RED MOUNTAIN FREEWAY (202L)

POWER ROAD TO UNIVERSITY DRIVE

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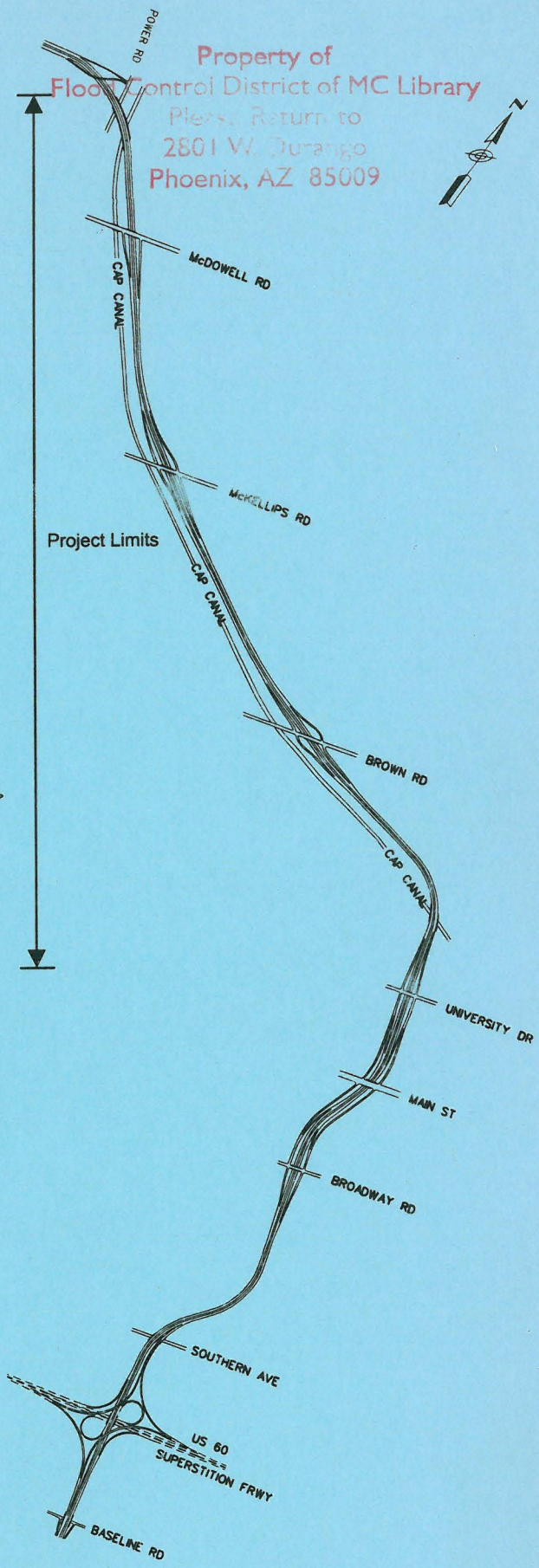
SPOOK HILL FLOODWATER RETARDING STRUCTURE

TECHNICAL REPORT NO. 2

EXISTING CONDITION PROBABLE MAXIMUM FLOOD (PMF) HYDRAULICS



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April 2002

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1.0 INTRODUCTION

1.1 Project Background

The Red Mountain Freeway (202L) is a major element of the Maricopa Association of Governments (MAG) adopted Regional Freeway System in the East Valley of Maricopa County. This freeway corridor is shown in Figure 1.

The 202L freeway in the project area is planned as a six-lane facility consisting of three general-purpose lanes in each direction of travel separated with a 46-foot open median. High occupancy vehicle (HOV) lanes will be added in the future within the median when traffic volumes warrant this improvement. Auxiliary lanes are planned between successive local service interchange entrance and exit ramps.

A half diamond traffic interchange is planned for local street access at McDowell Road (south side). Full diamond interchanges are planned at McKellips Road, Brown Road and University Drive. Each local arterial street will cross over the freeway at the interchange location.

Between Power Road and University Drive, the freeway is sited immediately adjacent to the upstream side of the Spook Hill Floodwater Retarding Structure (FRS), within the existing flood pool reservoir. A Project Vicinity map is provided as Figure 2.

The freeway profile is elevated over Power Road, the Central Arizona Project (CAP) Canal, the Spook Hill FRS, and the Spook Hill FRS emergency spillway. The freeway transitions to an elevation slightly above the 50-year water surface elevation within the FRS. Approximately 3,000 feet southeast of Brown Road, the freeway again passes over the Spook Hill FRS and the CAP Canal. The feasibility of providing a freeway design above the 100-year water surface elevation within the FRS will be investigated with this project.

The conceptual freeway section along the Spook Hill FRS is shown in Figure 3. In addition to the freeway embankment, an earthen berm is planned along the east side of the freeway to provide visual and noise mitigation for the existing and planned recreation and residential developments.

The freeway embankment volume will be offset with an equivalent volume of excavation located within the current flood retention area immediately upstream of the freeway, thereby maintaining the current volume of floodwater storage. The existing Spookhill Floodway conveyance capacity will also be maintained in accordance with the original design intent.

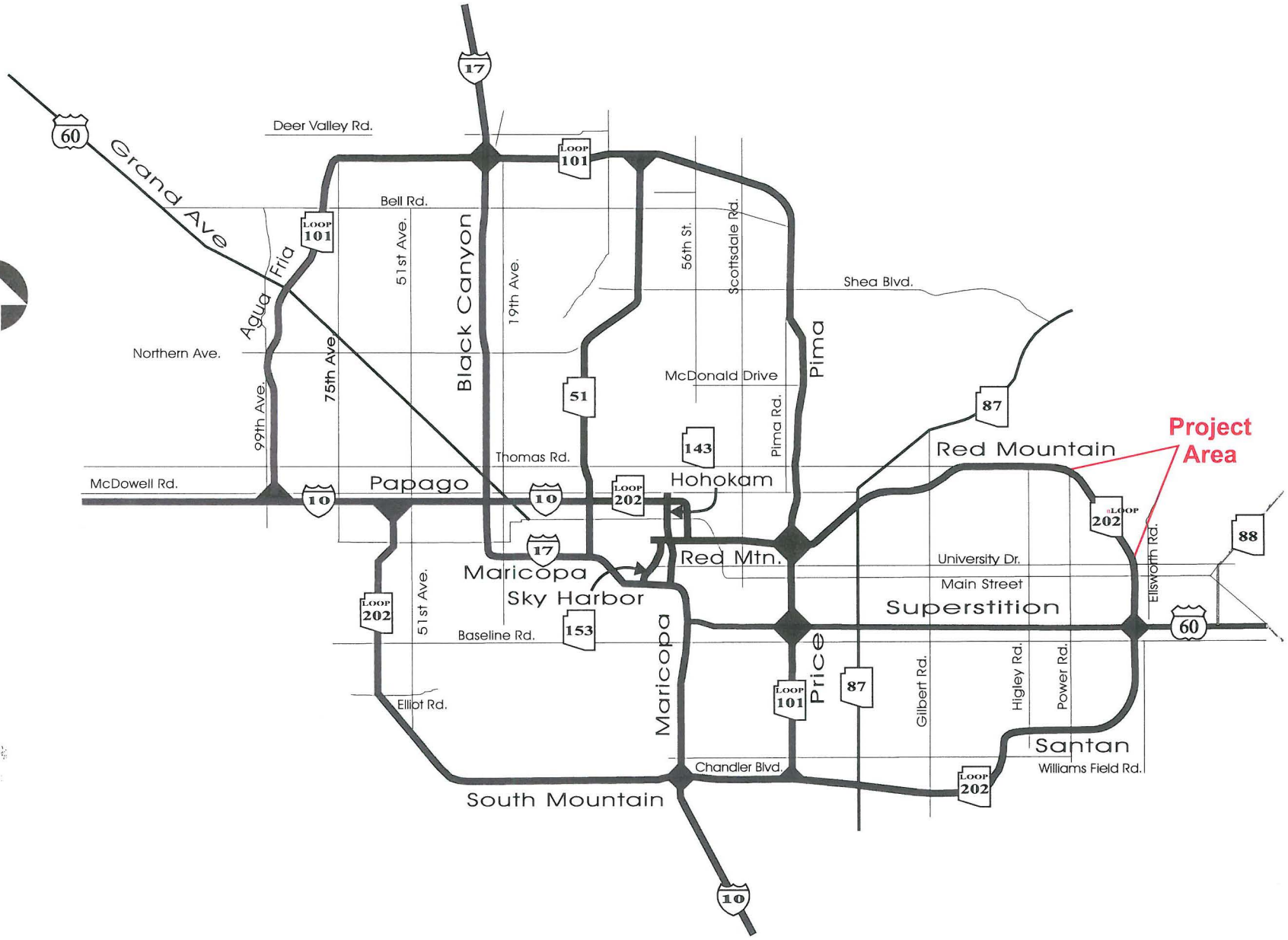

FIGURE 1

RED MOUNTAIN FREEWAY (202L)
POWER ROAD TO UNIVERSITY DRIVE

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DRAWN BY	AS	04/02
REVIEWED BY	JRM	04/02
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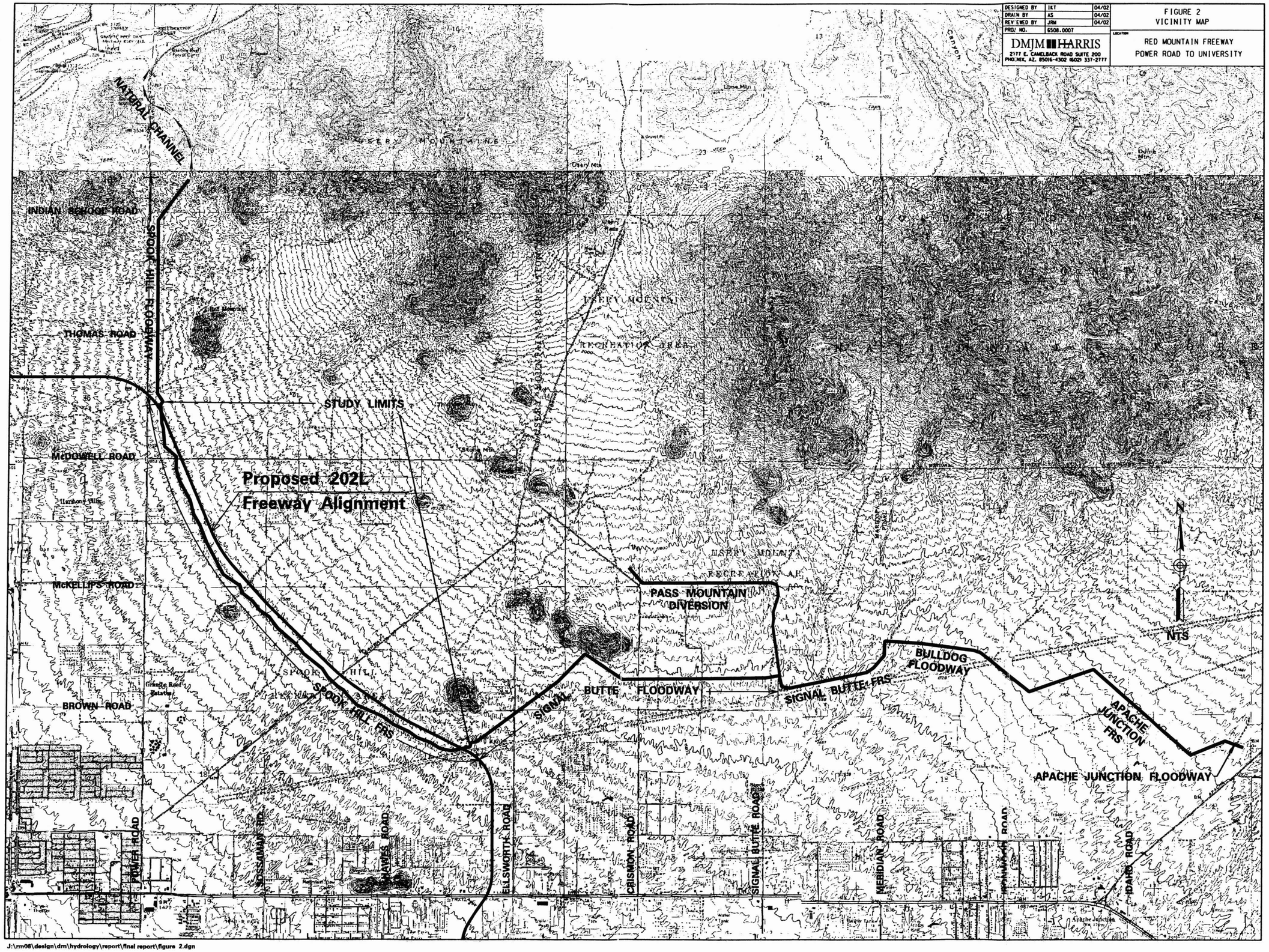
FIGURE 2
VICINITY MAP

LOCATION
RED MOUNTAIN FREEWAY
POWER ROAD TO UNIVERSITY



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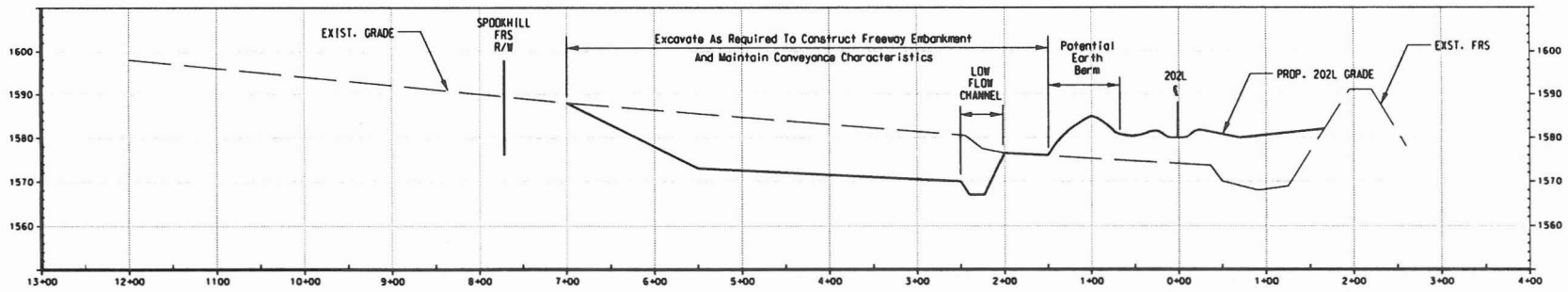

PROPOSED FREEWAY SECTION ADJACENT TO SPOOKHILL FRS

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FIGURE 3
TYPICAL CROSS SECTION

LOCATION
RED MOUNTAIN FREEWAY (202L)

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The freeway design concept will require the relocation of portions of the Spook Hill FRS embankment at McDowell Road, McKellips Road and Brown Road. Therefore, coordination will be required with the Flood Control District of Maricopa County (FCDMC), the Arizona Department of Water Resources (ADWR), the Natural Resource Conservation Service (NRCS), and the City of Mesa.

1.2 Previous Freeway Technical and Environmental Studies

The Red Mountain Freeway corridor was adopted into the MAG Regional Freeway System in 1985, and was then included in the State Highway System by approval of the State Transportation Board. In 1988, the Arizona Department of Transportation (ADOT) prepared a Design Concept Report for the section of the Red Mountain Freeway between Lindsay Road and Baseline Road which included the 202L freeway alignment located immediately upstream of the Spook Hill FRS between Power Road and University Drive. A State-Level Environmental Assessment (EA) was also prepared for this freeway segment. ADOT and the City of Mesa approved these early design and environmental studies in 1989.

The decisions resulting from the previous corridor studies were reviewed during the completion of the Red Mountain Freeway Final Environmental Impact Statement (FEIS). The FEIS was prepared for the segment of the Red Mountain Freeway between SR87 (Country Club Drive) and Baseline Road, one-half mile south of US60. Some of the FEIS mitigation measures, relative to the FRS, were included within a technical report prepared by DMJM+HARRIS, Technical Report No. 1, Existing Condition Hydrology (Final).

1.3 Study Purpose

This report is the second in a series of Technical Reports that will be developed by ADOT in support of the design of the Red Mountain Freeway segment between Power Road and University Drive. These Technical Reports will be developed to address proposed modifications of the Spook Hill FRS in accordance with *ADWR Rules and Regulations Pertaining to Dam Safety Procedures* (12 AAC 15).

ADWR rules apply to projects that reconstruct, repair, alter, enlarge, breach, or remove an existing dam and reservoir. As defined in the Arizona Administrative Code (AAC), "alteration or repair of an existing dam or appurtenant structure" means to change the originally approved construction drawings and specifications or current condition without changing the height or storage capacity of the dam or reservoir, except for ordinary repairs and general maintenance as prescribed in R12-15-1217. Since the FEIS approved concept requires the relocation of the Spook Hill FRS dam embankment at McDowell Road, McKellips Road and Brown Road to accommodate freeway traffic interchanges, the freeway project will require approval from ADWR, the FCDMC

(owner of the structure) and other governmental agencies.

Using the guidelines in Sections R12-15-1203, Exempt Structures, and R12-15-1206, Classification of Dams, the Spook Hill FRS is classified as a small, high hazard jurisdictional dam. Section R12-15-1216, Design of a High, Significant, or Low Hazard Potential Dam makes the following recommendation to establish the inflow design flood requirements:

> "For a high hazard potential dam, the applicant shall design the dam to withstand an inflow design flood that varies from 0.5 PMF to the full PMF, with size increasing based on persons at risk and potential for downstream damage. The applicant shall consider foreseeable future conditions."

The PMF is the flood runoff expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region. The existing condition hydrology was documented in Technical Report No. 1.

The specific purpose of this second Technical Report is to define the existing hydraulic conditions for the Spook Hill FRS as it relates to the ADWR dam safety rules and regulations. Once the existing hydraulic conditions are established, the Red Mountain Freeway hydrologic and hydraulic impacts can be quantified and mitigation measures defined.

As required, subsequent Technical Reports may address the following issues:

- Alternatives Evaluation
- Risk Analyses
- Geotechnical Investigations
- Surface Water Diversion Plan
- Dewatering Plan
- Materials Information
- Grout Design
- Reinforced Concrete Design
- Stability Analysis
- Seismicity
- Cutoff Trench Design
- Seepage
- Internal Drainage
- Erosion Protection
- Dam Foundation Design
- Post Construction Vertical and Horizontal Movement Systems
- Foundation Conditions

1.4 Previous Hydraulic Studies

The Spook Hill FRS is located in the north central part of the Buckhorn-Mesa watershed in Maricopa County, about 10 miles northeast of downtown Mesa, Arizona. It was designed in 1977 as one element of the Buckhorn-Mesa Public Law 566 Small Watershed Project that was developed by the Soil Conservation Service (SCS). The SCS has recently been renamed the Natural Resource Conservation Service (NRCS).

As shown in Figure 2, the Buckhorn-Mesa project facilities include three floodwater-retarding structures, four floodways, and one diversion structure that were designed to detain a 100-year flood event. The project features include:

- **Apache Junction Dam and Floodway**; includes 1.6 miles of earthen dam and a 1500-foot floodway that diverts floodwater from a wash above the dam into the reservoir area. The structure drains six square miles north of the Town of Apache Junction.
- **Bulldog Floodway**; is 1.7 miles in length and transports stormwater impounded behind the Apache Junction Dam and the contributing watershed into the reservoir behind the Signal Butte Dam.
- **Pass Mountain Diversion and Outlet**; consists of a 1.2 mile long earth embankment and a 2,800-foot long outlet channel that drains floodwaters from a four square mile area to the Signal Butte Dam.
- **Signal Butte Dam and Floodway**; consists of a 1.3 mile long earthen dam and a 2.7 mile long floodway that conveys floodwaters discharged from the Signal Butte Dam and the contributing watershed to the Spook Hill Dam. The structure drains 16 square miles above the Apache Trail near the Maricopa - Pinal County boarder.
- **Spook Hill Dam and Floodway.**

Evaluation of Preliminary Design Report

The primary purpose of this report (1975) was to review the preliminary design hydrology for the Spook Hill FRS. The computations for determining the required floodwater retarding capacity, principal spillway size, and the emergency spillway crest were found to be satisfactory.

Final Design Report

This report was finalized by the SCS in 1976 and documents the basis of the hydrologic, hydraulic, structural, foundation and embankment designs for the Spook Hill FRS.

Phase I Inspection Report

Ertec Western, Inc. (1981) prepared the Inspection Report through a contract with the ADWR, in accordance with the National Dam Inspection Act of 1972. An assessment was performed to verify the structural integrity of the dam and the hydraulic capabilities of the reservoir and outlet facilities to safely pass expected hydrologic events.

The results of this investigation indicated that the spillway can accommodate about 90 percent of the PMF, and the dam crest would experience a maximum overtopping of up to 0.22 feet for one-half hour, during a PMF. However, because of the uncertainties associated with hydrologic calculations, the dam was considered full to capacity, but safe from a hydrologic viewpoint.

In general, the overall condition of the Spook Hill Dam was found to be satisfactory. It was recommended that a warning system and evacuation plan should be developed and implemented in the event of a possible failure.

2.0 ORIGINAL SPOOK HILL FRS HYDRAULIC DESIGN

The SCS's hydraulic design of the Spook Hill Dam's three major structural elements: dam embankment, spillways and crossroads were developed using the methodology summarized below. Details of the hydrologic and hydraulic methods are documented in the Evaluation of Preliminary Design and Final Design Reports. Supporting documentation from these reports were provided in Technical Report No. 1.

2.1 Hydrologic Methodology

The SCS hydrologically designed the Spookhill FRS using methods defined in the National Engineering Handbook No. 4, Hydrology [NEH-4, (1972)]. During the design process for the structure, the SCS developed the principal spillway, emergency spillway and freeboard hydrographs. The purpose of these design hydrographs is defined in Table 1.

Table 1 - FRS Design Hydrographs

FRS Structure Element	Design Hydrograph	Design Feature	Design Storm
Dam Embankment	Freeboard	Crest Elevation	PMF[1]
Emergency Spillway	Principal Spillway	Crest Elevation	100-year
Emergency Spillway	Freeboard	Spillway Dimensions	PMF
Emergency Spillway	Emergency Spillway	Outlet Channel	N.A.[2]
Principal Spillway	Principal Spillway	Crest Elevation	100-year[3]
Crossroads	Principal Spillway	Cross-Culvert Size	10-year

[1] Probable Maximum Flood (PMF)
[2] Not applicable to design storm frequency
[3] Supporting documentation could not be located

2.2 Hydrology Summary

The inflow hydrograph to the Spook Hill FRS from the Signal Butte Floodway was computed using the process documented in Technical Report No. 1, and resulted in a peak flow estimate of 2888 cfs at the inlet to the Spook Hill FRS.

The SCS developed the peak inflows along the Spook Hill FRS for the probable maximum precipitation (PMP) using the methodology described in Section 2.1. The design inflows, which were utilized to define the freeboard hydrograph and top of dam embankment, are summarized in Table 2.

Table 2 - Final Design Peak Flows and Volumes

Subbasin No.	Peak Discharge (cfs)	Peak Volume (acre-ft.)	Remarks
18	5,125	477	Start Spook Hill FRS
19	15,675	2,142	
20	6,492	662	
21	9,124	1,002	
22	9,945	980	End Spook Hill FRS

2.3 Hydraulic Summary

The details of the hydraulic design for the crossroad ramps and top of dam elevation were provided in the SCS Final Design Report. Pertinent segments of this report are provided in Appendix A.

The crossroad ramps at Brown Road, McKellips Road, and McDowell Road were designed using the Storage-Indication method documented in NEH-4. As explained in the Final Design Report (1976), elevation-storage relationships were developed for the reservoir area for the two ponded areas separated by the proposed road crossing. These curves in coordination with the Principal Spillway Hydrographs were incorporated into the Storage-Indication method to balance the water-surface elevations at the upstream and downstream face of the crossroads. This process resulted in a recommended crossroad elevation of 1,578.7 feet, 1578.8 feet, and 1,579.0 feet at Brown Road, McKellips Road, and McDowell Road, respectively. These elevations are based on the NGVD 29 datum.

The top of dam elevation was computed using the Freeboard Hydrograph methodology documented in NEH-4. This process resulted in a top of dam elevation of 1,591 feet (NGVD 29).

It should be noted that the design intent of the Spook Hill FRS is to safely impound and discharge the 100-year flood event through the principal spillway without any discharges from the emergency spillway.

3.0 FRS STRUCTURE DESIGN ELEVATIONS

Using the results of the hydrograph methodologies outlined in the previous section, the SCS defined the Spook Hill FRS structure control elevations and dimensions. A summary of these critical elevations is provided below.

3.1 Dam Embankment

The Spook Hill FRS is a compacted zoned earthfill structure with a total length of 21,712 feet. The maximum height of the structure is 23 feet and the width varies from 14 feet at the crest to a maximum of about 125 feet at the base. The minimum embankment crest elevation is 1,591.0 feet (NGVD 29).

3.2 Principal Spillway

The principal spillway consists of a drop inlet structure cast into a 7.5 x 7-foot reinforced concrete box culvert through the dam, with a Saint Anthony Falls (SAF) energy dissipator at the outlet. The outlet leads to the Spook Hill floodway, constructed to convey floodwaters northward to a point where the flood waters discharge to a natural wash and ultimately into the Salt River just upstream from the Granite Reef Dam. The uncontrolled overflow elevation of the Principal Spillway intake is 1,577.5 feet (NGVD 29).

3.3 Emergency Spillway

The single emergency spillway for the dam is a 260-foot wide Type C, reinforced concrete, straight drop spillway. The crest elevation is 1,582.0 (NGVD 29) and the bottom elevation of the stilling basin is 1,568.0 feet (NGVD 29).

3.4 Summary of Critical Structure Elevations

The following conversion factor was developed for the Area Drainage Master Plan (ADMP) Update to convert NGVD 29 elevations to the North American Vertical Datum of 1988 (NAVD 88):

(NGVD 29 Elevation) + 1.86 feet = (NAVD 88 Elevation)

A summary of the critical structure elevations for the Spookhill FRS is provided in Table 3.

Table 3 - Critical Structure Elevations

Structure	NGVD 29 Elevation (ft)	NAVD 88 Elevation (ft)
Dam Crest[1]	1,591.00	1,592.86
Principal Spillway Intake	1,577.50	1,579.36
Emergency Spillway Crest	1,582.00	1,583.86

[1] Minimum dam crest elevation along the Spook Hill FRS.

3.5 Crossroads

Principal Spillway Hydrograph (PSH) procedures were used to compute the crossroad elevation and its impact on dam safety. A schematic of the multi-reservoir system between Brown Road and the Principal Spillway was presented in Technical Report No. 1. The PSH was developed using one and 10-day precipitation depths for the 10-year flood. The SCS as-built plans, presented in Appendix B, indicate the use of 9-foot diameter Corrugated Metal Pipes (CMP's) at the crossroads. The study confirmed that the proposed crossroad profiles did not impact the dam crest elevation using the freeboard hydrograph. The peak inflow rates along the multi-reservoir system and the invert elevation of the CMP's at crossroads are summarized in Tables 4 and 5, respectively.

Table 4 - Crossroad Design Peak Inflows

Reservoir No.	Location	Peak Inflow[1] (cfs)
1	North of McDowell Road	106
2	McDowell Road to McKellips Road	222
3	McKellips Road to Brown Road	412
4	South of Brown Road	306

[1]10-year storm event.

Table 5 – Culvert Invert Elevations

Structure	NGVD 29 Elevation (ft)	NAVD 88 Elevation (ft)
Brown Road Culvert	1,569.38	1,571.24
McKellips Road Culvert	1,567.74	1,569.60
McDowell Road Culvert	1,566.52	1,568.38

4.0 EXISTING CONDITION HYDROLOGIC ANALYSIS

The existing condition hydrologic model along the Spook Hill FRS was developed using the parameters and procedures described in Technical Report No. 1. This model is the basis of the existing condition hydraulic analysis. The results of the hydrologic analyses for the full PMF condition as presented in Technical Report No. 1 are summarized in Table 6.

