# FOURMILE CREEK

# DRAINAGE BASIN PLANNING STUDY

# FOR

# CANON CITY, COLORADO

PREPARED BY:

ASSOCIATED DESIGN PROFESSIONALS, INC.
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May 25, 2000
Job No. 990604

ADP
Associated Design Professionals, Inc.

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# I. INTRODUCTION

## A. Contract Authorization

The Fourmile Creek Drainage Basin Planning Study was authorized under the terms of an agreement between the City of Canon City and Associated Design Professionals, Inc. This study covers drainage development alternatives within the Fourmile Creek Drainage Basin. For the purpose of this study, the upper limits of the Fourmile Creek Drainage Basin is confined to the region just south of Wilson Creek along the steep, forested region that defines the lower limits of Sixmile Park.

## B. Purpose and Scope of Work

The purpose of this study is to develop the most feasible drainage plans for the Fourmile Creek Drainage Basin. The detailed scope of services is as follows:

I. Fourmile Creek Drainage Basin as a whole

A. Review previous studies, maps and other available information.
B. Provide additional analysis and/or data that are critical to the project and not currently available, in order to accomplish II.

II. Conceptual Master Plan for Basin

A. Recommend improvements for the basin
B. Prioritize the improvements
C. Provide a planning level cost estimate for each improvement

## C. Previous Drainage Reports

There has been one previous drainage study and one floodplain management study performed within the Fourmile Creek Drainage Basin. The following is a summary of the reports:

"Drainage Planning Report for Fourmile Ranch" by Crosby Mead Benton and Associates, Inc. December 3, 1992.

"Flood Plain Management Study for Fourmile Creek and Mud Gulch at Canon City, Colorado" by U.S. Department of Agriculture, Natural Resources Conservation Service. June 1996

## D. Agency Jurisdictions

The City of Canon City and Fremont County have jurisdiction over the proposed drainage criteria and design requirements. Any proposed improvements or changes to the existing canals within the basins will need to be approved by one of the following canal boards:

- Titsworth Ditch
- Park Center Lateral
- Grandview Ditch
- Oil Creek Ditch

The US Army Corps of Engineers will have review approval for any work that disturbs existing wetland areas or for any modifications to the Arkansas River.

E. Drainage Criteria

The drainage criteria used in this study were obtained from the City of Canon City. Flow calculations are determined from the TR-20 Computer Program for Project Formulation Hydrology developed by the Soil Conservation Service. The charts used in determining input for the program are contained in the Appendix of this report.

F. Mapping

The Canon City, Colorado, 7.5-minute series topographic quadrangle map prepared by the U.S. Geological Survey was used as the basin map for this project. This map uses 20 feet contour intervals and was photo revised in 1976. The map was used for the general purposes of basin boundary delineation and for the establishment of principal tributary regions and sub-basins within these regions. Recent road improvements were added to the maps to reflect current conditions.

The mapping was supplemented with ¼ section aerial photographs of the region. These maps were produced in 1994 by Kucera West and used to better delineate the drainage in undeveloped areas and to identify current land uses.

G. Field Reconnaissance

Field reconnaissance of the basin was performed in order to supplement existing roadway and site development plans and existing drainage reports. Culvert locations, sizes, and depths were field checked and sub-basin flow patterns were analyzed. In addition, existing as well as potential problem areas were noted for a more in-depth evaluation.

H. Environmental Considerations

Although most of the basin is comprised of dry rangeland areas, some existing wetlands exist along Fourmile Creek. One major area exists at the outlet of the storm sewer near the end of High Street. An energy dissipater at the end of the pipe allows the flow to pond up before entering Fourmile Creek.

## II. PROJECT DESCRIPTION

A. Basin Description and Location

The Fourmile Creek Drainage Basin encompasses the eastern portion of Canon City including Fourmile Ranch, Canon Ridge Ranch, and a portion of Fremont County. It spans from Sixmile Creek Drainage Basin on the west to the Abbey Drainage Basin on the east and the Arkansas River to the south. It is situated in Township 18S and 19S, Range 70W and 69W of the 6th PM, Fremont County, Colorado. The basin contains approximately 13.4 Square Miles. A portion of the lands are currently platted, but not yet developed.

The runoff from this basin flows in a southerly direction and into the Arkansas River through two major drainage ways; Fourmile Creek and Mud Gulch. The topography

varies from a relatively flat slope of about 0.5% to 1% in the lower portion of the basin to about 8% to 18% in the upper portion of the basin. The vegetation consists primarily of native rangeland grasses with agricultural crops in the lower portion of the basin to forestland in the northeastern part of the basin.

B. *Major Drainageways and Facilities*

The upper channels in the Fourmile Creek Drainage Basin vary from broad swales with heavy vegetation to well-defined channels and roadside ditches with relatively sparse vegetation. There are four irrigation canals that traverse the basin from the west to east. The southern-most waterway is the Grandview Ditch that serves as an overflow ditch for the Hydraulic Ditch. This ditch crosses under Fourmile Creek, Highway 50, and Mud Gulch before flowing above ground east of Mackenzie Avenue and southeast onto private state prison land. A short portion of Oil Creek Ditch crosses under Fourmile Creek through a small siphon and east to Mud Gulch where flows converge and flow south to the Arkansas River. The Park Center Lateral runs generally north and south and originates at Turner Reservoir at the northern end of the basin. Flows in this ditch are for general irrigation purposes and has a very low capacity. The Titsworth Ditch conveys flow into the northern portion of the basin and continues south along Fourmile Road to a region south of the water tank. Although most basin runoff is currently tributary to these canals, their capacities are such that large storm flows will inundate the canals and allow water to overtop their banks.

The watersheds that produce runoff to Fourmile Creek originate in the southern portion of Pike National Forest and span south to the Arkansas River. This total area of 434 square miles contributing to Fourmile Creek is comprised of steep, forested lands in the upper portions of the basin to relatively flat regions along the Arkansas River mainly used for agricultural purposes. This study limits the northern reach of the basin to a region just south of Wilson Creek along the steep, forested region that defines the lower limits of Sixmile Park. Flows in this defined basin flow south undisturbed until reaching the bridge at Highway 50. A 177-foot span bridge at Highway 50 is currently in place and is in good condition. Two bridges are in place near the intersection of Grandview Street and Steinmeier Avenue. The roadway bridge along Grandview Street has a span of 98 feet and is in fair condition. The Denver and Rio Grande Western Railroad crosses Fourmile Creek by means of a 118-foot span truss bridge located approximately 200 feet south of Grandview Street. These three bridges were not evaluated in this drainage study. A comprehensive analysis of these structures has been performed using the program developed by the U.S. Army Corps of Engineers for analysis of rivers called HEC-RAS. This evaluation can be found in the report performed by Associated Design Professionals, Inc. for the restudy of the floodplain limits for a portion of Fourmile Creek.

The watershed contributing to Mud Gulch is confined within the limits of this study. The total area of the watershed is 3.61 square miles and is comprised of fairly steep slopes of approximately 20% in the upper reaches to around 1% near the Arkansas River. There currently exists an SCS dam 1500 feet north of County Road 123 between the cut in the hogbacks. This dam was constructed in 1972 and is inspected periodically by the regional state dam inspector for safety. Past reports have revealed poor maintenance of the facility with major concern of the outflow structure being clogged

with sediment. Developed conditions within the basin do not warrant the upsize of this facility. However, with increased development downstream of this facility there is a major concern in the performance of this structure during a major storm event. Therefore, maintenance of this facility must be addressed as development occurs downstream. Flows released from the SCS dam flow southwest and cross under Fourmile Road via a 30' single span bridge. Flows then cross under Highway 50 through a three celled box culvert with an overall dimension of 31feet long by 5 feet high. This structure was found to be 90% clogged with sediment at the time of our field investigation. As with the SCS dam upstream, this structure must be cleared of any obstructions to protect from potential flooding problems in the area. There are four small crossings south of Highway 50 at Grandview Street, Highland Avenue, Adams Avenue, and at the Denver and Rio Grande Western Railroad. As with Fourmile Creek, these structures (not including the SCS dam) were evaluated using HEC-RAS and are presented in the report for the restudy of the floodplain along Fourmile Creek.

C. Existing Surface Water Improvements

The SCS dam located in the southeast corner of section 19 is the only significant surface water impoundments within the Fourmile Creek Drainage Basin. The dam has a capacity of 99.72 acre-feet at the elevation of the high stage riser and a maximum capacity of 432 acre-feet at the emergency spillway.

## III. HYDROLOGIC EVALUATION

A. Basin Hydrology

The hydrologic model used to determine peak flows and volumes throughout Fourmile Creek Drainage Basin was the TR-20 Computer Program for Project Formulation Hydrology developed by the Soil Conservation Service.

The overall basin was divided into tributary basins and again into smaller sub-basins. The sub-basins and existing structures were then numbered for data input into TR-20 (see the Existing Structures Map in the back pocket of this report). The sub-basins were chosen with respect to the natural topography, roadway crossings and future development considerations. Peak flows for the 100-year, 50-year and 25-year, 24-hour storms, were calculated and evaluated.

B. Time of Concentration

The time of concentration (Tc) used in the TR-20 calculations was determined by first calculating an initial overland flow time from the sub-basin boundary to the naturally occurring swales and channels. Then a travel time was calculated in these natural swales to the outlet of the sub-basins and added to the initial overland flow time to determine the overall time of concentration for existing conditions. For future developed conditions, the channel travel times were adjusted to reflect improved conditions and therefore, a shorter time of concentration.

C. Rainfall

Rainfall amounts for the Fourmile Creek Basin were determined from the National Oceanic and Atmospheric Administration Atlas 2, Precipitation-Frequency Atlas of the Western United States, Volume III - Colorado, 1973.

Precipitation for the 100-year 50-year and 25-year, 24-hour storms were 3.40, 3.05, and 2.75 inches, respectively.

D. Projected Surface Characteristics

Existing land uses in the Fourmile Creek Drainage Basin were determined by examining current development plans supplemented with field reconnaissance. Currently most development is occurring along Highway 50 and on the bluff along the western edge of the basin.

Projected surface characteristics for the area were determined through examination of current development plans and through discussions with Fremont County Planning Department officials and Canon City officials. For design purposes, undeveloped areas were assumed to be fully developed using projected densities. The projected surface characteristics map is a composite of this land use information. There is not a time frame or date associated with this ultimate projected land use.

E. Soil Characteristics

The soils information contained in this report is derived from the "Soil Survey of Fremont County Area, Colorado", issued December 1995. Of the 24 soils classifications found within the Fourmile Creek drainage basin, 26% of the basin area includes Hydrologic Soil Group B, 16% for Hydrologic Soil Group C, and 58% for Hydrologic Soil Group D (see the enclosed Soils Map prepared by ADP).

F. Runoff Curve Numbers

Runoff Curve Numbers (CN's) were determined for the basin by utilizing soils and land use information described in previous sections. Curve numbers for the undeveloped portions of the basin were prepared based on projected land densities with some agricultural and forest land remaining in its existing condition.

## IV. HYDRAULIC DESIGN EVALUATION

A. Existing Structure Evaluation

Only the existing structures that transport flows out of major sub-basins have been examined in this report. An allowable headwater of 6" below the edge of pavement was utilized to calculate maximum culvert capacities. The existing capacities of these structures were estimated primarily using inlet control analysis.

The analysis revealed that a majority of the existing structures throughout the basin are unable to effectively handle the 100-year, 24-hour storm without overflowing the roadways. An existing structure evaluation chart was developed to summarize these findings and is included at the end of this section.

B. Existing Drainageway Evaluation

As outlined in the Major Drainageway and Facilities section, most of the major drainageways within the Fourmile Creek Drainage Basin are natural, unimproved channels. In the upper reaches of the basin, the channels are typically wide, grassed swales with little or no signs of erosion. As development occurs adjacent to the natural drainage reaches, improvements must be made to ensure proper conveyance in these

channels. The existing capacities of major channel reaches within the basin were estimated using normal depth flow analysis.

C. Environmental Inventory

The significant environmentally sensitive area within the Fourmile Creek Drainage Basin is the SCS dam as described in the Existing Surface Water Improvements Section.

