetrachloroethylene (PCE)	127-18-4	4.70	C	16.00	C	1.100	C																			801		35.7	
Toluene	Toluene	108-88-3	520.00	sat	520.00	sat	720.000	N						5.47			4.91			2.74		3.01		5.22			29000		1590	
1,2,3-Trichlorobenzene	SURROGATE	1,2,4-Trichlorc	480.00	N	3000.00	sat	190.000	N																			4.99			
1,2,4-Trichlorobenzene	1,2,4-Trichlorobenzene	120-82-1	480.00	N	3000.00	sat	190.000	N																			16.2			
Trichloroethene	Trichloroethylene (TCE)	79-01-6	2.70	C	6.10	C	1.600	C																			23.1		9.59	
Trichlorofluoromethane	Trichlorofluoromethane	75-69-4	380	N	1300	N	1300	N																						
1,2,4-Trimethylbenzene	1,2,4-Trimethylbenzene	95-63-6	51.00	N	170.00	N	12.000	N									132							3.77			1730		155	
1,3,5-Trimethylbenzene	1,3,5-Trimethylbenzene	108-67-8	21.00	N	70.00	N	12.000	N									13.2							3.73			752		51.9	
Xylenes-m,p	m-Xylene	108-38-3	210.00	sat	210.00	sat	1400.000	N						7	3.12		15.8							28.4			9530		828	
	p-Xylene	106-42-3	370.00	sat	370.00	sat																								
Xylene-o	o-Xylene	95-47-6	280.00	sat	280.00	sat	1400.000	N									3.47							7.5			2520		361	
BNA																														
Benzo (a) anthracene	Benzo[a]anthracene	56-55-3	0.56	C	3.60	C	0.092	C																63.2J						
Benzo (b) fluoranthene	Benzo[b]fluoranthene	205-99-2	0.56	C	3.60	C	0.092	C																82						
Benzo (g,h,I) perylene	SURROGATE	Benzo (b) fluo	0.56	C	3.60	C	0.092	C																44.9J						
Benzo (a) pyrene	Benzo[a]pyrene	50-32-8	0.06	C	0.36	C	0.0092	C																119						
Carbazole	Carbazole	86-74-8	22.00	C	150.00	C	0.340	C	0.03				637J																	
Chrysene	Chrysene	218-01-9	56.00	C	360.00	C	9.200	C																66.6J						
Dibenzo (a,h) anthracene	Dibenz[ah]anthracene	53-70-3	0.06	C	0.36	C	0.0092	C																						
Fluoranthene	Fluoranthene	206-44-0	2000.00	N	37000.00	N	1500.000	N																106						
Indeno (1,2,3-cd) pyrene	Indeno[1,2,3-cd]pyrene	193-39-5	0.56	C	3.60	C	0.092	C																235						
2-Methylnaphthalene	SURROGATE	Naphthalene	55.00	N	190.00	N	6.200	N	4.00				1090J																	
Phenanthrene	SURROGATE	Anthracene	14000	N	100000	max	1800	N	590				650J																	
Pyrene	Pyrene	129-00-0	1500.00	N	26000.00	N	180.000	N																73.7						

ND = Not Detected

NS = Not Sampled

Region 6 Human Health Medium-Specific Screening Levels (updated October 8, 1998) were obtained from the web site of the Environmental Protection Agency: http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/r6scrval.htm

																																		Swamp	Swamp Ne	Swamp
		MB #6			MB #7			MB #8			MB #11	MB #13	MB #14	MB #21		MB #22		MB #23		MB #24		MB #25	MB #26	MB #27	MB #28	MB # 29	MB #30	MB #30	MB #30	MB #31	MB #31	MB #31	MB #31	Near	Treatment	Near
10	19	1.5	10	19	1.5	10	19	1.5	10	19	5	9	5	1.5	12	1.5	12	3	12	1.5	12	Water	Water	Water	Water	Water	5	15	Water	5	15	25	Water	MB #29	Plant	MB #26
mg/Kg	NS	mgKg	mg/Kg	mgKg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	mg/Kg	NS	mg/Kg	ug/L	ug/L	ug/L	ug/L	ug/L	mg/Kg	mg/Kg	ug/L	mg/Kg	mg/Kg	mg/Kg	ug/L	ug/L	ug/L	ug/L
4.63		6.7	6.28	2.69	6.7	4.66	5.78	43.2	4.47	5.05	2.31	8.15	5.26	3.47	1.95	4.27	6.34	3.45	5.34	1.25	0.884		4	99	31	7	2.39	1.25	5	3.23	1.92	3.84	5	4	7	5
99.4		189	98.5	106	98	102	130	85.5	219	154	96.5	215	49.7	93.1	70.3	168	129	133	206	41.6	23	336	926	1980	447	288	78.7	33.7	168	125	125	106	224	92	54	21J
											5.42																									
17.3		21.3	24.6	17.5	19.8	18.2	21.3	20.9	18.4	19.4	18.8	42.6	38.1	17	8.54	18.1	20.8	14	13	4.64	2.33			120	33	24	8.03	3.3	26	19	17.9	17.1	17			
0 028							0 03	0 077				0 022	0 03											0 2						0 021						
41 6		20 9	5 01	4 82	24 1	17 4	2 95	20	17 7	16 8	9 55	16 8	14 4	9 6	4 48	11 7	14 4	9 83	16 3	7 54	2 39	10		90	17	3	7 85	3 77	14	20 1	8 88	11 8	3	4		
		0 532	1 3			0 711	0 415	0 35	0 532	0 777		0 272				0 432		0 228				3		3								0 305				
ug/Kg	ug/Kg	NS	ug/Kg	ug/Kg	NS	ug/Kg	ug/Kg	NS	ND	ND	ug/Kg	ND	ND	NS	ND	ug/Kg	ug/Kg	NS	ND	NS	ug/Kg	ND	ug/L	ug/L	ug/L	ug/L	ug/Kg	ug/Kg	ug/L	ug/Kg	ug/Kg	ND	ug/L	ug/L	ug/L	ND
118	170						42 6																13 8J	6 24J										12 2J		
																																			4 55J	
																							7 52													
																								0 62J	0 55J				4 3							
4 26																							0 98J													
																							0 75J													
2220																	178B					12.1		30.2	18.6									22.8		5.33J
																							20.8													
																													0.95J							
																								3.3	2.51				21.4							
3.59																							4.57													
																																	2.73			
																																	14.6			
																															0.63J		30.4			
6 37																																				
6 68																							3 98		0 55J											
3 82																31 4B							0 89J		2 45											
21 5B	26 8B		36 4B	28 5B		34 2B	33 2B										27 0B																			
38 3	5 14																						139													
4 51																							1 95													
																											1 47J	0 90J		0 52J						
9 46																																				
																											1.00J				2.79		25.4			
																																	0.90J			
28.6																							9.78													
																							0.40J													
57.3																							2.31													
9.67																							0.66J													
																										ND	ND	ND	ND		ND	ND	ND			
						60.6J																														
						88.6																														
						77.2																														
						129																														
																							1 57J													
						95 9																														
						181																														
																							2 45							45 6J						
						245																														
																							12 4							31 8J						
																							1 95J							47 2J						

Attachment D
Analysis of Results

May Branch
HTRW Investigation
Analysis of Results

The U.S. Army Corps of Engineers, Little Rock District, is proposing a drainage improvement project in conjunction with the city of Ft. Smith. The project will include routing the May Branch stormwater channel through the Ft. Smith industrial area to the Arkansas River. To be environmentally proactive, the Corps of Engineers investigated the site, which included several proposed routings, for hazardous wastes. RCRA metals, volatile, and semivolatile analytes were assayed from 43 samples from 17 boring locations during the initial investigation. During the second investigation, 36 samples from 7 borings plus three groundwater samples were analyzed. The results of the investigation are presented in Attachment C, May Branch HTRW Investigation Results.