Table 6 - Design Peak Discharges

Subbasin No.	Peak Discharge (cfs)
A1	3,197
B1	11,044
B2	2,907
C1	10,683
D2	4,833

The PMF hydrology is based on the Probable Maximum Precipitation, which was developed for the local storm using procedures in HMR 49. The procedures and guidelines presented in the FCDMC Hydrology Manual were used to develop the rainfall loss parameters and rainfall-excess to runoff transformation functions.

The hydrologic characteristics of the Spook Hill Reservoir including the peak inflow, outflow, maximum runoff volume and water-surface elevation for the full PMF event as presented in Technical Report No. 1 are summarized in Table 7.

Table 7 - Hydrologic Summary

Hydrologic Variable	Unit	Value
Storm Duration	Hours	6
Storm Precipitation	Inches	12.8
Peak Hour	Inches	9.4
Peak Inflow	cfs	28,208
Peak Outflow	cfs	14,478
Runoff Volume	ac-ft	3,139
Maximum W.S. Elevation[1]	Feet	1,590.36
Top of Dam Elevation[1]	Feet	1,592.86
Residual Freeboard	Feet	2.5

[1] Based on NAVD 88 datum.

The hydrologic variables and water-surface elevations presented in Table 7 are based on hydrologic routing and are refined with the hydraulic analysis presented in the following section.

The existing condition PMF hydrologic analysis considers planned future conditions based on current and zoned land use data. Future developments, channels and park improvements many impact the drainage pattern within the contributing watershed for more frequent flood events. However, considering the magnitude of a PMF event, it is common practice to define the contributing watershed based on the prevailing land slope. More frequent floods events (i.e., 50-year and 100-year return interval) will be impacted by development and the hydrology for these more frequent flood events will consider these impacts.

5.0 PROBABLE MAXIMUM FLOOD HYDRAULIC ANALYSIS

The existing condition hydraulic analysis along the Spook Hill Floodwater Retarding Structure (FRS) was performed for the Probable Maximum Flood (PMF). The structural facilities incorporated into the hydraulic model include the Spook Hill FRS, the principal and emergency spillways and the crossroads at Brown, McKellips and McDowell Roads.

5.1 Hydraulic Model Evaluation

Flow routing is the primary mathematical process for predicting the changing magnitude, speed, and shape of a flood wave, as a function of time (i.e., the flood hydrograph) at one or more points along a watercourse. The design inflow hydrograph routing methods that were evaluated for use along the Spook Hill FRS includes the hydrologic and hydraulic routing processes.

In hydrologic routing, the flow is computed as a function of time at one location along the watercourse, however, in hydraulic routing, the flow is computed as a function of time simultaneously at several sections along the watercourse.

Hydrologic Routing

The maximum water surface elevation presented in Table 7 reflects a hydrologic routing process (level-pool routing) used in HEC-1.

Although the hydrologic routing techniques function adequately in many situations, they have serious disadvantages in the following applications:

- In cases where the unsteady flows are subjected to backwater effects due to reservoirs or inflows from large tributaries;
- If channel bottom slopes are quite mild, the inertial effects ignored in the hydrologic techniques become important (NWS, 1998); and
- Highly transient flows from dam breaks are not treated adequately by hydrologic routing.

Muskingam, Muskingam-Cunge, Straddle/Stagger, and Storage (Modified Puls, normal depth, or level pool), available in HEC-1, are all different forms of hydrologic routing (USCOE, 1990). The advantages and disadvantages of hydrologic routing methods are summarized in Table 8.

Hydraulic Routing

In order to avoid the limitations of the hydrologic routing models, a hydraulic routing model will be used along the Spook Hill FRS.

Table 8 - Hydrologic Routing Methods

Method	Advantages	Disadvantages	Primary Applications
- Storage or Modified Puls	- Effectively accounts for flood peak attenuation caused by floodplain storage. - Fast and stable computations. - Employs some hydraulic principles.	- Does not account for downstream backwater effects.	Rivers and reservoirs.
- Muskingam-Cunge	- Simple analytical expression. - Computationally fast and stable. - Less wave attenuation compared to kinematic wave methods, permitting a more flexible choice of time and space increments.	- Requires calibration to observed events. - Linear relationship.	Rivers with little floodplain storage.
- Straddle/Stagger	Simple and fast.	- Does not consider storage. - Implies knowledge of both energy and storage. - Implies knowledge of hydraulics of wave itself.	Rivers with little floodplain storage.

Source: Jansen (1988)

Hydraulic routing models are based on the differential equations of one-dimensional unsteady flow (the Saint-Venant equations). Hydraulic routing based on the complete Saint-Venant equations is known as dynamic routing. Simplified forms of the Saint-Venant equations, referred to as the kinematic and diffusion equations, can also be used for hydraulic routing. Kinematic wave routing, available in HEC-1, is a simplified hydraulic routing process.

Table 9 summarizes the relative advantages and disadvantages of hydraulic routing methods.

Table 9 - Hydraulic Routing Methods

Method	Advantages	Disadvantages	Primary Applications
- Dynamic routing	- A complete analysis of the hydraulics of flow which includes all energy components (potential, pressure, kinetic, inertial), plus continuity integrated in both time and space. - Measures the impact of changes in floodplain storages directly in terms of the response of discharge and water-surface elevation.	- Requires a detailed description of geometry and hydraulic roughness in channel and overbanks. - Numerical solution often becomes unstable.	- Rivers or reservoirs. - Dam break or other dynamic flood waves.
- Diffusion routing	- Adequately describes most flood routing because inertial terms are usually small. - Numerical solution techniques are more stable than full Saint-Venant equations.	- Less accurate in predicting the stage in channel transitions where critical depth would occur. - More computationally intensive than hydrologic routing methods.	Most river systems.
- Kinematic routing	- Uses basic hydraulic principles. - Good estimates of flood wave travel time. - Stable computational methods.	- Limited to simplified prismatic channel shapes. Does not provide attenuation associated with floodplain storage.	Rivers with little floodplain storage and sufficient slope.

Source: Jansen (1988)

Dynamic Routing Models

As described in Table 9, the dynamic form of the Saint-Venant equations is the most appropriate hydraulic routing method for applications in dam break or other dynamic flood waves, assuming gradually varied flow. The dynamic routing software evaluated for use along the Spook Hill FRS was FLDWAV and UNET. These programs are summarized below.

FLDWAV

FLDWAV is a generalized flood routing (unsteady flow simulation) model developed by the National Weather Service (NWS). The latest version is Version 2-0-0 (June 2000). It combines the capabilities of the Dynamic Wave Operational Model (DWOPER) and DAMBRK, developed by the NWS, and provides features not contained in either of these models (NWS, 1998). FLDWAV solves the complete one-dimensional Saint-Venant equations of unsteady flow.

Solution Technique

A weighted, four-point implicit, finite difference scheme is used to represent the Saint-Venant equations by a corresponding set of finite-difference algebraic equations. The boundary conditions used for the solution of the algebraic equations include the upstream, downstream and internal boundaries; and initial conditions.

Limitations

The major limitations of the FLDWAV model can be summarized as follows:

- The direct application of the implicit finite difference scheme results in a system of nonlinear algebraic equations. In FLDWAV, these nonlinear equations are solved using the Newton-Raphson iteration technique. As reported by Liggett and Cunge (1975) this iterative scheme can result in convergence problems at discontinuities in the waterway geometry.

- The structural features that can be modeled using FLDWAV are limited to dams and bridges, which can be hydraulically modeled using the empirical functions developed by Fread (1988). A culvert routine is not provided in the current version of FLDWAV.

UNET

UNET is a one-dimensional unsteady flow model developed by Barkau (1985) in partnership with the U.S. Army Corp of Engineers (USCOE) Hydrologic Engineering Center (HEC). UNET solves the complete one-dimensional Saint-Venant equations of unsteady flow.

UNET was recently incorporated into the current version of HEC-RAS (Version 3.0).

Solution Technique

A weighted, four-point implicit, finite-difference scheme is used. To avoid the nonlinear solution, a technique developed by Preissmann (as reported by Liggett and Cunge, 1975) and Chen (1973) is used to linearize the Saint-Venant equations.

The major advantages of UNET compared to the FLDWAV model are summarized as follows:

- The linearization is a preferred methodology to avoid convergence problems at discontinuities in the waterway geometry (i.e., crossroad geometry).
- Culverts and bridges can be hydraulically modeled more efficiently using the empirical functions provided in HEC-RAS. The efficiency and modeling accuracy for culverts and bridges will be a significant factor for the proposed condition hydraulic models.

The existing condition hydraulic model developed by DMJM+HARRIS using the FLDWAV model resulted in numerical convergence problems at Brown Road, McKellips Road, and McDowell Road. Therefore, to avoid this convergence problem, and more efficiently model proposed alternatives, UNET is the recommended computer model to define the existing hydraulic conditions for the Spook Hill FRS.

5.2 Hydraulic Model Development

The existing conditions hydraulic model was developed using the most recent version of HEC-RAS (Version 3.0) that incorporates UNET. The downstream and upstream limits of the hydraulic model are the principal spillway and the Signal Butte Floodway outlet, respectively. The parameters associated with the hydraulic model development are presented in the following paragraphs and documented in Appendix C.

Boundary Conditions

Upstream and Downstream Boundary Conditions

The numerical solutions of the Saint-Venant equations require the definition of the hydraulic conditions at the most upstream and downstream locations of the study reach. These are known as the upstream and downstream boundary conditions.

The Signal Butte inflow hydrograph and combined emergency/principal spillway stage-discharge-rating curve, as presented in Technical Report No. 1, is the basis of the upstream and downstream boundary conditions.

Internal Boundary Conditions

The crossroads at Brown Road, McKellips Road and McDowell Road and the inflow hydrographs for subbasins A1 through D1 were modeled using the available options in HEC-RAS as follows:

- Internal structures such as dams, bridges, or waterfalls (short rapids) along a waterway cannot be modeled using the Saint-Venant equations. At these internal locations (boundaries), the flow is rapidly varied (spatially) rather than gradually varied as necessary for the applicability of the Saint-Venant equations. Empirical relations are utilized for simulating rapidly-varying flow. In UNET, unsteady flows are routed along the waterway including locations of rapidly-varying flow by utilizing internal boundaries.

  The crossroads were modeled using the culvert option in HEC-RAS. The crossroads are hydraulically modeled as broad-crested weirs. By using the guidelines in Brater et. al. (1996) and USCOE Waterways Experiment Station Hydraulic Design Criteria (Sheet 711), a discharge coefficient, C, of 2.67 was used in the broad-crested weir equation (i.e., $Q = CLH^{1.5}$).

- The inflow hydrographs were modeled using the uniform lateral inflow option in HEC-RAS. This option allows the user to define an inflow hydrograph and distribute it uniformly along the river reach between specified cross-sections. The design inflow hydrographs associated with the peak discharges in Table 5 are presented in Appendix C.

Initial Flow Conditions

In order to solve the Saint-Venant equations, the flow must be known or assumed at the beginning of the mathematical simulation. This is the definition of the initial flow conditions. The basic requirement of HEC-RAS is a non-zero flow condition at the beginning of the simulation. Therefore, the inflow hydrograph at the upstream boundary was modified, replacing the zero flow values along the rising limb of the inflow hydrograph, with nonzero values (i.e., 1 cfs). The uniform lateral inflow hydrographs were not modified.

Geometric Data

Plate 1 illustrates the hydraulic cross-section locations for the Spook Hill FRS. The project digital terrain models and the associated 1-foot contour interval topographic mapping developed by Kenney Aerial Mapping, Inc. (2001) and HJW Geospatial, Inc. (2001) were used to develop the cross-section geometry data.

As shown in Plate 1, cross-sections are provided at approximately 400-foot intervals along the Spook Hill FRS. Special consideration was given to provide sections at the immediate upstream and downstream ends of the crossroads at Brown, McKellips and McDowell Roads.

The skewed cross-sections at the crossroads were modified by adjusting the cross-section dimensions to define an equivalent section perpendicular to the flow direction for large magnitude flood events. These sections were modified as follows:

- For the sections at the downstream and upstream sides of the crossroads, the skew angle option available in HEC-RAS was used to automatically adjust the section dimensions.
- For the roadway profile information, the adjusted sections were input into the culvert routine in the HEC-RAS program.

The skew angles used at Brown Road, McKellips Road and McDowell Road is 50°, 36°, and 20°, respectively.

Expansion/Contraction Coefficients
In general, contraction and expansion coefficients along the study were defined as 0.1 and 0.3, respectively. In the vicinity of the crossroads, contraction and expansion coefficients were defined as 0.3 and 0.5, respectively, for the culverts.

Manning's Roughness Coefficient
The following guidelines were used to identify the representative roughness values for the FRS:

- Aerial photo dated January 13, 2000,
- Open Channel Hydraulics (Chow, 1959),
- U.S. Geological Survey (USGS) 7.5 Minute Series topographic map,
- U.S. Geological Survey Water-Supply Paper 2339 (1989), and
- Flood Control District of Maricopa County Hydraulics Manual.

Field observations and engineering judgement were used to establish the Manning's n values for the existing condition hydraulics model. Typically, a Manning's n value of 0.035 was used along the Spook Hill FRS. It was determined that this variable had little impact on the maximum water-surface elevation in the reservoir during the PMF event.

5.3 Results

The existing condition PMF hydraulic model along the Spook Hill FRS is recommended to be the basis of the proposed condition hydraulic analysis models for the design of the Red Mountain Freeway. The results of the hydraulic analysis are summarized in Table 10.

The HEC-RAS output files documented in Appendix C represent the peak discharge and water-surface elevation at discrete sections along the Spook Hill FRS. The associated stage (water-surface elevation) and flow hydrographs are documented as well.

Table 10 - Hydraulic Summary

Station (miles)	Discharge[1] (cfs)	Minimum Channel Elevation (ft)	Maximum Water-Surface Elevation[2] (ft)	Maximum Depth (ft)	Residual Freeboard[3] (ft)	Comments
0.000	11530	1568.99	1589.43	20.44	3.43	Principal Spillway
0.016	11515	1568.89	1589.64	20.75	3.22	
0.019	11510	1568.71	1589.65	20.94	3.21	Emergency Spillway
0.063	11473	1569.37	1589.80	20.43	3.06	Emergency Spillway
0.068	11469	1569.32	1589.81	20.49	3.05	
0.109	11427	1569.32	1589.90	20.58	2.96	
0.185	11355	1569.58	1590.00	20.42	2.86	
0.261	11296	1569.20	1590.05	20.85	2.81	
0.336	11233	1569.34	1590.08	20.74	2.78	
0.425	11153	1568.88	1590.12	21.24	2.74	McDowell Road
0.465	11153	1569.15	1590.26	21.11	2.60	
0.533	11110	1569.13	1590.31	21.18	2.55	
0.604	11068	1569.28	1590.33	21.05	2.53	
0.680	11009	1569.80	1590.35	20.55	2.51	
0.756	10975	1570.22	1590.40	20.18	2.46	
0.831	10928	1569.31	1590.46	21.15	2.40	
0.906	10886	1569.66	1590.50	20.84	2.36	
0.983	10838	1569.94	1590.53	20.59	2.33	
1.058	10793	1570.83	1590.55	19.72	2.31	
1.135	10749	1570.23	1590.57	20.34	2.29	
1.164	10721	1570.04	1590.58	20.54	2.28	
1.210	10700	1570.03	1590.58	20.55	2.28	
1.283	10671	1569.85	1590.60	20.75	2.26	
1.358	10625	1570.00	1590.61	20.61	2.25	
1.433	10589	1569.98	1590.62	20.64	2.24	
1.509	10546	1570.57	1590.62	20.05	2.24	
1.607	10354	1570.24	1590.63	20.39	2.23	McKellips Road
1.656	10468	1570.09	1590.72	20.63	2.14	
1.756	10241	1570.56	1590.73	20.17	2.13	
1.826	10048	1570.90	1590.74	19.84	2.12	
1.874	9907	1570.85	1590.74	19.89	2.12	
1.901	9709	1570.66	1590.74	20.08	2.12	
1.977	9626	1570.52	1590.76	20.24	2.10	
2.053	9350	1570.79	1590.78	19.99	2.08	
2.129	9285	1570.63	1590.79	20.16	2.07	
2.205	9022	1570.47	1590.80	20.33	2.06	
2.281	8834	1569.87	1590.82	20.95	2.04	
2.328	8721	1570.67	1590.82	20.15	2.04	
2.357	8508	1570.91	1590.83	19.92	2.03	
2.433	7921	1570.78	1590.84	20.06	2.02	
2.509	7304	1571.29	1590.85	19.56	2.01	
2.585	6741	1570.54	1590.85	20.31	2.01	

Station (miles)	Discharge[1] (cfs)	Minimum Channel Elevation (ft)	Maximum Water-Surface Elevation[2] (ft)	Maximum Depth (ft)	Residual Freeboard[3] (ft)	Comments
2.662	6181	1571.72	1590.86	19.14	2.00	
2.736	5617	1570.94	1590.87	19.93	1.99	
2.815	5001	1571.07	1590.87	19.80	1.99	
2.871	4577	1571.33	1590.88	19.55	1.98	
2.891	4431	1571.26	1590.88	19.62	1.98	
2.966	3853	1571.96	1590.88	18.92	1.98	
3.096	2798	1571.78	1590.89	19.11	1.97	Brown Road
3.138	2867	1572.36	1590.92	18.56	1.94	
3.285	2881	1573.04	1590.93	17.89	1.93	
3.349	2892	1573.32	1590.93	17.61	1.93	
3.424	2877	1573.19	1590.94	17.75	1.92	
3.500	2855	1572.48	1590.94	18.46	1.92	
3.576	2861	1572.90	1590.94	18.04	1.92	
3.645	2871	1572.16	1590.94	18.78	1.92	
3.749	2869	1575.57	1590.94	15.37	1.92	
3.824	2871	1576.54	1590.94	14.40	1.92	
3.851	2872	1576.18	1590.96	14.78	1.90	
3.852	2872	1576.18	1590.96	14.78	1.90	

[1]Discharge corresponding to the maximum computed water-surface elevation for the PMF event.
[2]Maximum water-surface elevation computed using the UNET model for the PMF event.
[3]Based on ADWR approved top of dam elevation of 1592.86 feet (NAVD 88).

As presented in Table 10, the minimum freeboard identified along the Spook Hill FRS is 1.9 feet.

Sediment Elevation Considerations

The stage-storage function developed by Wood, Patel & Associates (WPA) for the Spook Hill Area Drainage Master Plan Update defines a sediment volume of 271 acre-feet. This volume was computed using recent 2-foot contour interval topographic mapping and corresponds to an elevation of 1,577.2 feet (NAVD 88).

The soffit elevations for the culverts at Brown Road, McKellips Road and McDowell Road are 1,578.38 ft, 1,576.74 ft, and 1,575.52 ft, respectively. The estimated sediment elevation of 1,577.2 feet will effectively block the crossroad culverts. It is unlikely that the FCDMC will allow this sediment accumulation to occur without intervening maintenance. The maximum sediment elevation, can impact the maximum water-surface elevation by approximately one foot based on the results of the draft report hydraulic model.

6.0 SUMMARY

Due to the unsteady state nature of the hydraulic parameters and backwater impacts along the Spook Hill FRS, a one-dimensional steady-state model cannot be used to compute the existing flood pool water-surface elevation. Also, the hydrologic routing and the simplified hydraulic routing processes (kinematic wave routing) in HEC-1 cannot accurately represent the hydraulic conditions along the Spook Hill FRS. Therefore, a hydraulic routing process was implemented.

Among the available hydraulic routing models, a dynamic routing model, HEC-RAS (UNET), will be used to compute the maximum water-surface elevation and discharge along the Spook Hill FRS.

The boundary conditions used to define the hydraulic solution include:

- the Signal Butte Floodway Inflow Hydrograph at the upstream boundary,
- the Spook Hill FRS combined Emergency/Principal Spillway stage-discharge rating curve at the downstream boundary, and
- the uniform lateral inflow hydrographs (subbasins A1-D1) and the existing crossroad geometry at Brown Road, McKellips Road, and McDowell Road as the internal boundaries.

It is recommended that the hydraulic analysis presented with this report be used to define existing conditions for the inflow design flood, the probable maximum flood (PMF), for the Spook Hill Floodwater Retarding Structure.

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PLATE 1

HEC-RAS CROSS-SECTION LOCATION MAP

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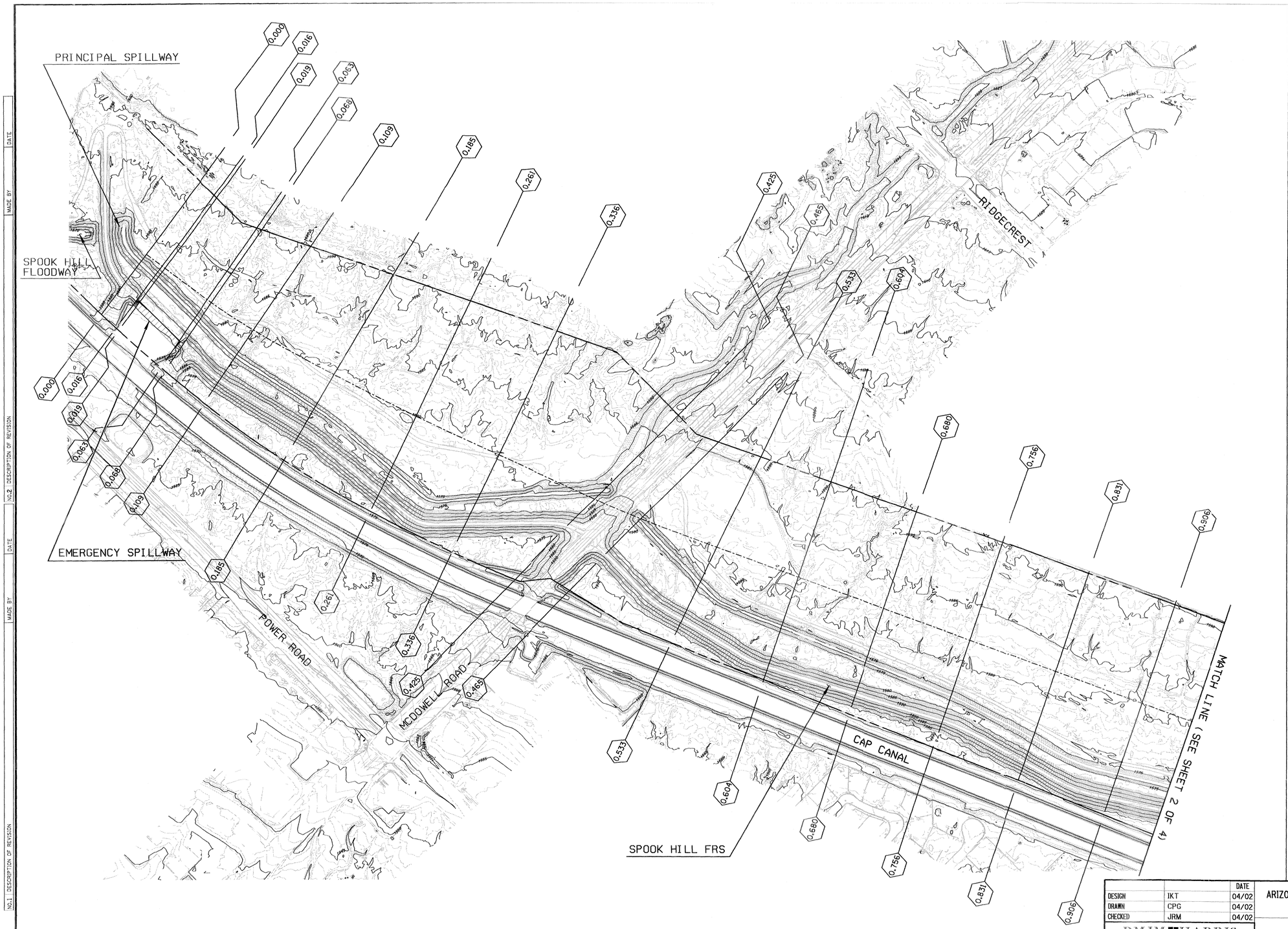


LEGEND

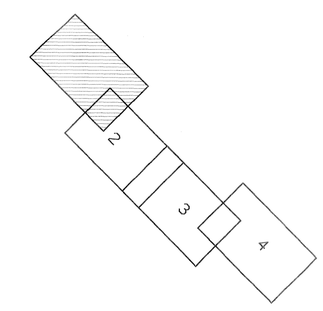
HYDRAULIC BASE LINE

CROSS SECTION LOCATION (0.283 — 0.283)

FCDMC RIGHT OF WAY

NOTES

INDEX MAP



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SCALE: 1"=200'

CONTOUR INTERVAL = 1 FOOT

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2777 E. CAMELBACK ROAD SUITE 200
PHOENIX, AZ. 85016-4302 (602) 337-2777

ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

SPOOK HILL FRS
HEC-RAS CROSS-SECTION
LOCATION MAP

PRELIMINARY
NOT FOR
CONSTRUCTION
OR RECORDING

ROUTE	MILEPOST	STRUCTURE NO.	LOCATION
202L			RED MOUNTAIN FREEWAY

DWG. NO. - .

TRACS NO. H 5782 01C

1 OF 4

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GROUND CONTROL SURVEY DATA PROVIDED BY
PROJECT ENGINEERING CONSULTANTS, INC. AND WOOD, PATEL & ASSOCIATES, INC.