## V. ALTERNATE DRAINAGE SYSTEMS

A. Alternate Development Policies

The alternate drainage considerations were developed in a cooperative effort with input from the City of Canon City and the local residents. Several additional variations of the presented alternates were also examined but are not included in this report. It is also assumed that the improvements delineated in the Four Mile Ranch Drainage Plan are implemented. No costs have been included in this report for the Four Mile Ranch improvements.

B. Alternate 1

This alternate investigates developed flow conditions with existing structures throughout the project area. It assumes that all ditches are completely filled with storm flows from the north and west and will allow flows to overtop the canal banks.

Based on the assumptions, 525 cfs accumulates from approximately 490 acres at structure 2 near the break in the hogbacks in Canon Ridge Ranch. The existing road crossing contains two 36" CMP's with approximately 4 feet of head above the pipes. The flow continues south into an existing detention area near Fourmile Road that has been heavily overgrown with tamarack and brush. A notch has been cut into the downstream bank by a local landowner to allow flows to proceed downstream with very little detention. The total flow of 591 cfs from 627 acres is allowed to cross over Fourmile Road and on to the adjacent property west of the road and into Fourmile Creek.

The total flow of 552 cfs from an area of 850 acres accumulates at a low point in Fourmile Road north of the water tank. This flow originates in the steep upper reaches of the basin and passes through a number of small dams along its way. The total combined flow in Fourmile Creek is 3,050 cfs at its confluence with the Arkansas River.

The total flow into the existing SCS dam from 1,400 acres of dense forest is 980 cfs. The total flow out of the dam through the 10" steel outflow pipe downstream into Mud Gulch is 30 cfs. The majority of the flow into Mud Gulch comes in the form of sheet flow as the channel traverses southwest to Fourmile Road. The total flow at Fourmile Road is 925 cfs from a combined area of 2,110 acres upstream. The total combined flow in Mud Gulch is 1,510 cfs at its confluence with the Arkansas River.

C. Alternate 2

This alternate investigates developed flow conditions with proposed structures throughout the project area. It assumes that all ditches are completely filled with storm flows from the north and west and will allow flows to overtop the canal banks.

Based on the assumptions presented in alternate 2, the total developed flow to reach structure 2 will increase to 533 cfs. To effectively convey flow downstream without overtopping Canon Ridge Road, a 6' x 14' concrete box culvert will need to be constructed. This alternate will include the redesign and reshaping of the existing detention facility at structure 3 adjacent to Fourmile Road. The new 25 acre-foot facility would include the excavation of the overgrowth in the existing detention area and would extend the banks eastward to protect the existing home site just north of the facility. This detention facility is currently privately owned. In order for this alternate to be feasible, the City of Canon City would have to purchase this property of approximately 4 acres and take on full responsibility for the maintenance of the facility. Currently, the landowner is responsible for the upkeep and liability of the facility. No other state or federal agency has jurisdiction over the detention facility or will compensate for any injury or loss due to the failure of this facility.

A 6' x 14' concrete box culvert will need to be constructed to effectively convey the accumulated flow of 552 cfs under Fourmile Road at structure 4 and on to Fourmile Creek. The total flow in Fourmile Creek is now 2,695 cfs at its confluence with the Arkansas River. The total flow to reach the Arkansas River dropped due to the detention of flows at structure 3 upstream.

The conditions outlined in Alternate 1 for Mud Gulch will also apply in Alternate 2.

The estimated probable construction cost of Alternate 2 is $675,680. This cost does not include land or easement purchase costs and is based on 1998 dollars.

D. Alternate 3

This alternate investigates developed flow conditions with proposed structures throughout the project area. It assumes that all ditches are completely filled with storm flows from the north and west and will allow flows to overtop the canal banks.

In order to alleviate the problem of the privately owned detention facility, a large storm channel is conceived to reroute flows behind the large bluff between the water tank and Canon Ridge Road. This channel would have a bottom width of 15 feet and a depth of 6 feet to a point where existing flows from the west converge with the diverted flow into one channel. From this point to Fourmile Creek, the bottom width increases to 20 feet and the depth of the channel remains at 6 feet deep. Due to the high velocity in the channel, 12" diameter riprap would be required to armor the channel banks and bottom its entire length to Fourmile Creek. The total length of the channel would be 6,000 feet and would cost $1,622,000. Structure 4 will require a 4 celled 6' x 28' box culvert to convey 1,085 cfs to Fourmile Creek.

This alternate will include the cost to upgrade the bridges at Highland Avenue and Adams Avenue along Mud Gulch. Each bridge will need to be upgraded with a

minimum span of 40 feet at each crossing. The approximate cost of each bridge is $90,000. A complete analysis of these structures can be found in the report for the restudy of the floodplain along Fourmile Creek.

The estimated probable construction cost of Alternate 3, not including the redesign of the existing detention facility, is $2,065,520. This cost does not include land or easement purchase costs and is based on 1998 dollars.

E. Summary of Alternatives

Factors used to evaluate the three alternatives explained in this report were cost, constructability, citizen feedback, and city input. As a result of the meetings held with public and private individuals, Alternate 2 was selected. The estimated probable construction cost is $675,680. This cost does not include land or easement purchase costs and is based on 1998 dollars.

## VI. PRELIMINARY DESIGN

A. General

Based on the results of the alternatives, the evaluation and comments from the public meetings and the City, the concepts from the chosen alternative were developed into preliminary designs. Each major system in the Fourmile Creek drainage basin is delineated on the conceptual plans contained in Appendix B with the associated costs for the facilities included in a summary table in the Economic Analysis section.

Although specific types of erosion protection and pipe structures are delineated on the Preliminary Estimate of Probable Construction Costs, this does not preclude the use of other design materials or design schemes that will serve the intended purpose as well as or better than those presented herein both hydraulically and environmentally. The designs presented in this study represent one method of stabilizing a channel reach. Other methods of stabilization are permitted as long as they meet the approval of the Canon City Engineering Department and other affected agencies.

## VII. WATER QUALITY

A. General

Concern regarding storm water quality has grown since the past decade. The Environmental Protection Agency (EPA) has regulations for monitoring storm water and the use of Best Management Practices to control storm water. The actual design for any necessary control facilities will vary according to the type of pollutants present. Pollutants can enter storm water in the following manner:

1. Absorbed as raindrops pass through the atmosphere.
2. Extracted from paved and unpaved surfaces by storm water runoff.
3. Accumulated contaminates in storm sewers, ditches, and channels.

B. Treatments

Most of the pollutants expected to reach the main stem of the channel should be of the suspended solid variety. However, it may be necessary to sample and analyze the storm water to determine the exact control measures to implement.

Dry basins should be designed in areas where the main pollutants are suspended solids, which simply settle out in the basin when the channel velocity drops. However, if dissolved solids, nitrates and nitrites, and soluble phosphorus are present, a wet pond will need to be constructed to reduce these pollutants.

## VIII. ECONOMIC ANALYSIS

A. General

The economic analysis of the channel improvements listed in this study was derived from current construction prices for materials and labor in the Canon City, Fremont County area. In addition, the 1997 edition of the Colorado Department of Highways "Cost Data" was utilized. Estimated probable construction costs were determined for each channel reach for the selected alternative utilizing the protection scheme delineated in the Alternate Drainage Systems section and on the Conceptual Plans located in Appendix B.

The following table lists the specific unit construction costs used in determining the Estimated Probable Construction Costs for each alternative:

*UNIT CONSTRUCTION COSTS*

| Item Description | Unit | Estimated Unit Cost |
|---|---|---|
| Rip Rap | CY | $35.00 |
| Heavy Rip Rap | CY | $45.00 |
| Granular bedding materials | CY | $20.00 |
| Reinforced concrete | CY | $275.00 |
| Structural backfill | CY | $8.00 |
| Structural excavation | CY | $5.00 |
| Muck excavation | CY | $6.00 |
| Unclassified excavation and embankment | CY | $3.00 |
| Seeding (native) | Acre | $550.00 |
| 48" RCP | LF | $100.00 |
| 60" RCP | LF | $175.00 |
| 78" RCP | LF | $425.00 |
| 76" X 48" ERCP (60" EQIV.) | LF | $185.00 |
| 3' X 6' Box culvert | LF | $245.00 |
| 3' X 12' Box culvert | LF | $415.00 |
| 3' X 14' Box culvert | LF | $460.00 |
| 4' X 6' Box culvert | LF | $325.00 |
| 4' X 7' Box culvert | LF | $380.00 |
| 4' X 8' Box culvert | LF | $440.00 |
| 4' X 12' Box culvert | LF | $550.00 |
| 4' X 14' Box culvert | LF | $610.00 |

| | | |
|---|---|---|
| 4' X 15' Box culvert | LF | $670.00 |
| 6' X 10' Box culvert | LF | $740.00 |
| 6' X 12' Box culvert | LF | $825.00 |
| 6' X 14' Box culvert | LF | $915.00 |
| 6' X 16' Box culvert | LF | $1,100.00 |

**NOTE:** Pipe and culvert costs do not include utility relocation costs.

B. Preliminary Estimate of Probable Construction Costs

As previously stated, the proposed improvements are illustrated on the alternate conceptual plans that are included in Appendix B. Conceptual construction costs were estimated for each alternate based on the unit construction costs provided in this section and are also in Appendix B. Preliminary construction costs for the selected alternate are provided in Appendix C.

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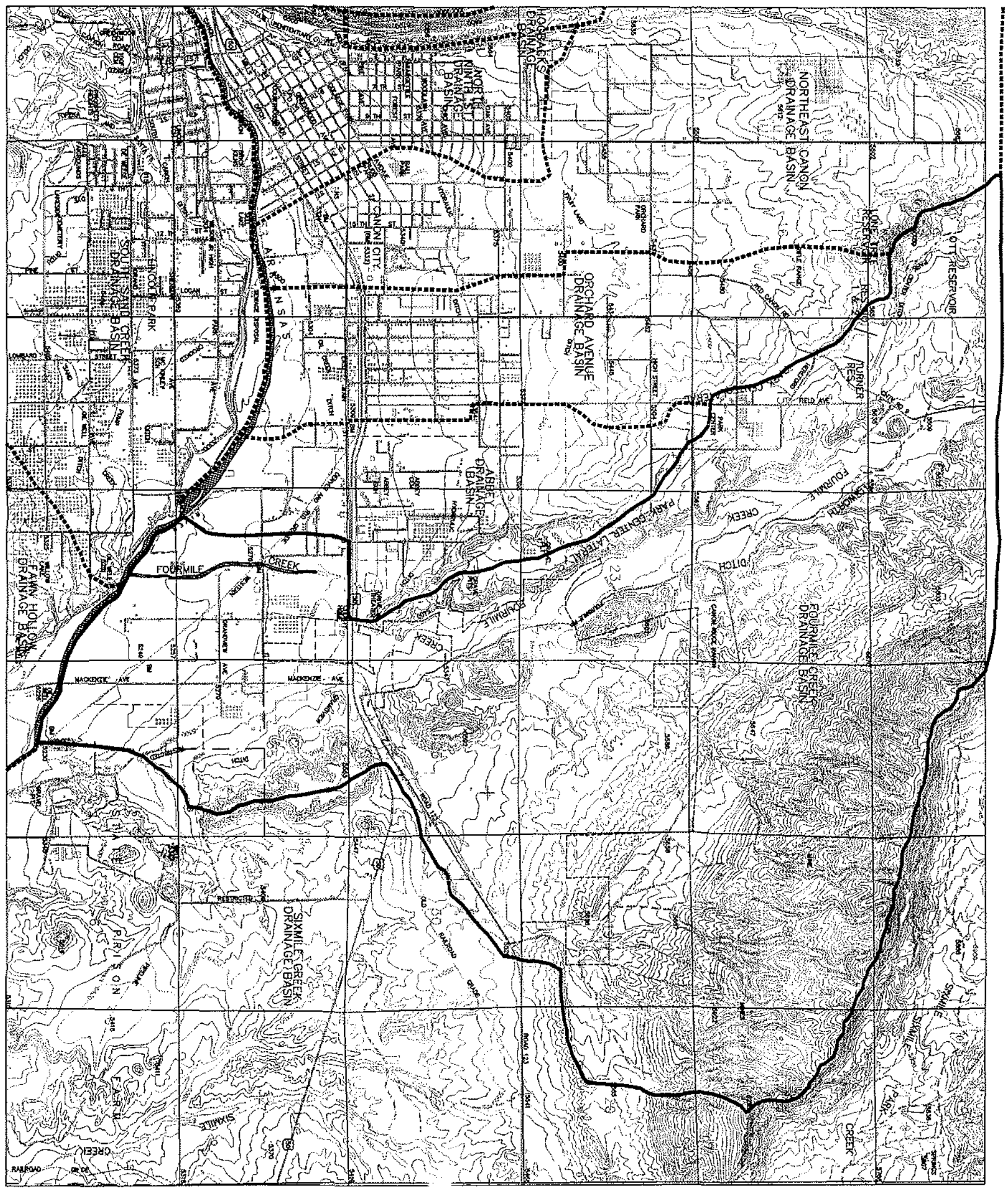
PREVIOUS DRAINAGE STUDIES:

SOUTH SAND CREEK
NORTHEAST CANON
HOGBACKS
ORCHARD AVENUE
ABBEY




**DRAINAGE BASIN PLANNING STUDY**

**FOURMILE CREEK**

**CITY OF CANON CITY, COLORADO**

**ADJACENT BASINS MAP**

| NO. | DATE | REVISION | BY |
|---|---|---|---|
| | | | |

PREPARED BY:

ADP

Associated Design Professionals, Inc.