The proposed route C would pass over MB-24, MB-21, MB-22, MB-31 toward MB-9. The analyses showed that this route contained the lowest contaminant concentrations.

As directed by the Arkansas Department of Environmental Quality (ADEQ), the concentrations of contaminants detected were compared with the Environmental Protection Agency's Human Health Screening Levels. The Region 6 Human Health Medium-Specific Screening Levels (updated October 8, 1998) were obtained from the web site of the Environmental Protection Agency: http://www.epa.gov/earth1r6/6pd/rcra_c/pd-n/r6scrval.htm. Since the soil from the industrial area in which the investigation took place has been disturbed, and since the area is industrialized and is likely to remain an industrial area, the Corps of Engineers proposed to the ADEQ that the Industrial Soil Screening levels are the only levels that are applicable. The analyte concentrations were also compared with the Residential Soil Screening levels, Tap Water Screening (TWS) levels and the Dilution Attenuation Factor (DAF).

The concentrations of all compounds detected were below the Industrial Soil Screening levels.

The Residential Soil Screening levels were exceeded five times. In MB#8 at 1.5 ft. Arsenic was detected at 43.2 mg/kg. In MB#2, bis (2-ethylhexyl) phthalate was detected at 47,400 mg/kg. Although this typical lab contaminant was detected in the method blanks, the concentration was not this high. The semi-volatile compound benzo (a) pyrene was detected above the Residential Soil Screening level at boring MB#3A at 12 ft. and MB#7 at 10 ft. Also in MB#7 at 10 ft., dibenzo (a,h) anthracene was detected above the Residential Soil Screening level.

Soil samples were analyzed from MB-30 between 5 and 7 feet and between 15 and 17 feet. Soil samples were analyzed from MB-31 from these depths, and from between 25 and 27 feet. The concentrations of all compounds detected in MB-30 were below the Industrial and Residential Soil Screening levels. One of the compounds detected from MB-31 (Trichloroethene) exceeded the Residential Soil Screening level, but was below the Industrial Soil Screening level.

Almost all of the barium levels are above the Dilution Attenuation Factor of 1 (DAF1). The sample which most accurately depicts the naturally occurring background concentration, sample MB #13, contained the most barium. Therefore the barium is assumed to be naturally occurring.

Two samples, MB #2 at 12 ft. and MB #11 at 5 ft., contained cadmium levels in excess of the DAF1, but less than DAF20 (twenty times the DAF). Since sample MB #2 is from disturbed soil in the landfilled area, and sample MB #11 was taken beside the railroad tracks in an industrialized area, the Industrial Soil Screening levels are more applicable.

All samples (including the background sample) exceeded the DAF1 for chromium. All concentrations are close to the background concentration. Therefore the chromium is assumed to be naturally occurring.

Some of the selenium concentrations near the railroad in the industrial area exceed the DAF1 concentration. However, all are below the DAF10 concentration (ten times the DAF). All concentrations detected are near the background concentration.

The lead concentrations detected were consistent, and assumed to be naturally occurring.

Volatiles/Semivolatiles:

On sample, MB #4 at 10 ft., contained a value of acetone which exceeded the established method calibration range of the analytical instrument. This concentration was in excess of the DAF1, but below the DAF10.

Benzene was detected in two samples (MB #2A at 12 ft. and MB #4 at 10 ft.) in excess of the DAF1. Both concentrations were below a DAF10. Both sampling locations were from the closed landfill. Since the operation of the landfill included burning solvents, some solvent residues and combustion byproducts are expected. Additional analytes, described below, are solvents and combustion by-products from compounds that were burned in the landfill before the landfill was closed and capped.

Carbon disulfide was detected in sample MB #2A at 12 ft. slightly in excess of a DAF1 (but below a DAF2). This sample came from the closed landfill.

Sample MB #4 at 10 ft. contained cis-1,2-dichloroethene in excess of the DAF1. This sample came from the closed landfill. In the same sample, ethylbenzene was detected in excess of the DAF1 (but below the DAF10).

Although several samples appeared to contain concentrations of methylene chloride in excess of the DAF1, the analyte was also detected in the method blanks. The methylene chloride was a laboratory contaminant.

Sample MB #2 at 3 ft. contained carbazole in excess of the DAF1. The laboratory value was an estimated value. The presence of the compound was confirmed but it was less than the reported detection limit. There were several other problems with sample MB #2 at 3 ft. Three of the analytes were estimated values which were present in concentrations that were less than the detection limits. Also the sample contained a high value for bis (2-ethylhexyl) phthalate, the plasticizer that is a typical lab contaminant.

Tap Water Screening Levels:

The concentrations of the analytes in the soil matrix were determined on a weight basis (mg/Kg), not on a liquid basis (mg/l). The Tap Water Screening levels are not applicable to this investigation. However considering the concentrations as parts per billion, some of the analytes exceed the Tap Water Screening levels.

All barium, cadmium, mercury, lead, and selenium concentrations exceeded the Tap Water Screening (TWS) levels. One estimated acetone and one estimated 2-butanone concentrations, the two benzene concentrations, exceeded the Tap Water Screening levels. All concentrations of the laboratory contaminants, bis (2-ethylhexyl) phthalate and methylene chloride, exceeded the Tap Water Screening levels. All the 1,4-dichloro benzene concentrations from the landfill area exceeded the TWS levels. One cis-1,2-dichloroethene concentration from the landfill exceeded the TWS level. One ethylbenzene concentration from the landfill exceeded the TWS level. One 4-methyl-2-pentanone concentration from the landfill exceeded the TWS level. Several naphthalene concentrations from the landfill exceeded the TWS level. One n-propylbenzene concentration from the landfill exceeded the TWS level. Two tetrachloroethene and two toluene and two trichloroethene concentrations from one boring (MB #4) in the landfill exceeded the TWS level. Trimethylbenzene was detected in excess of the TWS level in three borings in or near the landfill. Xylenes were detected in excess of the TWS level in one boring (MB #4) in the landfill. Concentrations of Benzo (a) anthracene were estimated in one boring from the landfill (MB #3A)and one near the railroad track (MB #7). Concentrations of Benzo (b) fluoranthene were detected in one boring from the landfill (MB #3A) and one near the railroad track (MB #7). Concentrations of Benzo (a) anthracene were estimated in one boring from the landfill (MB #3A) and detected in excess of the TWS level near the railroad track (MB #7). Concentrations of Benzo (a) pyrene were detected in one boring from the landfill (MB #3A)and one near the railroad track (MB #7). An estimated concentration was reported for carbazole from one boring in the landfill (MB #2). An estimated concentration was reported for chrysene from one boring in the landfill (MB #3A). One dibenzo (a,h) anthracene concentration from near the railroad track (MB #7) exceeded the TWS level. Concentrations of indeno (1,2,3-cd) pyrene were detected in one boring from the landfill (MB #3A) and one near the railroad track (MB #7). Concentrations which were less than the laboratory's detection limits were estimated for 2-methylnaphthalene and phenanthrene from one boring (MB #2) in the landfill. These estimated values exceeded the surrogate TWS levels for these compounds.