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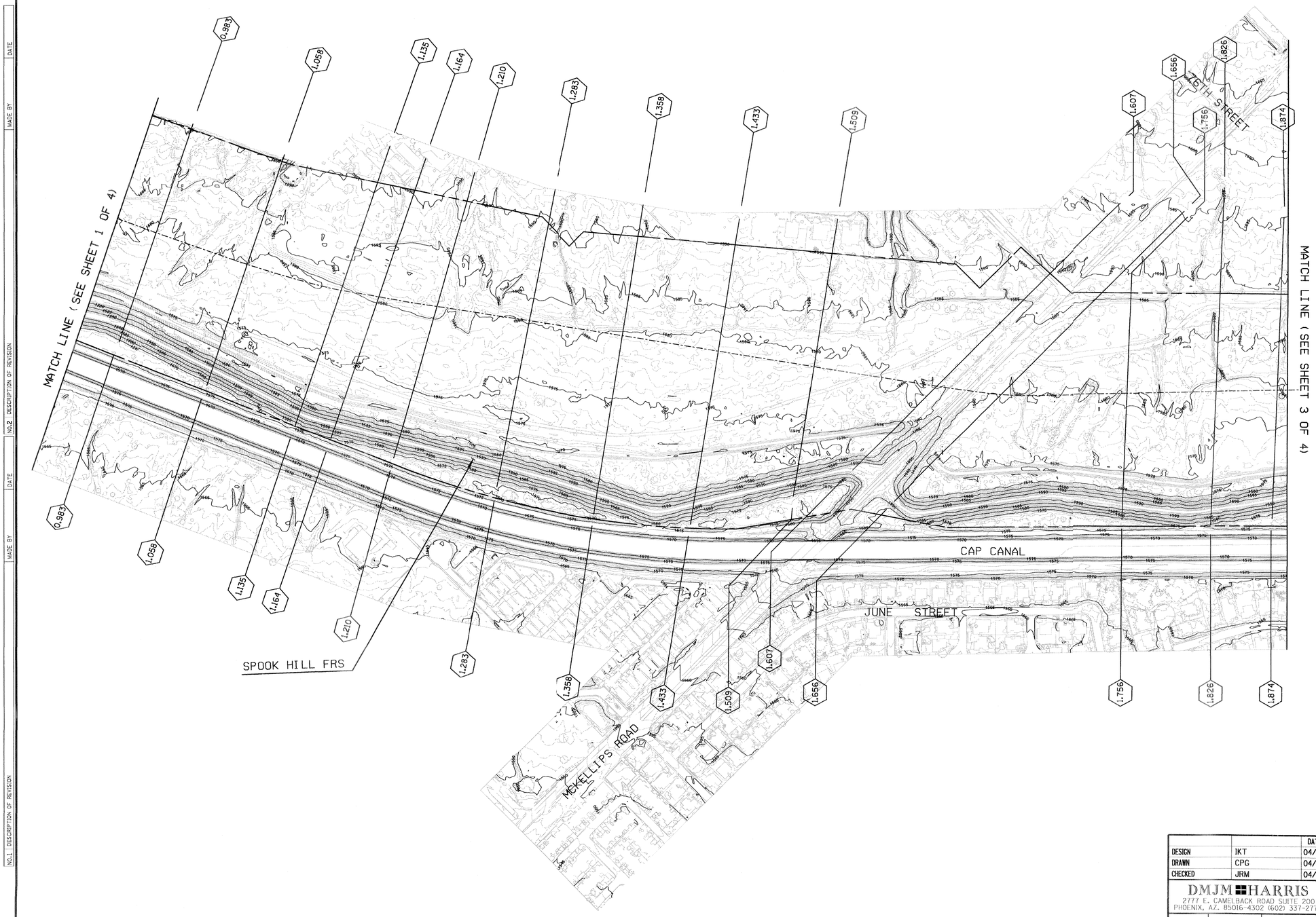


LEGEND

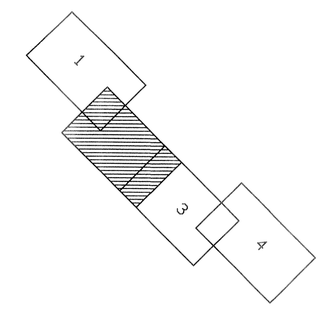
HYDRAULIC BASE LINE

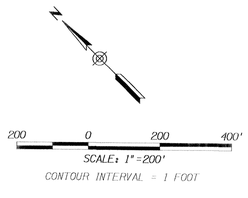
CROSS SECTION LOCATION (0.283 — 0.283)

FCDMC RIGHT OF WAY

NOTES

INDEX MAP





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SPOOK HILL FRS
HEC-RAS CROSS-SECTION
LOCATION MAP

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ROUTE	MILEPOST	STRUCTURE NO.	LOCATION
202L			RED MOUNTAIN FREEWAY

TRACS NO. H 5782 01C

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2 OF 4

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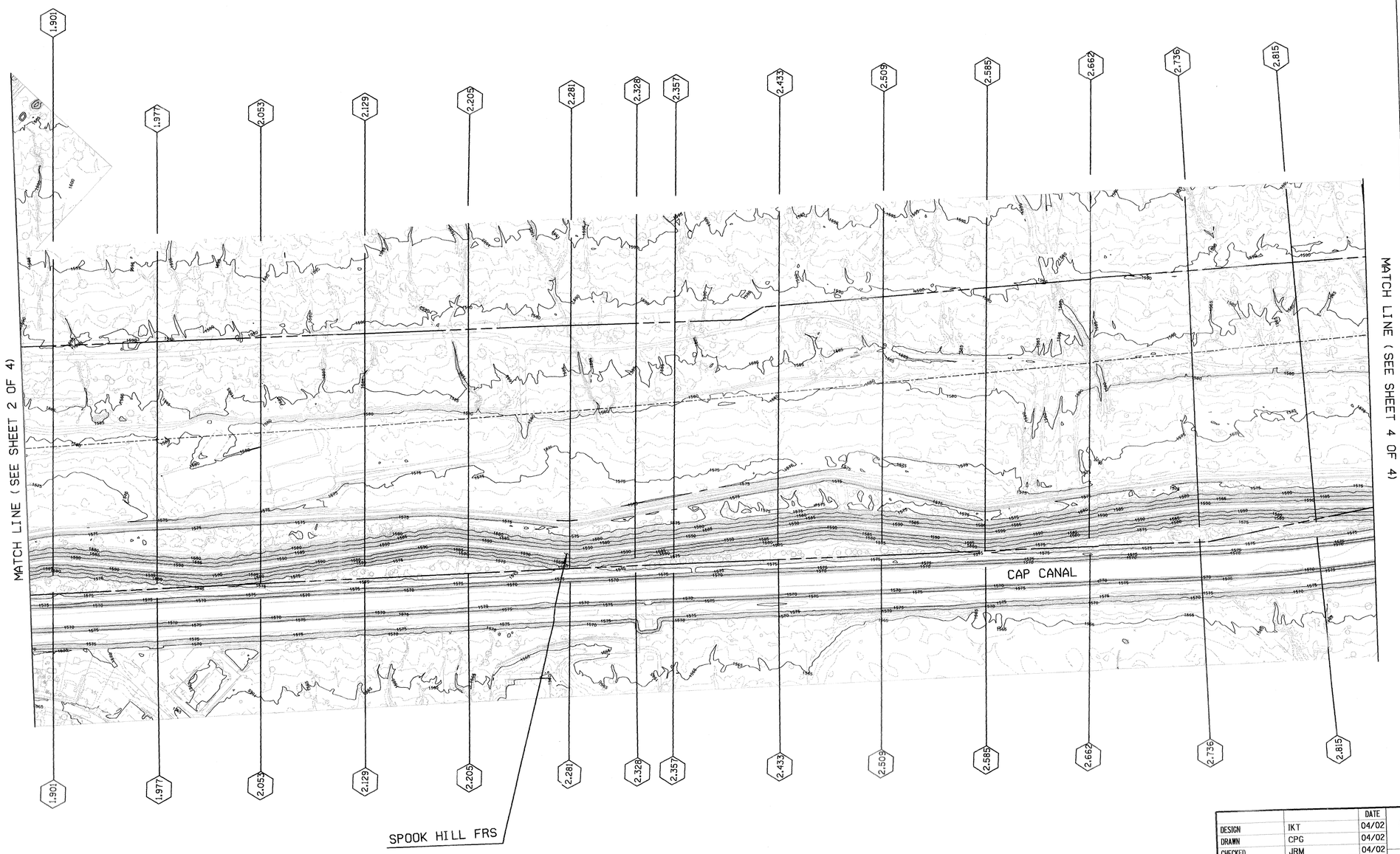

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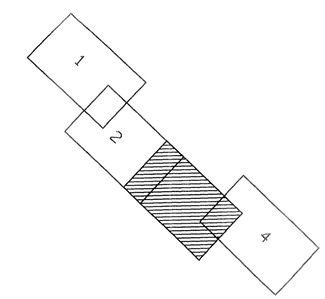
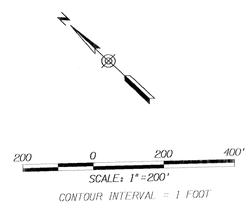
CROSS SECTION LOCATION (0.283) (0.283)

FCDMC RIGHT OF WAY

NOTES

INDEX MAP





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ARIZONA DEPARTMENT OF TRANSPORTATION
INTERMODAL TRANSPORTATION DIVISION

SPOOK HILL FRS
HEC-RAS CROSS-SECTION
LOCATION MAP

LOCATION: RED MOUNTAIN FREEWAY

202L (ROUTE) | MILEPOST | STRUCTURE NO.

TRACS NO. H 5782 01C

PRELIMINARY
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CONSTRUCTION
OR RECORDING

DWG. NO. - .
3 OF 4

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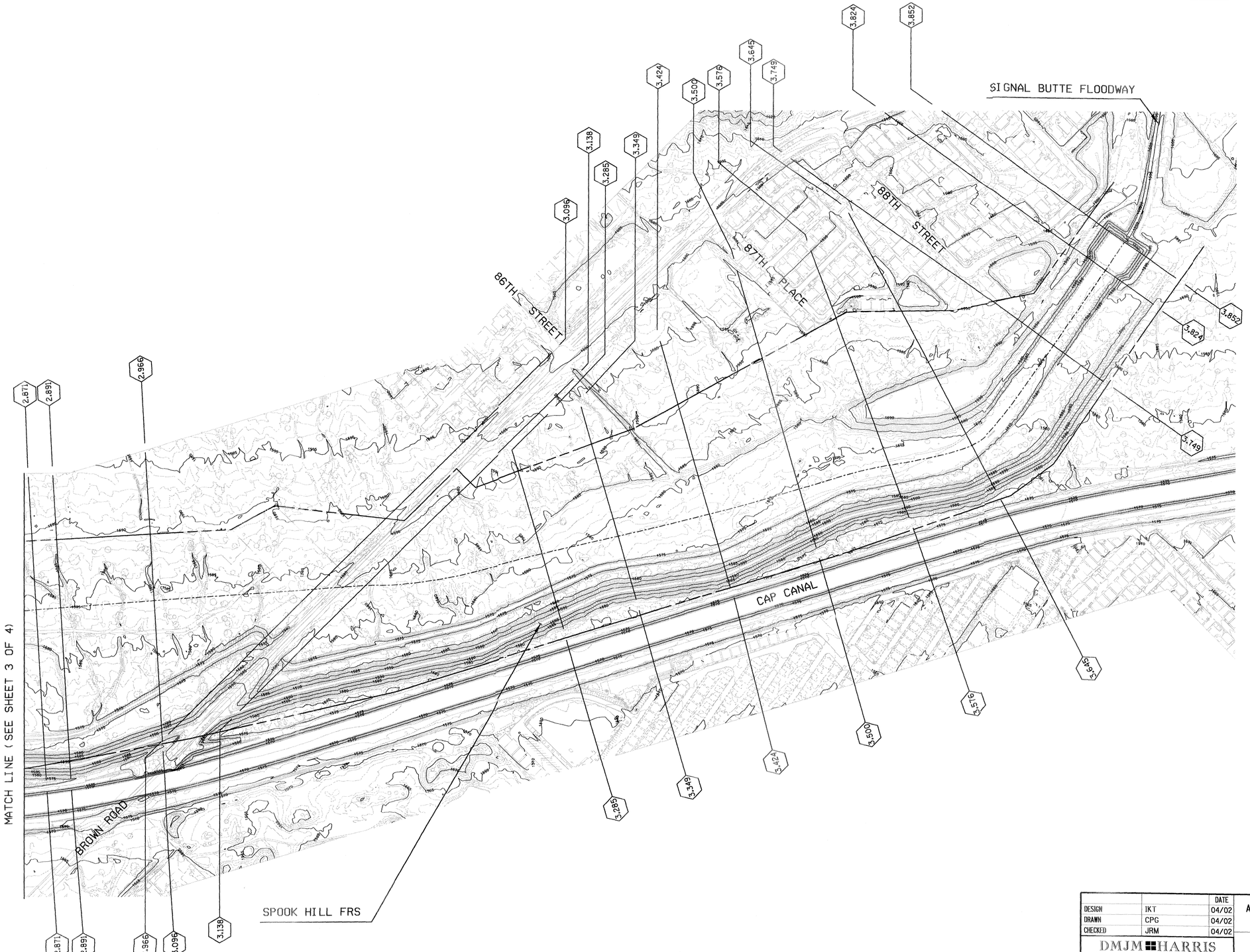

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CROSS SECTION LOCATION (0.283 — 0.283)

FCDMC RIGHT OF WAY

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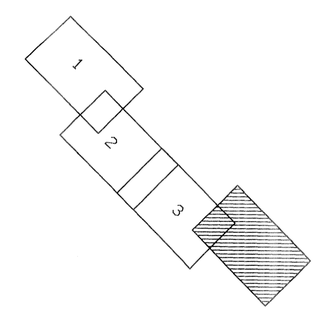

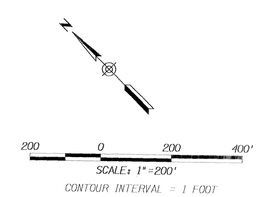

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INTERMODAL TRANSPORTATION DIVISION

SPOOK HILL FRS
HEC-RAS CROSS-SECTION
LOCATION MAP

LOCATION: RED MOUNTAIN FREEWAY

202L (ROUTE) | MILEPOST | STRUCTURE NO.

TRACS NO. H 5782 01C

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PROJECT ENGINEERING CONSULTANTS, INC. AND WOOD, PATEL & ASSOCIATES, INC.

APPENDIX A

SCS DESIGN DOCUMENTATION

BUCKHORN-MESA WPP, AZ

SPOOK HILL F.R.S.

FINAL DESIGN

12-22-76

2

RPM
5/20/72

PROPOSED McDOWELL ROAD CROSSING OVER STRUCTURE #3, BUCKEYE WATERSHED

HYDROLOGIC STUDIES

A. To Determine the Minimum Elevation of the Top of the Road Crossing Within the Reservoir

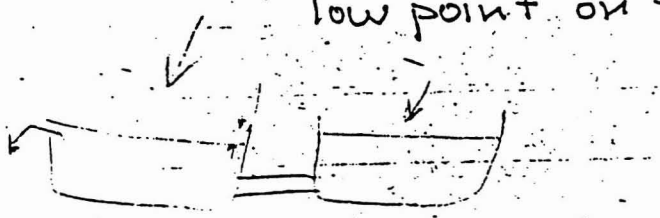
1. Determine the drainage area contributing to the reservoir (a) between the proposed road location and the principal spillway and (b) between the proposed road location and the emergency spillway.
2. Develop elevation-storage relationships for the reservoir area for the two ponded areas separated by the proposed road crossing. Extend top of dam 2 feet to ensure adequate data for flood routing
3. Develop principal spillway hydrographs (PSH) for the two drainage areas determined under item 1. above using SCS, NEH Sec. 4 Chap 2 Use all applicable input data originally developed for the PSH in sizing the storage capacity. Use the 1-day and 10-day rainfall values for the desired frequency (10 percent chance).
4. Flood route the PSH developed for the drainage area between the proposed road

and the principal spillway using the elevation-discharge relationship for the existing principal spillway and the elevation-storage relationship determined in item 2. Use the Storage-Indication Method SCS, NEH Sec. 4, Chap. 17.

5. Use the maximum water surface elevation attained ~~from~~ routing under 4. as the tailwater conditions for the proposed culvert or bridge structure in the road crossing. Develop elevation-discharge relationship(s) for the proposed culvert or bridge (alternative

6. Flood route the PSH developed for the area between the proposed road crossing and the emergency spillway using the elevation storage relationship derived in 2. above and the elevation-discharge relationship derived in 5. above. Use the Storage-Indication Meth

7. Use the maximum water surface elevation attained in the flood routing as the low point on the proposed road crossing.



B. Check the Effect of the Proposed Road Crossing Upon the Safety of the Dam; that is, the Freeboard.

1. Starting with the hydraulic characteristics of the emergency spillway, the elevation-discharge relationship, develop water surface profiles to a location immediately upstream of the proposed road ramp. Use as a maximum discharge the peak flow from previous routings; ~~20,670 cfs~~. Use cross-sections including an additional 2 feet of dam (vertically on top of dam).

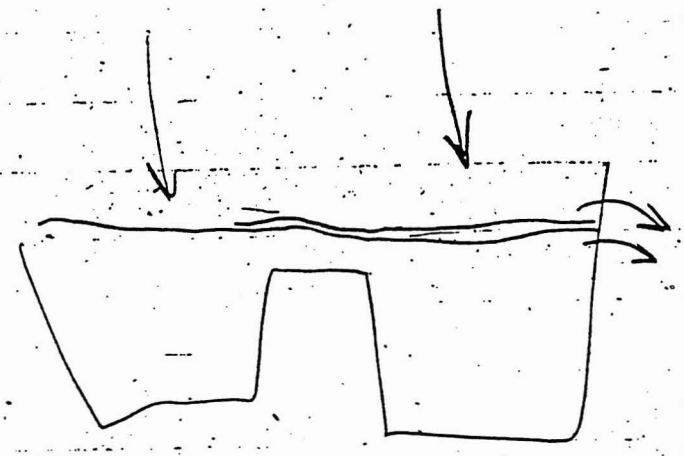
2. Develop a freeboard hydrographs (F.H.) for the two areas as separated, by the proposed road crossing (see Item A.1.). Use the procedures described in SCS, NEH Sec. 4, Chap. 21. Use all applicable input derived in original computations related to determining the freeboard.

3. Using the elevation-discharge relationship derived for the road crossing (1. above) and the elevation-storage relation derived in A.2 perform the flood routing using the Storage Indication Method. Check maximum water surface against top of dam elevation

4. Add the freeboard hydrograph for the area between the emergency spillway and the road crossing to the outflow hydrograph

derived from 3. above.

5. Using the elevation-discharge relationship for the emergency spillway and the elevation-storage relationship for this part of the reservoir flood route using the Storage-Indication Method. Check maximum water-surface elevation against existing top of dam.



STATE ARIZONA		PROJECT Buckhorn Mesa WPP Spook Hill FRS		
BY A.C.	DATE 6-21-76	CHECKED BY	DATE	JOB NO. 2005
SUBJECT Road Ramp Hydrology				SHEET 1 OF

(A1) Reservior is divided into 4 areas - see map.

Above McDowell Road area (1), 1.06 sq mi

Between McDowell + McKellips area (2), 2.64 sq mi = 13.57

Between Brown + McKellips area (3), 5.36 sq mi

Below Brown road area (4) 4.51 sq mi

Elev	Actual	Storage Volume (Acft) (1)	(2)	(3)	(4)	
1591	4063.4	475.42	1459.61	1900.22	786.68	=4621.93
1590	3610.34	424.25	1312.31	1690.01	685.29	4111.86
1588	2783.95	331.14	1042.37	1341.81	524.85	3240.18
1586	2059.83	250.13	804.01	1031.85	387.49	2473.49
1584	1432.73	180.8	595.94	761.31	272.39	1810.45
1582	901.61	123.22	419.25	531.24	178.89	1252.60
1580	466.40	77.60	274.89	343.42	106.87	802.77
1578	149.41	43.28	162.25	198.53	54.76	458.81
1576	-54.30	19.74	81.39	94.49	21.18	
1574	-161.37	6.35	37.54	30.95	10.67	
1572	-198.82	1.11	10.17	4.79	1.19	

No Storage below 1576.5 (This is sediment Storage)

COMPUTATION SHEET

SCS-ENG-523 Rev. 8-69

SOIL CONSERVATION SERVICE

☆GPO:1969—O-357-545

STATE ARIZONA		PROJECT BUCKHORN MESA WPP - SPOOK HILL FRS		
BY A.C.	DATE 6-22-76	CHECKED BY	DATE	JOB NO. 2005
SUBJECT Road Ramp Hydrology				SHEET 2 OF

Storage volume adjusted by percent

Elev	S (Ac ft) ①	②	③	④	
1591	418	1283	1670	692	4063
1590	372	1152	1484	602	
1588	284	896	1153	451	
1586	208	670	859	323	
1584	143	472	602	216	
1582	89	302	382	129	
1580	45	160	200	62	467
1578	14	53	65	18	150
1576.5	0	0	0	0	

(A7)

Since the flow between reserviors is dependent on the levels of each, discharges for changes in head are given

assume 108" pipes 225' long

p 31, C.S.P. manual

ΔH	Q
.4	170
.7	230
1.0	270
1.2	300
1.5	330

Principle Spillway

Elev	Discharge ($Q = 130.2H^{3/2}$)
1577.5	0
1578.0	46
1579.0	239
1580.0	515
1582.0	1243

STATE		PROJECT		
ARIZONA		BUCKHORN MESA WPP - SPOOK HILL FRS.		
BY A.C.	DATE 7-6-76	CHECKED BY	DATE	JOB NO.
SUBJECT				SHEET 3 OF

(A3) Principal Spillway Hydrograph

design for 10 year event (10% chance) in 1-day and 10-days
2.33" 3.73

100 yr - 1 day	3.90"	Principle Spillway
100 yr - 10 day	6.10"	
Freeboard -	13.0"	

To be compatible with work done previously, the drainage areas will be factored since the total drainage area is > 10 sq mi

1 day rainfall factor = .978
10 day rainfall factor = .991

from Lew Burton 2/18/75

Area #	Drainage Area	Area (sq mi)	Adjusted RCN	RCN	RCN (10 day)
	14	.25	75		
	15	.68	75		
(4)	16	1.22	75	75	58
	17	1.44	75		
	18	0.92	75		
(3)	19	4.08	76	76	60
	20	1.28	75		
(2)	21	1.91	76	77	61
	22	.73	79		
(1)	22	1.06	79	79	64

$$C_i = \frac{100\,P_a}{(T_a)^2} = \frac{100\,(8.26)}{(68.1)^2} = .174 < 1.0$$

C_i is obviously less than one, therefore channel losses may be included

Channel loss factor = 0.7 (Lew Burton 2/19/75)

STATE Az		PROJECT Buckhorn Mesa WPP - Spook Hill FRS		
BY A.C.	DATE 7-26-76	CHECKED BY	DATE	JOB NO. 2005
SUBJECT Road Ramp Hydrology				SHEET 27 OF

Comparison of two methods

reservior	Robin's short cut	Reservior Balancing	Difference
1	1578.15	1578.40	-.35
2	1578.16	1578.55	-.39
3	1578.20	1578.71	-.51
4	1579.12	1578.87	+.25

Several conditions effect the relative results.

1. There is continual flow between reserviors
2. flow can be in either direction
3. Storage volume v.s. drainage area for set elevations vary
4. a flash flood condition exists.

The short cut method has usable applications. It would seem that it would give conservative results for a two reservior system (one road ramp). If a realistic base flow figure could be added to simulate flow between reserviors, then the method may be useable for a series of reserviors.

The following road elevations will be used

McDowell Road. - 1578.7

McKellips Road - 1578.8

Brown Road - 1579.0

STATE		PROJECT		
Az		Buckhorn Mesa WPP - Spook Hill ERS.		
BY A.C.	DATE 8-2-76	CHECKED BY	DATE	JOB NO. 2005
SUBJECT Freeboard Design - Road Ramps				SHEET 1 OF

The road ramps have been designed. The next step is determining the maximum elevation of the top of the dam. It is hoped that the road ramps will not cause headlosses that will cause overtopping up stream.

Cross sections at Road Ramps (⊥ to dam, not along road) from ℄

Brown Road

Natural Ground offset	Natural Ground Elev.	Road Ramp offset	Road Ramp Elev.
0	1575	0	1591
100	1576	150	1590
210	1578	250	1582
300	1580	290	1580.25
520	1582	440	1580.25
610	1584	520	1582
680	1586	610	1584
770	1588	680	1586
860	1590	770	1588
950	1592	860	1590
		950	1592

McKellips Road

offset	Elev.
0	(1592)
140	1591
240	1589.7
390	1582.3
510	1579.7
670	1579.7
755	1580.8
1000	1589.0
1080	1590.0
1300	1592.0

McDowell Road

offset	Elev.
200	1591.25
300	1589.8
450	1582.6
550	1579.6
670	1579.6
790	1582.8
815	1589.8
915	1592

COMPUTATION SHEET
SCS-ENG-523 Rev. 8-69

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

STATE Az		PROJECT Buckhorn Mesa WPP - Spook Hill F.R.S.		
BY A.C.	DATE 8-2-76	CHECKED BY	DATE	JOB NO. 2005
SUBJECT Freeboard Design - Road Ramps				SHEET 2 OF

INFORMATION FROM TR-20 ROUTING - see map.

Drainage Area #	Total water	Peak discharge	Peak time	Res. discharge
14	129.64 Ac-ft	1590	3.03 hrs	—
(52)	129.47	—	3.09	1495
15	353 Ac ft	4325	3.03	—
(53)	482	—	3.04	5804
(54)	481	—	3.12	5533
16	631	6913	3.14	—
(55)	1113	—	3.13	12,440
(56)	1112	—	3.20	11,866
17	745	7610	3.18	
(57)	1857	—	3.19	19,474
(58)	1857	—	3.26	18,621
(59)				
Output into reservior				
18	477	5125	3.16	—
(60)	1210	—	3.16	8013 Brow Road
19	2142	15,674	3.47	—
(61)	3348	—	3.36	22,272
20	662	6492	3.22	—
(62)	4,011	—	3.30	28,412 McKellips Rd
21	1,002	9124	3.27	—

STATE Az		PROJECT Buckhorn Mesa WPP Spook Hill F.R.S.		
BY A.C.	DATE 8-2-76	CHECKED BY	DATE	JOB NO. 2005
SUBJECT Freeboard Design - Road Ramps				SHEET 3 OF

(63)	5014 c	-	3.29	37,699 McDowell Rd.
22	980	9945	3.18	—
(64)	5994 d	-	3.26	47,315 E.S.

Estimate of discharges

At Brown Road - At peak discharge, 8013 cfs, the total Volume of inflow is 1210 a Ac-ft - reservior capacity is 692 (*) Ac-ft

Ave discharge $\frac{6268 \text{ cfs hrs}}{3.16 \text{ hrs}}$ = 1,984 cfs max ≈ 4000 cfs

difference between 8000 and 4000 cfs figures is storage

At McKellips Road - At peak discharge, 28,412 b-1 cfs, the total Volume of inflow is 4,011 b Ac-ft - reservior capacity is (1670+692) or 2362 Ac-ft (diff = 1649 Ac ft = 19,953 cfs hrs)

Well flow

Inflow - Capacity = 4011 - 2362 = 1649 ac ft

Ave Q = $\frac{19,953 \text{ cfs-hrs}}{3.30 \text{ hrs}}$ = 6,046 cfs max ≈ 12,000 cfs

At McDowell Road - At peak discharge, 37,699 c-1 cfs, the total Volume of inflow is 5014 c Ac-ft - reservior capacity = 1283 + 1670 + 692 or 3,645 Ac-ft (diff = 1369 Ac-ft = 16,565 cfs-hrs)

Ave Q = $\frac{16,565 \text{ cfs-hr}}{3.29 \text{ hrs}}$ = 5,035 cfs max ≈ 11,000 cfs

At Emergency Spillway - peak discharge, 47,315 d-1, total vol. = 5994

res: capacity = 4063 diff = 1931 Ac-ft = 23,365 cfs-hrs

$\frac{23,365}{3.26}$ = 7,167 max ≈ 15,000 cfs

STATE Arizona		PROJECT Buckhorn Mesa WPP - Spook Hill FRS		
BY A.C.	DATE 8-2-76	CHECKED BY	DATE	JOB NO. 2005
SUBJECT Freeboard Design - Road Ramps				SHEET 4 OF

The estimates on the previous page were gross estimates. The timing of the inflows will greatly effect outflows. Another method for estimating the discharges across the roads is to proportion the discharges across the road and through the spillway to the maximum discharges of the reaches.