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LEGEND

- OPEN, ESTATES > 1 AC LOTS
- LOW DENSITY RES. < 6 DU/AC
- MULTI FAMILY
- AGRICULTURE
- GOLF / PARK
- COMMERCIAL
- RANGELAND
- FOREST

N

CANON CITY
ARKANSAS
FOURMILE CREEK
LONE TREE RESERVOIR 1 & 2
LOTT RESERVOIR
STATE PRISON FARM
SIXMILE CREEK
SIXMILE PARK CREEK
LINCOLN PARK
STATE PENITENTIARY
RAILROAD GRADE

**DRAINAGE BASIN PLANNING STUDY**
**FOURMILE CREEK**
**CITY OF CANON CITY, COLORADO**
**PROJECTED SURFACE CHARACTERISTICS**

| NO. | DATE | REVISION | BY |
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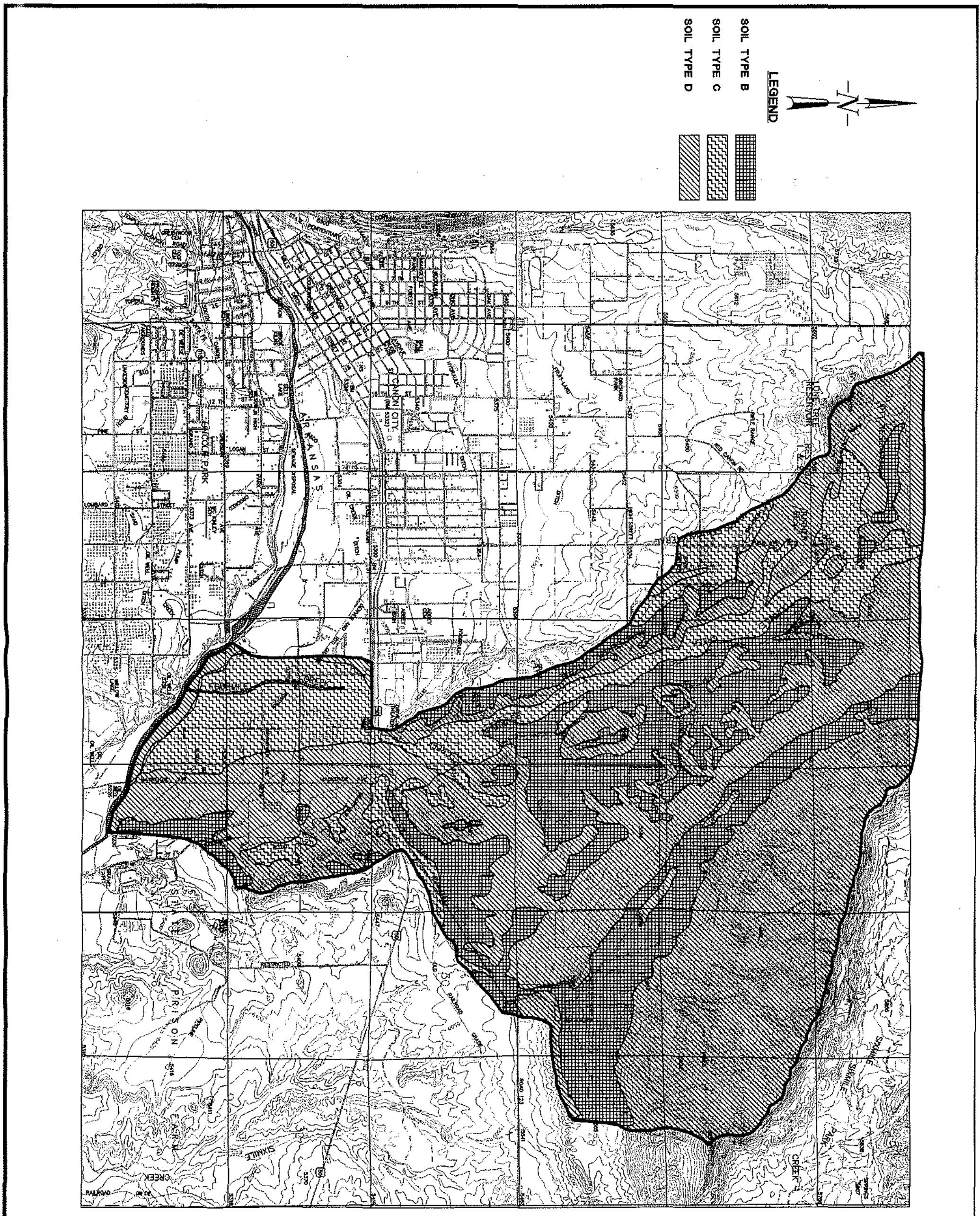


# DRAINAGE BASIN PLANNING STUDY

**FOURMILE CREEK**

**CITY OF CANON CITY, COLORADO**

**SOILS MAP**

| NO. | DATE | REVISION | BY |
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**STRUCTURE LEGEND**

1 SCS DAM WITH 10" STEEL PIPE
2 2-36" CMP DETENTION FACILITY
3 LOW FLOW CROSSING
4


**DRAINAGE BASIN PLANNING STUDY**
**FOURMILE CREEK**
**CITY OF CANON CITY, COLORADO**
**EXISTING STRUCTURES MAP**

SHEET 1 of 1

| NO. | DATE | REVISION | BY |
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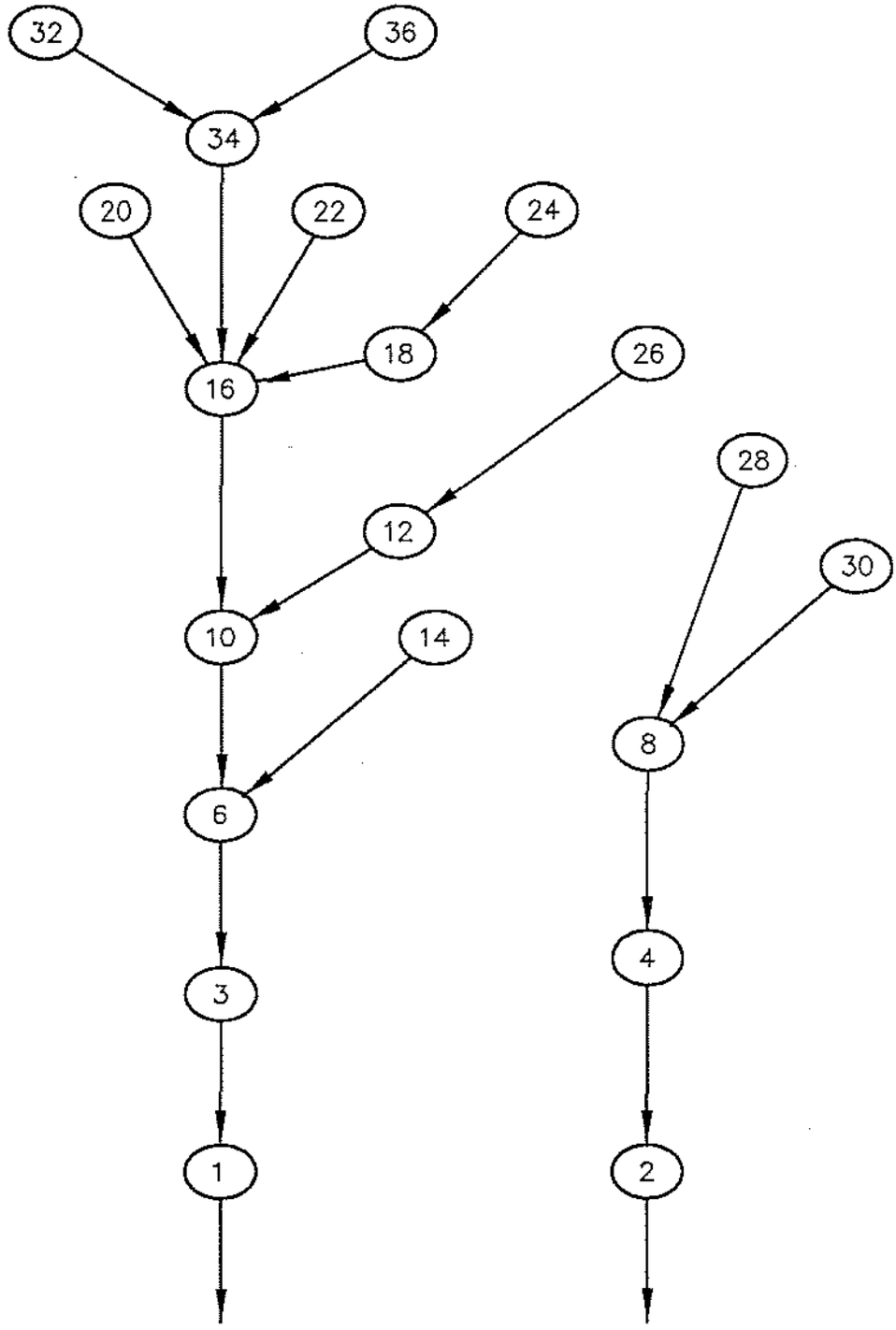


ARKANSAS RIVER

| | |
|---|---|
| FOURMILE CREEK BASIN PLANNING STUDY EXISTING CONDITIONS | |
| FLOW DIAGRAM | |
| DESIGNED BY: JJW | DRAWN BY: JJW |
| CHECKED BY: MAB | DATE: 9/28/99 |
| FILE NO: 4_XFLOW.DWG | JOB NO: 990604 |