The groundwater and surface water samples were compared with the Tap Water Screening levels. The concentrations of barium exceeded the TWSL. Two of the lead concentrations (MB-27 & MB-28) exceeded the TWSL. The concentrations of Benzene, Carbazole, 1,4-Dichlorobenzene, and Naphthalene in the groundwater from MB-26 exceeded the TWSL. Bromodichloromethane and Chloroform were detected in the groundwater from MB-27, MB-28, and MB-30 in excess of the TWSLs. Bis (2-etyhylhexyl) Phthalate was detected in the groundwater in five of the water samples in excess of the TWSL. The estimated value of Chlorodibromomethane from MB-30 exceeded the TWSL. Trichloroethene was detected in the groundwater from MB-31 in excess of the TWSL.

The sewage treatment plant is built on the landfill. Soil excavated for the plant would have the same typical concentrations as the soil analyses reported herein. This construction should follow similar precautions to the precautions followed during the sewage treatment plant construction.

The construction of the channel may involve removing soil. Bank stabilization will be applied at suspected point of erosion.

ABBREVIATIONS

ND: Not Detected
NS: Not Sampled
J: Estimated Value. Below the detection limit.
B: The compound was also found in the blank.
E: The calibration of the instrument was exceeded.

TIC: Tentatively identified compounds. There is no standard so the lab is not sure what the compound is.

Methylene Chloride and Bis (2-ethylhexyl) phthalate are probably lab contaminants.

MS: Matrix Spike
MSD: Matrix Spike Duplicate
RPD: Relative percent difference: The difference between the MS and the MSD expressed as a difference.
TWSL: Tap Water Screening Level

APPENDIX D
REAL ESTATE PLAN

REAL ESTATE PLAN
MAY BRANCH DRAINAGE CHANNEL PROJECT
FORT SMITH, ARKANSAS

Prepared for
US Army Corps of Engineers
Southwestern Division
Little Rock District

As of
7 December 2004
Revised: 15 September 2006

Prepared by
Ronald Bridges
Real Estate Branch

REAL ESTATE PLAN
MAY BRANCH DRAINAGE CHANNEL PROJECT
FORT SMITH, ARKANSAS

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Prepared By: Ronald Bridges
Real Estate Branch

Date: 7 December 2004
Revised Date: 15 September 2006

REAL ESTATE PLAN
MAY BRANCH DRAINAGE CHANNEL PROJECT
FORT SMITH, ARKANSAS

[1] Purpose of the Real Estate Plan

The purpose of this Real Estate Plan is to provide real estate acquisition cost estimates for lands required for the completion of the May Branch Drainage Channel Project. The project is for the construction of an approximate 2.75-mile drainage channel for the City of Fort Smith to alleviate the flooding problem that exists in the western area of the city. Project area maps, attached as Exhibit A, show the location of the project. Approximately 2.25 miles of the channel is situated in Reaches 1 to 4 and will be cost-shared with the City of Fort Smith which is the Non-Federal or Local Sponsor for this proposed project. Real estate costs are estimated for Reaches 1 to 6. Construction of the 0.5 mile portion of the drainage channel is situated within Reaches 5 and 6. Construction of the drainage channel for Reaches 5 and 6 is part of the Locally Preferred Plan. The total costs of Reaches 5 and 6 will be the responsibility of the Non-Federal Sponsor.

The Water Resources Development Act of 1986, (Public Law 99-662) as amended, provides the basis for the sharing of responsibilities between the federal government and the non-federal sponsor in further studies and/or implementation of a flood control project along May Branch in Fort Smith, Arkansas.

[2] Description of Lands, Easements and Rights-of-Way (LER's)

The entire project is situated within the city boundaries of Fort Smith, Arkansas. The proposed project will cover an aggregate area of approximately 47.81 acres. The project properties consist of commercial, industrial, and residential properties. There are approximately 88 ownerships within the drainage channel alignment for the proposed project. The largest single ownership within the project boundary is the Missouri Pacific Railroad right-of-way that extends from Reach 1 to Reach 4. The right-of-way for the Missouri Pacific Railroad covers an approximate 11.87-acre area. The railroad right-of-way also extends into Reaches 5 and 6 and encumbers approximately 3.01 acres. There are approximately 11 ownerships in Reach 1, approximately 40 ownerships in Reach 2 and approximately 23 ownerships in Reach 3. Properties in Reaches 1, 2 and 3 consist primarily of land suitable for industrial, commercial, and single-family uses. There are approximately 14 ownerships in Reach 4. Properties in Reach 4 consist primarily of land suitable for commercial, multi-family and single-family uses. Reaches 5 and 6 have approximately 32 ownerships that would be affected with the construction of the proposed drainage channel project. Reaches 5 and 6 consist primarily of residential properties. However, the acquisitions of the ownerships in Reaches 5 and 6 will be a 100 percent Non-Federal cost. The Non-Federal Sponsor will acquire the necessary real estate interest and will be responsible for all of the project costs in Reaches 5 and 6. All of the project properties are situated in parts of Sections 14, 15, 16, 17, 18, 19, 20, 21, and 22, Township 1 North, Range 12 West and Section 13, Township 1 North, Range 13 West, all in Sebastian County, Arkansas. All of the lands, easement and rights-of-way are within the corporate limits of the City of Fort Smith, Arkansas.

[3] LER owned by the Non-Federal Sponsor

The Non-Federal Sponsor owns eight (8) of the ownerships that cover, in the aggregate, approximately 3.96 acres of land within the proposed project area boundary. The Non-Federal ownerships or properties are situated in Reach Nos. 2 and 3. Two of the parcels are considered residential properties. Three of the parcels are part of the Fort Smith city park. The other three parcels are plottage acreage within a commercial area of the city.

There are an additional 5.76 acres in Reach No. 1 that were acquired by the Non-Federal Sponsor for a past federally funded project. This acreage is proposed to be used as a temporary work area for the May Branch project. Because this acreage was acquired for a past project federally funded project, the Non-Federal Sponsor will not be credited for the acquisition of this acreage.

[4] Non-Standard Estates

There are no non-standard estates for this proposed project. A channel improvement easement estate was considered for the project. Because of the degree of damages that would occur to the properties, it was estimated that the value of a channel improvement easement would be equivalent to the value of fee simple. However, channel improvement and temporary work area easements are the estates for the acquisition of the lands for the project that are yet to be acquired.