Max. Q	→ propor. Q	est. Q	→ prop. Q	ΔS (cfs hrs)	→ prop. Q
47,315	18,338	15,000	18,338	23,365	18,338
37,699	14,611	11,000	13,448	16,565	13,001
28,412	11,012	12,000	14,670	19,953	15,660
8,013	3,105	4,000	4,890	6,268	4,919

Max. Q's are unreasonable, if this Q were to pass McDowell Road, the w.s. downstream would soon be much higher than the upstream w.s. and the routed elevation at the E.S. It would be feasible for the discharge across McDowell Road to be greater that the E.S. discharge, but this would be a very small difference at these elevation (near top of dam. It would be reasonable to use the following discharge

Sta 293+00 (E.S.) to Sta 175+00 - 18,338 cfs

Sta 175+00 to Sta 220+00 - 17,000 cfs McDowell Sta 273+00

Sta 220+00 to Sta 140+00 - 15,000 cfs McKellips Sta 210+00 ±

Sta 140+00 to Sta 110+00 - 5,000 cfs Brown Road Sta 131+00 ±

STATE Arizona		PROJECT Buckhorn Mesa WPP - Spook Hill FRS		
BY A.C.	DATE 8-2-76	CHECKED BY	DATE	JOB NO. 2005
SUBJECT Freeboard Design - Road Ramps				SHEET 5 OF

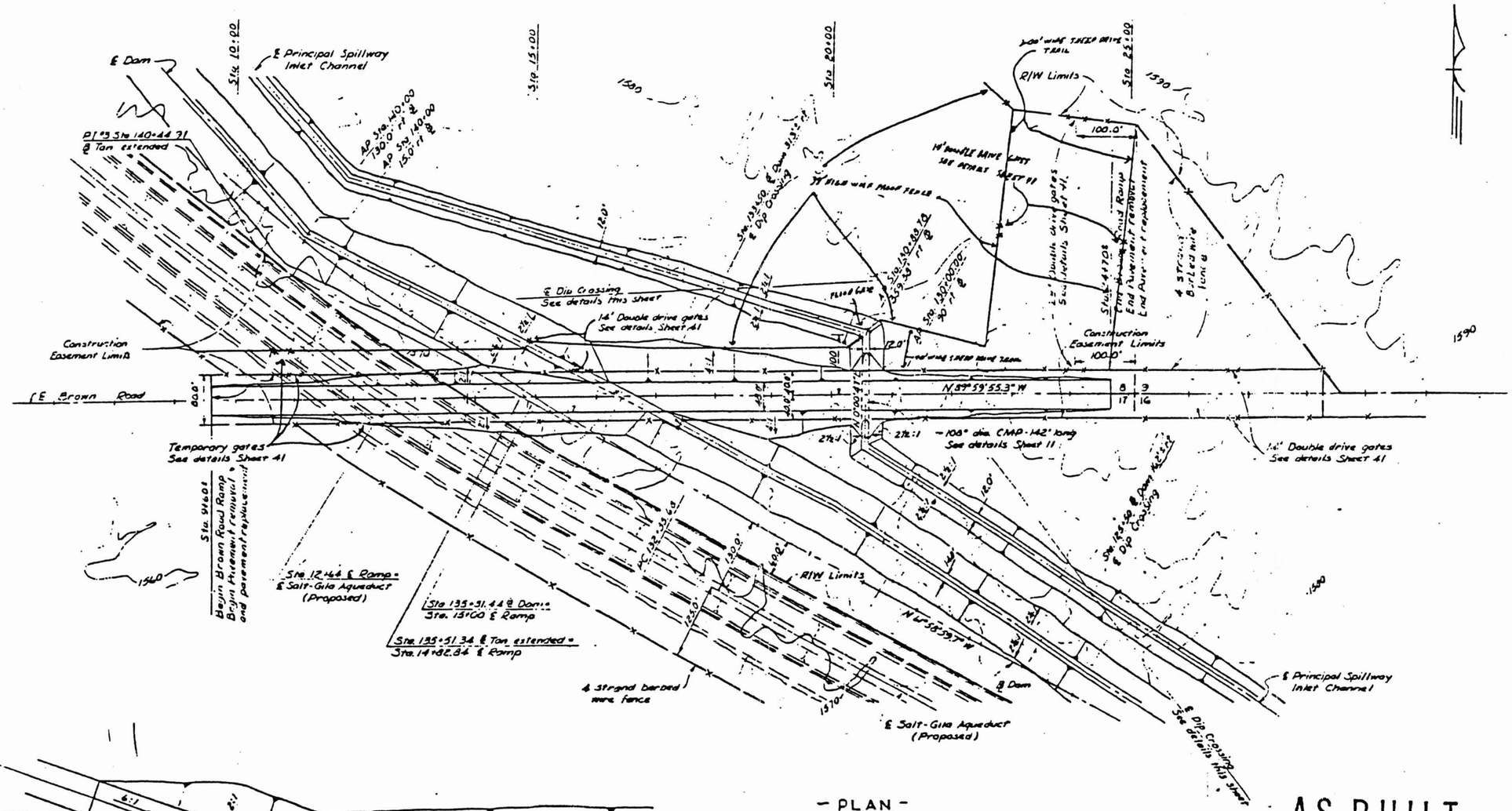
Backwater curves were run from Sta 293+00 to 115+00 carrying 18,338 cfs all the way. Both McDowell and McKellips Road Ramps were included, Brown Road was not. The road ramp designs have been changed. The area of the openings (at the ramps) are slightly greater and have been lowered several feet. The water surface elevation at 115+00 was 1591.023. One can easily see that with the modified discharges and the new road ramp designs that the addition of the ramp at Brown Road should not cause overtopping of the dam.

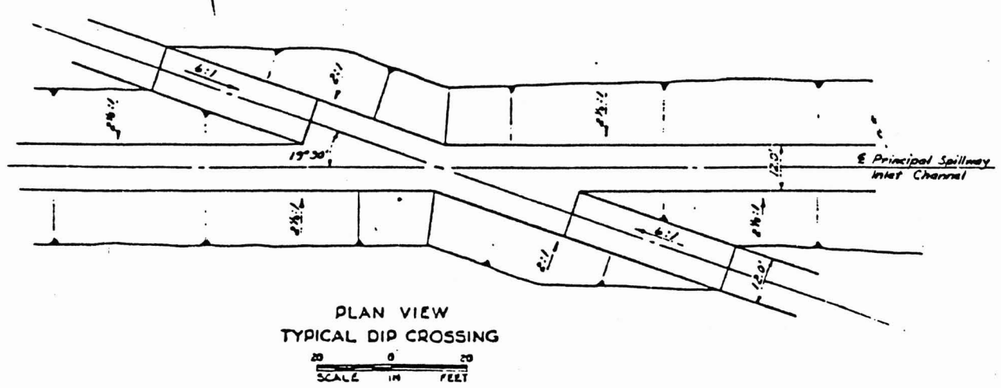
It should be noted that there will be an overflow section on the Signal Butte Floodway so that only the 100 yr discharge will reach the dam. This is why the inflow into the area below Brown Road is so much lower than the other reservoirs.

It was felt by both Robin and I that his approach would not give reasonable results in this case. (while it would be ok on the Buckeye structure).

APPENDIX B

SCS AS-BUILT PLANS





PLAN VIEW
TYPICAL DIP CROSSING

AS BUILT

Completed 4-10-80

REVISIONS
10-77 Change Brown Road Ramp Limits Add 2 - 28' Double Drive Gates

PLAN - BROWN ROAD RAMP

SPOOK HILL F.R.S.
BUCKHORN-MESA W.P.P.
MARICOPA & PINAL COUNTIES, ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed	AC	8-76	
Drawn			
Traced	ES	9-76	
Checked	OJM	12-76	7-E-23797

FORM SCS-1216

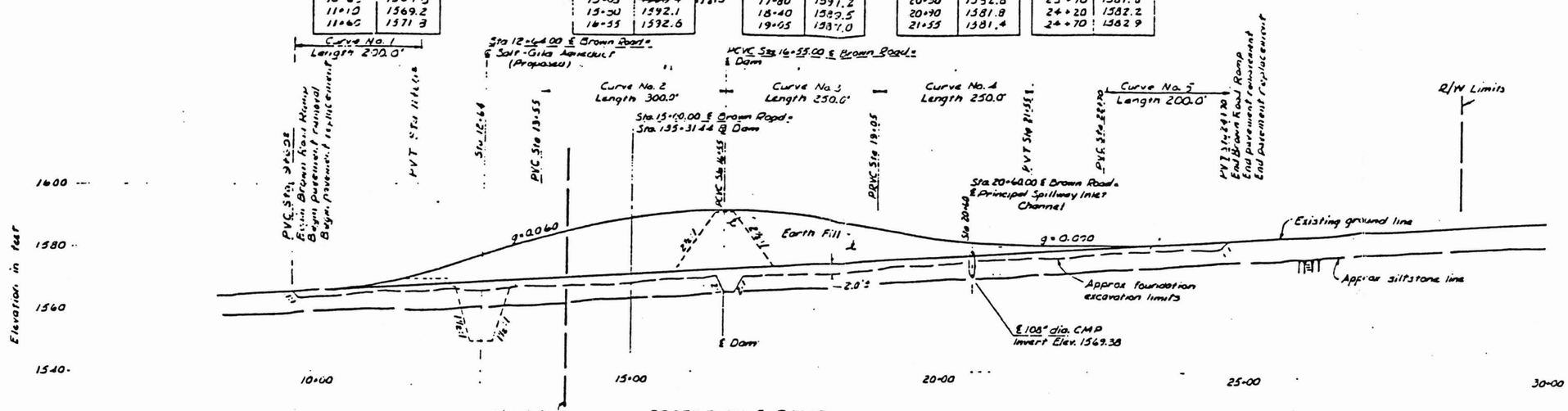
CURVE No 1 L=200.0'	
Station	Elevation
9+40	1564.7
10+10	1565.6
10+65	1567.0
11+10	1569.2
11+65	1571.3

CURVE No 2 L=300.0'	
Station	Elevation
13+55	1583.6
14+30	1587.6
15+05	[illegible]
15+30	1592.1
16+55	1592.6

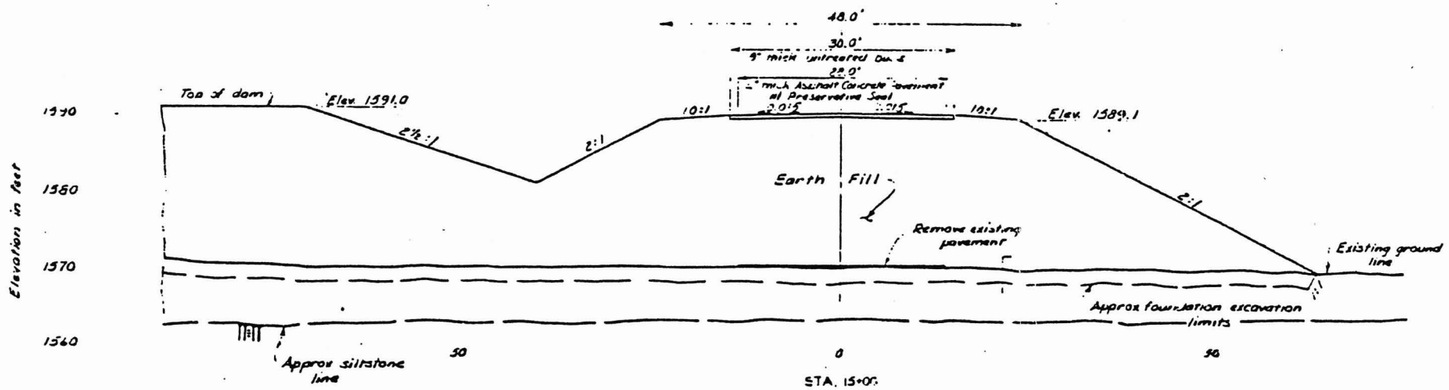
CURVE No 3 L=250.0'	
Station	Elevation
16+55	1592.6
17+20	1592.2
17+80	1591.2
18+40	1589.5
19+05	1587.0

CURVE No 4 L=250.0'	
Station	Elevation
19+05	1587.0
19+70	1584.5
20+30	1582.8
20+90	1581.8
21+55	1581.4

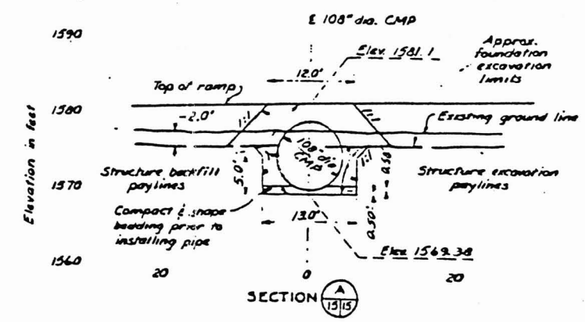
CURVE No 5 L=200.0'	
Station	Elevation
22+70	1581.4
23+20	1581.5
23+70	1581.8
24+20	1582.2
24+70	1582.9



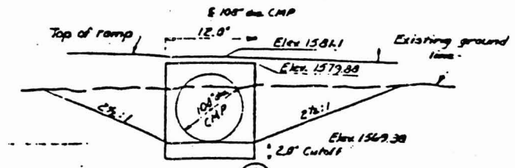
PROFILE ON ℄ RAMP



STA. 15+00
CROSS SECTION

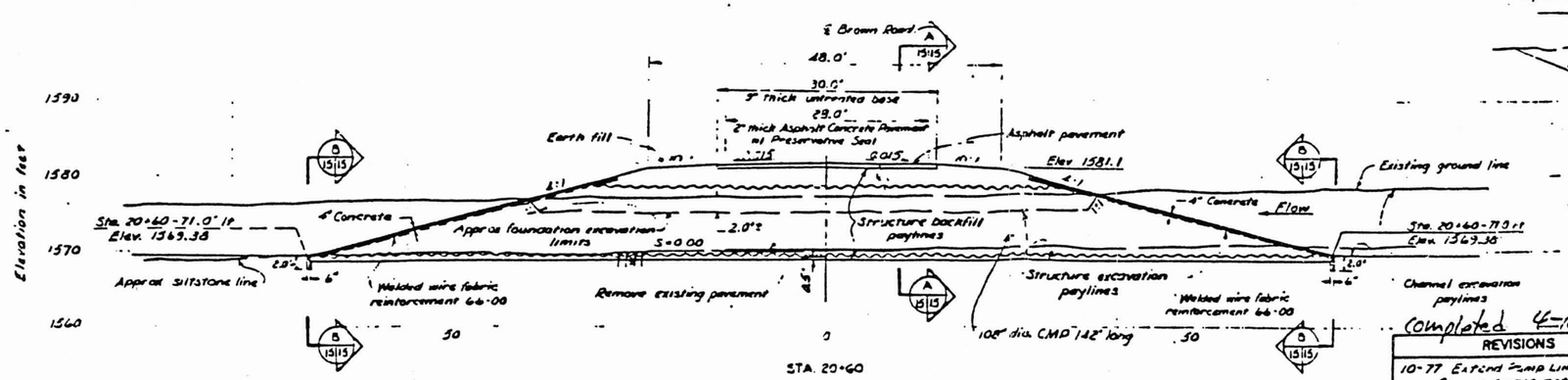


SECTION A 15|15



SECTION B 2-5
CONCRETE HEADWALL

AS BUILT



STA. 20+60
CROSS SECTION

Completed 4-10-80

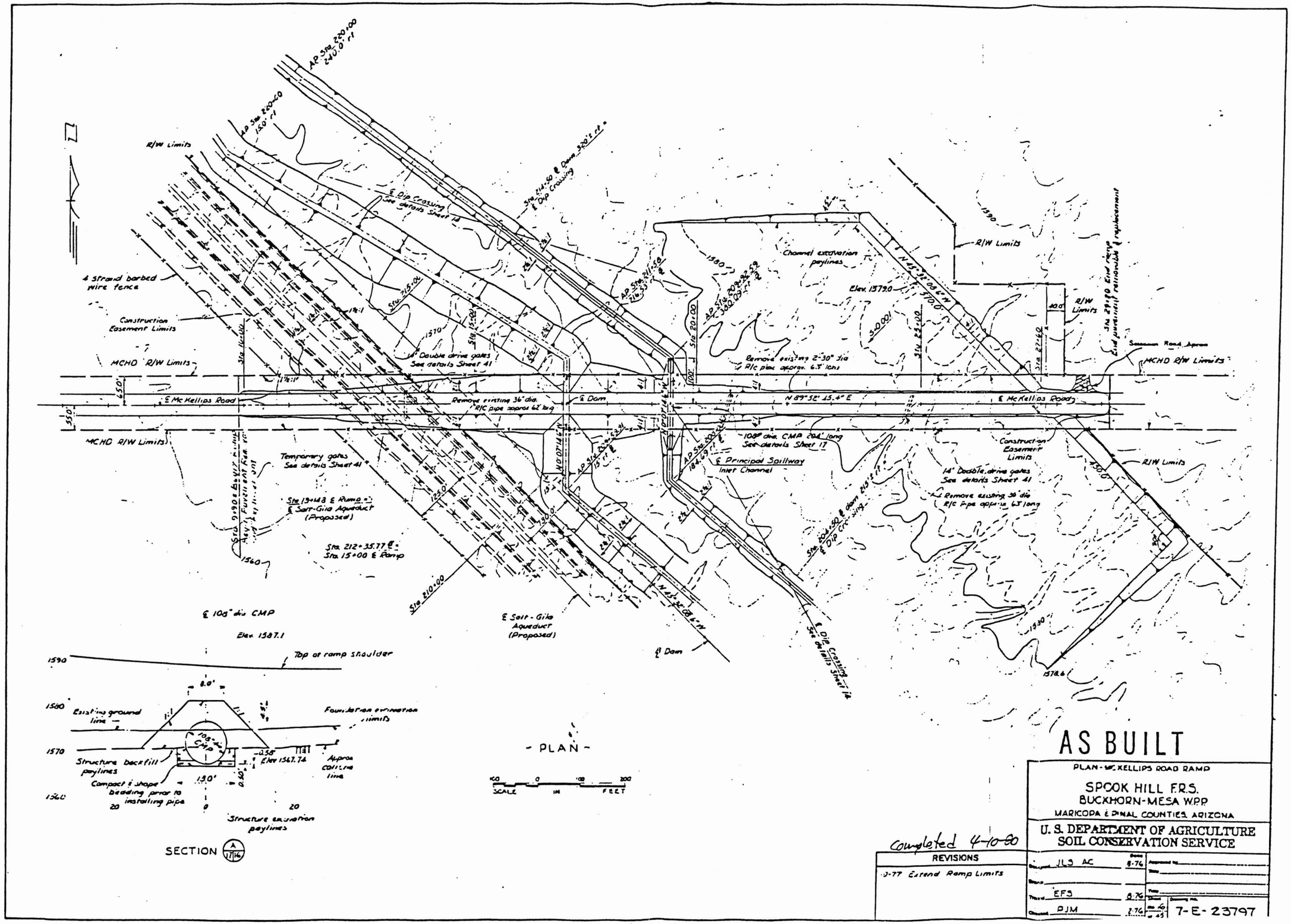
REVISIONS
10-77 Extend Ramp Limits Change curve data

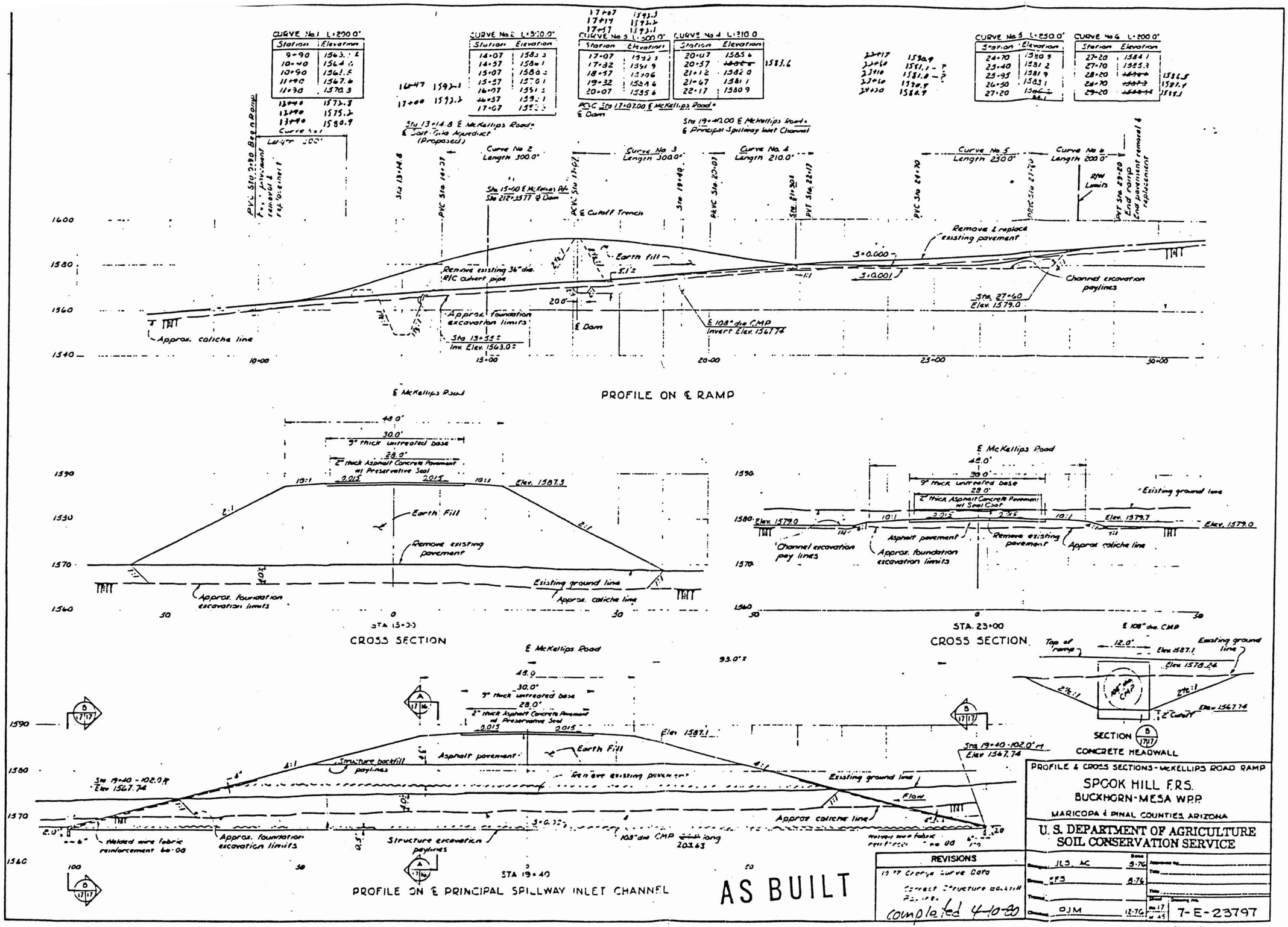
PROFILE & CROSS SECTIONS - BROWN ROAD RAMP
SPOOK HILL F.R.S.
BUCKHORN-MESA W.R.P.
MARICOPA & PINAL COUNTIES, ARIZONA

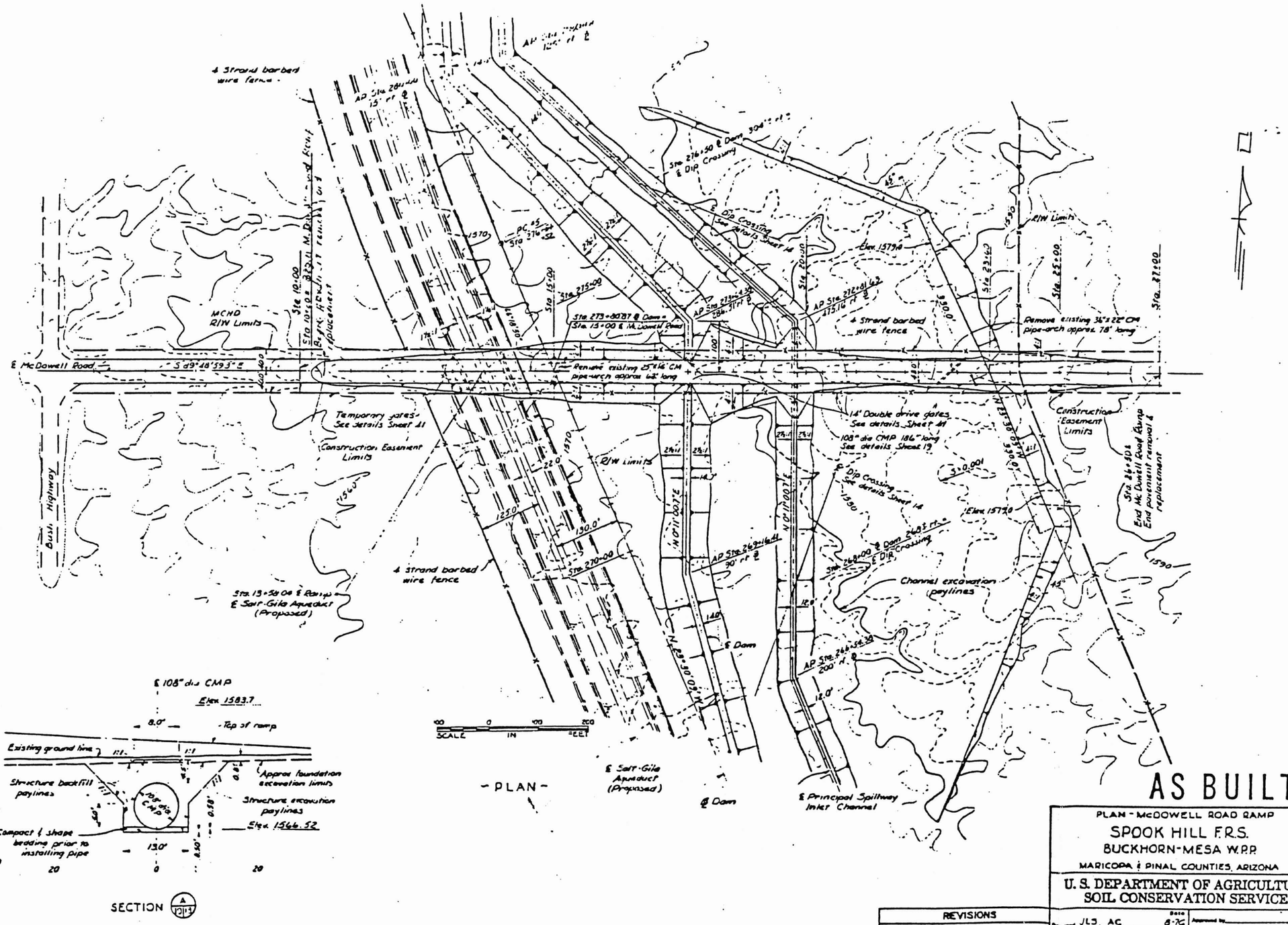
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Designed AC PJM	8-76	Approved by	
Drawn		Date	
Traced ES	8-76	Date	
Checked PJM	12-76	Sheet No. 15 of 45	Drawing No. 7-E-23797

FORM SCS-1136


AS BUILT
PLAN - McKELLIPS ROAD RAMP
SPOOK HILL F.R.S.
BUCKHORN-MESA W.P.P.
MARICOPA & PINAL COUNTIES, ARIZONA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Completed 4-10-80
REVISIONS
3-77 Extend Ramp Limits
JLS AC 8-76
EFS 8-76
PJM 2-76
7-E-23797
- PLAN -
SCALE IN FEET
SECTION A 17/16
R/W Limits
4 strand barbed wire fence
Construction Easement Limits
MCHD R/W Limits
℄ McKellips Road
℄ Dip Crossing See details Sheet 12
14' Double drive gates See details Sheet 41
Remove existing 36" dia. R/C pipe approx 62' long
℄ Dam
Temporary gates See details Sheet 41
Sta 13+48 ℄ Ramp = ℄ Salt-Gila Aqueduct (Proposed)
Sta 212+35.77 ℄ = Sta 15+00 ℄ Ramp
℄ 108" dia CMP
Elev. 1587.1
℄ Salt-Gila Aqueduct (Proposed)
Top of ramp shoulder
Existing ground line
Foundation excavation limits
Structure backfill paylines
Compact & shape bedding prior to installing pipe
Elev 1567.74
Approx centerline
Structure excavation paylines
Channel excavation paylines
Elev. 1579.0
Remove existing 2-30" dia R/C pipe approx. 63' long
N 89°52' 15.4" E
108" dia. CMP 204' long See details Sheet 17
℄ Principal Spillway Inlet Channel
Construction Easement Limits
14' Double drive gates See details Sheet 41
Remove existing 36" dia R/C pipe approx 63' long
Sta 200+50 ℄ Dam 215'
℄ Dip Crossing See details Sheet 14
Sta 210+00
Sta 214+00 ℄ Dam 320'
Sta 215+00
Sta 20+00
Sta 22+00
Sta 22+60
Sta 11+00
Sta 9+90 ℄ Equip. Fuel Facility
Sta 209+26.59 ℄ 300.03'
Sta 211+58 ℄ 216.33'
Sta 200+00 240.0' rt
Sta 200+00 150' rt
Sta 220+00 240.0' rt
Sta 22+60 End new R/W
End pavement replacement
Sacaton Road Approx
1590
1580
1570
1560
1578.6