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**FOURMILE CREEK DBPS**
**DEVELOPED CN CALCULATION 1 OF 2**

| BASIN # | AREA (ac) | SOIL TYPE | AGRI | % | EST | % | S.F | % | M.F | % | RNG | % | COMM | % | GOLF | % | FRST | % | TOTAL SOIL % | DEV CN | BASIN # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | B | 69 | | 68 | | 75 | | 75 | | 61 | | 92 | | 61 | | 60 | | 0 | | |
| 1 | 359.2 | C | 79 | 80 | 79 | | 83 | | 83 | | 74 | | 94 | | 74 | | 73 | | 80 | 80.0 | 1 |
| | | D | 84 | 20 | 84 | | 87 | | 87 | | 80 | | 95 | | 80 | | 79 | | 20 | | |
| | | B | 69 | 10 | 68 | | 75 | | 75 | | 61 | 2.5 | 92 | | 61 | | 60 | | 12.5 | | |
| 2 | 597.5 | C | 79 | 10 | 79 | | 83 | | 83 | | 74 | 5 | 94 | | 74 | | 73 | | 15 | 80.5 | 2 |
| | | D | 84 | 62.5 | 84 | | 87 | | 87 | | 80 | 10 | 95 | | 80 | | 79 | | 72.5 | | |
| | | B | 69 | | 68 | | 75 | | 75 | | 61 | | 92 | | 61 | | 60 | | 0 | | |
| 3 | 217.0 | C | 79 | | 79 | | 83 | 50 | 83 | | 74 | | 94 | 22.5 | 74 | | 73 | | 72.5 | 87.8 | 3 |
| | | D | 84 | | 84 | | 87 | 12.5 | 87 | | 80 | | 95 | 15 | 80 | | 79 | | 27.5 | | |
| | | B | 69 | | 68 | | 75 | | 75 | | 61 | | 92 | | 61 | | 60 | | 0 | | |
| 4 | 271.9 | C | 79 | | 79 | | 83 | | 83 | | 74 | 20 | 94 | 10 | 74 | | 73 | | 30 | 86.1 | 4 |
| | | D | 84 | | 84 | | 87 | 20 | 87 | | 80 | 20 | 95 | 30 | 80 | | 79 | | 70 | | |
| | | B | 69 | | 68 | 15 | 75 | 3 | 75 | | 61 | 3 | 92 | | 61 | 3 | 60 | | 22 | | |
| 6 | 480.6 | C | 79 | | 79 | | 83 | 18 | 83 | | 74 | | 94 | 1 | 74 | 6 | 73 | | 25 | 79.5 | 6 |
| | | D | 84 | | 84 | 11 | 87 | 20 | 87 | | 80 | 11 | 95 | 1 | 80 | 10 | 79 | | 53 | | |
| | | B | 69 | | 68 | 5 | 75 | 10 | 75 | 7 | 61 | | 92 | 11 | 61 | 5 | 60 | | 38 | | |
| 8 | 712.7 | C | 79 | | 79 | | 83 | 2 | 83 | | 74 | | 94 | 11 | 74 | 1 | 73 | | 14 | 82.0 | 8 |
| | | D | 84 | | 84 | 18 | 87 | 7 | 87 | 4 | 80 | 5 | 95 | 1 | 80 | 4 | 79 | 9 | 48 | | |
| | | B | 69 | | 68 | 15 | 75 | 26 | 75 | | 61 | 2 | 92 | | 61 | 4 | 60 | | 49 | | |
| 10 | 246.6 | C | 79 | | 79 | | 83 | 19 | 83 | | 74 | | 94 | | 74 | 4 | 73 | | 23 | 76.4 | 10 |
| | | D | 84 | | 84 | 4 | 87 | 4 | 87 | | 80 | 20 | 95 | | 80 | | 79 | | 28 | | |
| | | B | 69 | | 68 | 17 | 75 | 31 | 75 | | 61 | | 92 | | 61 | 3 | 60 | 20 | 71 | | |
| 12 | 251.5 | C | 79 | | 79 | | 83 | | 83 | | 74 | | 94 | | 74 | | 73 | | 0 | 72.4 | 12 |
| | | D | 84 | | 84 | 16 | 87 | | 87 | | 80 | 5 | 95 | | 80 | | 79 | 8 | 29 | | |
| | | B | 69 | | 68 | 25 | 75 | 7 | 75 | | 61 | | 92 | | 61 | 10 | 60 | 4 | 46 | | |
| 14 | 450.2 | C | 79 | | 79 | | 83 | | 83 | | 74 | | 94 | | 74 | | 73 | | 0 | 74.7 | 14 |
| | | D | 84 | | 84 | 15 | 87 | 6 | 87 | | 80 | 2 | 95 | | 80 | 5 | 79 | 26 | 54 | | |
| | | B | 69 | | 68 | 15 | 75 | 15 | 75 | | 61 | 1 | 92 | | 61 | | 60 | 2 | 33 | | |
| 16 | 445.1 | C | 79 | | 79 | 25 | 83 | 15 | 83 | | 74 | | 94 | | 74 | | 73 | | 40 | 78.2 | 16 |
| | | D | 84 | | 84 | 11 | 87 | 10 | 87 | | 80 | 2 | 95 | | 80 | | 79 | 4 | 27 | | |
| | | B | 69 | | 68 | 25 | 75 | 10 | 75 | | 61 | 25 | 92 | | 61 | | 60 | | 60 | | |
| 18 | 136.7 | C | 79 | | 79 | | 83 | | 83 | | 74 | | 94 | | 74 | | 73 | | 0 | 72.8 | 18 |
| | | D | 84 | | 84 | 25 | 87 | | 87 | | 80 | 15 | 95 | | 80 | | 79 | | 40 | | |
| | | B | 69 | | 68 | 5 | 75 | | 75 | | 61 | | 92 | | 61 | | 60 | | 5 | | |
| 20 | 254.4 | C | 79 | | 79 | 30 | 83 | 5 | 83 | | 74 | | 94 | | 74 | | 73 | | 35 | 81.7 | 20 |
| | | D | 84 | | 84 | 60 | 87 | | 87 | | 80 | | 95 | | 80 | | 79 | | 60 | | |
| | | B | 69 | | 68 | 20 | 75 | | 75 | | 61 | | 92 | | 61 | | 60 | 20 | 40 | | |
| 22 | 291.8 | C | 79 | | 79 | | 83 | | 83 | | 74 | | 94 | | 74 | | 73 | | 0 | 73.3 | 22 |
| | | D | 84 | | 84 | 5 | 87 | | 87 | | 80 | | 95 | | 80 | | 79 | 55 | 60 | | |
| | | B | 69 | | 68 | 5 | 75 | | 75 | | 61 | | 92 | | 61 | | 60 | 25 | 30 | | |
| 24 | 469.9 | C | 79 | | 79 | | 83 | | 83 | | 74 | | 94 | | 74 | | 73 | | 0 | 74.0 | 24 |
| | | D | 84 | | 84 | 5 | 87 | | 87 | | 80 | | 95 | | 80 | | 79 | 65 | 70 | | |

**FOURMILE CREEK DBPS**
**DEVELOPED CN CALCULATION 2 OF 2**

| BASIN # | AREA (ac.) | SOIL TYPE | AGRI | % | EST | % | S.F | % | M.F | % | RNG | % | COMM | % | GOLF | % | FRST | % | TOTAL % | DEV CN | BASIN # |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | B | 69 | | 68 | 10 | 75 | | 75 | | 61 | | 92 | | 61 | | 60 | 20 | 30 | | |
| 26 | 598.4 | C | 79 | | 79 | | 83 | | 83 | | 74 | | 94 | | 74 | | 73 | | 0 | 74.6 | 26 |
| | | D | 84 | | 84 | 10 | 87 | | 87 | | 80 | | 95 | | 80 | | 79 | 60 | 70 | | |
| | | B | 69 | | 68 | | 75 | | 75 | | 61 | | 92 | | 61 | | 60 | 30 | 30 | | |
| 28 | 772.4 | C | 79 | | 79 | | 83 | | 83 | | 74 | | 94 | | 74 | | 73 | | 0 | 73.3 | 28 |
| | | D | 84 | | 84 | | 87 | | 87 | | 80 | | 95 | | 80 | | 79 | 70 | 70 | | |
| | | B | 69 | | 68 | | 75 | | 75 | | 61 | | 92 | | 61 | | 60 | 30 | 30 | | |
| 30 | 626.8 | C | 79 | | 79 | | 83 | | 83 | | 74 | | 94 | | 74 | | 73 | | 0 | 73.3 | 30 |
| | | D | 84 | | 84 | | 87 | | 87 | | 80 | | 95 | | 80 | | 79 | 70 | 70 | | |
| | | B | 69 | | 68 | | 75 | | 75 | | 61 | | 92 | | 61 | | 60 | 10 | 10 | | |
| 32 | 485.3 | C | 79 | | 79 | | 83 | | 83 | | 74 | | 94 | | 74 | | 73 | 30 | 30 | 75.3 | 32 |
| | | D | 84 | | 84 | | 87 | | 87 | | 80 | | 95 | | 80 | | 79 | 60 | 60 | | |
| | | B | 69 | | 68 | 5 | 75 | 5 | 75 | | 61 | | 92 | | 61 | | 60 | 15 | 25 | | |
| 34 | 675.5 | C | 79 | | 79 | 10 | 83 | 5 | 83 | | 74 | | 94 | | 74 | | 73 | 15 | 30 | 75.1 | 34 |
| | | D | 84 | | 84 | 5 | 87 | 2 | 87 | | 80 | | 95 | | 80 | | 79 | 36 | 45 | | |
| | | B | 69 | | 68 | | 75 | | 75 | | 61 | | 92 | | 61 | | 60 | 40 | 40 | | |
| 36 | 213.8 | C | 79 | | 79 | | 83 | | 83 | | 74 | | 94 | | 74 | | 73 | | 0 | 71.4 | 36 |
| | | D | 84 | | 84 | | 87 | | 87 | | 80 | | 95 | | 80 | | 79 | 60 | 60 | | |

FOURMLE CREEK DBPS - PROPOSED CONDITIONS
TIME OF CONCENTRATION CALCULATIONS

| AREA DESIG | AREA (SQ-MI) | DEV $C_{10}$ (10 yr.) | $L_i$ (ft) | Initial $T_C$ Slope (%) | $t_i$ (min) | L (ft) | Travel Time Slope (%) | V (fps) | $T_t$ (min) | $T_C$ (min) | $T_C$ (hr) | EXIST CN | DEV CN | AREA DESIG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.561 | 0.5 | 300 | 0.56 | 25.56 | 3600 | 0.56 | 2.45 | 24.52 | 50.08 | 0.835 | 80.0 | 80.0 | 1 |
| 2 | 0.934 | 0.4 | 300 | 0.71 | 24.93 | 6300 | 0.71 | 2.87 | 36.59 | 61.52 | 1.025 | 80.5 | 80.5 | 2 |
| 3 | 0.339 | 0.7 | 300 | 0.60 | 17.30 | 4200 | 0.60 | 2.60 | 26.95 | 44.25 | 0.737 | 80.3 | 87.8 | 3 |
| 4 | 0.425 | 0.6 | 300 | 0.97 | 17.03 | 3100 | 0.97 | 3.43 | 15.07 | 32.10 | 0.535 | 82.4 | 86.1 | 4 |
| 6 | 0.751 | 0.5 | 300 | 1.29 | 18.89 | 7000 | 1.29 | 3.53 | 33.06 | 51.95 | 0.866 | 75.7 | 79.5 | 6 |
| 8 | 1.114 | 0.6 | 300 | 1.93 | 14.31 | 11400 | 1.93 | 6.81 | 27.92 | 42.23 | 0.704 | 70.8 | 82.0 | 8 |
| 10 | 0.385 | 0.4 | 300 | 0.26 | 35.15 | 3900 | 0.26 | 1.65 | 39.41 | 74.56 | 1.243 | 71.9 | 76.4 | 10 |
| 12 | 0.393 | 0.3 | 300 | 3.05 | 17.19 | 5900 | 3.05 | 4.18 | 23.50 | 40.69 | 0.678 | 66.2 | 72.4 | 12 |
| 14 | 0.703 | 0.4 | 300 | 3.82 | 15.35 | 6600 | 3.82 | 5.55 | 20.43 | 35.79 | 0.596 | 71.0 | 74.7 | 14 |
| 16 | 0.695 | 0.4 | 300 | 0.91 | 22.78 | 4400 | 0.91 | 3.82 | 19.20 | 41.98 | 0.700 | 73.2 | 78.2 | 16 |
| 18 | 0.214 | 0.3 | 300 | 3.56 | 16.30 | 4500 | 3.56 | 4.31 | 17.39 | 33.69 | 0.562 | 69.2 | 72.6 | 18 |
| 20 | 0.398 | 0.4 | 300 | 3.13 | 14.50 | 6700 | 3.13 | 4.89 | 22.85 | 37.34 | 0.622 | 78.3 | 81.7 | 20 |
| 22 | 0.456 | 0.2 | 300 | 4.40 | 17.23 | 5000 | 4.40 | 5.44 | 15.32 | 32.55 | 0.543 | 71.4 | 73.3 | 22 |
| 24 | 0.765 | 0.2 | 300 | 11.21 | 13.02 | 6600 | 11.21 | 8.68 | 12.68 | 25.70 | 0.428 | 73.3 | 74.0 | 24 |
| 26 | 0.935 | 0.2 | 300 | 8.23 | 14.06 | 9600 | 8.23 | 7.75 | 20.64 | 34.70 | 0.578 | 73.3 | 74.6 | 26 |
| 28 | 1.207 | 0.2 | 300 | 7.96 | 14.95 | 9800 | 7.96 | 7.68 | 21.27 | 36.22 | 0.604 | 73.3 | 73.3 | 28 |
| 30 | 0.979 | 0.2 | 300 | 5.74 | 16.65 | 10100 | 5.74 | 6.17 | 27.28 | 43.93 | 0.732 | 73.3 | 73.3 | 30 |
| 32 | 0.758 | 0.2 | 300 | 2.69 | 21.16 | 6700 | 2.69 | 4.96 | 22.51 | 43.67 | 0.728 | 75.3 | 75.3 | 32 |
| 34 | 1.055 | 0.3 | 300 | 1.31 | 24.64 | 8400 | 1.31 | 3.96 | 35.35 | 59.99 | 1.000 | 72.5 | 75.1 | 34 |
| 36 | 0.334 | 0.2 | 300 | 17.27 | 11.64 | 4400 | 17.27 | 8.42 | 8.71 | 20.35 | 0.339 | 71.4 | 71.4 | 36 |