Channel Improvement Easement

A perpetual and assignable right and easement to construct, operate, and maintain channel improvement works on, over and across (the land described in Schedule A) (Tracts Nos. _____, ______ and ______) for the purposes as authorized by the Act of Congress approved ____________________, including the right to clear, cut, fell, remove and dispose of any and all timber, trees, underbrush, buildings, improvements and/or other obstructions therefrom; to excavate, dredge, cut away, and remove any or all of said land and to place thereon dredge or spoil material; and for such other purposes as may be required in connection with said work of improvement; reserving, however, to the owners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

Temporary Work Easement

A temporary easement and right-of-way in, on, over and across (the land described in Schedule A) Tract Nos. ______, ______, ______), for period not to exceed ______________________, beginning with the date possession of the land is granted to the United States, for use by the United States, its representatives, agents, and contractors as a (borrow area) (work area), including the right to borrow and/or deposit fill, spoil and waste material thereon_ move, store and remove equipment and supplies, and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the _______________________________________ Project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

[5] Any existing federal project that lies fully or partially within the LER required for the project.

Approximately 5.76 acres of land situated in Reach 1 were part of a Federal Emergency Management Agency (FEMA) program in this area of Fort Smith, Arkansas. Approximately 0.60 acre of land was acquired by the Non-Federal Sponsor for the construction of a flood control levee in this area of the city is situated within the project alignment. Though located in the project area and possessed by the Non-Federal Sponsor, acquisition of these acreages will not and cannot be credited to the non-federal sponsor. This acreage is also being considered for use as a temporary work area for this project. There was a concern as to whether construction of the drainage channel would be in compliance with regulations pertaining to these FEMA project properties. It was found that the construction of the drainage channel in Reach 1 would be compliant with the Hazard Mitigation Grant Program (HMGP) policy of the Federal Emergency Management Agency (FEMA). (See Exhibit C).

[6] Any federally owned land

None of the lands are federally owned that lie within this proposed project alignment.

[7] LER that lies below the ordinary high water mark

None of the Land, Easement and Rights-of-Way (LER) for the proposed project lies under the ordinary high-water mark with the exception of the westernmost end of Reach No. 1 that ends at the Arkansas River. At this point of Reach No. 1, the land is encumbered with a permanent and an occasional flowage easement. The permanent flowage easement for this area is up the 392-foot elevation contour. The occasional flowage easement is up to the 395-foot elevation contour. The project’s land use is outside of the use authorized for the existing Federal flowage easements.

[8] Maps depicting project area

The maps depicting the location of the proposed project are shown in Exhibit A.

[9] Any possible flooding

No induced flooding will occur as a result of the proposed drainage channel project.

[10] Real Estate Cost Estimate

The real estate cost estimate is based upon a gross appraisal dated August 17, 2002 by Reed and Associates. The 2002 gross appraisal was reviewed and recommended for approval by Ronald Bridges, Review Appraiser, US Army Corps of Engineers, Little Rock District. Nancy J. Boyd, Southwestern Division, U.S. Army Corps of Engineers approved the gross appraisal report. Subsequent real estate cost estimates for this project were made after the initial gross appraisal of Reaches 1 to 6. Land values were analyzed with the original gross appraisal and other available market data were obtained to estimate the estimated current land values for the baseline real cost estimate. The overall real estate values also include a conservative 20% contingency. This contingency is based on past experience involving other acquisition projects for the Little Rock District. Reaches 1 to 2 were valued considering a .01 probability flood protection plan scenario. Reaches 3 and 4 were valued considering a 0.1 probability flood protection plan scenario. Reaches 5 to 6 were valued considering a 0.1 probability flood protection plan scenario.

The estimated real estate acquisition costs are as follows:

Reach No. 1 = $541,500
Non-Federal Sponsor: $524,400 Federal: $17,100
Reach No. 2 = $1,422,000
Non-Federal Sponsor: $1,356,000 Federal: $66,000
Reach No. 3 = $363,600
Non-Federal Sponsor: $334,700 Federal: $28,900
Reach No. 4 = $951,000
Non-Federal Sponsor: $926,500 Federal: $24,600

A real estate acquisition cost was also estimated for Reaches 5 and 6 of the Locally Preferred Plan. Reaches 5 and 6 have an estimated real estate acquisition cost of $1,905,000.00. The real estate cost estimate for Reaches 5 and 6 is premised on the assumption that a grocery business, adjacent to the proposed channel, will not be adversely affected by the construction of the drainage channel in Reach No. 6.

BASELINE COST ESTIMATE FOR REAL ESTATE
MAY BRANCH DRAINAGE PROJECT, REACH 1 – FORT SMITH
SEBASTIAN COUNTY, ARKANSAS

01	Lands & Damages		
01.23	Construction Contract Documents		
01.23.03	Real Estate Analysis Documents		
01.23.03.01	Real Estate Planning Documents		
	Planning by Non-Federal Sponsor	$2,400	20% = $480
	Corps of Engineers Real Estate Plan	$1,400	20% = $280
	Corps Review of Non-Federal Sponsor	$400	20% = $80
01.23.03.02	Real Estate Acquisition Documents		
	Acquisitions by Non-Federal Sponsor (includes estimated survey cost)	$32,000	20% = $6,400
	Corps Review of Non-Federal Sponsor	$4,000	20% = $800
01.23.03.03	Real Estate Condemnation Documents		
	Condemnations by Non-Federal Sponsor	$4,000	20% = $800
	Corps Review of Non-Federal Sponsor	$800	20% = $160
01.23.03.05	Real Estate Appraisal Documents		
	Appraisals by Non-Federal Sponsor	$16,500	20% = $3,300
	Corps Review of Non-Federal Sponsor	$4,000	20% = $800
01.23.03.06	Real Estate PL 91-646 Asst. Documents		
	PL 91-646 Asst. by Non-Federal Sponsor	$8,000	20% = $1,600
	Corps Review of Non-Federal Sponsor	$800	20% = $160
01.23.03.15	Real Estate Payment Documents		
	Payments by Non-Federal Sponsor (Land)	$117,120	
	Payments by Non-Federal Sponsor (Damages)	$275,400	
	Payments by Non-Federal Sponsor (PL 91-646 Asst.)	$51,600	
	Corps Review of Non-Federal Sponsor	$1,600	20% = $320
01.23.03.17	Real Estate LERRD Crediting Documents		
	Preparation by Non-Federal Sponsor	$4,000	20% = $800
	Corps Review of Non-Federal Sponsor	$1,200	20% = $240
	TOTAL ADMIN & PAYMENTS	$525,220	
	TOTAL CONTINGENCY		$16,220
	ESTIMATED TOTAL		$541,440 **(R) $541,500**