PROFILE ON ℄ RAMP
CROSS SECTION
STA 15+00
STA. 23+00
PROFILE ON ℄ PRINCIPAL SPILLWAY INLET CHANNEL
STA 19+40
SECTION
CONCRETE HEADWALL
AS BUILT
completed 4-10-80
PROFILE & CROSS SECTIONS - McKELLIPS ROAD RAMP
SPOOK HILL F.R.S.
BUCKHORN-MESA W.P.P.
MARICOPA & PINAL COUNTIES, ARIZONA
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
REVISIONS
7-E-23797



AS BUILT

PLAN - McDOWELL ROAD RAMP
SPOOK HILL F.R.S.
BUCKHORN-MESA W.P.P.
MARICOPA & PINAL COUNTIES, ARIZONA

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

REVISIONS			
10-77 Extend Ramp limits	Designed JLS, AC	Date 8-76	Approved by
completed 4-10-80	Drawn		Title
	Traced EFS	8-76	Title
	Checked PJM	12-76	Sheet No. 18 of 45 — Drawing No. 7-E-23797

FORM SCS-1126

CURVE No.1 L=140.0'

Station	Elevation
10+20	1561.3±
10+70	1562.5
11+20	1564.3
11+70	1566.5
12+20	1569.3
13+00	1570.1
14+00	1580.1

CURVE No.2 L=250.0'

Station	Elevation
14+80	1584.4
15+17	1586.2
15+67	1589.2
16+05	1590.5
16+17	1590.8
16+67	1591.9
17+17	1592.3
17+30	1592.4
17+63	1592.4
17+67	1592.4
17+76	1592.4
17+83	1592.4
17+90	1592.4
17+92.8	1591.3

CURVE No.3 L=210.0'

Station	Elevation
17+30	1592.4
17+65	1592.0
18+35	1590.9
18+85	1589.2
19+40	1586.6

CURVE No.4 L=230.0'

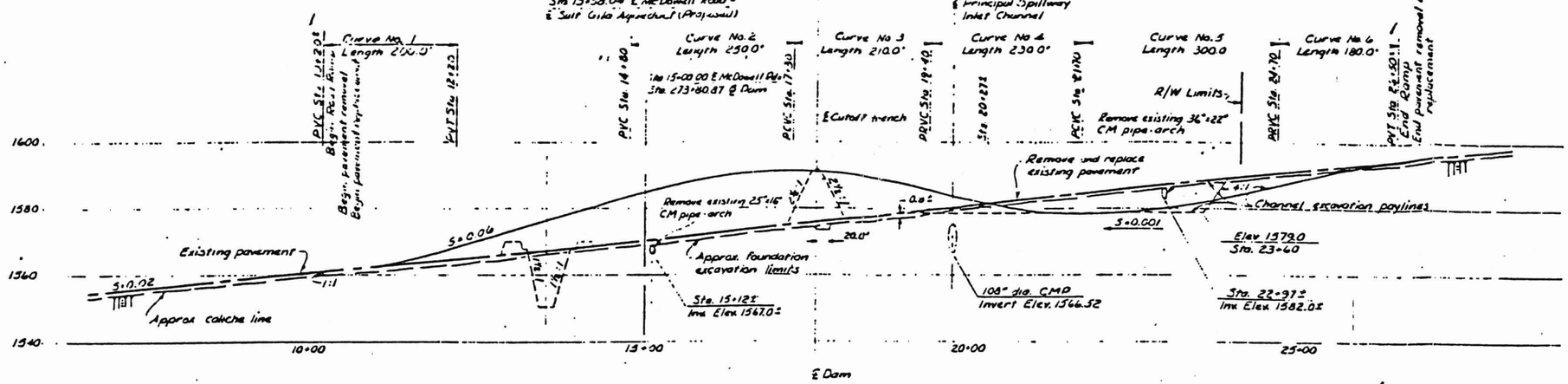
Station	Elevation
19+40	1586.6
20+00	1583.7
20+55	1581.9
21+10	1580.7
21+70	1580.3

CURVE No.5 L=300.0'

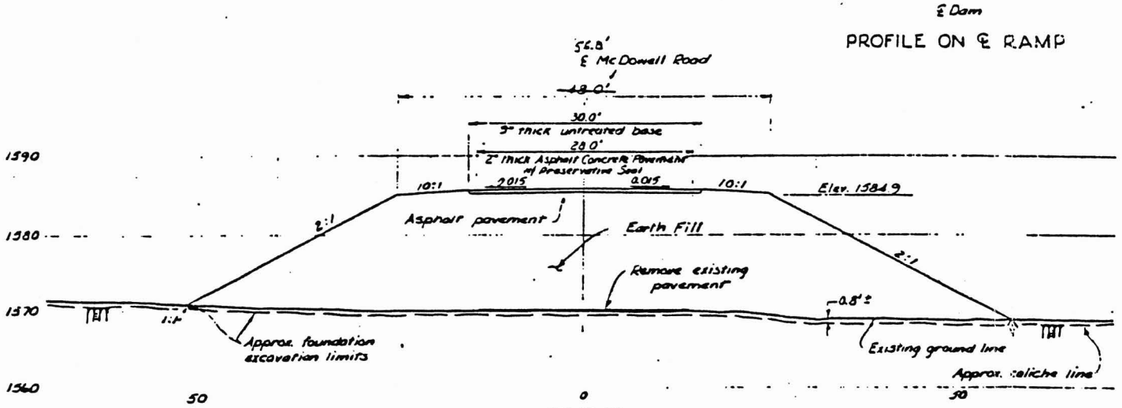
Station	Elevation
21+70	1580.3
22+20	1580.5
22+70	1580.9
23+20	1581.7
23+70	1582.9
24+20	1584.2
24+70	1586.0

CURVE No.6 L=180.0'

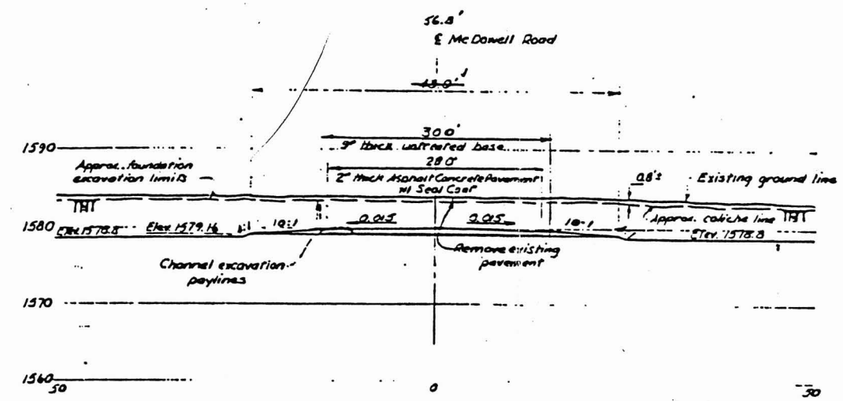
Station	Elevation
24+70	1586.0
25+15	1587.6
25+60	1589.0
26+05	1590.2
26+50	1591.3±



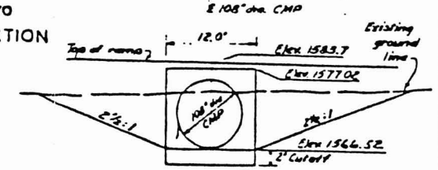
PROFILE ON ℄ RAMP



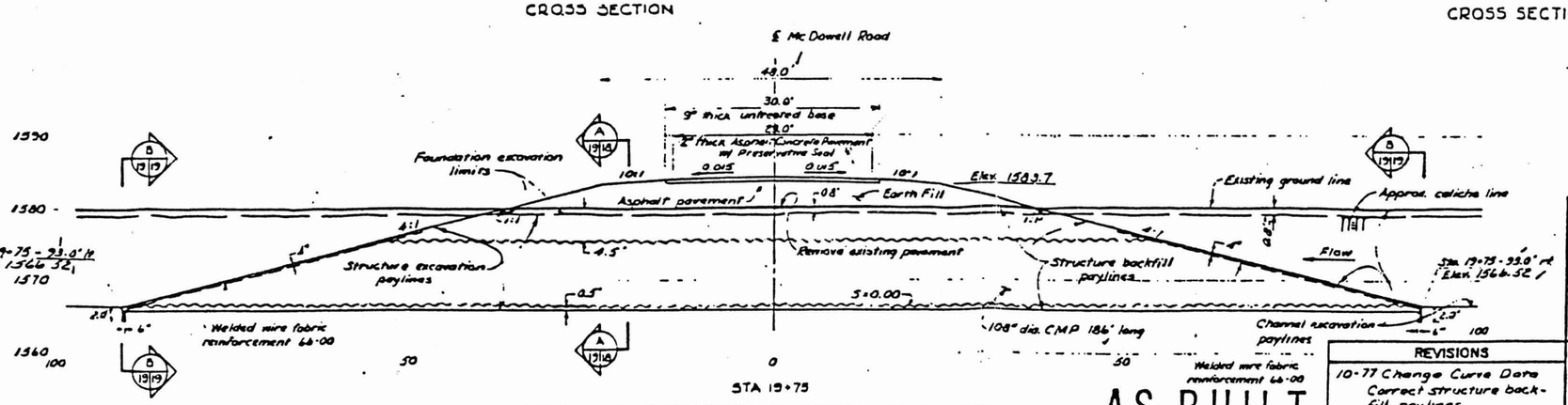
STA. 13+00
CROSS SECTION



STA. 21+70
CROSS SECTION



SECTION B/19/19
CONCRETE HEADWALL



STA 19+75
PROFILE ON ℄ PRINCIPAL SPILLWAY INLET CHANNEL

AS BUILT

REVISIONS
10-77 Change Curve Data Correct structure back-fill paylines
Completed 4-10-80

PROFILE & CROSS SECTIONS - McDOWELL ROAD RAMP
SPOOK HILL F.R.S.
BUCKHORN-MESA W.P.P.
MARICOPA & PINAL COUNTIES, ARIZONA

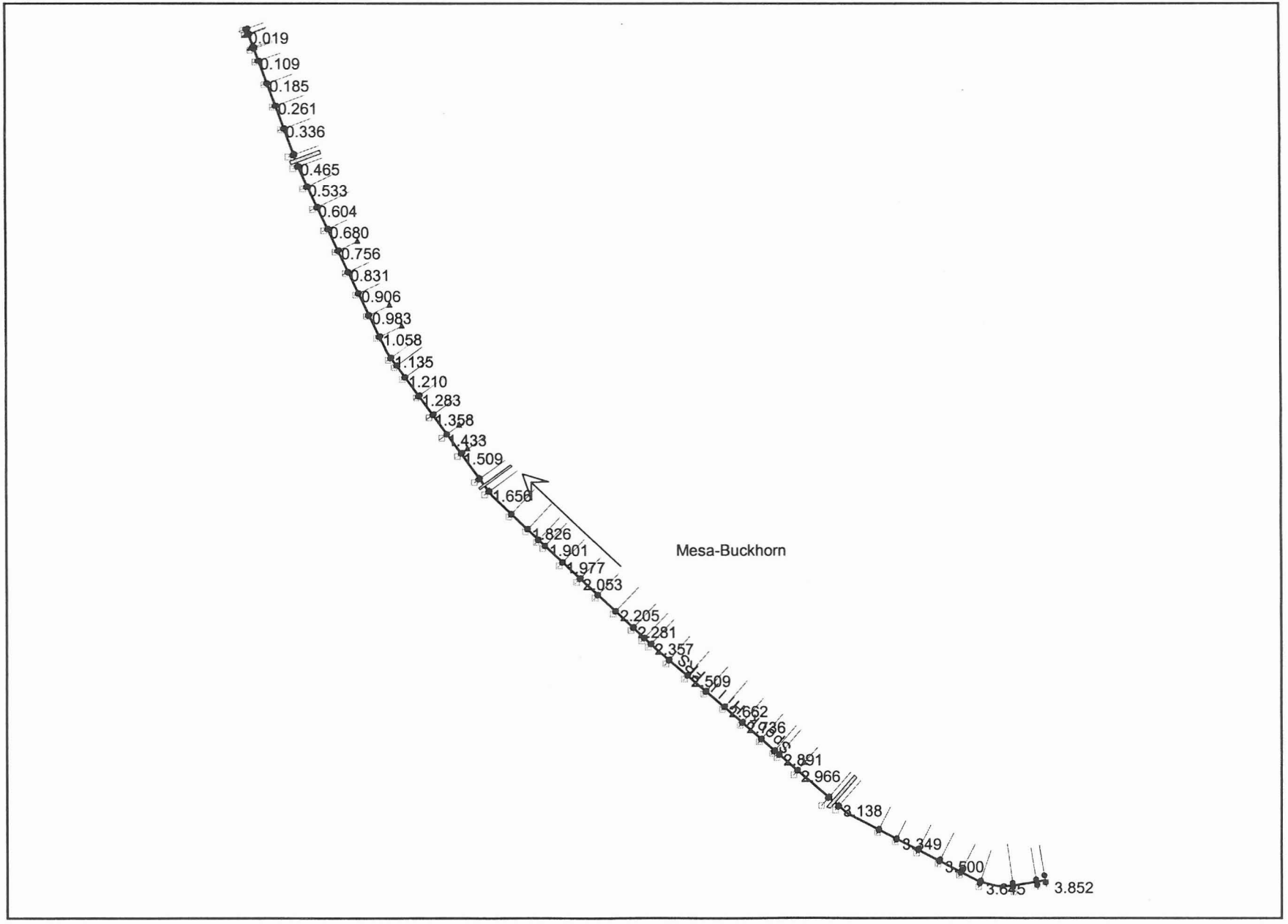
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

		Date
Designed	JLS AC	8-76
Drawn		
Traced	EFS	8-76
Checked	DJM	8-76

Approved by: Title:
Title:
Scale: Sheet No. 19 of 45
Drawing No. 7-E-23797

APPENDIX C

HEC-RAS OUTPUT

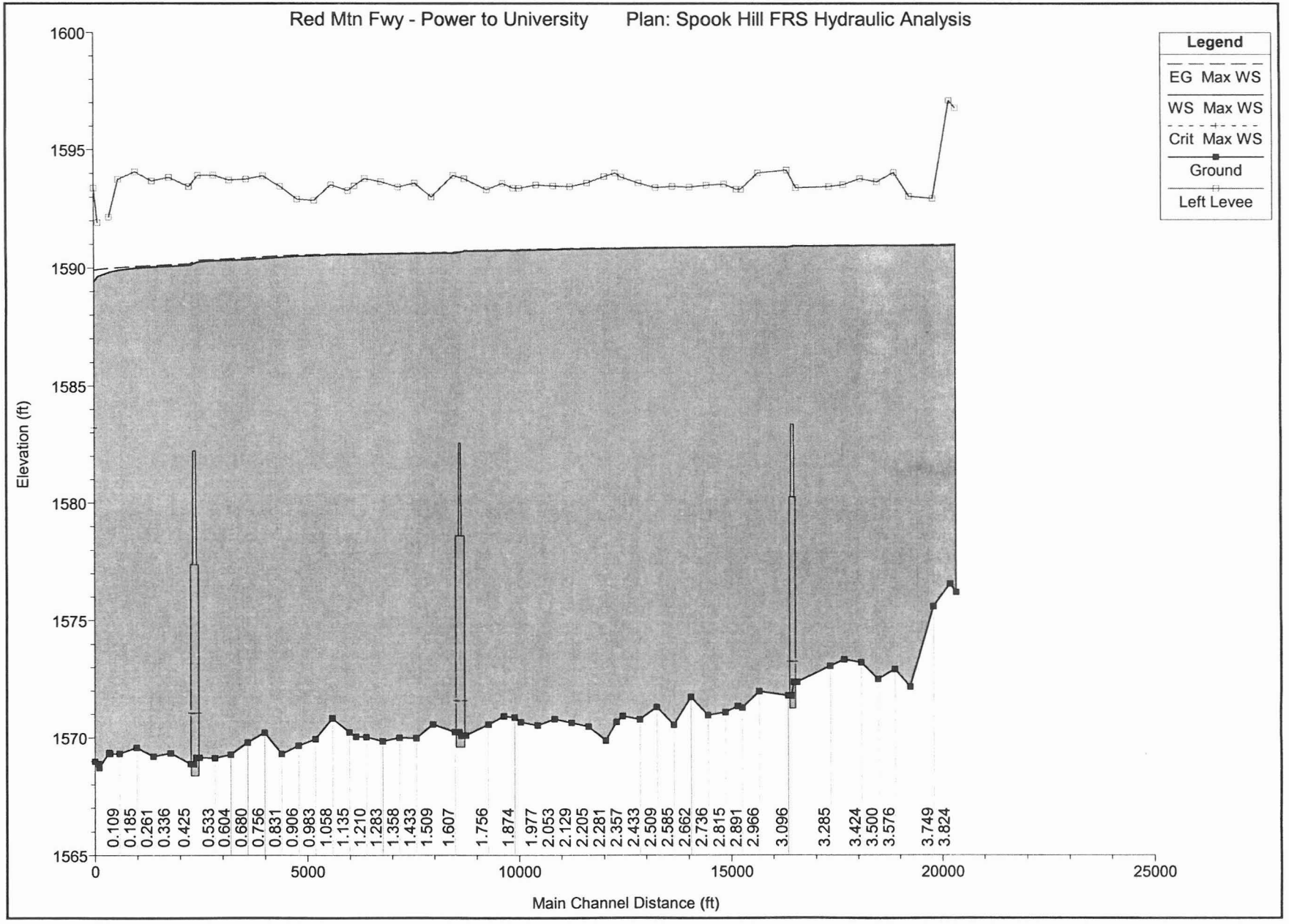

0.019
0.109
0.185
0.261
0.336
0.465
0.533
0.604
0.680
0.756
0.831
0.906
0.983
1.058
1.135
1.210
1.283
1.358
1.433
1.509
1.658
1.826
1.901
1.977
2.053
2.205
2.281
2.357
2.509
2.662
2.736
2.891
2.966
3.138
3.349
3.500
3.645
3.852
Mesa-Buckhorn

HEC-RAS Plan: PMF River: Spook Hill FRS Reach: Mesa-Buckhorn Profile: Max WS

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Mesa-Buckhorn	0.000	11529.82	1568.99	1589.43	1583.22	1589.91	0.000657	6.34	2522.34	412.97	0.29
Mesa-Buckhorn	0.016	11514.69	1568.89	1589.64		1589.92	0.000403	5.24	3217.26	497.89	0.23
Mesa-Buckhorn	0.019	11510.42	1568.71	1589.65		1589.93	0.000371	5.04	3209.99	641.19	0.22
Mesa-Buckhorn	0.063	11472.63	1569.37	1589.80		1589.99	0.000268	4.34	3880.46	696.20	0.19
Mesa-Buckhorn	0.068	11468.99	1569.32	1589.81		1589.98	0.000248	4.22	4068.32	560.70	0.18
Mesa-Buckhorn	0.109	11426.76	1569.32	1589.90		1590.02	0.000180	3.72	4904.49	688.67	0.16
Mesa-Buckhorn	0.185	11355.41	1569.58	1590.00		1590.06	0.000113	2.96	6025.63	759.09	0.12
Mesa-Buckhorn	0.261	11296.11	1569.20	1590.05		1590.10	0.000081	2.58	6757.46	796.26	0.11
Mesa-Buckhorn	0.336	11232.50	1569.34	1590.08		1590.14	0.000092	2.70	6542.17	819.53	0.11
Mesa-Buckhorn	0.425	11153.40	1568.88	1590.12		1590.17	0.000074	2.44	6285.75	632.19	0.10
Mesa-Buckhorn	0.445	Culvert									
Mesa-Buckhorn	0.465	11152.64	1569.15	1590.26		1590.32	0.000117	2.76	5743.57	705.60	0.12
Mesa-Buckhorn	0.533	11109.54	1569.13	1590.31		1590.35	0.000061	2.18	7366.27	812.32	0.09
Mesa-Buckhorn	0.604	11068.42	1569.28	1590.33		1590.38	0.000082	2.49	6702.80	838.17	0.11
Mesa-Buckhorn	0.680	11008.97	1569.80	1590.35		1590.43	0.000113	2.93	5721.68	717.03	0.12
Mesa-Buckhorn	0.756	10975.01	1570.22	1590.40		1590.47	0.000125	3.02	5776.16	805.82	0.13
Mesa-Buckhorn	0.831	10927.52	1569.31	1590.46		1590.51	0.000092	2.77	6324.18	787.08	0.11
Mesa-Buckhorn	0.906	10885.75	1569.66	1590.50		1590.54	0.000058	2.23	7639.94	867.93	0.09
Mesa-Buckhorn	0.983	10838.26	1569.94	1590.53		1590.56	0.000056	2.10	7588.85	860.03	0.09
Mesa-Buckhorn	1.058	10793.40	1570.83	1590.55		1590.58	0.000040	1.79	8659.73	911.56	0.08
Mesa-Buckhorn	1.135	10748.93	1570.23	1590.57		1590.59	0.000033	1.71	9478.81	976.45	0.07
Mesa-Buckhorn	1.164	10720.70	1570.04	1590.58		1590.60	0.000032	1.72	9622.73	1002.01	0.07
Mesa-Buckhorn	1.210	10700.02	1570.03	1590.58		1590.61	0.000033	1.75	9290.59	965.35	0.07
Mesa-Buckhorn	1.283	10670.82	1569.85	1590.60		1590.62	0.000025	1.53	10432.66	1065.33	0.06
Mesa-Buckhorn	1.358	10625.20	1570.00	1590.61		1590.63	0.000017	1.27	11978.22	1110.35	0.05
Mesa-Buckhorn	1.433	10589.12	1569.98	1590.62		1590.63	0.000016	1.20	12142.74	1064.76	0.05
Mesa-Buckhorn	1.509	10546.37	1570.57	1590.62		1590.64	0.000027	1.49	9701.23	933.64	0.06
Mesa-Buckhorn	1.607	10354.34	1570.24	1590.63		1590.66	0.000042	1.83	8486.41	992.79	0.08
Mesa-Buckhorn	1.632	Culvert									
Mesa-Buckhorn	1.656	10468.26	1570.09	1590.72		1590.73	0.000022	1.35	11033.44	1102.37	0.06
Mesa-Buckhorn	1.756	10240.70	1570.56	1590.73		1590.75	0.000026	1.50	9856.48	991.24	0.06
Mesa-Buckhorn	1.826	10048.46	1570.90	1590.74		1590.76	0.000026	1.50	9812.12	986.86	0.06
Mesa-Buckhorn	1.874	9907.46	1570.85	1590.74		1590.76	0.000034	1.69	8819.11	929.13	0.07
Mesa-Buckhorn	1.901	9708.55	1570.66	1590.74		1590.77	0.000035	1.72	8311.67	866.58	0.07
Mesa-Buckhorn	1.977	9625.82	1570.52	1590.76		1590.78	0.000038	1.76	8253.40	934.56	0.07
Mesa-Buckhorn	2.053	9349.87	1570.79	1590.78		1590.80	0.000034	1.64	8221.42	893.20	0.07
Mesa-Buckhorn	2.129	9285.05	1570.63	1590.79		1590.81	0.000027	1.51	8947.87	891.89	0.06
Mesa-Buckhorn	2.205	9021.70	1570.47	1590.80		1590.82	0.000028	1.53	8805.69	915.30	0.06

HEC-RAS Plan: PMF River: Spook Hill FRS Reach: Mesa-Buckhorn Profile: Max WS (Continued)

Reach	River Sta	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
		(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Mesa-Buckhorn	2.281	8833.81	1569.87	1590.82		1590.83	0.000018	1.27	10117.31	974.02	0.05
Mesa-Buckhorn	2.328	8721.38	1570.67	1590.82		1590.84	0.000023	1.40	9236.99	951.47	0.06
Mesa-Buckhorn	2.357	8508.05	1570.91	1590.83		1590.84	0.000021	1.34	9342.23	961.29	0.06
Mesa-Buckhorn	2.433	7921.13	1570.78	1590.84		1590.85	0.000020	1.26	8949.26	939.54	0.05
Mesa-Buckhorn	2.509	7304.27	1571.29	1590.85		1590.86	0.000014	1.09	9483.01	927.37	0.05
Mesa-Buckhorn	2.585	6741.13	1570.54	1590.85		1590.86	0.000012	1.02	9743.34	955.65	0.04
Mesa-Buckhorn	2.662	6180.88	1571.72	1590.86		1590.87	0.000010	0.90	9821.22	993.10	0.04
Mesa-Buckhorn	2.736	5616.90	1570.94	1590.87		1590.87	0.000009	0.89	9470.31	976.19	0.04
Mesa-Buckhorn	2.815	5000.76	1571.07	1590.87		1590.88	0.000006	0.71	10431.71	1028.62	0.03
Mesa-Buckhorn	2.871	4576.78	1571.33	1590.88		1590.88	0.000006	0.70	9833.97	1070.50	0.03
Mesa-Buckhorn	2.891	4430.66	1571.26	1590.88		1590.88	0.000006	0.72	9394.86	1055.25	0.03
Mesa-Buckhorn	2.966	3853.32	1571.96	1590.88		1590.88	0.000007	0.72	8045.34	945.71	0.03
Mesa-Buckhorn	3.096	2798.31	1571.78	1590.89		1590.89	0.000005	0.55	6771.03	872.83	0.03
Mesa-Buckhorn	3.117	Culvert									
Mesa-Buckhorn	3.138	2866.55	1572.36	1590.92		1590.93	0.000007	0.67	6446.81	872.49	0.03
Mesa-Buckhorn	3.285	2881.41	1573.04	1590.93		1590.94	0.000015	1.00	4615.98	688.92	0.04
Mesa-Buckhorn	3.349	2892.39	1573.32	1590.93		1590.94	0.000008	0.76	5446.49	628.33	0.03
Mesa-Buckhorn	3.424	2877.16	1573.19	1590.94		1590.94	0.000006	0.63	6645.40	787.49	0.03
Mesa-Buckhorn	3.500	2855.13	1572.48	1590.94		1590.94	0.000003	0.51	8047.03	849.84	0.02
Mesa-Buckhorn	3.576	2860.81	1572.90	1590.94		1590.95	0.000003	0.52	7626.81	880.37	0.02
Mesa-Buckhorn	3.645	2870.72	1572.16	1590.94		1590.95	0.000005	0.68	6251.03	961.78	0.03
Mesa-Buckhorn	3.749	2868.73	1575.57	1590.94		1590.96	0.000027	1.20	2946.98	460.00	0.06
Mesa-Buckhorn	3.824	2871.32	1576.54	1590.94		1590.98	0.000054	1.54	1859.97	164.05	0.08
Mesa-Buckhorn	3.851	2871.97	1576.18	1590.96		1590.98	0.000028	1.16	2481.46	208.62	0.06
Mesa-Buckhorn	3.852	2872.00	1576.18	1590.96		1590.98	0.000028	1.16	2481.46	208.62	0.06