FOURMILE CREEK DBPS
SUMMARY OF DISCHARGES

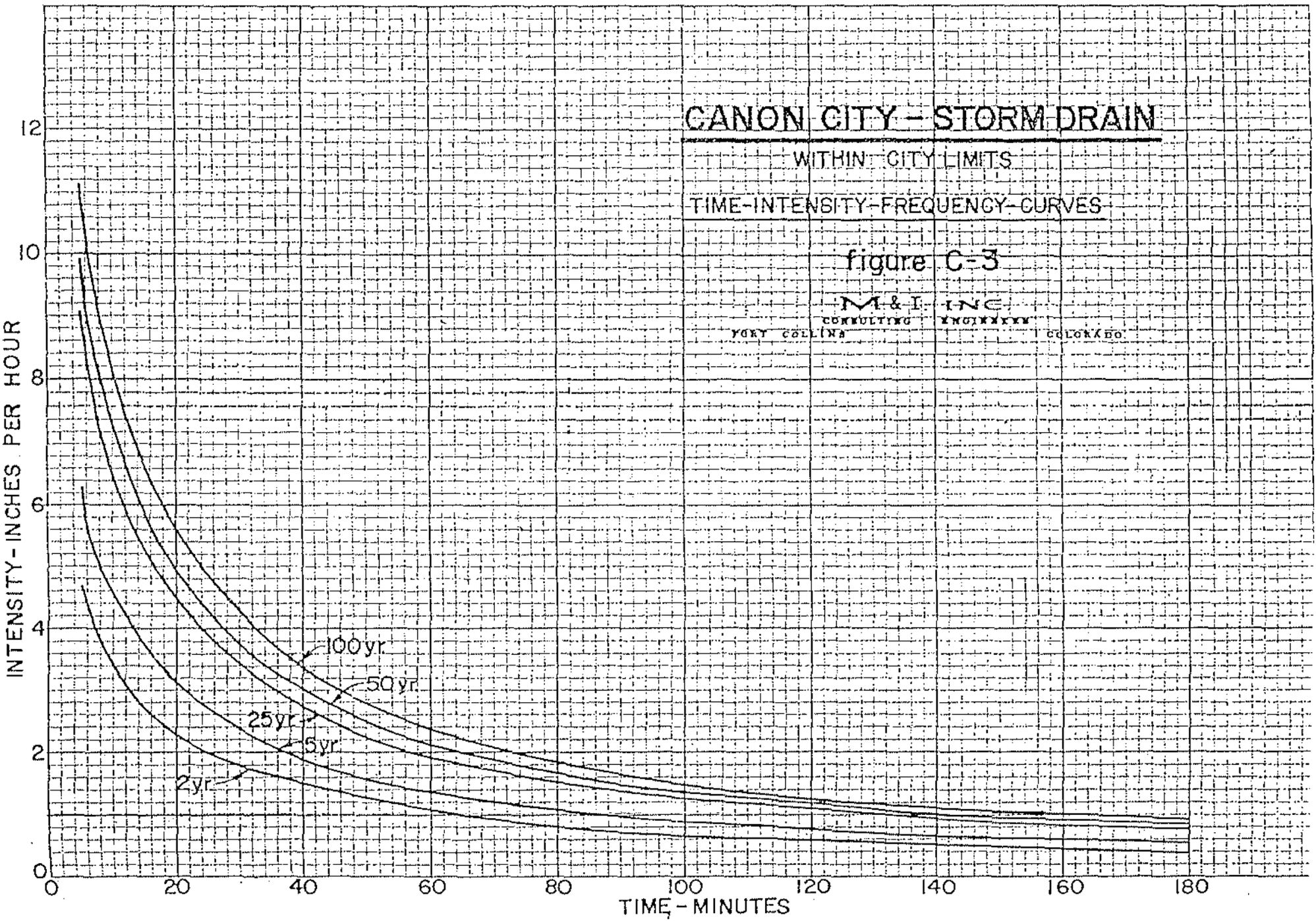
| SUB-BASIN | SUB-BASIN FLOWS 100 YR | 50 YR | 25 YR | ACCUMULATED FLOWS 100 YR | 50 YR | 25 YR | DETAINED FLOWS 100 YR | 50 YR | 25 YR | SUB-BASIN |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 886 | 312 | 252 | 3050 | 2267 | 1684 | | | | 1 |
| 2 | 556 | 451 | 365 | 1530 | 1266 | 1023 | | | | 2 |
| 3 | 386 | 326 | 276 | 2997 | 2230 | 1661 | | | | 3 |
| 4 | 550 | 463 | 390 | 1254 | 1026 | 840 | | | | 4 |
| 6 | 483 | 389 | 314 | 2985 | 2228 | 1665 | | | | 6 |
| 8 | 977 | 801 | 657 | 977 | 801 | 659 | | | | 8 |
| 10 | 154 | 121 | 95 | 2924 | 2203 | 1485 | | | | 10 |
| 12 | 196 | 151 | 115 | 552 | 415 | 310 | | | | 12 |
| 14 | 456 | 357 | 275 | | | | | | | 14 |
| 16 | 487 | 390 | 312 | 2115 | 1613 | 1224 | | | | 16 |
| 18 | 128 | 99 | 76 | 563 | 430 | 315 | 567 | 427 | 320 | 18 |
| 20 | 372 | 305 | 250 | | | | | | | 20 |
| 22 | 289 | 224 | 172 | | | | | | | 22 |
| 24 | 594 | 460 | 358 | | | | 533 | 408 | 312 | 24 |
| 26 | 613 | 479 | 373 | | | | | | | 26 |
| 28 | 709 | 543 | 417 | | | | | | | 28 |
| 30 | 489 | 377 | 288 | | | | 980 | 743 | 535 | 30 |
| 32 | 440 | 345 | 269 | | | | | | | 32 |
| 34 | 467 | 365 | 284 | 870 | 661 | 499 | | | | 34 |
| 36 | 255 | 196 | 150 | | | | | | | 36 |

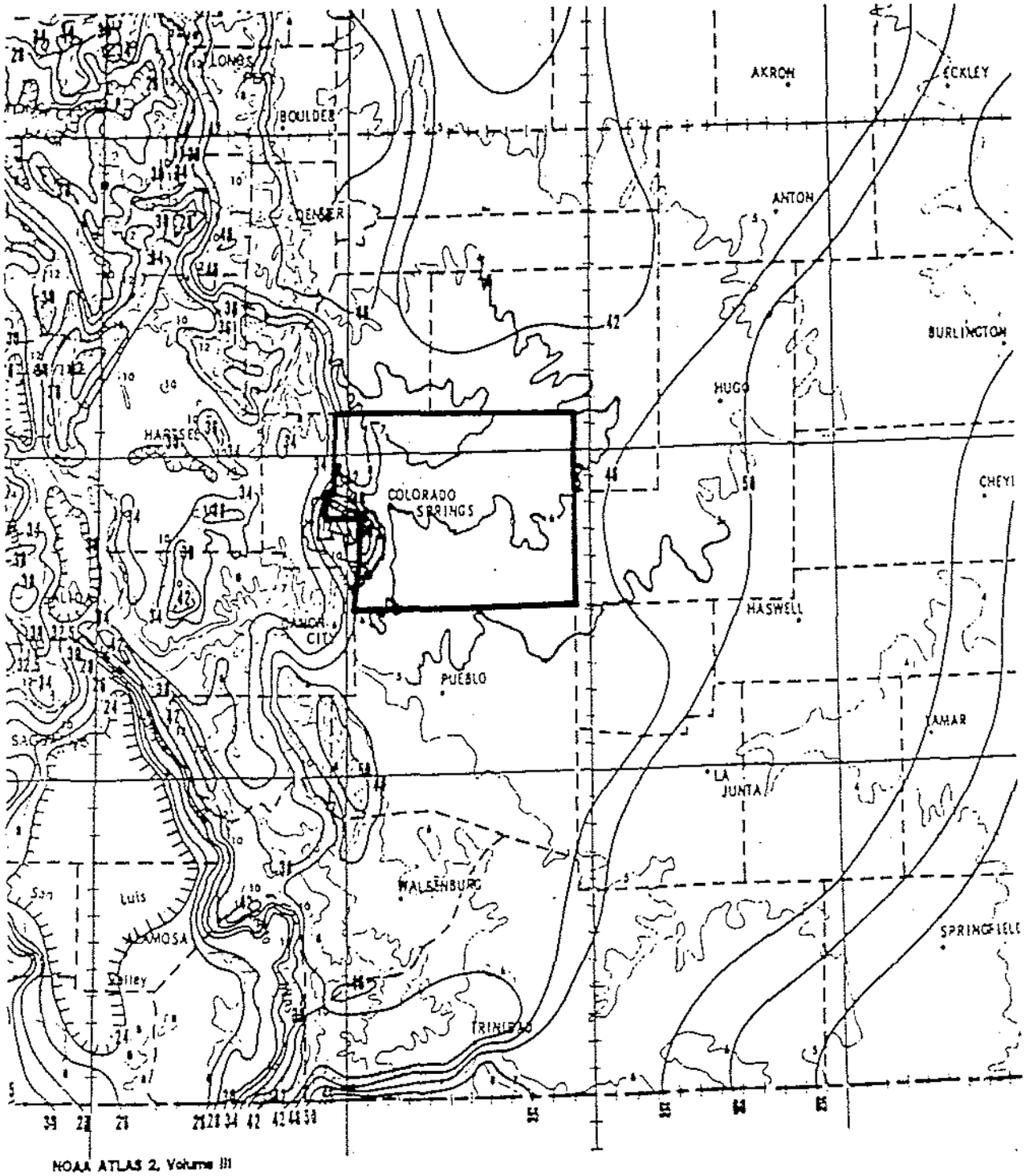
FOURMILE CREEK DBPS
STRUCTURE EVALUATION

| LOCATION | ALT 1 VS. ALT 2 100 yr (cfs) | 50 yr (cfs) | 25 yr (cfs) | EXISTING CULVERT SIZE | CAPACITY (cfs) | PROPOSED CULVERT SIZE | CAPACITY (cfs) | COST | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| CANON RIDGE ROAD | 525 / 533 | 412 / 405 | 319 / 312 | 2-36" CMP | 140 | 6' X 14' BOX | 588 | $ 87,840 | LOCAL FLOWS |
| FOURMILE ROAD | 552 / 552 | 415 / 415 | 310 / 310 | LOW FLOW CROSSING | - | 6' X 14' BOX | 588 | $ 87,840 | LOCAL FLOWS |
| DETENTION BASIN (IN / OUT) | 567 / 114 | 427 / 100 | 320 / 83 | - | - | 48" RCP | 130 | $ 500,000 | DETAINED FLOWS |

| LOCATION | ALT 1 VS. ALT 3 100 yr (cfs) | 50 yr (cfs) | 25 yr (cfs) | EXISTING CULVERT SIZE | CAPACITY (cfs) | PROPOSED CULVERT SIZE | CAPACITY (cfs) | COST | REMARKS |
|---|---|---|---|---|---|---|---|---|---|
| CANON RIDGE ROAD | 525 / 533 | 412 / 405 | 319 / 312 | 2-36" CMP | 140 | 6' X 14' BOX | 588 | $ 87,840 | LOCAL FLOWS |
| FOURMILE ROAD | 552 / 1085 | 415 / 820 | 310 / 612 | LOW FLOW CROSSING | - | 6' X 28' BOX | 1176 | $ 175,680 | DIVERTED FLOWS |
| 6' DIVERSION CHANNEL | 1085 | 820 | 612 | - | - | - | 1085 | $ 1,885,520 | DIVERTED FLOWS |