BASELINE COST ESTIMATE FOR REAL ESTATE
MAY BRANCH DRAINAGE PROJECT, REACH 2 – FORT SMITH
SEBASTIAN COUNTY, ARKANSAS

01	Lands & Damages		
01.23	Construction Contract Documents		
01.23.03	Real Estate Analysis Documents		
01.23.03.01	Real Estate Planning Documents		
	Planning by Non-Federal Sponsor	$2,400	20% = $480
	Corps of Engineers Real Estate Plan	$1,400	20% = $280
	Corps Review of Non-Federal Sponsor	$400	20% = $80
01.23.03.02	Real Estate Acquisition Documents		
	Acquisitions by Non-Federal Sponsor (includes estimated survey cost)	$124,800	20% = $24,960
	Corps Review of Non-Federal Sponsor	$16,000	20% = $3,200
01.23.03.03	Real Estate Condemnation Documents		
	Condemnations by Non-Federal Sponsor	$16,000	20% = $3,200
	Corps Review of Non-Federal Sponsor	$1,600	20% = $320
01.23.03.05	Real Estate Appraisal Documents		
	Appraisals by Non-Federal Sponsor	$60,000	20% = $12,000
	Corps Review of Non-Federal Sponsor	$15,600	20% = $3,120
01.23.03.06	Real Estate PL 91-646 Asst. Documents		
	PL 91-646 Asst. by Non-Federal Sponsor	$44,000	20% = $8,800
	Corps Review of Non-Federal Sponsor	$4,000	20% = $800
01.23.03.15	Real Estate Payment Documents		
	Payments by Non-Federal Sponsor (Land)	$711,600	
	Payments by Non-Federal Sponsor (Damages)	$67,200	
	Payments by Non-Federal Sponsor (PL 91-646 Asst.)	$270,000	
	Corps Review of Non-Federal Sponsor	$14,000	20% = $2,800
01.23.03.17	Real Estate LERRD Crediting Documents		
	Preparation by Non-Federal Sponsor	$8,200	20% = $1,640
	Corps Review of Non-Federal Sponsor	$2,400	20% = $480
	TOTAL ADMIN & PAYMENTS	$1,359,600	
	TOTAL CONTINGENCY		$62,160
	ESTIMATED TOTAL		$1,421,760 **(R) $1,422,000**

BASELINE COST ESTIMATE FOR REAL ESTATE
MAY BRANCH DRAINAGE PROJECT, REACH 3 – FORT SMITH
SEBASTIAN COUNTY, ARKANSAS

01	Lands & Damages		
01.23	Construction Contract Documents		
01.23.03	Real Estate Analysis Documents		
01.23.03.01	Real Estate Planning Documents		
	Planning by Non-Federal Sponsor	$2,400	20% = $480
	Corps of Engineers Real Estate Plan	$1,400	20% = $280
	Corps Review of Non-Federal Sponsor	$300	20% = $60
01.23.03.02	Real Estate Acquisition Documents		
	Acquisitions by Non-Federal Sponsor (includes estimated survey cost)	$70,400	20% = $14,080
	Corps Review of Non-Federal Sponsor	$8,800	20% = $1,760
01.23.03.03	Real Estate Condemnation Documents		
	Condemnations by Non-Federal Sponsor	$11,200	20% = $2,240
	Corps Review of Non-Federal Sponsor	$2,400	20% = $480
01.23.03.05	Real Estate Appraisal Documents		
	Appraisals by Non-Federal Sponsor	$34,500	20% = $6,900
	Corps Review of Non-Federal Sponsor	$8,800	20% = $1,760
01.23.03.06	Real Estate PL 91-646 Asst. Documents		
	PL 91-646 Asst. by Non-Federal Sponsor	0	0
	Corps Review of Non-Federal Sponsor	0	0
01.23.03.15	Real Estate Payment Documents		
	Payments by Non-Federal Sponsor (Land)	$187,680	
	Payments by Non-Federal Sponsor (Damages)	0	0
	Payments by Non-Federal Sponsor (PL 91-646 Asst.)	0	0
	Corps Review of Non-Federal Sponsor	0	0
01.23.03.17	Real Estate LERRD Crediting Documents		
	Preparation by Non-Federal Sponsor	$4,000	20% = $800
	Corps Review of Non-Federal Sponsor	$2,400	20% = $480
	TOTAL ADMIN & PAYMENTS	$334,280	
	TOTAL CONTINGENCY		$29,320
	ESTIMATED TOTAL		**$363,600**

BASELINE COST ESTIMATE FOR REAL ESTATE
MAY BRANCH DRAINAGE PROJECT, REACH 4 – FORT SMITH
SEBASTIAN COUNTY, ARKANSAS

01	Lands & Damages		
01.23	Construction Contract Documents		
01.23.03	Real Estate Analysis Documents		
01.23.03.01	Real Estate Planning Documents		
	Planning by Non-Federal Sponsor	$2,400	20% = $480
	Corps of Engineers Real Estate Plan	$1,400	20% = $280
	Corps Review of Non-Federal Sponsor	$300	20% = $60
01.23.03.02	Real Estate Acquisition Documents		
	Acquisitions by Non-Federal Sponsor (includes estimated survey cost)	$55,000	20% = $11,000
	Corps Review of Non-Federal Sponsor	$5,200	20% = $1,040
01.23.03.03	Real Estate Condemnation Documents		
	Condemnations by Non-Federal Sponsor	$8,000	20% = $1,600
	Corps Review of Non-Federal Sponsor	$800	20% = $160
01.23.03.05	Real Estate Appraisal Documents		
	Appraisals by Non-Federal Sponsor	$19,500	20% = $3,900
	Corps Review of Non-Federal Sponsor	$5,200	20% = $1,040
01.23.03.06	Real Estate PL 91-646 Asst. Documents		
	PL 91-646 Asst. by Non-Federal Sponsor	$24,000	20% = $4,800
	Corps Review of Non-Federal Sponsor	$2,400	20% = $480
01.23.03.15	Real Estate Payment Documents		
	Payments by Non-Federal Sponsor (Land)	$283,920	
	Payments by Non-Federal Sponsor (Damages)	$371,760	
	Payments by Non-Federal Sponsor (PL 91-646 Asst.)	$135,000	
	Corps Review of Non-Federal Sponsor	$4,000	20% = $800
01.23.03.17	Real Estate LERRD Crediting Documents		
	Preparation by Non-Federal Sponsor	$4,000	20% = $800
	Corps Review of Non-Federal Sponsor	$1,200	20% = $240
	TOTAL ADMIN & PAYMENTS	$924,080	
	TOTAL CONTINGENCY		$26,680
	ESTIMATED TOTAL		$950,760 **(R) $951,000**

BASELINE COST ESTIMATE FOR REAL ESTATE
MAY BRANCH DRAINAGE PROJECT, REACHES 5 AND 6 – FORT SMITH
SEBASTIAN COUNTY, ARKANSAS

01	Lands & Damages		
01.23	Construction Contract Documents		
01.23.03	Real Estate Analysis Documents		
01.23.03.01	Real Estate Planning Documents		
	Planning by Non-Federal Sponsor	$2,400	20% = $480
	Corps of Engineers Real Estate Plan	$1,400	20% = $280
	Corps Review of Non-Federal Sponsor	$400	20% = $80
01.23.03.02	Real Estate Acquisition Documents		
	Acquisitions by Non-Federal Sponsor (includes estimated survey cost)	$98,800	20% = $19,760
	Corps Review of Non-Federal Sponsor	$12,400	20% = $2,480
01.23.03.03	Real Estate Condemnation Documents		
	Condemnations by Non-Federal Sponsor	$12,400	20% = $2,480
	Corps Review of Non-Federal Sponsor	$1,600	20% = $320
01.23.03.05	Real Estate Appraisal Documents		
	Appraisals by Non-Federal Sponsor	$46,500	20% = $9,300
	Corps Review of Non-Federal Sponsor	$12,400	20% = $2,480
01.23.03.06	Real Estate PL 91-646 Asst. Documents		
	PL 91-646 Asst. by Non-Federal Sponsor	$40,000	20% = $8,000
	Corps Review of Non-Federal Sponsor	$8,000	20% = $1,600
01.23.03.15	Real Estate Payment Documents		
	Payments by Non-Federal (Land)	$781,840	
	Payments by Non-Federal Sponsor (Damages)	$614,400	
	Payments by Non-Federal Sponsor (PL 91-646 Asst.)	$216,000	
	Corps Review of Non-Federal Sponsor	$6,400	20% = $1,280
01.23.03.17	Real Estate LERRD Crediting Documents		
	Preparation by Non-Federal Sponsor	$6,200	20% = $1,240
	Corps Review of Non-Federal Sponsor	$2,400	20% = $480
	TOTAL ADMIN & PAYMENTS	$1,854,740	
	TOTAL CONTINGENCY		$50,260
	ESTIMATED TOTAL		**(R) $1,905,000**