Red Mtn Fwy - Power to University
Plan: Spook Hill FRS Hydraulic Analysis
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Left Levee
Elevation (ft)
1600
1595
1590
1585
1580
1575
1570
1565
0
5000
10000
15000
20000
25000
Main Channel Distance (ft)
0.109
0.185
0.261
0.336
0.425
0.533
0.604
0.680
0.756
0.831
0.906
0.983
1.058
1.135
1.210
1.283
1.358
1.433
1.509
1.607
1.756
1.874
1.977
2.053
2.129
2.205
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2.433
2.509
2.585
2.662
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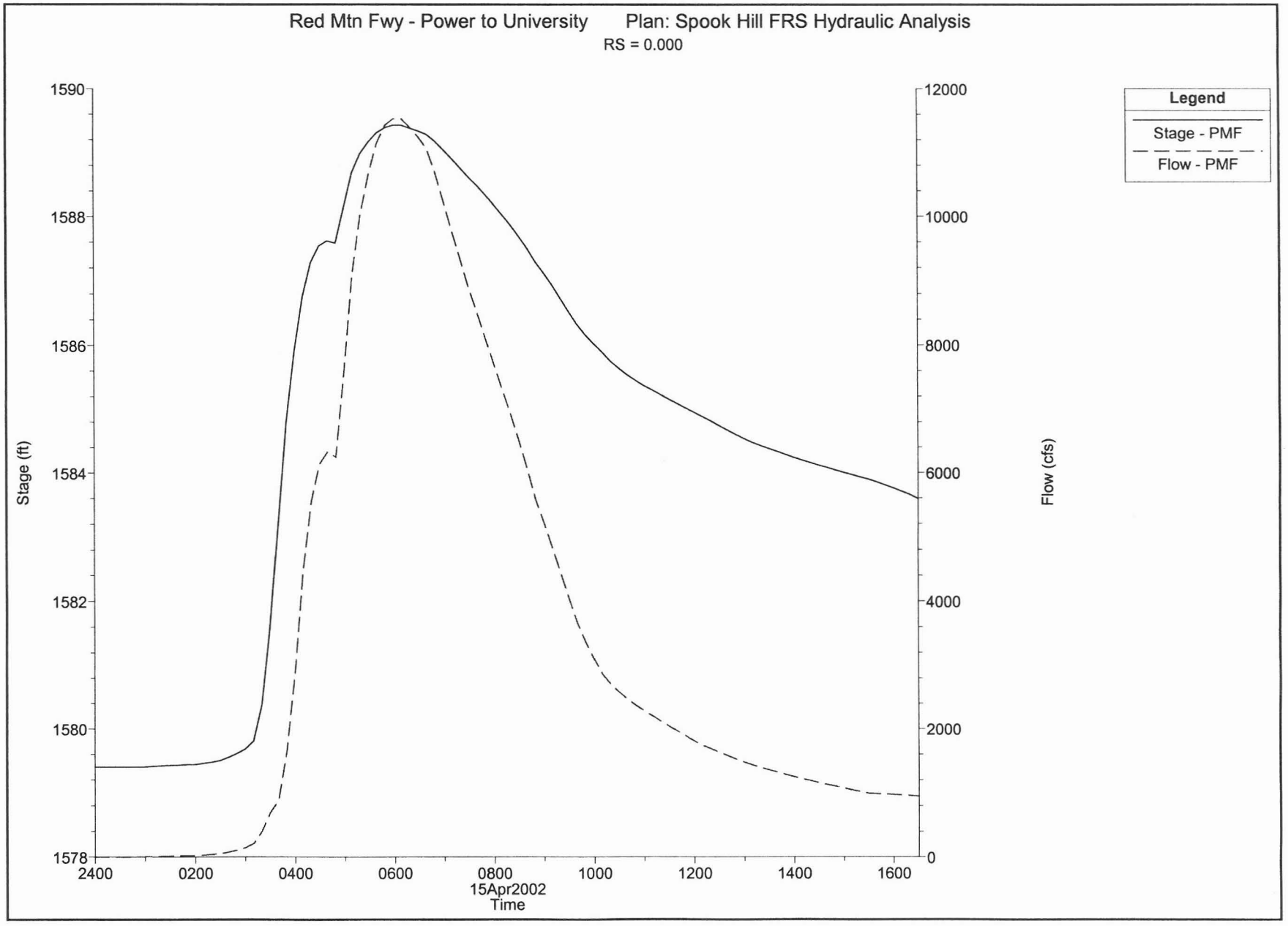
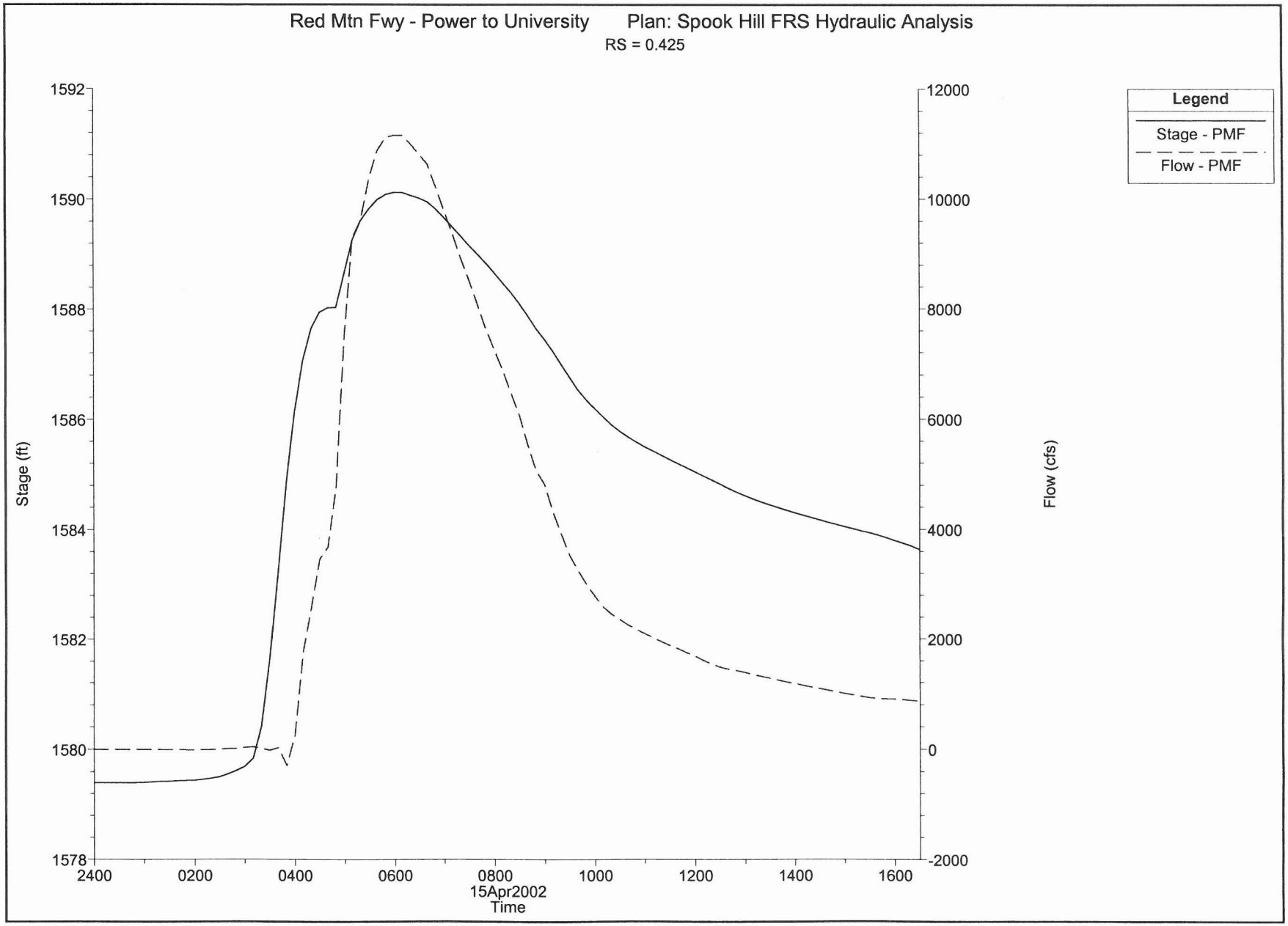
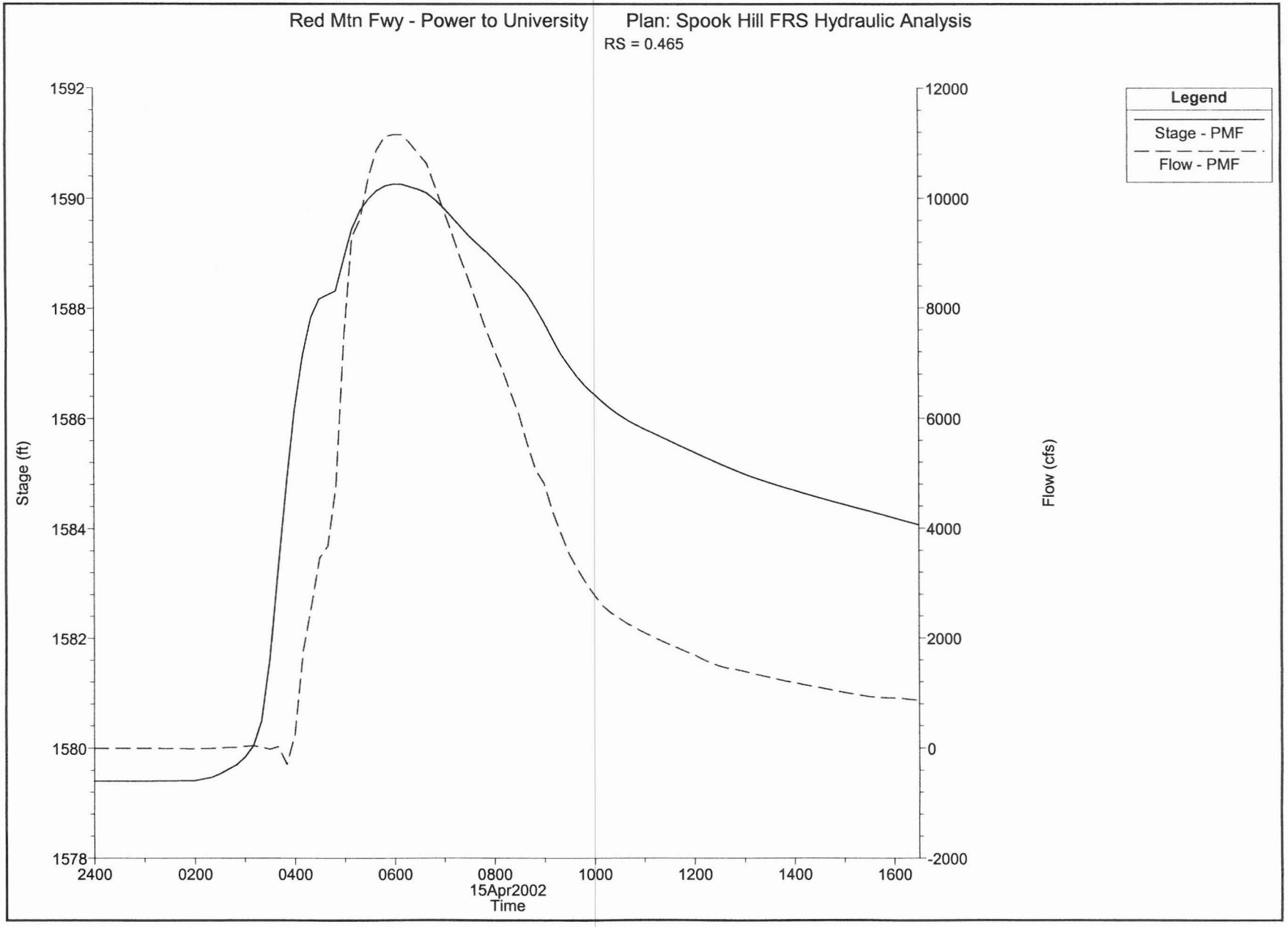
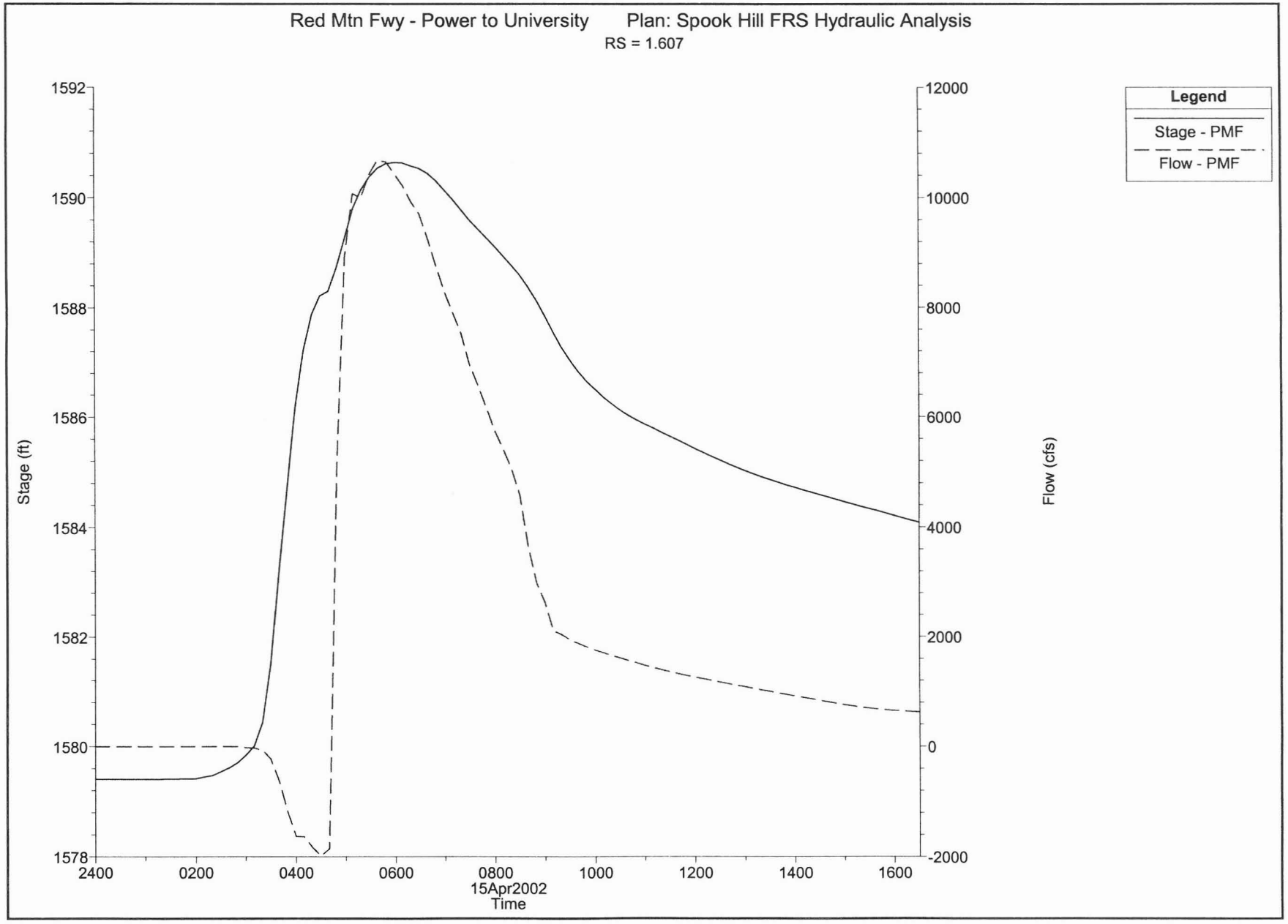
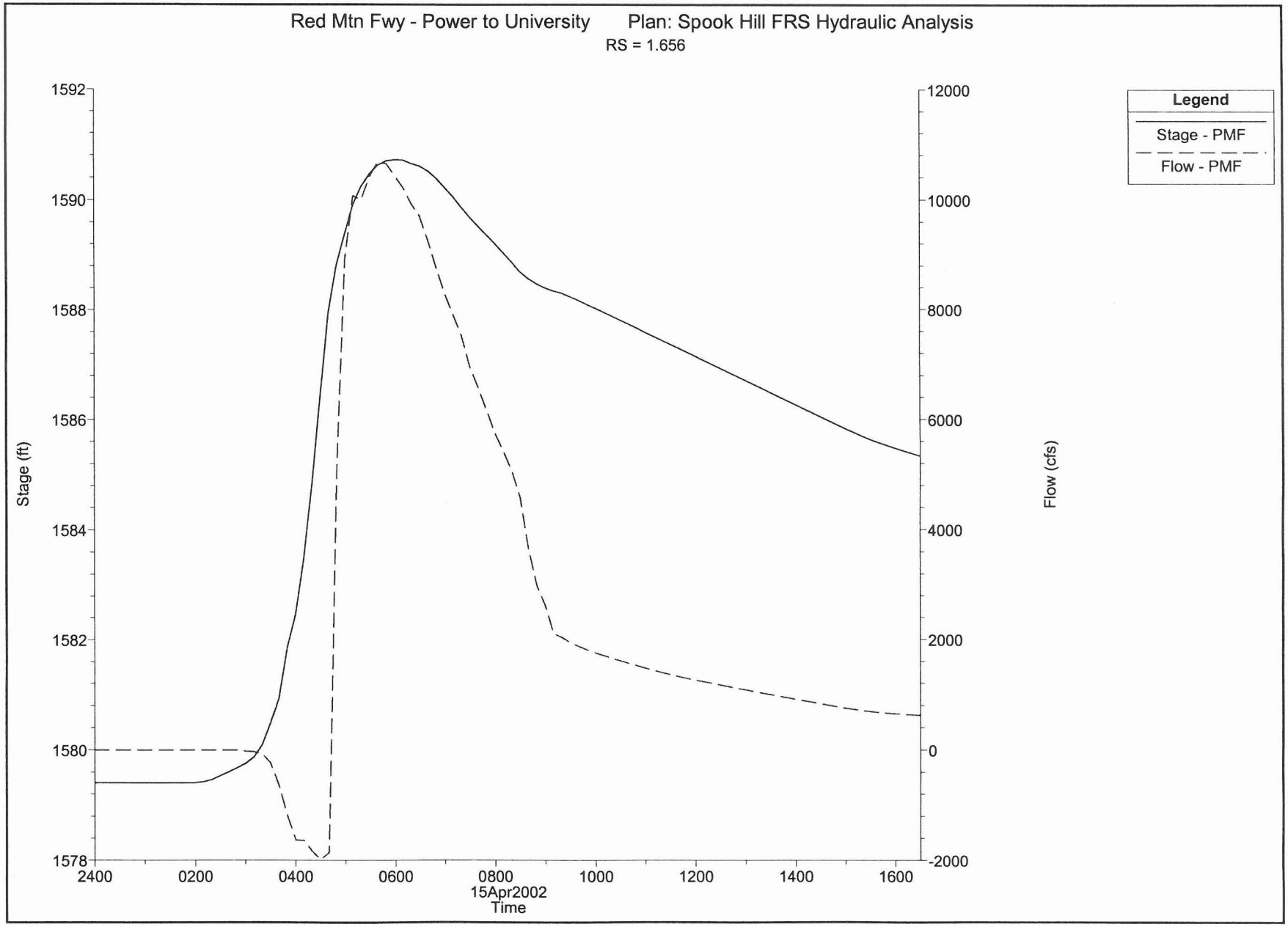
3.749
3.824

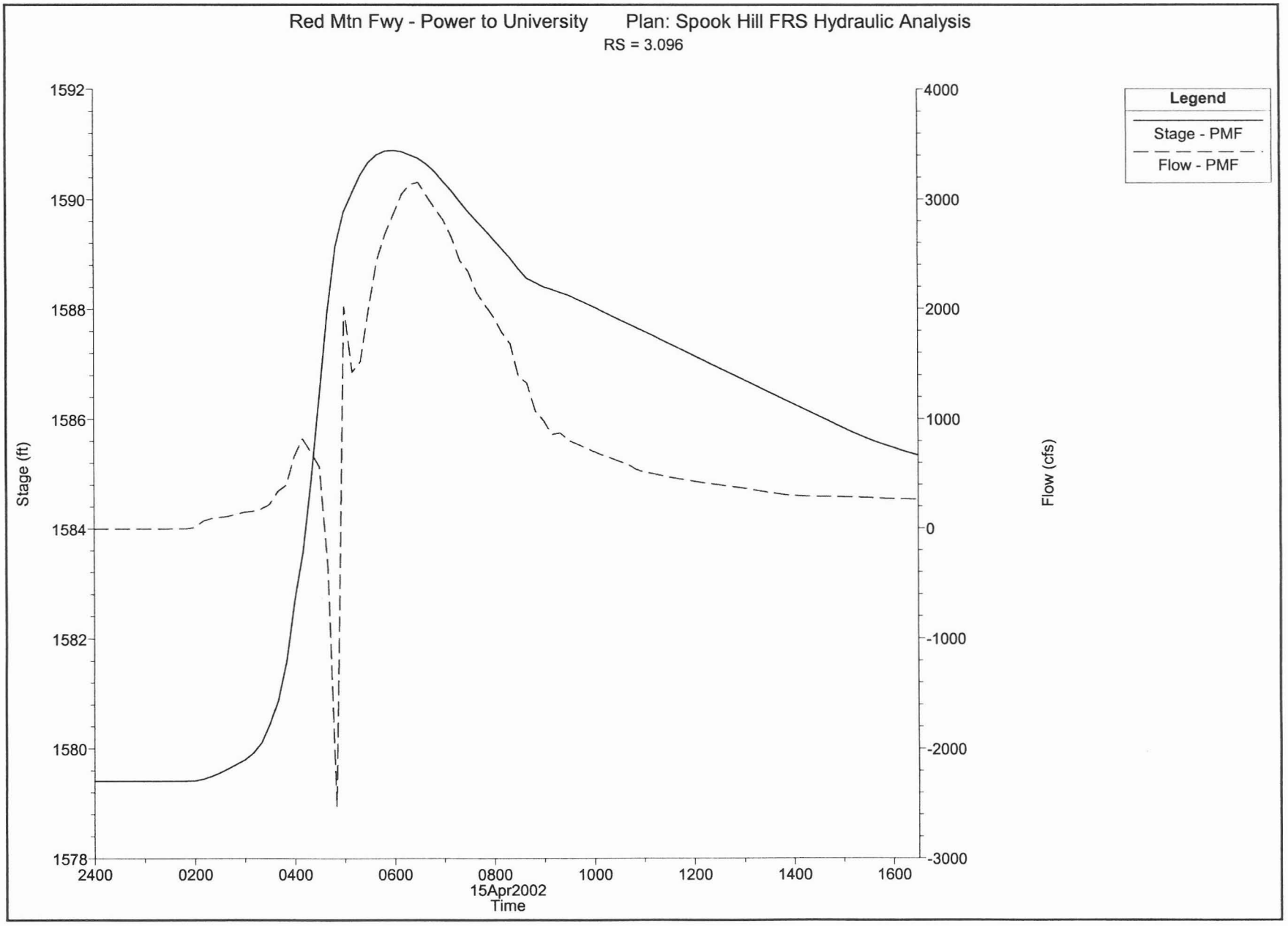

Red Mtn Fwy - Power to University
Plan: Spook Hill FRS Hydraulic Analysis
RS = 0.000
Legend
Stage - PMF
Flow - PMF
Stage (ft)
Flow (cfs)
1590
1588
1586
1584
1582
1580
1578
12000
10000
8000
6000
4000
2000
0
2400
0200
0400
0600
0800
1000
1200
1400
1600
15Apr2002
Time

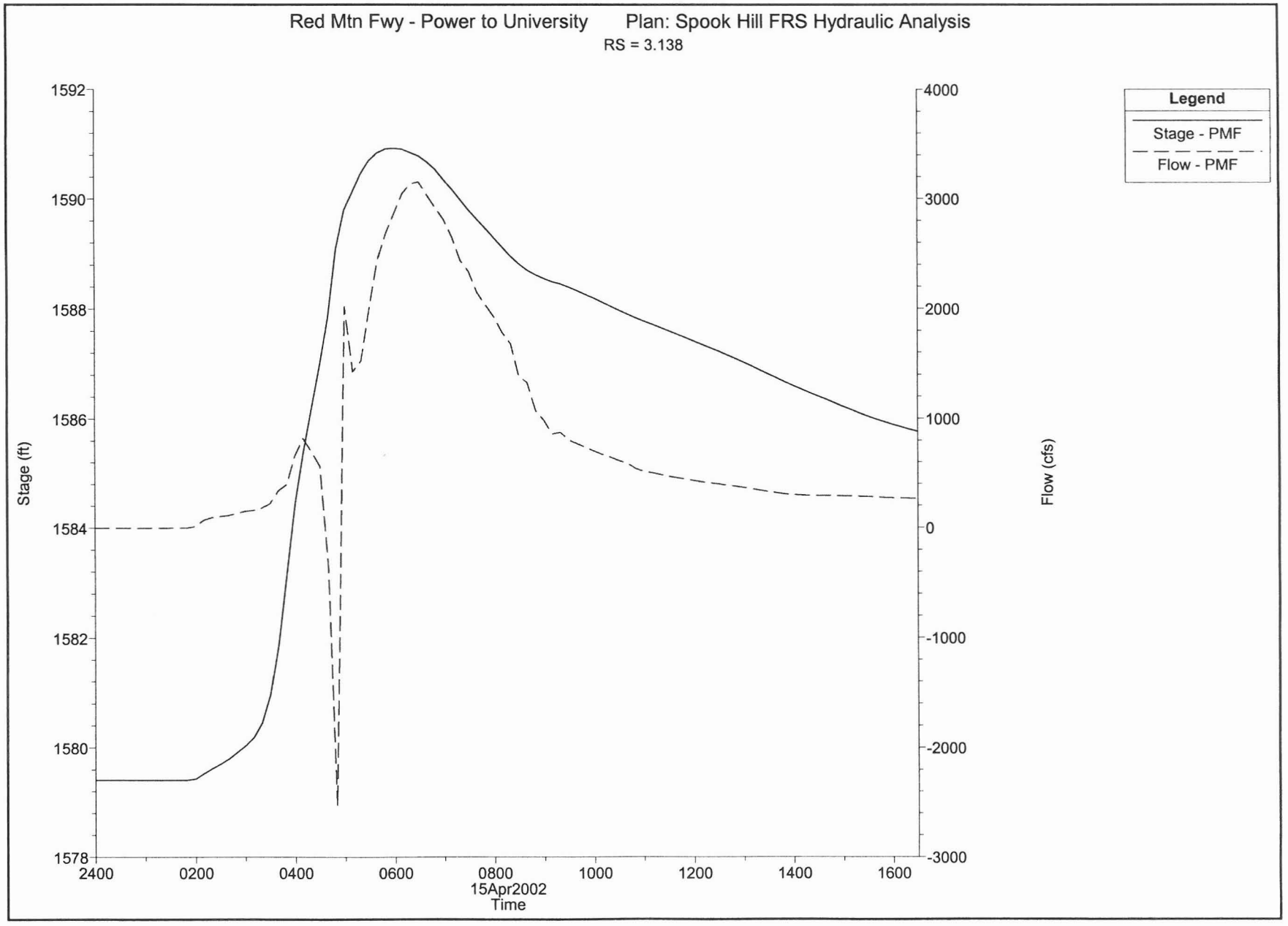

Red Mtn Fwy - Power to University
Plan: Spook Hill FRS Hydraulic Analysis
RS = 0.425
Legend
Stage - PMF
Flow - PMF
Stage (ft)
Flow (cfs)
1592
1590
1588
1586
1584
1582
1580
1578
12000
10000
8000
6000
4000
2000
0
-2000
2400
0200
0400
0600
0800
1000
1200
1400
1600
15Apr2002
Time