# APPENDIX A
## Design Charts


CANON CITY - STORM DRAIN
WITHIN CITY LIMITS
TIME-INTENSITY-FREQUENCY-CURVES
figure C-3
M & I INC
CONSULTING ENGINEERS
FORT COLLINS COLORADO
INTENSITY - INCHES PER HOUR
TIME - MINUTES
100 yr
50 yr
25 yr
5 yr
2 yr
0
2
4
6
8
10
12
0
20
40
60
80
100
120
140
160
180




NOAA ATLAS 2, Volume III

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

ISOPLUVIALS OF 100-YR 24-HR PRECIPITATION
IN TENTHS OF AN INCH

## RUNOFF CURVE NUMBERS FOR HYDROLOGIC SOIL COVER COMPLEXES - URBAN AND SUBURBAN CONDITIONS 1/
(Antecedent Moisture Condition II)
(From: U.S. Dept. of Agriculture, Soil Conservation Service, 1977)

| Land Use | | Hydrologic Soil Group A | B | C | D |
|---|---|---|---|---|---|
| Open spaces, lawns, parks, golf courses, cemeteries, etc. | | | | | |
| Good condition: | grass cover on 75% or more of the area | 39* | 61 | 74 | 80 |
| Fair condition: | grass cover on 50% to 75% of the area | 49* | 69 | 79 | 84 |
| Commercial and Business areas (85% Impervious) | | 89* | 92 | 94 | 95 |
| Industrial Districts 72% Impervious) | | 81* | 88 | 91 | 93 |
| Residential: 2/ | | | | | |
| Acres per Dwelling Unit | Average % Impervious 3/ | | | | |
| 1/8 acre or less | 65 | 77* | 85 | 90 | 92 |
| 1/4 acre | 38 | 61* | 75 | 83 | 87 |
| 1/3 acre | 30 | 57* | 72 | 81 | 86 |
| 1/2 acre | 25 | 54* | 70 | 80 | 85 |
| 1 acre | 20 | 51* | 68 | 79 | 84 |
| Paved parking lots, roofs, driveways, etc. | | 98 | 98 | 98 | 98 |
| Streets and Roads: | | | | | |
| paved with curbs and storm sewers | | 98 | 98 | 98 | 98 |
| gravel | | 76* | 85 | 89 | 91 |
| dirt | | 72* | 82 | 87 | 89 |

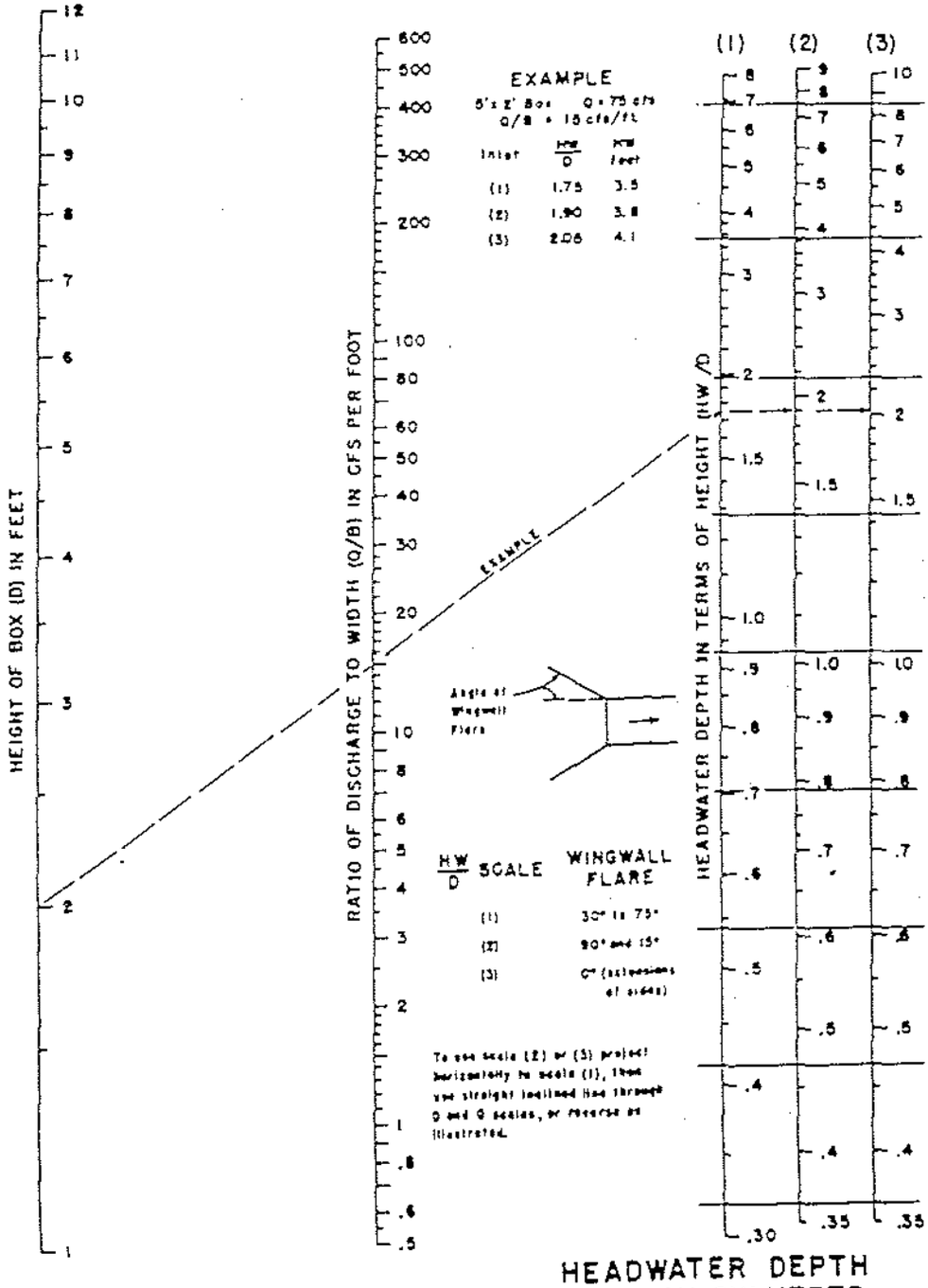
1/ For a more detailed description of agricultural land use curve numbers, refer to the National Engineering Handbook (U.S. Dept. of Agriculture, Soil Conservation Service, 1972).
2/ Curve numbers are computed assuming the runoff from the house and driveway is directed towards the street with a minimum of roof water directed to lawns where additional infiltration could occur.
3/ The remaining pervious areas (lawn) are considered to be in good pasture condition for these curve numbers.

* Not to be used wherever overlot grading or filling is to occur.

**RUNOFF CURVE NUMBERS FOR HYDROLOGIC SOIL COVER COMPLEXES - RURAL CONDITIONS**
**(Antecedent Moisture Condition II, and Ia = 0.2 S)**
(From: U.S. Dept. of Agriculture, Soil Conservation Service, 1977)

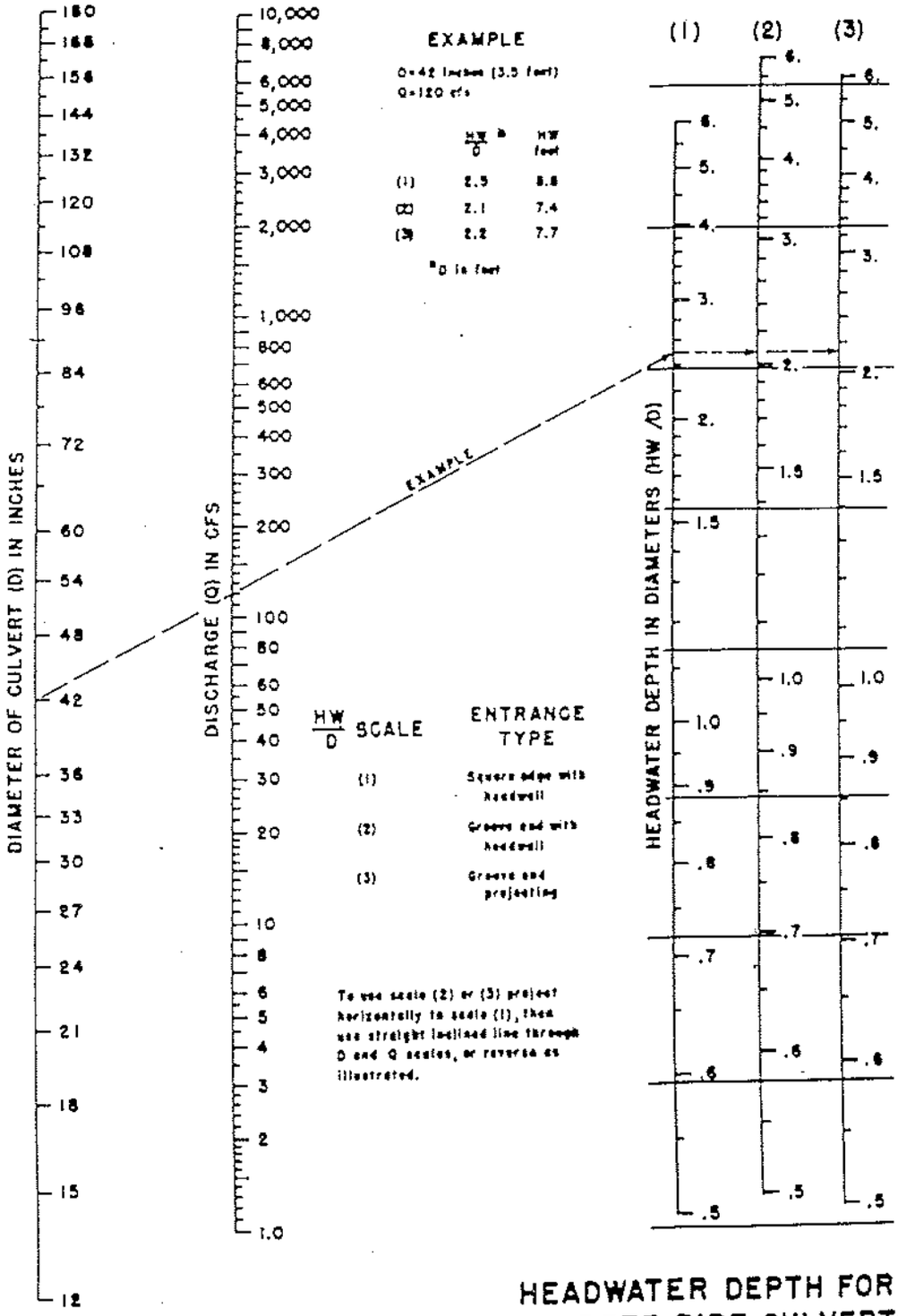
| Land Use | Cover Treatment or Practice | Hydrologic Condition | Runoff Curve Number by Hydrologic Soil Group A | B | C | D |
|---|---|---|---|---|---|---|
| Fallow | Straight Row | ---- | 77 | 86 | 91 | 94 |
| Row Crops | Straight Row | Poor | 72 | 81 | 88 | 91 |
| | Straight Row | Good | 67 | 78 | 85 | 89 |
| | Contoured | Poor | 70 | 79 | 84 | 88 |
| | Contoured | Good | 65 | 75 | 82 | 86 |
| | Cont. & Terraced | Poor | 66 | 74 | 80 | 82 |
| | Cont. & Terraced | Good | 62 | 71 | 78 | 81 |
| Small Grain | Straight Row | Poor | 65 | 76 | 84 | 88 |
| | Straight Row | Good | 63 | 75 | 83 | 87 |
| | Contoured | Poor | 63 | 74 | 82 | 85 |
| | Contoured | Good | 61 | 73 | 81 | 84 |
| | Cont. & Terraced | Poor | 61 | 72 | 79 | 82 |
| | Cont. & Terraced | Good | 59 | 70 | 78 | 81 |
| Close-seeded legumes 1/ or rotation meadow | Straight Row | Poor | 66 | 77 | 85 | 89 |
| | Straight Row | Good | 58 | 72 | 81 | 85 |
| | Contoured | Poor | 64 | 75 | 83 | 85 |
| | Contoured | Good | 55 | 69 | 78 | 83 |
| | Cont. & Terraced | Poor | 63 | 73 | 80 | 83 |
| | Cont. & Terraced | Good | 51 | 67 | 76 | 80 |
| Pasture or range | | Poor | 68 | 79 | 86 | 89 |
| | | Fair | 49 | 69 | 79 | 84 |
| | | Good | 39 | 61 | 74 | 80 |
| | Contoured | Poor | 47 | 67 | 81 | 88 |
| | Contoured | Fair | 25 | 59 | 75 | 83 |
| | Contoured | Good | 6 | 35 | 70 | 79 |
| Meadow | | Good | 30 | 58 | 71 | 78 |
| Woods | | Poor | 45 | 66 | 77 | 83 |
| | | Fair | 36 | 60 | 73 | 79 |
| | | Good | 25 | 55 | 70 | 77 |
| Farmsteads | | ---- | 59 | 74 | 82 | 86 |
| Roads (dirt) 2/ | | ---- | 72 | 82 | 87 | 89 |
| (hard surface) 2/ | | ---- | 74 | 84 | 90 | 92 |