[11] Relocation Assistance Benefits

Relocation assistance benefits will be available for displaced businesses impacted by this project. Relocation benefits will involve 2 businesses in Reach 1, 5 businesses in Reach 2, and 5 businesses in Reach 4 where the construction of the May Branch drainage channel will result in the removal of the improvements within the alignment of the channel. The estimated relocation costs are included in Section 10. For Reaches 1 - 4, the estimated relocation assistance cost estimate is $561,800.

[12] Mineral Activity

There are no ongoing or anticipated mineral activities within the project area. The anticipated risk of conflicting mineral production in the project area is very low and is unlikely to require subordination of minerals. The project footprint or alignment and potential surface damages would likely prevent mineral development from impacting the project structures.

[13] Assessment of Non-Federal Sponsor

See Assessment of the Non-Federal Sponsor's Capability (Exhibit B). The Non-Federal Sponsor has been advised of the requirement for documenting expenses for crediting purposes.

[14] Application of Zoning Ordinances

The subject properties for the proposed project are zoned as commercial, industrial, manufacturing, single family, multifamily, and open space.

[15] Land Acquisition Milestones

The Non-Federal Sponsor is already in possession of eight (8) of the 88 ownerships within Reaches 1 to 4. The Non-Federal ownerships in Reaches 1 to 4 total approximately 3.96 acres. Given the nature of adverse impact to landowners, land acquisition is expected to take a minimum of 1 year depending upon available manpower and funding resources for Reaches 1 to 6. General elements contributing to acquisition timelines are landowner attitude, funding, manpower resources, and title issues. Some title defects can require significant time and efforts to cure. In some cases, curative efforts may require forced probate or condemnation to identify and provide legal notice to all owners. Where condemnation is required, an additional 2 years would be required after all negotiation efforts fail. The Non-Federal Sponsor can "take" possession of the properties needed for the project through eminent domain proceedings. If the properties were condemned, just compensation to the landowners would be decided in state court.

The estimated schedule for the real estate acquisition for this project is as follows:

Right-of-entry: two weeks
Survey: four weeks/parcel
Mapping: one week/parcel
Title: eight weeks/parcel
Appraisal: nine weeks/parcel
Acquisition: four weeks/parcel
Condemnation: 2 years

[16] Facility or Utility Relocations

The project will impact a number of utilities and facilities such street and railroad crossings, sewer lines, electrical lines, water lines and natural gas lines. If project construction requires movement of these utilities and/or facilities, their owners have a compensable interest. The estimated costs associated with these relocations and construction are estimated at $7,435,600.00, for Reaches 1 to 4 and $2,421,700.00 for Reaches 5 and 6. Theses are upfront project costs to the Non-Federal Sponsor. A Preliminary Attorney's Opinion of Compensability has been prepared for this study to address compensation involving facility and utility relocation issues.

Non-Federal Sponsor Construction Costs

Non-Federal Relocation Cost	Reach 1	Reach 2	Reach 3	Reach 4	Total
Utilities and Structures	$ 549,300	$ 845,800	$ 252,000	$ 992,000	$2,639,300
Roads	$1,118,600	$ 63,600	$ 38,700	$ 40,300	$1,261,200
Railroads	$ 334,500	-------------	-------------	-------------	$ 334,500
Engineering & Design	$ 193,900	$ 88,000	$ 28,100	$ 99,900	$ 409,000
Supervision & Administration	$ 174,500	$ 79,200	$ 25,300	$ 90,000	$ 369,000
Total, Non-Fed. Reloc. Costs	$2,370,800	$1,076,600	$ 344,100	$1,222,400	$5,013,900

Total Non-Federal Relocation Costs	$ 5,013,900
Reaches 5 and 6, Construction Costs	$ 2,421,700
Total Non-Federal Construction Costs	$ 7,435,600
5% Cash Contribution	$ 1,084,000
Estimated Land Costs, Reaches 1–4	$ 3,140,600
Estimated Land Costs, Reaches 5-6	$ 1,905,000
Total Non-Federal First Costs	$13,566,100

[17] Known Contaminants

Engineering data indicates that subsurface explorations were performed in the project location to assist in determining channel layout. No significant Hazardous, Toxic, Radiological Waste (HTRW) concerns were identified in the proposed channel location.

[18] Support or opposition to the project

The city of Fort Smith, the Non-Federal sponsor, supports the project. Support for this project includes the Arkansas Natural Resources Commission, the Arkansas Forestry Commission, the Arkansas Game and Fish Commission, and the Natural Resources Conservation Service. Congressional interest includes Arkansas Senators Lincoln and Pryor and Representative Boozman. No unfavorable comments were received during the public review of the draft feasibility report and Environmental Assessment.

[19] Statement that non-federal sponsor has been notified in writing about the risks associated with acquiring land for this proposed project.

The non-federal sponsor has been notified in writing regarding the risks of acquiring land for this project. The non-federal sponsor acknowledges the risk and expressed that there is no intention to acquire any rights-of-way until the project cooperation agreement (PCA) is signed.

[20] Other Real Estate Issues

There are no other issues that need to be considered or addressed relevant to this proposed project.