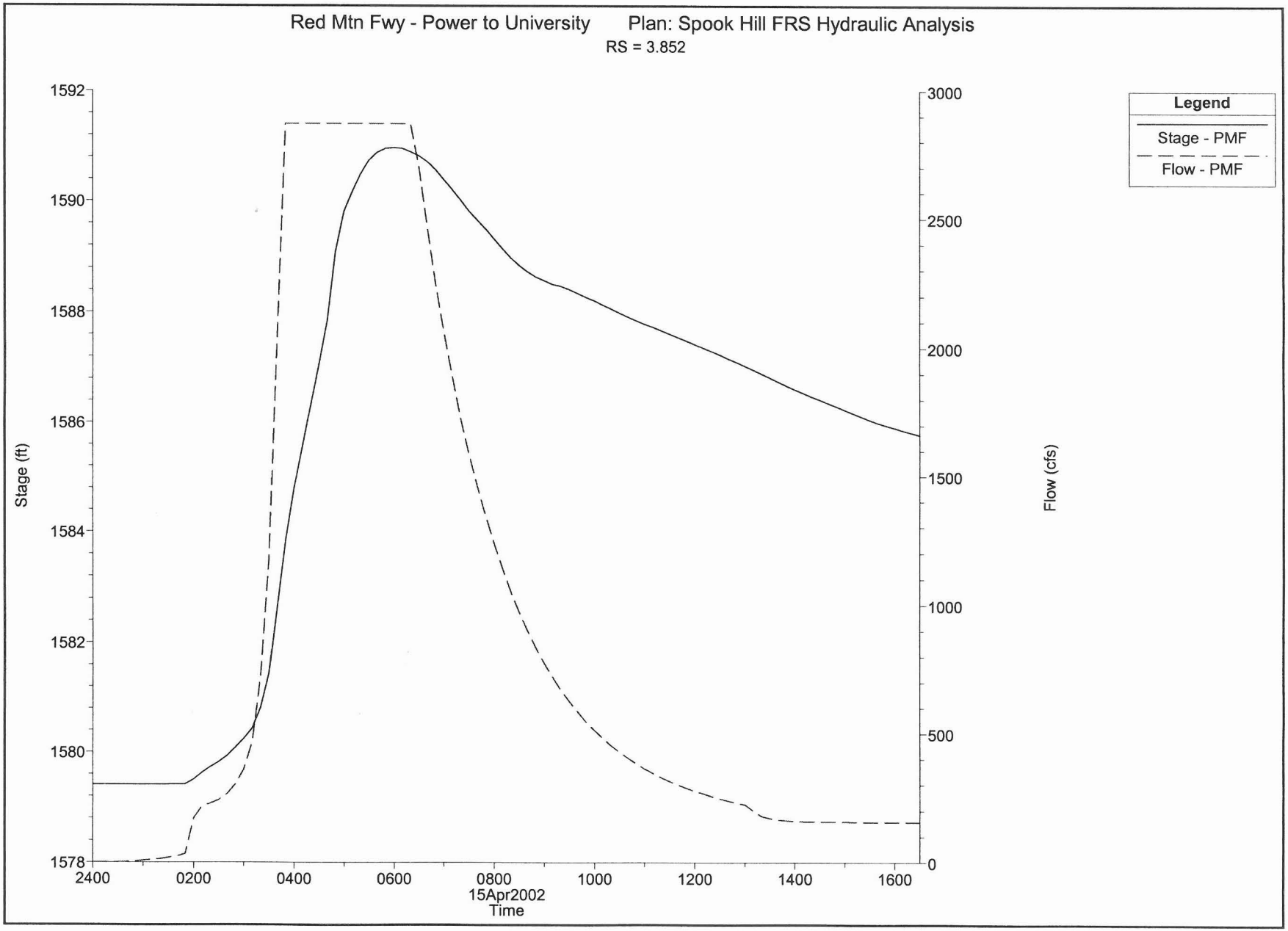

Red Mtn Fwy - Power to University
Plan: Spook Hill FRS Hydraulic Analysis
RS = 0.465
Legend
Stage - PMF
Flow - PMF
Stage (ft)
Flow (cfs)
1592
1590
1588
1586
1584
1582
1580
1578
12000
10000
8000
6000
4000
2000
0
-2000
2400
0200
0400
0600
0800
1000
1200
1400
1600
15Apr2002
Time

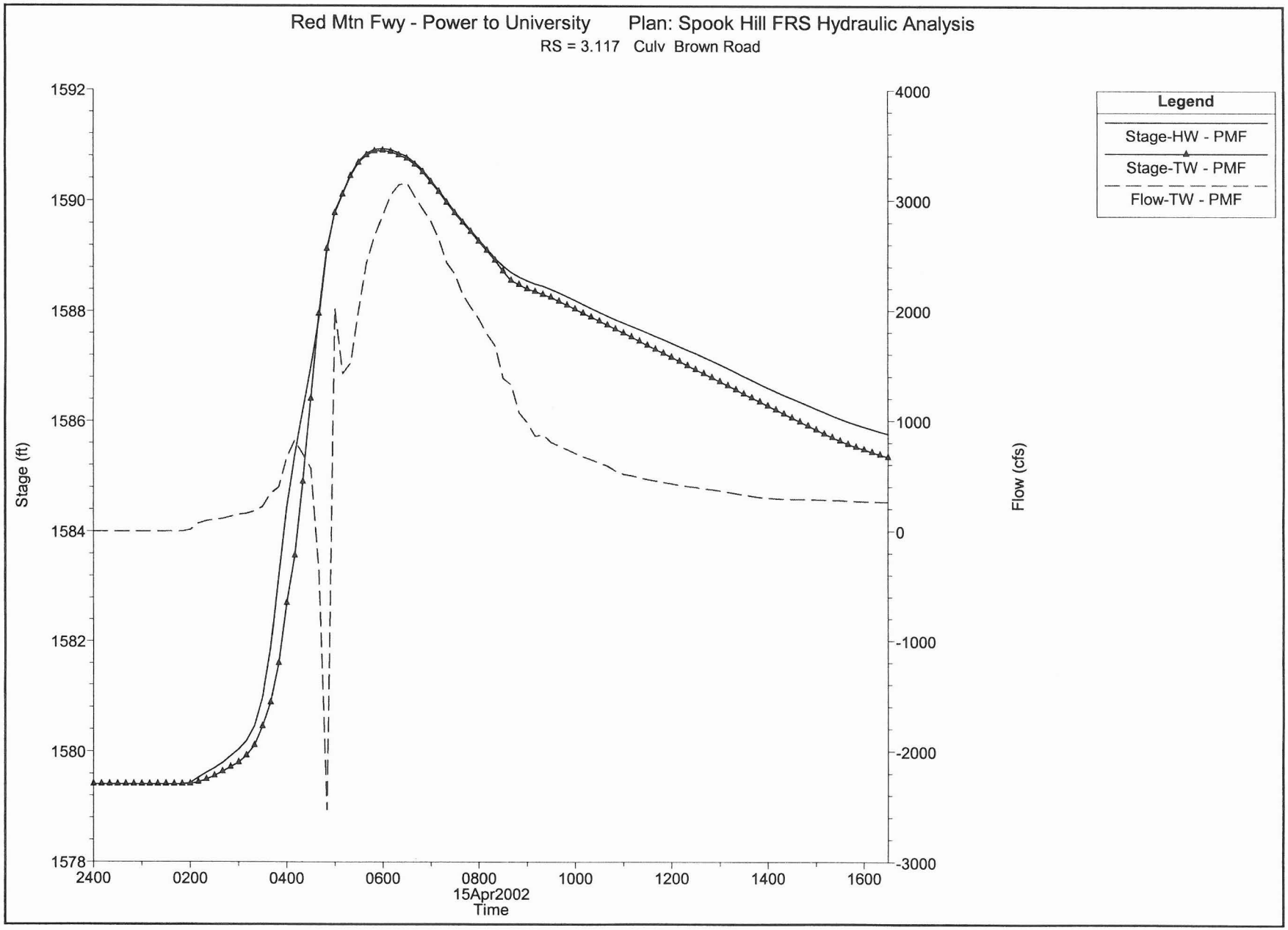

Red Mtn Fwy - Power to University
Plan: Spook Hill FRS Hydraulic Analysis
RS = 1.607
Legend
Stage - PMF
Flow - PMF
Stage (ft)
Flow (cfs)
1592
1590
1588
1586
1584
1582
1580
1578
12000
10000
8000
6000
4000
2000
0
-2000
2400
0200
0400
0600
0800
1000
1200
1400
1600
15Apr2002
Time

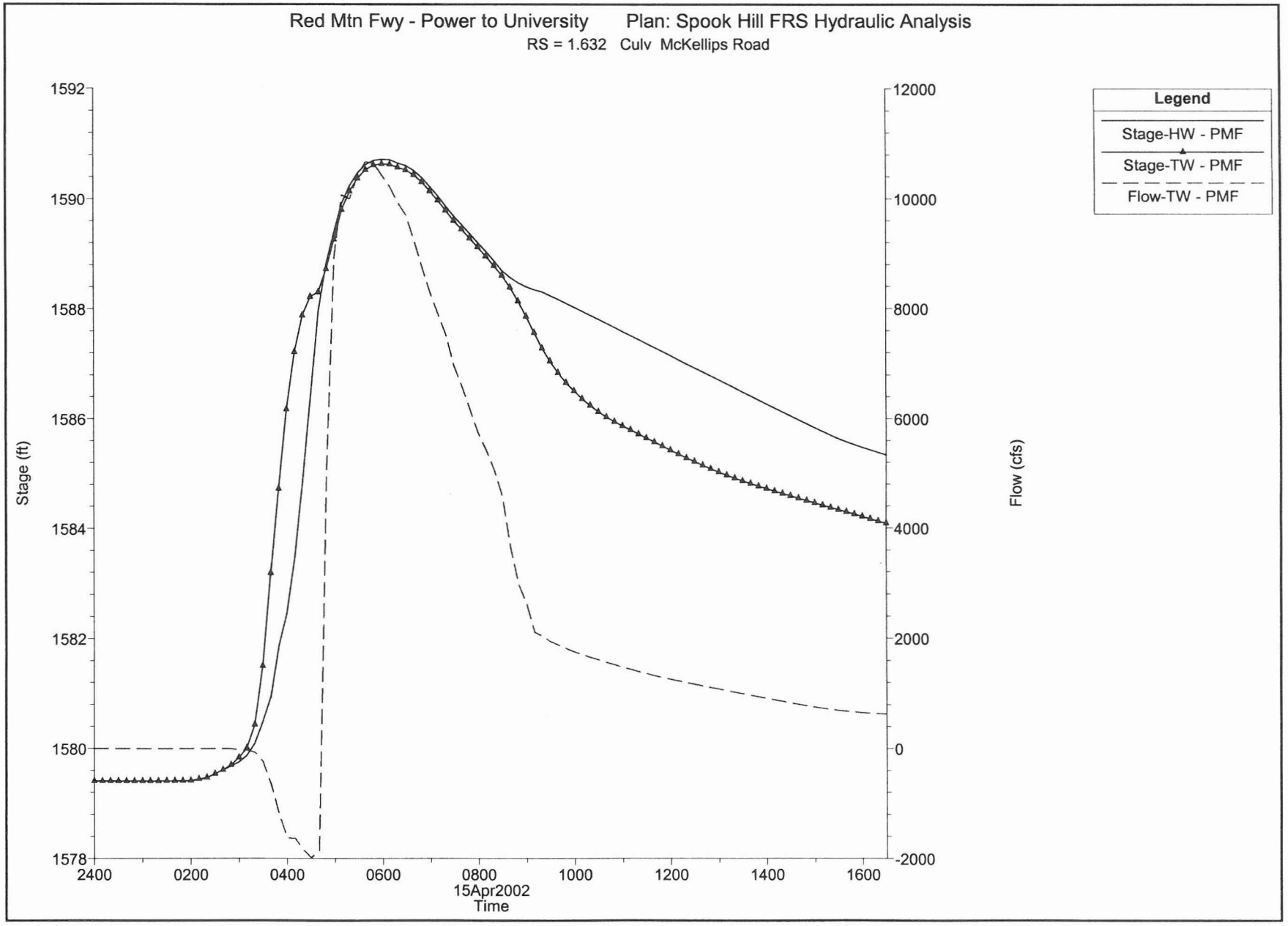

Red Mtn Fwy - Power to University
Plan: Spook Hill FRS Hydraulic Analysis
RS = 1.656
Stage (ft)
1592
1590
1588
1586
1584
1582
1580
1578
Flow (cfs)
12000
10000
8000
6000
4000
2000
0
-2000
2400
0200
0400
0600
0800
1000
1200
1400
1600
15Apr2002
Time
Legend
Stage - PMF
Flow - PMF

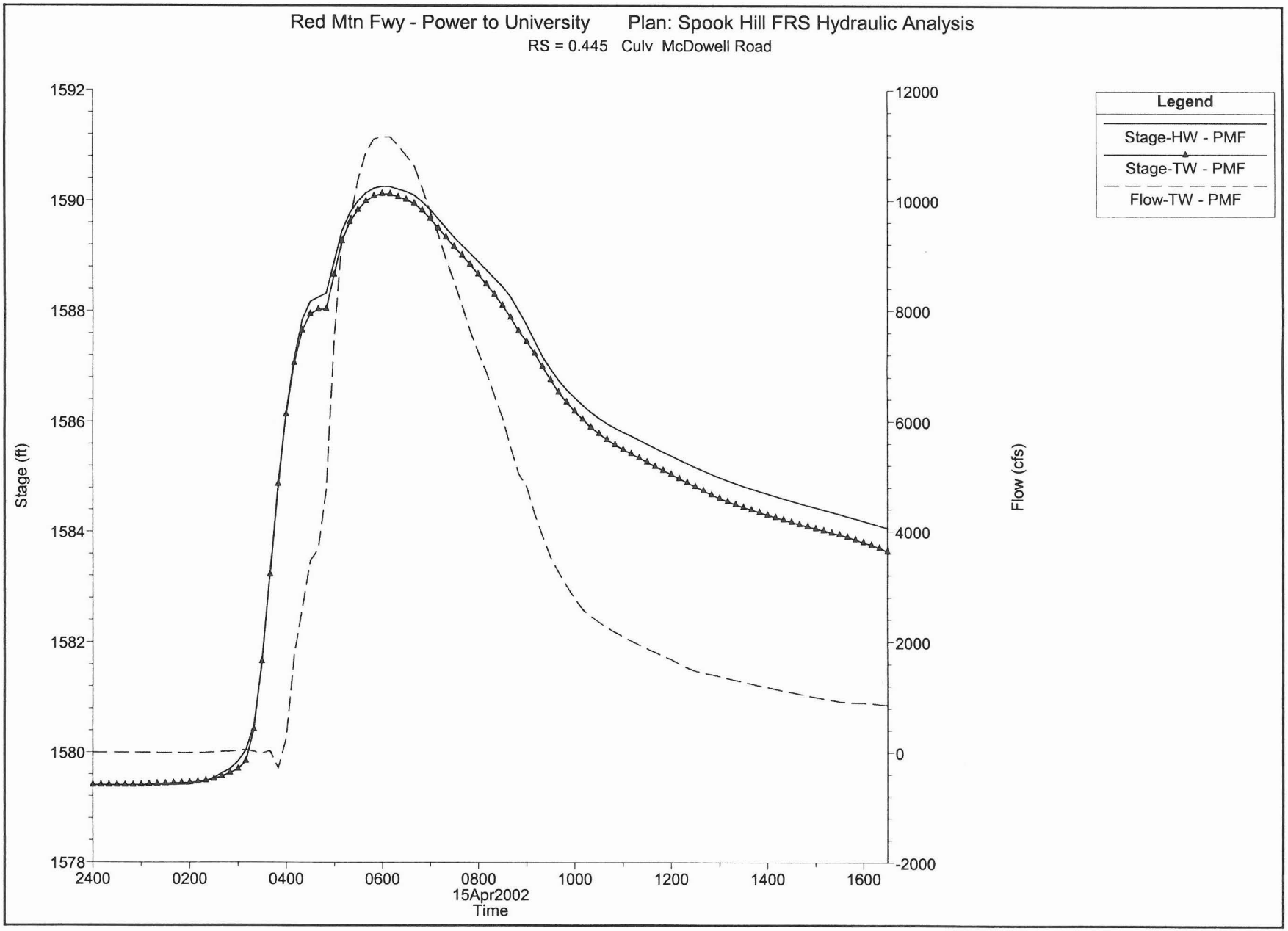

Red Mtn Fwy - Power to University
Plan: Spook Hill FRS Hydraulic Analysis
RS = 3.096
Legend
Stage - PMF
Flow - PMF
Stage (ft)
Flow (cfs)
1592
1590
1588
1586
1584
1582
1580
1578
4000
3000
2000
1000
0
-1000
-2000
-3000
2400
0200
0400
0600
0800
1000
1200
1400
1600
15Apr2002
Time


Red Mtn Fwy - Power to University
Plan: Spook Hill FRS Hydraulic Analysis
RS = 3.138
Legend
Stage - PMF
Flow - PMF
Stage (ft)
Flow (cfs)
1592
1590
1588
1586
1584
1582
1580
1578
4000
3000
2000
1000
0
-1000
-2000
-3000
2400
0200
0400
0600
0800
1000
1200
1400
1600
15Apr2002
Time


Red Mtn Fwy - Power to University
Plan: Spook Hill FRS Hydraulic Analysis
RS = 3.852
Legend
Stage - PMF
Flow - PMF
Stage (ft)
Flow (cfs)
1592
1590
1588
1586
1584
1582
1580
1578
3000
2500
2000
1500
1000
500
0
2400
0200
0400
0600
0800
1000
1200
1400
1600
15Apr2002
Time

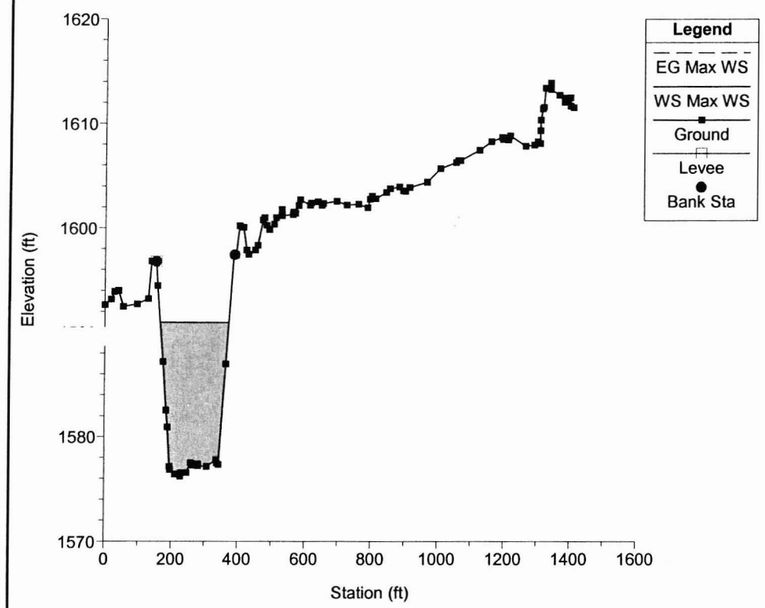

Red Mtn Fwy - Power to University
Plan: Spook Hill FRS Hydraulic Analysis
RS = 3.117 Culv Brown Road
Stage (ft)
1592
1590
1588
1586
1584
1582
1580
1578
Flow (cfs)
4000
3000
2000
1000
0
-1000
-2000
-3000
2400
0200
0400
0600
0800
1000
1200
1400
1600
15Apr2002
Time
Legend
Stage-HW - PMF
Stage-TW - PMF
Flow-TW - PMF


Red Mtn Fwy - Power to University
Plan: Spook Hill FRS Hydraulic Analysis
RS = 1.632 Culv McKellips Road
Stage (ft)
1592
1590
1588
1586
1584
1582
1580
1578
Flow (cfs)
12000
10000
8000
6000
4000
2000
0
-2000
2400
0200
0400
0600
0800
1000
1200
1400
1600
15Apr2002
Time
Legend
Stage-HW - PMF
Stage-TW - PMF
Flow-TW - PMF


Red Mtn Fwy - Power to University
Plan: Spook Hill FRS Hydraulic Analysis
RS = 0.445 Culv McDowell Road
Stage (ft)
1592
1590
1588
1586
1584
1582
1580
1578
Flow (cfs)
12000
10000
8000
6000
4000
2000
0
-2000
2400
0200
0400
0600
0800
1000
1200
1400
1600
15Apr2002
Time
Legend
Stage-HW - PMF
Stage-TW - PMF
Flow-TW - PMF

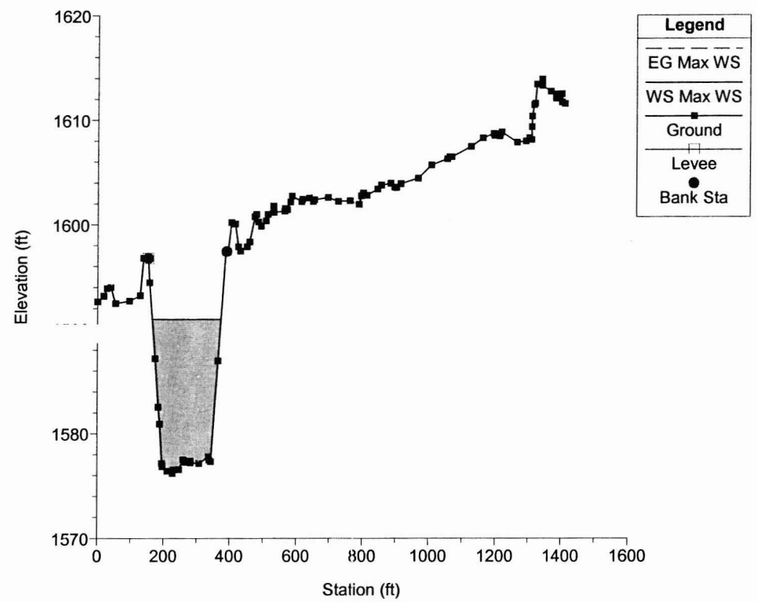
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.852



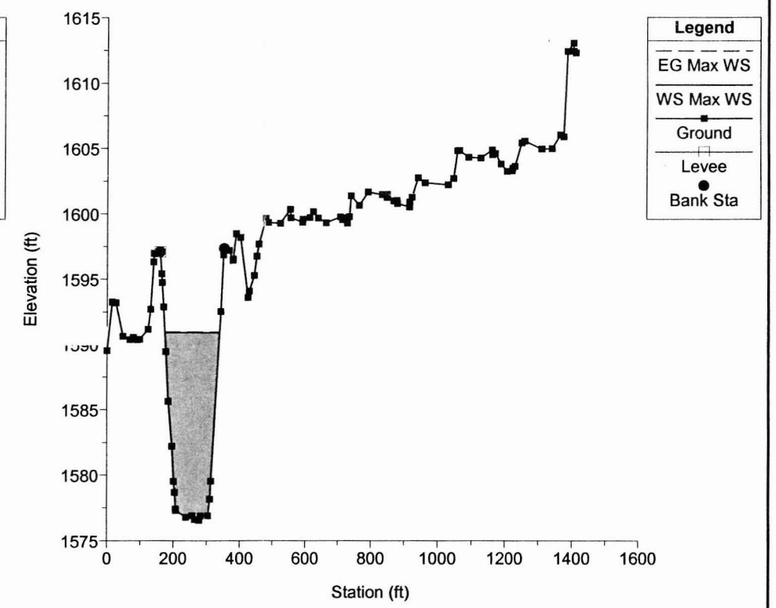
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.851 Starting section for application of uniform lateral inflow hydro



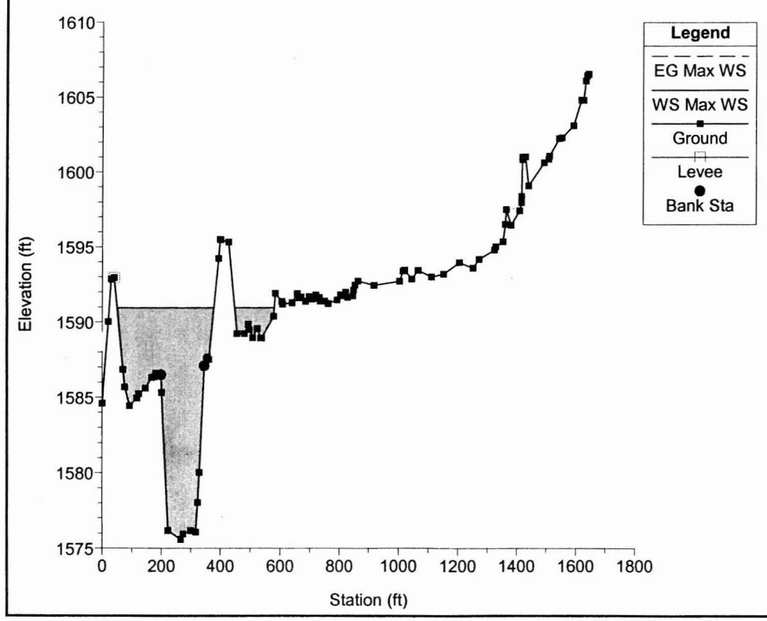
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.824



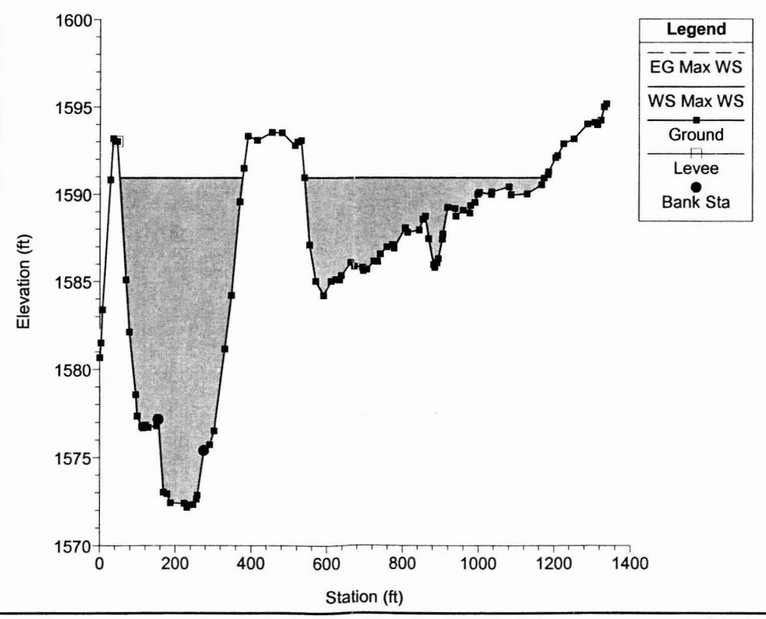
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.749



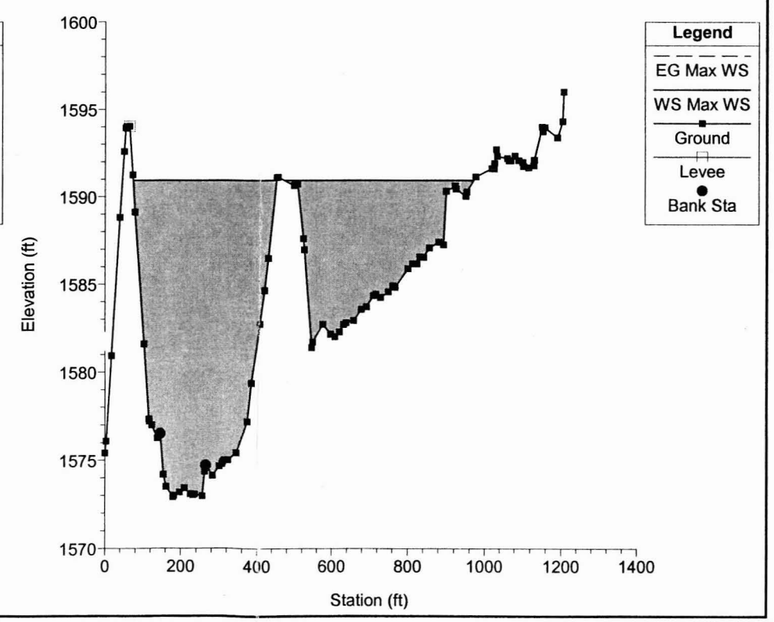
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.645



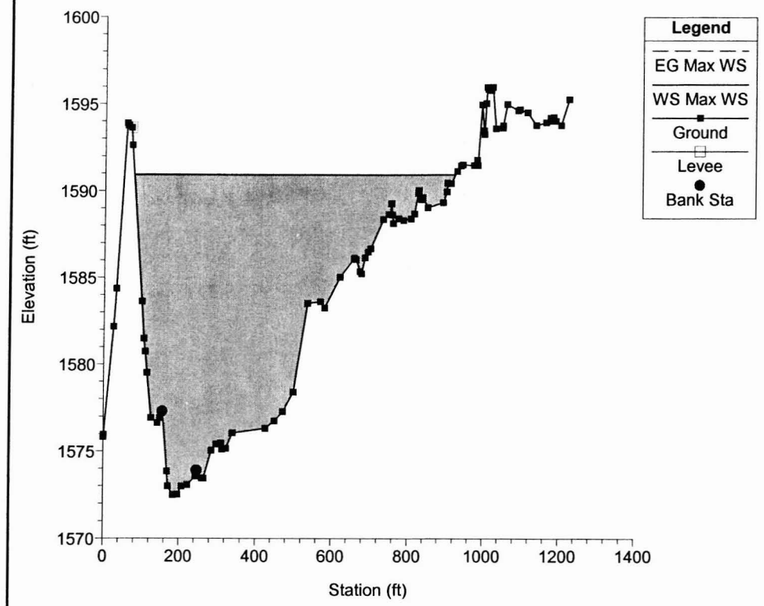
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.576