1/ Close-drilled or broadcast
2/ Including right-of-way




# HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN. 1963




# HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3
REVISED MAY 1964

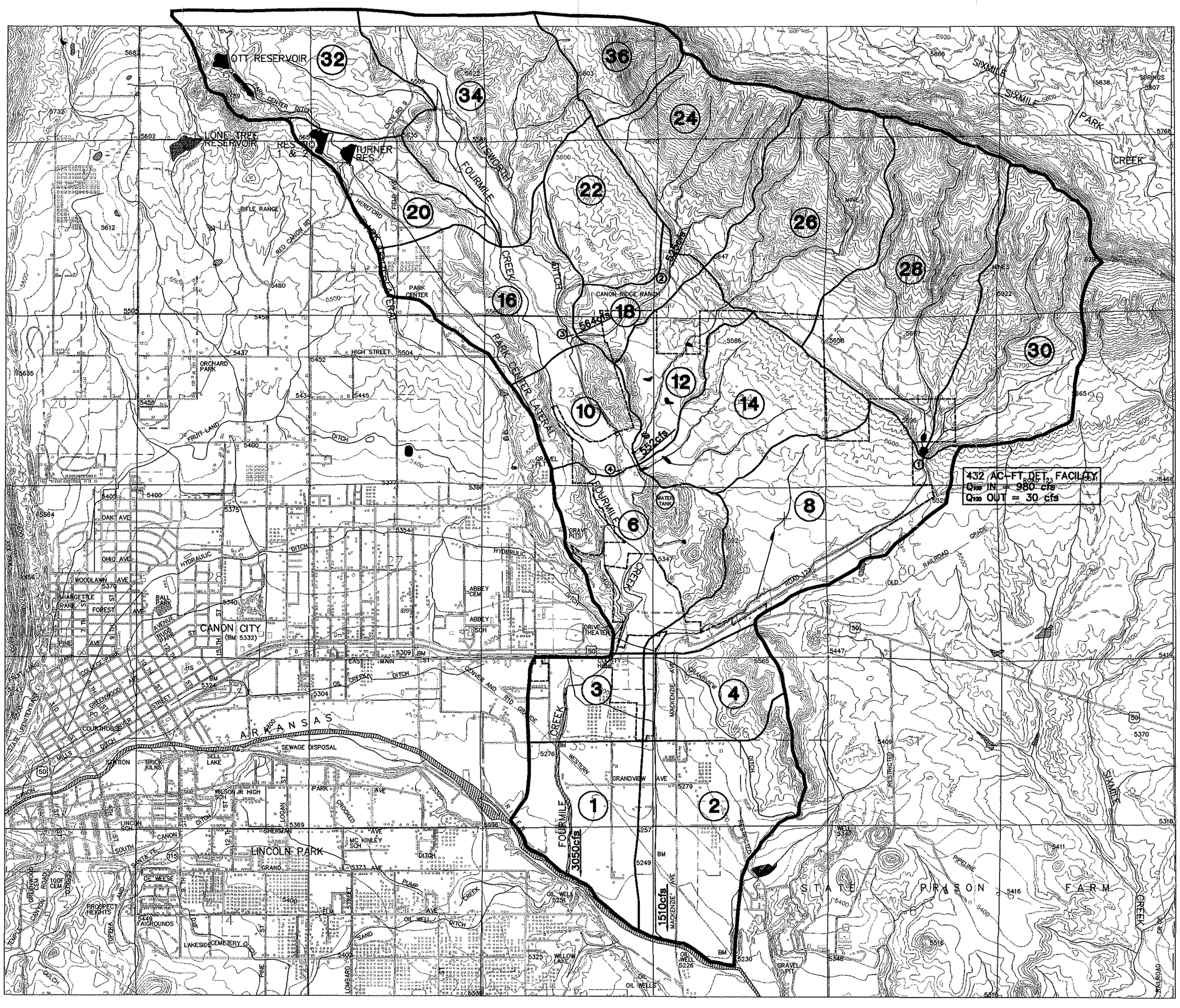
BUREAU OF PUBLIC ROADS JAN. 1963

# APPENDIX B
## Preliminary Construction Costs

# ALTERNATE 1

## STRUCTURE LEGEND

| | |
|---|---|
| 1 | SCS DAM WITH 10" STEEL PIPE |
| 2 | 2 – 36" CMP |
| 3 | DETENTION FACILITY |
| 4 | LOW FLOW CROSSING |




DESIGNED BY: MW
PROJECT ENGINEER: MJD
PROJECT MANAGER: MJD
DATE: 10/07/99
JOB NO.: 990024
CAD FILE NO.: L:\JOBS\1990\990024\DWG\ALT1.DWG
SCALE: 1" = 1000'
DRAWN BY: JJH
CHECKED BY: MJD
SHEET: 1 of 1

PREPARED BY:

ADP
1960 Austin Bluffs Parkway
Suite 201
Colorado Springs, CO 80915
(719) 596-0411
Fax: (719) 596-0541

| NO. | DATE | REVISION | BY |
|---|---|---|---|

# FOURMILE CREEK

## DRAINAGE BASIN PLANNING STUDY

## CITY OF CANON CITY, COLORADO

ALT 1 - DEVELOPED CONDITIONS W/ EXISTING STRUCTURES

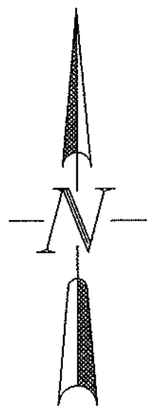
# ALTERNATE 2

# ESTIMATED PROBABLE CONSTRUCTION COST
# ALTERNATE 2

| STR # | SIZE | LOCATION | ITEM COST |
|---|---|---|---|
| 2 | 6' x 14' BOX CULVERT | CANON RIDGE ROAD | $ 87,840 |
| 3 | 25 AC-FT DET FAC | FOURMILE ROAD | $ 500,000 |
| 4 | 6' x 14' BOX CULVERT | FOURMILE ROAD | $ 87,840 |
| | | SUB-TOTAL | **$ 675,680** |

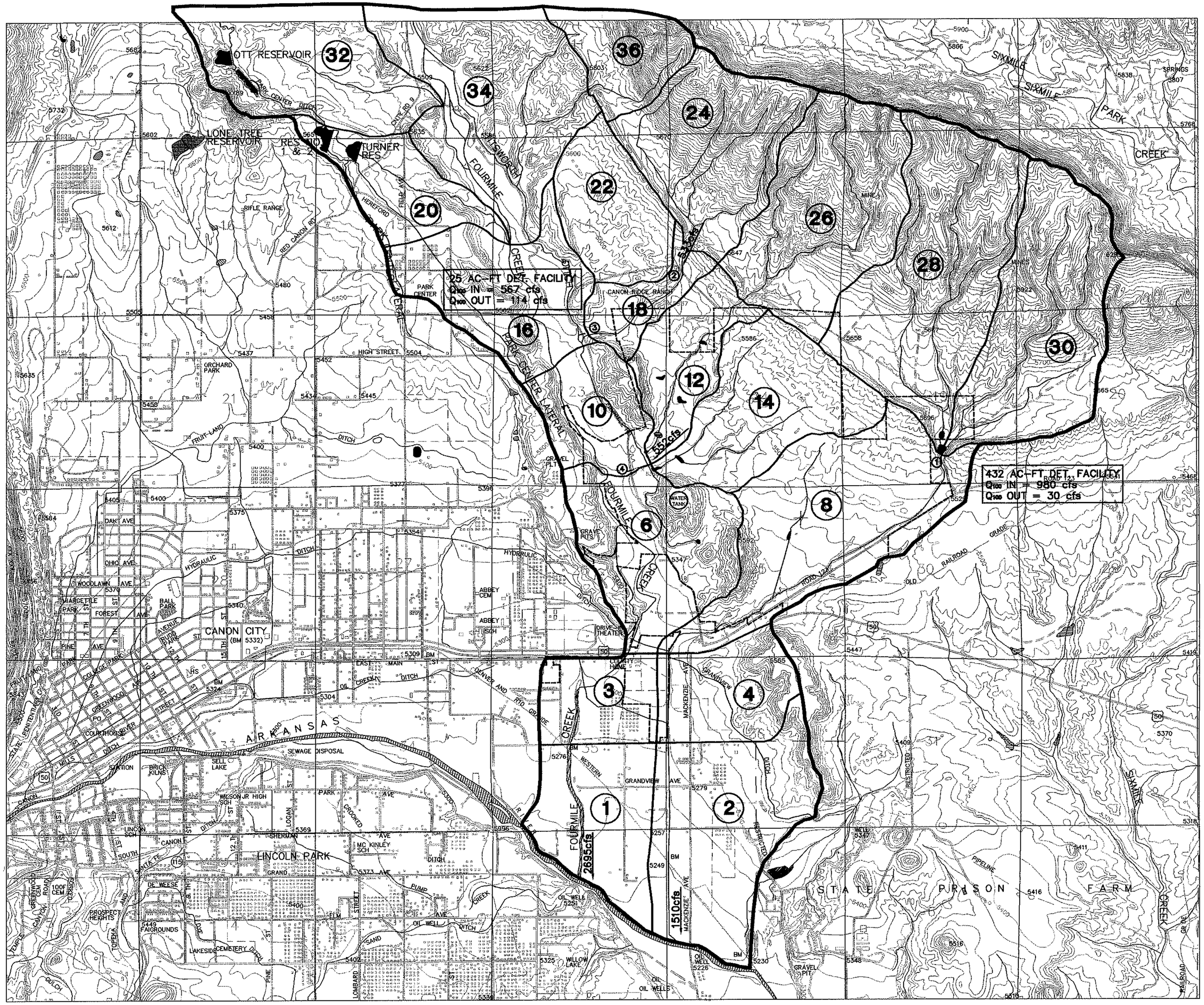
| | |
|---|---|
| GRAND TOTAL | **$ 675,680** |

**NOTE:** TOTAL COST ESTIMATE INCLUDES COST OF PIPE, HEADWALL, RIPRAP AND ANY REQUIRED CHANNEL EXCAVATION. IT DOES NOT INCLUDE COST FOR LAND, REMOVAL OF EXISTING STRUCTURES, OR RELOCATION OF UTILITIES.