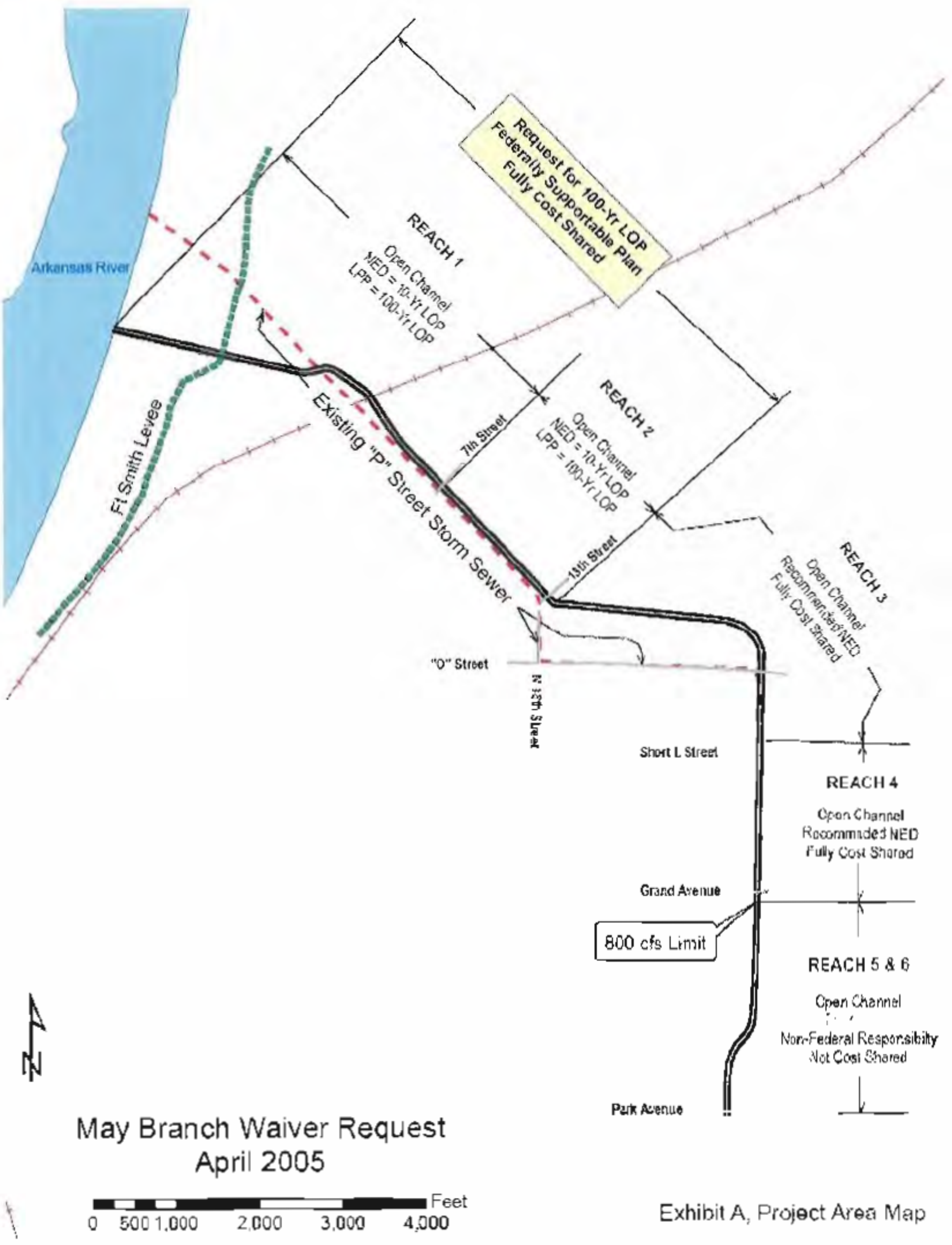

Exhibit A, Project Area Map

MAY BRANCH DRAINAGE CHANNEL PROJECT
(CITY OF FORT SMITH, ARKANSAS – NON-FEDERAL SPONSOR)

ASSESSMENT OF NON-FEDERAL SPONSOR'S
REAL ESTATE ACQUISITION CAPABILITY

1. LEGAL AUTHORITY:

(a) Does the sponsor have legal authority to acquire and hold title to real property for project purposes? yes

(b) Does the sponsor have the power of eminent domain for this project? yes

(c) Does the sponsor have "quick-take" authority for this project? yes

(d) Are any of the lands/interests in land required for the project located outside of the sponsor's political boundary? No

(e) Any of the lands/interests in land required for the project owned by an entity whose property the sponsor cannot condemn? No

2. HUMAN RESOURCE REQUIREMENTS:

(a) Will the sponsor's in-house staff require training to become familiar with the real estate requirements of Federal projects including P.L. 91-646, as amended? Yes

(b) If the answer to 2.a is "yes", has a reasonable plan been developed to provide such training? __________

(c) Does the sponsor's in-house staff have sufficient real estate acquisition experience to meet its responsibilities for the project? Yes

(d) Is the sponsor's projected in-house staffing level sufficient considering its other workload, if any, and the project schedule? Yes

(e) Can the sponsor obtain contractor support, if required, in a timely fashion? Yes

(f) Will the sponsor likely request USACE assistance in acquiring real estate? No (If "yes", provide description).

Exhibit B

3. OTHER PROJECT VARIABLES:

(a) Will the sponsor's staff be located within reasonable proximity to the project site? Yes

(b) Has the sponsor approved the project/real estate schedule milestones? Yes

4. OVERALL ASSESSMENT:

(a) Has the sponsor performed satisfactorily on other USACE projects? Yes

(b) With regard to this project, the sponsor is anticipated to be: xx Highly capable; _____Fully capable; _____Moderately capable; _____Marginally capable; _____Insufficiently capable. (If sponsor is believed to be? Insufficiently capable?, provide explanation).

5. COORDINATION:

(a) Has this assessment been coordinated with the sponsor? Yes

(b) Does the sponsor concur with this assessment? Yes (If "No", provide explanation).

Prepared by:

_______________(Signature)
JENNIFER DALTON
Attorney Advisor

Reviewed and Approved by:

Mark W. Moore
_______________(Signature)
MARK W. MOORE
Chief, Real Estate Branch

U.S. Department of Homeland Security
FEMA Region 6
800 North loop 288
Denton, TX 76209-3698

FEMA

October 14, 2004

The Little Rock District
Little Rock District, Corps of Engineers
Mr. Ronald Bridges
P.O. Box 867
Little Rock, AR 72203-0867

Reference: Fort Smith- May Branch – Drainage Channel

Dear Mr. Bridges:

We have received your letter and thank you for the opportunity to comment on the above-proposed project. The concerns of the Federal Emergency Management Agency (FEMA) are directed toward the National Flood Insurance Program (NFIP) and the possible negative impact upon identified flood hazard areas and wetlands within the outlined project boundaries. Our comment is that when any new development or construction is being considered that you consult with the local Floodplain Administrator (FPA).

In your letter you requested guidance and regulations relating to whether or not construction of a drainage channel would be compliant with policy of the Hazard Mitigation Grant Program (HMGP) agreement. This type of project would be considered compliant with the Open Space Agreement.

The Code of Federal regulations regarding this matter are as follows: The property shall be dedicated and maintained in perpetuity for uses compatible with open space, recreational, or wetlands management practices.

Furthermore after completion of the project, no application for additional disaster assistance will be made for any purpose with respect to the property to any federal entity or source, and no federal entity or source will provide such assistance.

If you have any questions, you may contact me at (940) 898-5279.

Sincerely,

Linda Delamare

Linda Delamare
Natural Hazards
Program Specialist

www.fema.gov

Exhibit C

AUTHORITY FOR ENTRY OF CONSTRUCTION

I, ____*(name of accountable official),*_______________, __*(title)*_________________________ for ______*name of non-Federal Sponsor*__________________, do hereby certify that the ____*(name of the non-Federal Sponsor)*________________has acquired the real property interests required by the Department of the Army, and otherwise is vested sufficient title and interest in lands to support construction of *(________project name, specifically identified project features, etc.)*________. Further, I hereby authorize the Department of the Army, its agents, employees and contractors, to enter upon ___*(identify tracts)*___________________ to construct ______*(project name, specifically identified project features, etc.)*______________ as set forth in the plans and sections held in the US Army Corps of Engineers ______________________________ District Office, _____*(city and state*________________.

WITNESS my signature as _________*(title)*______________________ for ______*(name of non-Federal Sponsor)*__________________ this _____ day of ______________________, 20____.