## STRUCTURE LEGEND

| | |
|---|---|
| 1 | SCS DAM WITH 10" STEEL PIPE |
| 2 | 6' X 14' CONCRETE BOX |
| 3 | 25 AC-FT DETENTION FACILITY W/ 48" RCP OUTLET WORKS |
| 4 | 6' X 14' CONCRETE BOX |




| | | | |
|---|---|---|---|
| DESIGNED BY JW | PROJECT ENGINEER MJB | DATE 9/25/99 | PROJECT MANAGER MJB |
| JOB NO. 98-018 | CAD FILE NO. c:\...\25yr2hr | SCALE: 1000' | |
| DRAWN BY JW | | VERT. | |

PREPARED BY:

ADP
Associated Design Professionals

1661 Austin Bluffs Parkway
Suite 101
Colorado Springs, CO 80918
(719) 260-0315
fax: (719) 260-0341

| NO. | DATE | REVISION | BY |
|---|---|---|---|
| | | | |

# FOURMILE CREEK

## DRAINAGE BASIN PLANNING STUDY

## CITY OF CANON CITY, COLORADO

## ALT 2 - DEVELOPED CONDITIONS W/ IMPROVED STRUCTURES

SHEET 1 of 1

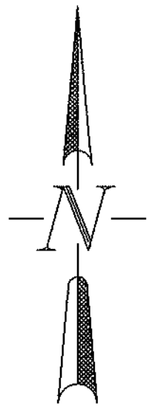
# ALTERNATE 3

# ESTIMATED PROBABLE CONSTRUCTION COST
# ALTERNATE 3

| STR # | SIZE | LOCATION | ITEM COST |
|---|---|---|---|
| 2 | 6' x 14' BOX CULVERT | CANON RIDGE ROAD | $ 87,840 |
| 4 | 6' x 28' BOX CULVERT | FOURMILE ROAD | $ 175,680 |
| 5 | 40' SPAN BRIDGE | HIGHLAND AVE & MUD GULCH | $ 90,000 |
| 6 | 40' SPAN BRIDGE | ADAMS AVE & MUD GULCH | $ 90,000 |
| CHAN | 6000' @ 6' DEEP | CANON RIDGE RD TO FOURMILE CRK | $ 1,622,000 |
| | | **SUB-TOTAL** | **$ 2,065,520** |

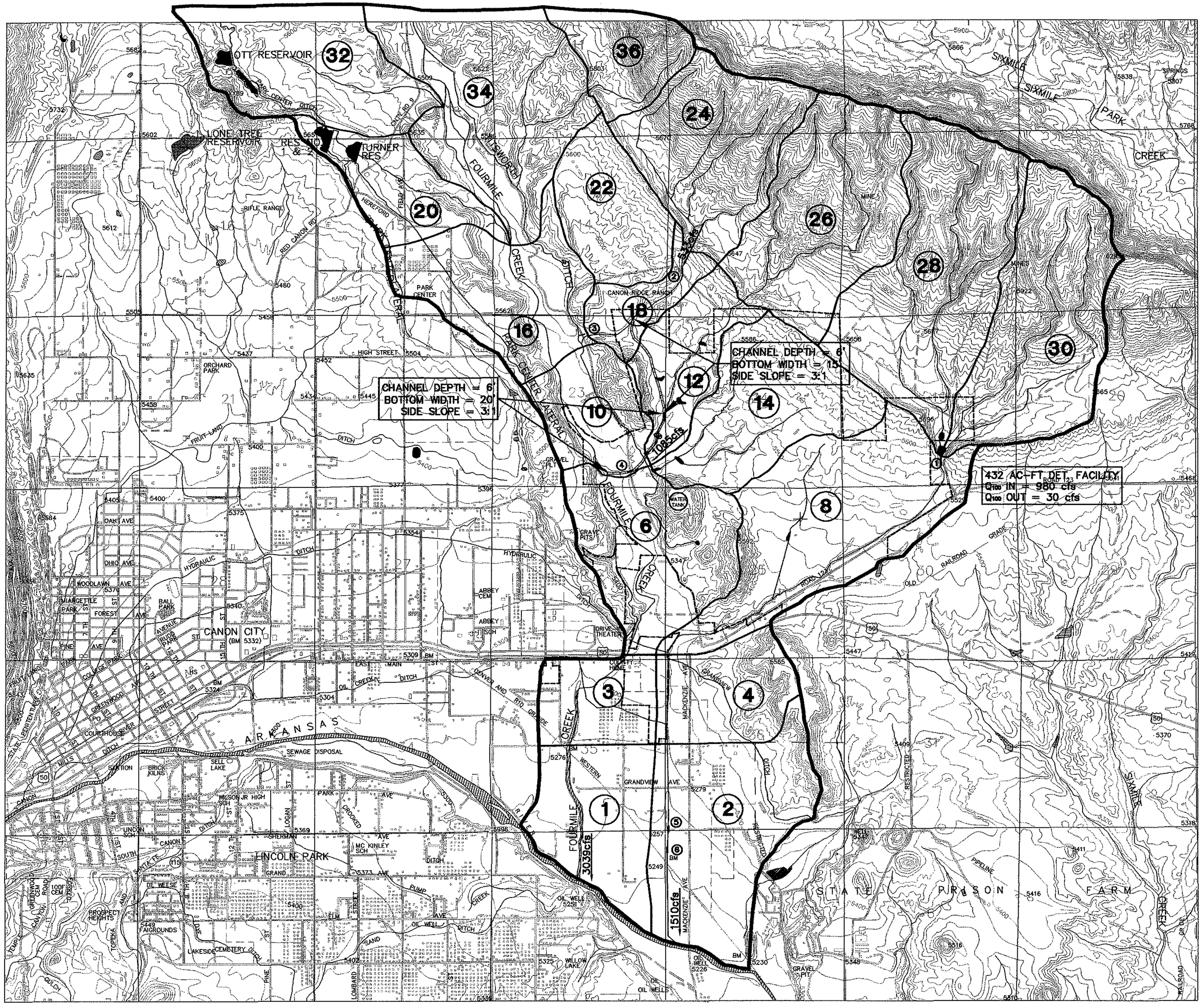
| | |
|---|---|
| **GRAND TOTAL** | **$ 2,065,520** |

NOTE: TOTAL COST ESTIMATE INCLUDES COST OF PIPE, HEADWALL, RIPRAP AND ANY REQUIRED CHANNEL EXCAVATION. IT DOES NOT INCLUDE COST FOR LAND, REMOVAL OF EXISTING STRUCTURES, OR RELOCATION OF UTILITIES.




## STRUCTURE LEGEND

| | |
|---|---|
| 1 | SCS DAM WITH 10" STEEL PIPE |
| 2 | 6' X 14' CONCRETE BOX |
| 3 | EXISTING CONDITIONS |
| 4 | 6' X 28' CONCRETE BOX |
| 5 | 40' SPAN ROAD BRIDGE |
| 6 | 40' SPAN ROAD BRIDGE |




# FOURMILE CREEK
## DRAINAGE BASIN PLANNING STUDY
## CITY OF CANON CITY, COLORADO

**ALT 8 - DEVELOPED CONDITIONS W/ DIVERSION CHANNEL**

| NO. | DATE | REVISION | BY |
|---|---|---|---|
| | | | |

DESIGNED BY: JM
PROJECT ENGINEER: KNG
PROJECT MANAGER: MAB
DATE: 2/1/00
SCALE: HOR. 1"=1000'
VERT. ____
JOB NO.: 4,417.5/JSMG
CAD FILE NO.: 4,417.5/JSMG
DRAWN BY: JM

PREPARED BY:

ADP
Associated Design Professionals
1961 Austin Bluffs Parkway
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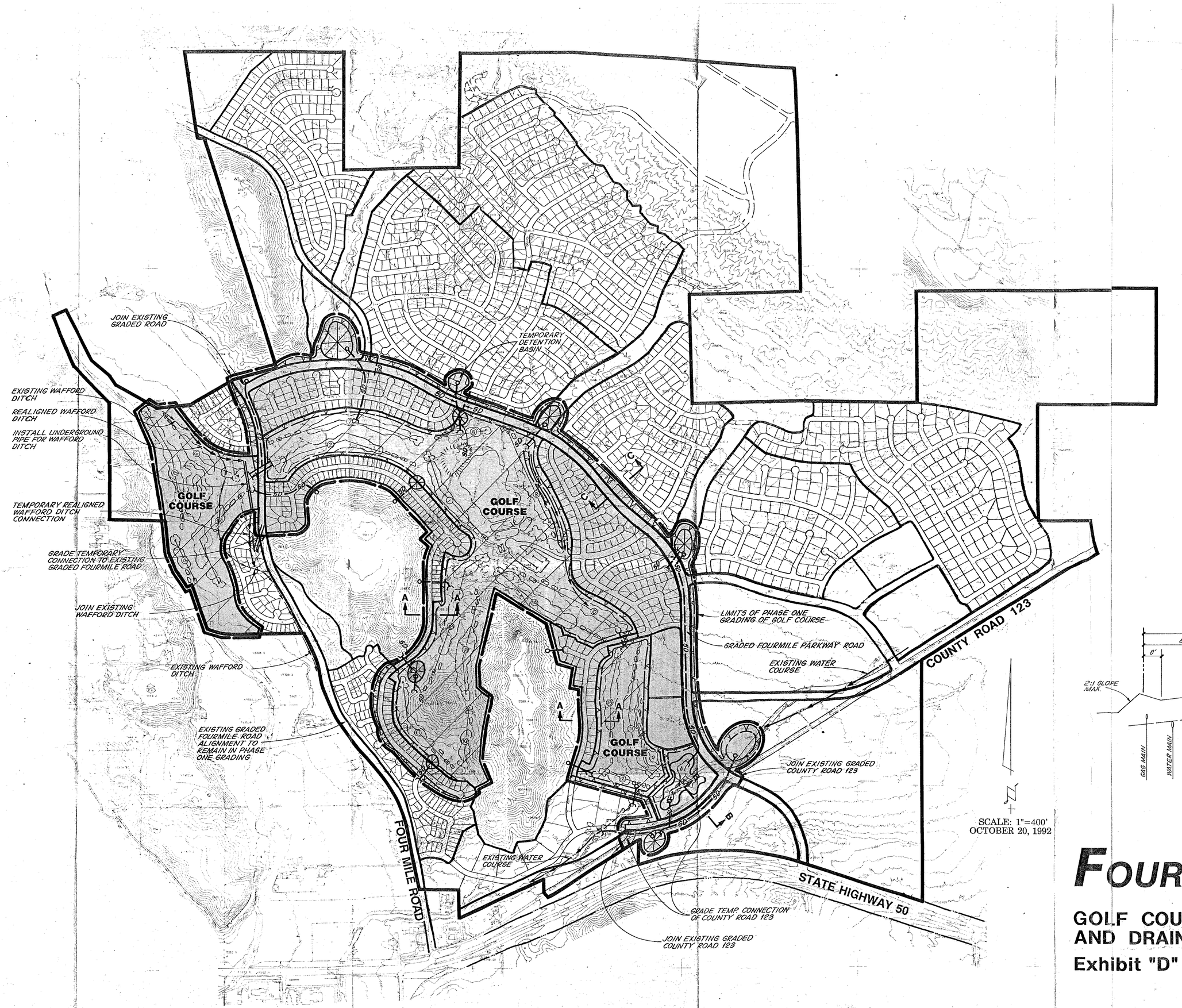
Colorado Springs, CO 80918
(719) 598-0818
fax: (719) 598-0341

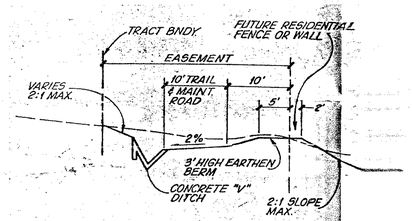
SHEET
1 of 1

# APPENDIX C
## Alternate Conceptual Plans

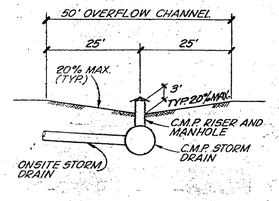



**LEGEND:**

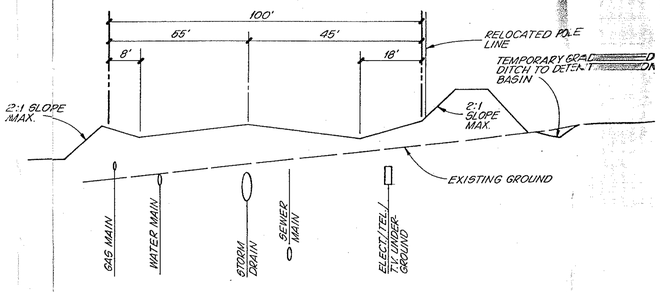
- DETENTION BASIN/TEMPORARY DEBRIS BASIN
- —SD— STORM DRAIN
- CATCH BASIN
- SUMP INLET
- 2:1 SLOPE/4:1 SLOPE GOLF COURSE
- 5400 EXISTING CONTOUR
- CULVERT CROSSING
- LIMITS OF PHASE ONE GRADING FOR GOLF COURSE CONSTRUCTION




**SECTION "A–A"**




**SECTION "B–B"**




**SECTION "C–C"**

SCALE: 1"=400'
OCTOBER 20, 1992

# FOURMILE RANCH

## GOLF COURSE GRADING AND DRAINAGE PLAN

**Exhibit "D"** DEC 03 1992

CROSBY MEAD BENTON & ASSOCIATES

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