BY: ______________*(name)*__________________

______________*(title)*____________________

ATTORNEY’S CERTIFICATE OF AITHORITY

I, _____________*(name),*_______________, __*(title of legal officer)*__________________________ for ______*name of non-Federal Sponsor*___________________, certify that the ____*(name of the non-Federal Sponsor)*________________has authority to grant Authorization for Entry; that said Authorization for Entry is executed by the proper duly authorized officer; and that the Authorization for Entry is in sufficient form to grant the authorization therein stated.

WITNESS my signature as _________*(title)*______________________ for ______*(name of non-Federal Sponsor)*__________________ this _____ day of ______________________, 20____.

BY: ______________*(name)*__________________

______________*(title)*____________________

EXHIBIT D

Attachment E
Notes from SWD Meeting.

CESWL-ET-WP 1 September 1999

MEMORANDUM FOR RECORD

SUBJECT: August 25, 1999, In Progress Review Meeting, May Branch, Ft. Smith, Arkansas Feasibility Study

1. A meeting was held at the Corps of Engineers, Southwestern Division Office, in Dallas, Texas on 25 August 1999 to share information pertaining to HTRW and landfill concerns with the proposed May Branch channel drainage project, Ft. Smith, Arkansas.
2. Attendees: SWD Representatives: Bud Gerrity, Charles Armstrong, Larry Donovan, Gene Kastenek, Brian Condike, Patty Taylor, Bill Pearson; SWL Representatives: Bruce Watson, Chris Hicklin, Julia Smethurst, Randy Hathaway, Max Frauenthal.
3. SWD had accrued recent experience with a project similar to the May Branch project. The Dallas Floodway Extension project, as proposed by Ft. Worth District, crossed a former Dallas municipal landfill. The preliminary analytical testing showed that the contamination in the leachate exceeded the Toxicity Characteristics Leaching Procedure (TCLP) limit for lead. Headquarters, Corps of Engineers wanted the sponsor (Dallas, TX) to clean up the whole landfill. The soil contaminant concentrations were not high and the leachate concentration is decreasing with time. The Texas Natural Resources Conservation Commission (TNRCC) required monitoring every 200 feet. The policy of the Corps of Engineers is to clean up contamination before a project is performed at a location. Over $100,000 have been spent to date for the ongoing analytical testing at the landfill site.
4. In addition to the soil samples that have been analyzed at May Branch, SWD recommended that SWL obtain and analyze groundwater and surface water samples. These should be compared to any existing river water quality data and results from monitoring wells at the wastewater treatment plant.
5. SWD recommended that we obtain a copy of the Chemical Quality Assurance Report from J. Roxanne Welch at Ft. Worth District. (This has been requested.) Ms. Welch sends the CQAR to the HTRW Center of Expertise at CEMRD.
6. EM200-1-2, Technical Project Planning (TPP), should be used in planning projects such as May Branch. According to the TPP, Chemical Quality Data Objectives (CQDOs) should be established. This means that chemical analyses are picked to look for the contaminants that are expected to occur. (We did this although we didn’t call it CQDOs.) The TPP should take into account the receiver(s) of the data, (such as the Arkansas Department of Environmental Quality), and what they want (which analyses).

7. The following suggestions were also offered: The use of Tulsa District's SCAPS unit for the subsurface investigations was promoted. The cost for groundwater monitoring should be borne 100% by the sponsor. Solid disposal is a project cost. Dioxin was mentioned as an additional analyte.

MAX D.FRAUENTHAL, P.E.

CF: Julia Smethurst
Bruce Watson

Attachment F
ADEQ Memorandums

ADEQ
ARKANSAS
Department of Environmental Quality

January 11, 2000

Attn: CESWL-ET-WP (Frauenthal)
Little Rock Corps of Engineers
P.O. Box 897
Little Rock AR 72203

Mr. Frauenthal:

After review of the materials submitted on the May Channel Project, Fort Smith, and in light of the proposal to use the B route instead of the A route, which is adjacent to the old landfill, the Hazardous Waste Division of ADEQ does not see any problems with the project. There is limited data for proposed route B, but the data we have received does not show cause for a hazardous waste concern. Should further data become available that you wish us to consider, please let us know. Any future analytical submittals should include all Quality Assurance and Quality Control information. A review fee may be charged at that time as stated in APC&EC Regulation 23.

With regards to your question on soil disposal, all soil removed should be disposed of properly based on knowledge of the material.

Because of the change in location for this project, as with any new project, the Water Division and the Environmental Preservation Division will need to be contacted.

If you have any questions regarding this letter or our evaluation of your submittals, please contact Dianna Kilburn of my staff or myself at 501-682-0833.

Sincerely,

Mike Bates

Mike Bates, Chief
Hazardous Waste Division

cc: Joe Hoover, Manager, Active Sites Branch, HWD, ADEQ
Tammie Hynum, Manager, Technical and Administrative Branch, HWD, ADEQ
Jim Rigg, Geologist Supervisor, Active Sites Branch, HWD, ADEQ
Dianna Kilburn, Geologist, P.G., Active Sites Branch, HWD, ADEQ
Steve Drown, Program Support Manager, State Permits Branch, Water Div., ADEQ
Greg Patterson, Chief, Environmental Preservation Division, ADEQ

HAZARDOUS WASTE DIVISION
8001 NATIONAL DRIVE / POST OFFICE BOX 8913 / LITTLE ROCK, ARKANSAS 72219-8913 / TELEPHONE 501-682-0833 / FAX 501-682-0565
www.adeq.state.ar.us

ADEQ
ARKANSAS
Department of Environmental Quality

June 18, 2004

Attn: CESWL-ET-WP (Frauenthal)
Little Rock Corps of Engineers
P.O. Box 897
Little Rock, AR 72203

Mr. Frauenthal,

We have reviewed the data submitted previously concerning the May Branch Channel Project in Fort Smith and the track of route C. This information and information discussed during phone conversations with my staff do not indicate a Hazardous Waste Concern. Should any material appear suspect during the excavation, samples should be collected for analysis to determine if there is a risk to human health or the environment. Any soil removed should be disposed of properly based on knowledge of the material.

Because of the potential regulatory complexity of the project, a request for review should be sent to the Environmental Preservation Division with a letter stating the purpose of requesting a review, a project proposal, and a contact name, phone number and address for more information if it is needed. The Environmental Preservation Division will route your request to all appropriate divisions for review.

If you have any questions regarding this letter or our evaluation of your submittal, please contact Dianna Kilburn or Tammie Hynum of my staff or myself at 501-682-0833.

Sincerely,

Mike Bates, Chief
Hazardous Waste Division, ADEQ

cc: Joe Hoover, Technical Assistance Manager, Active Sites Branch, HWD
Tammie Hynum, Technical Assistance Manager, Tech. and Administrative Support Branch, HWD
Jim Rigg, Geologist Supervisor, Active Sites Branch, HWD
Dianna Kilburn, P.G., Geologist P.G., Active Sites Branch, HWD
Audree Miller, Pollution Prevention Program Coordinator, Environmental Preservation Division, ADEQ

HAZARDOUS WASTE DIVISION
8001 NATIONAL DRIVE / POST OFFICE BOX 8913 / LITTLE ROCK, ARKANSAS 72219-8913 / TELEPHONE 501-682-0833 / FAX 501-682-0565
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