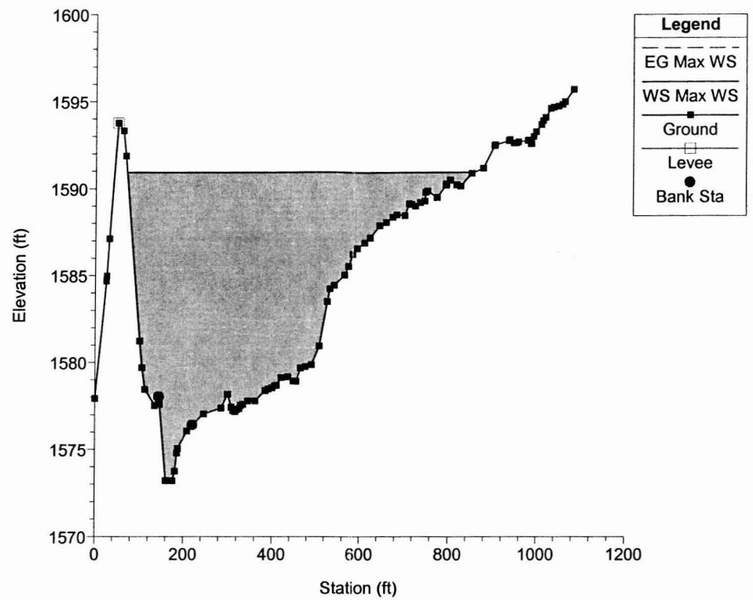
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.500



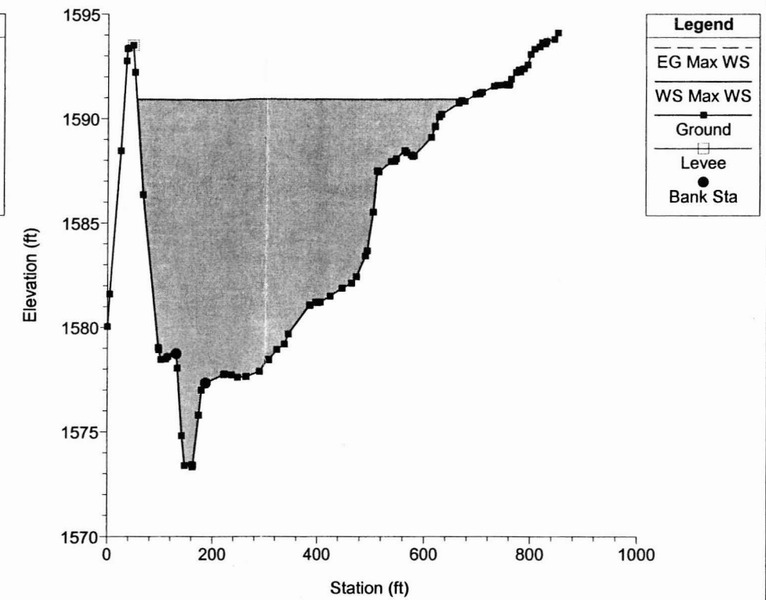
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.424



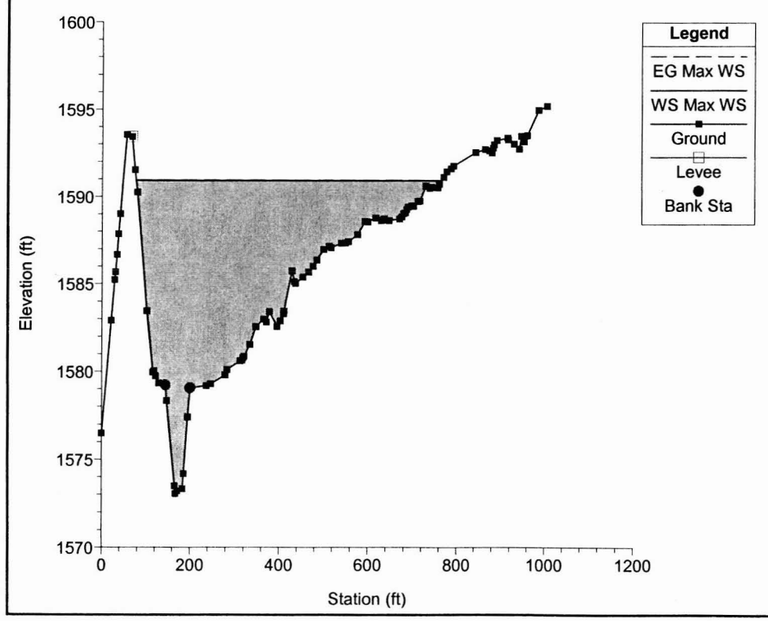
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.349



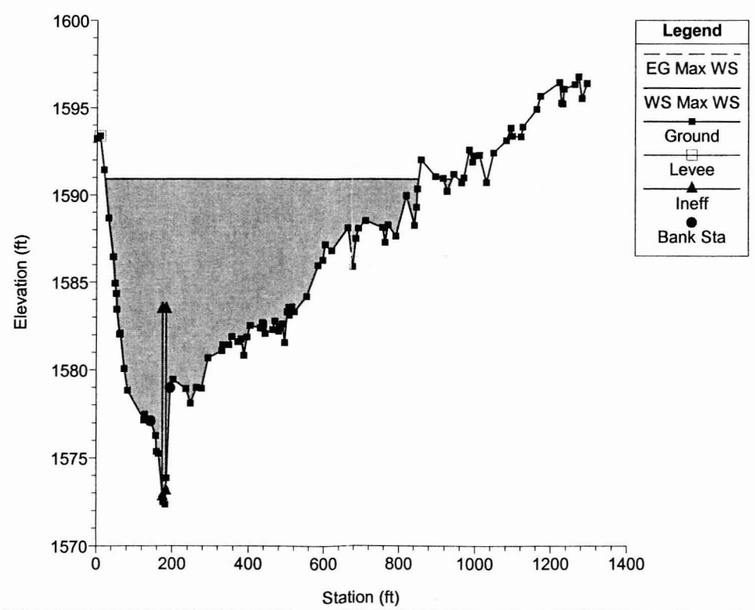
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.285



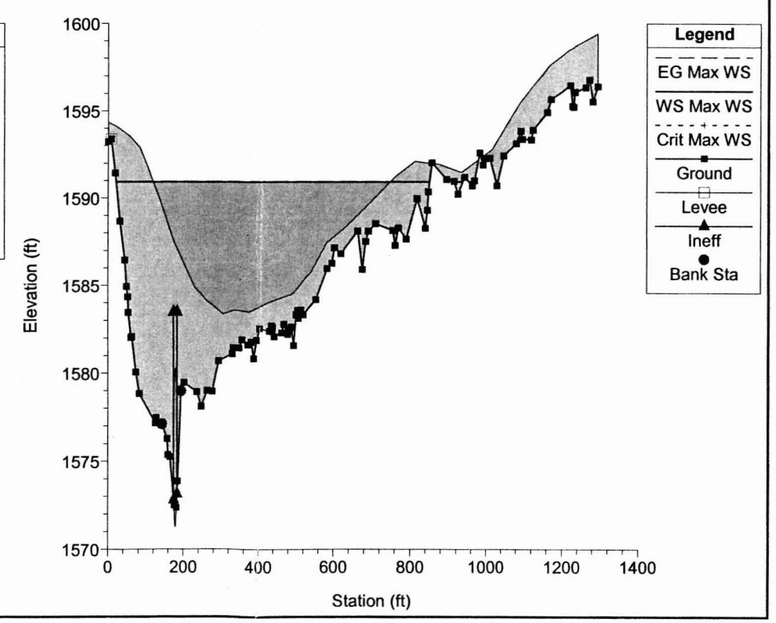
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.138



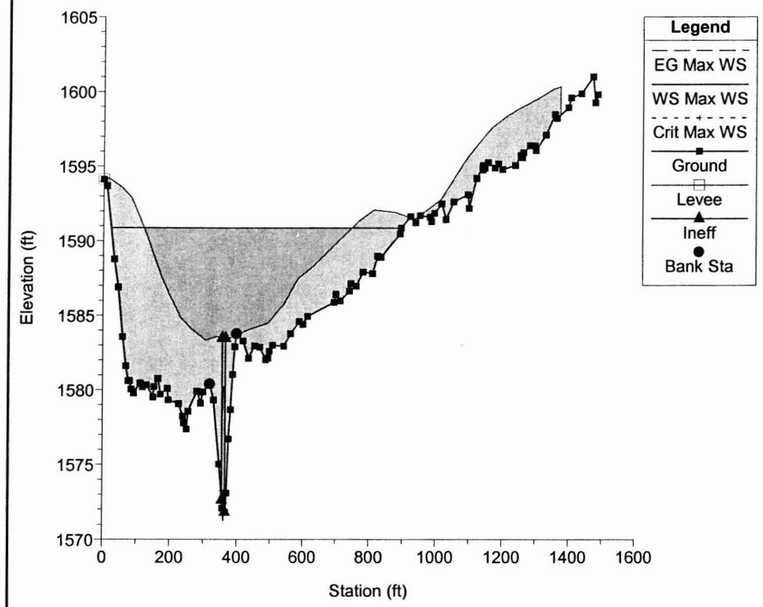
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.117 Brown Road



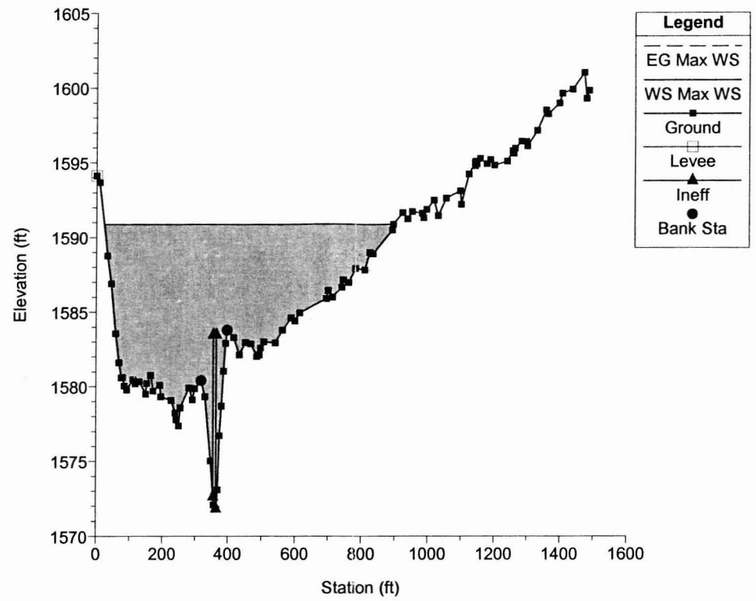
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.117 Brown Road



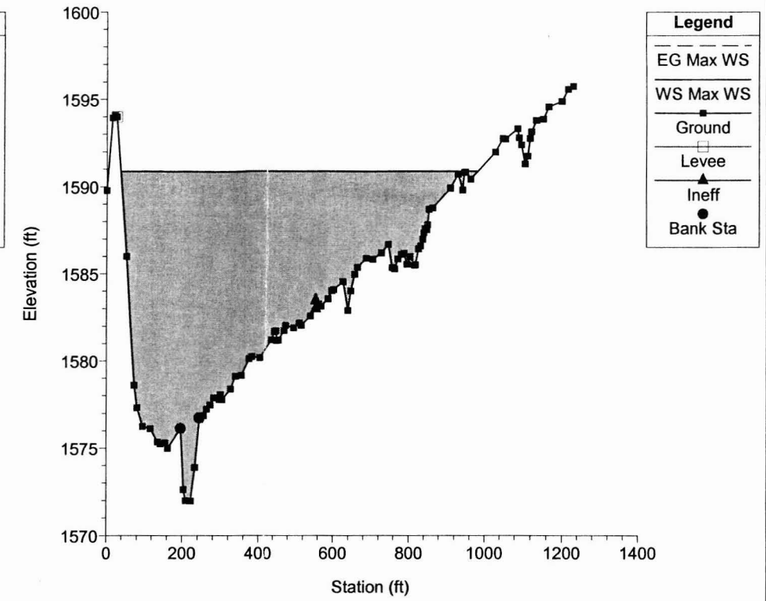
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 3.096



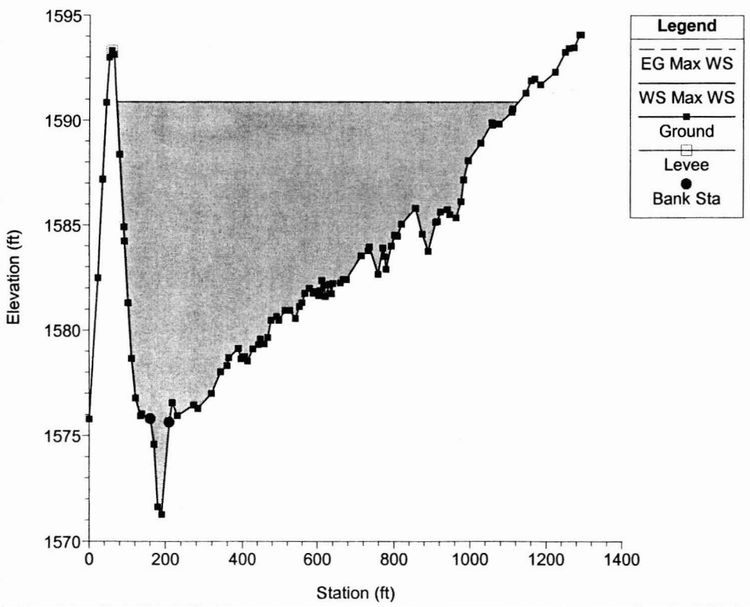
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.966



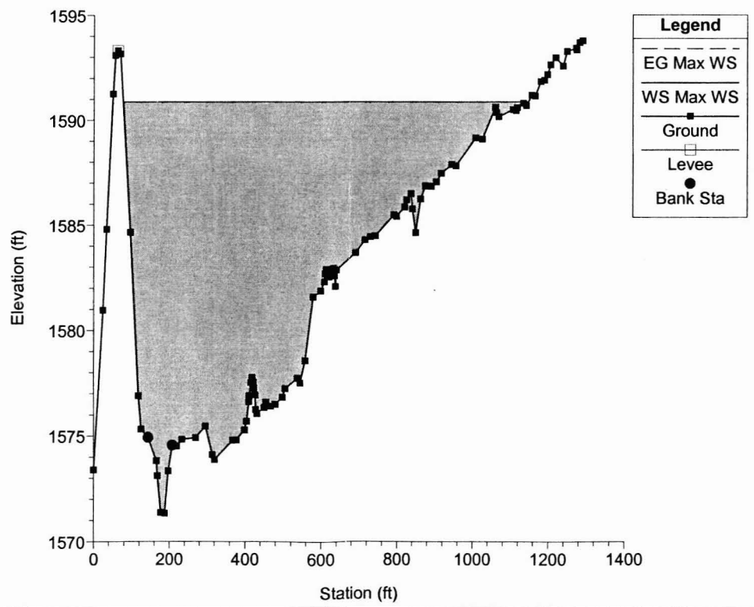
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.891



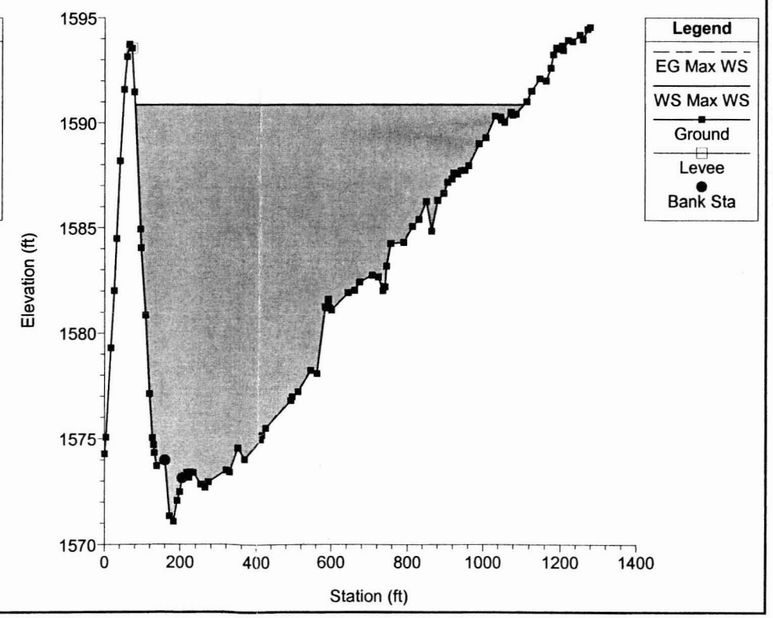
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.871



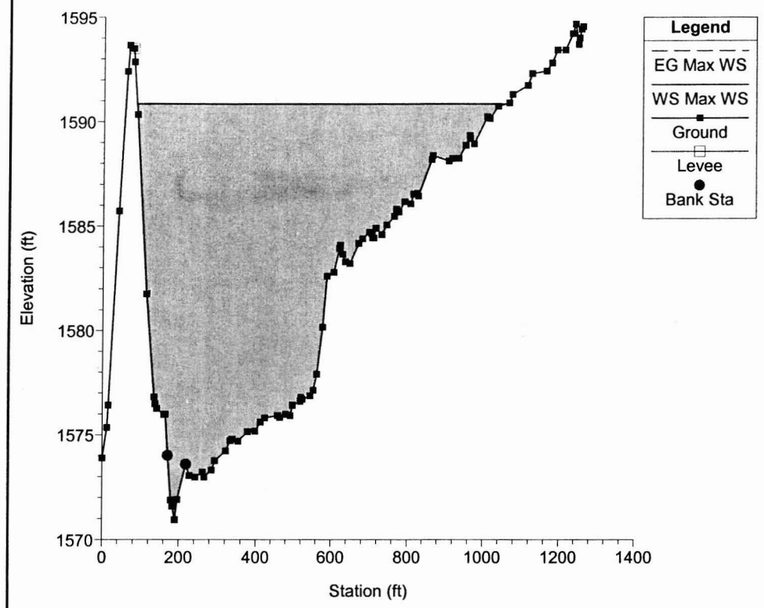
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.815



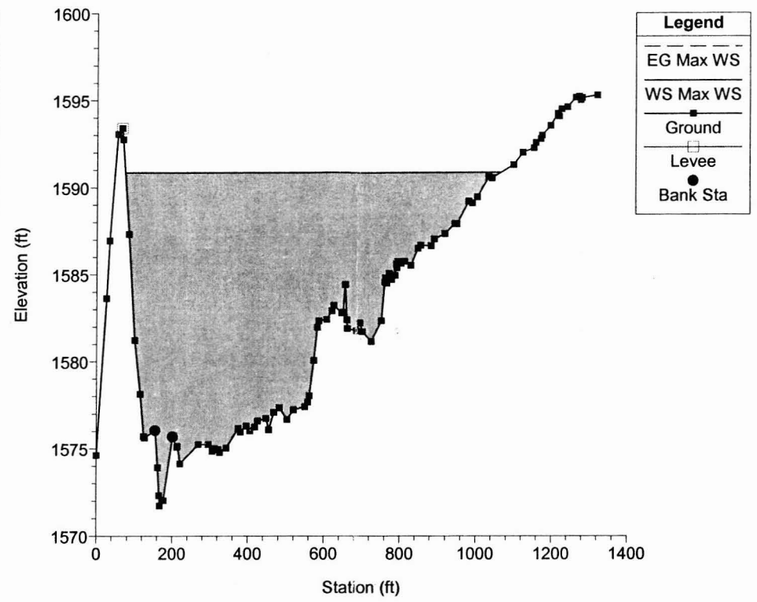
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.736



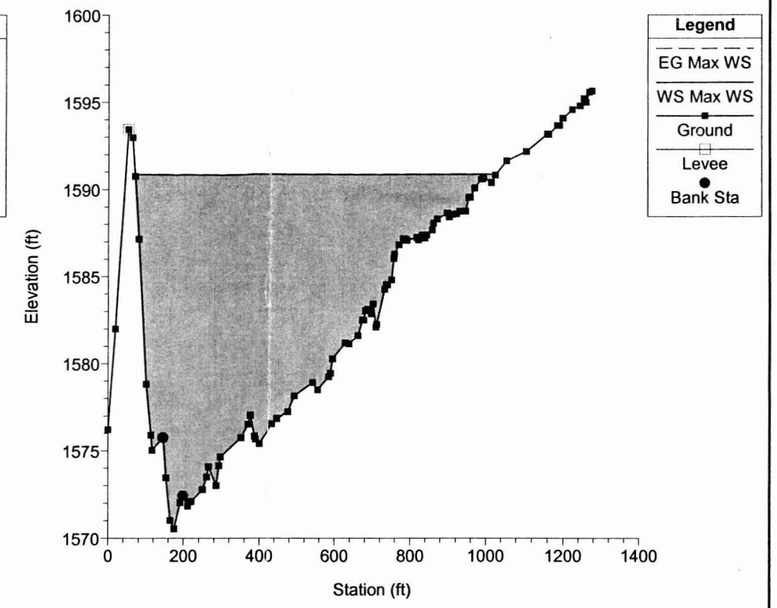
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.662



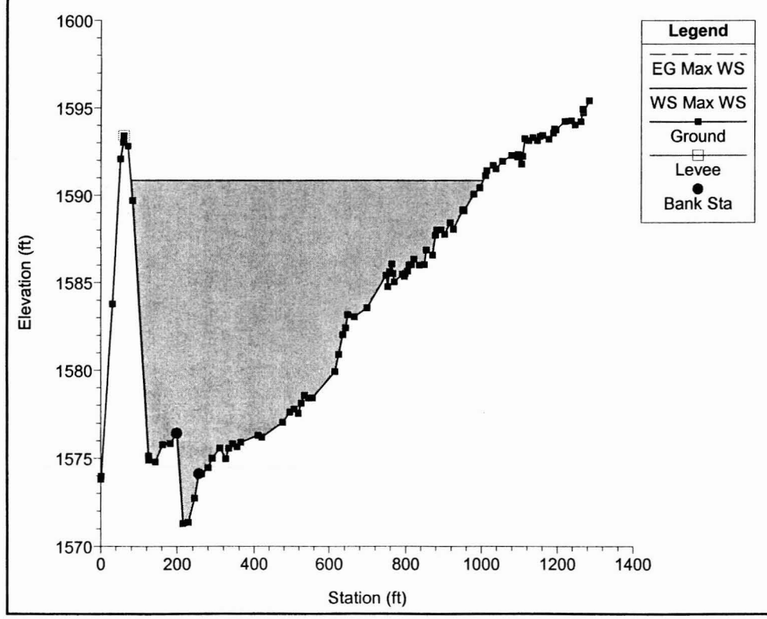
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.585



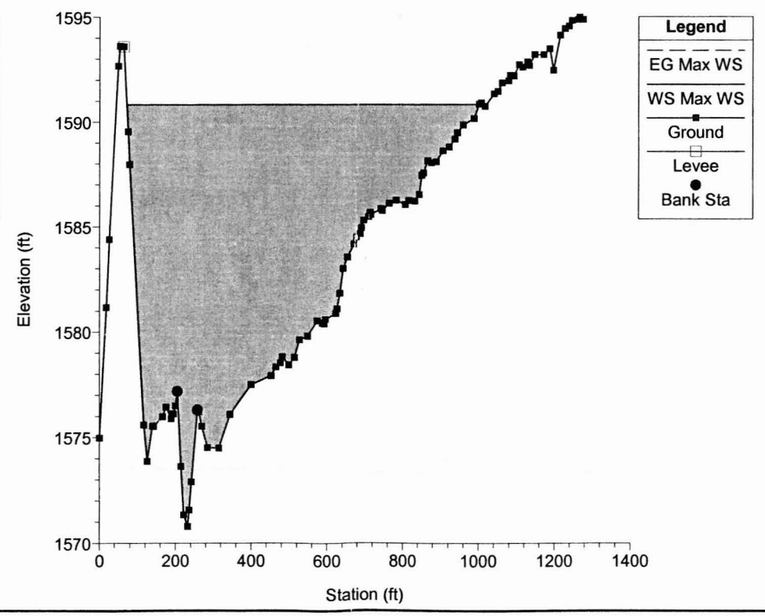
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.509



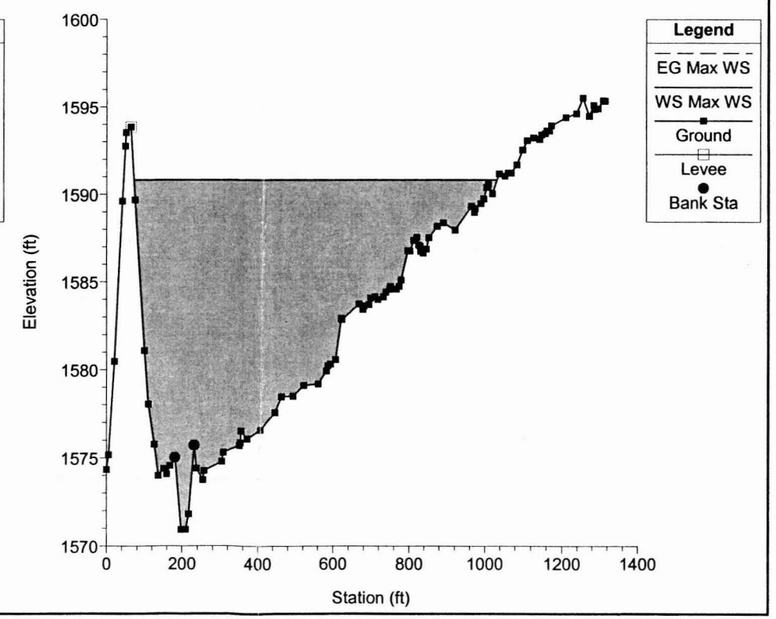
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.433



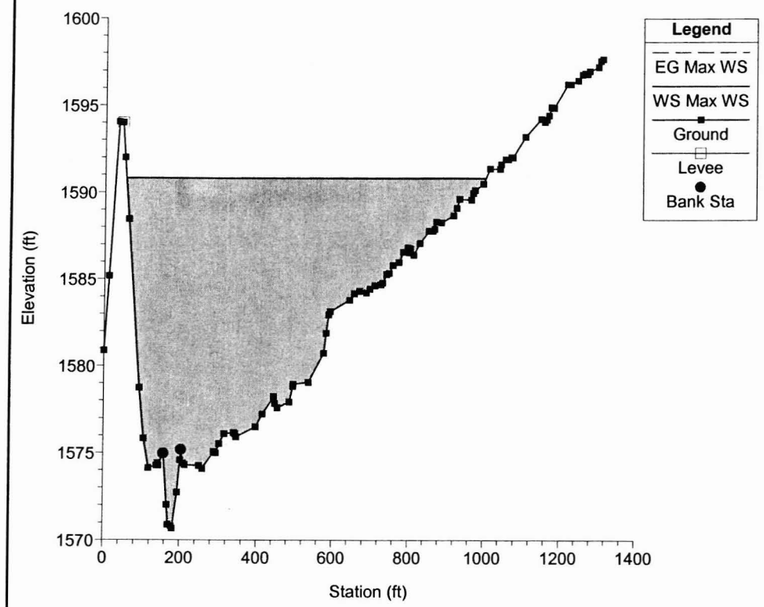
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.357



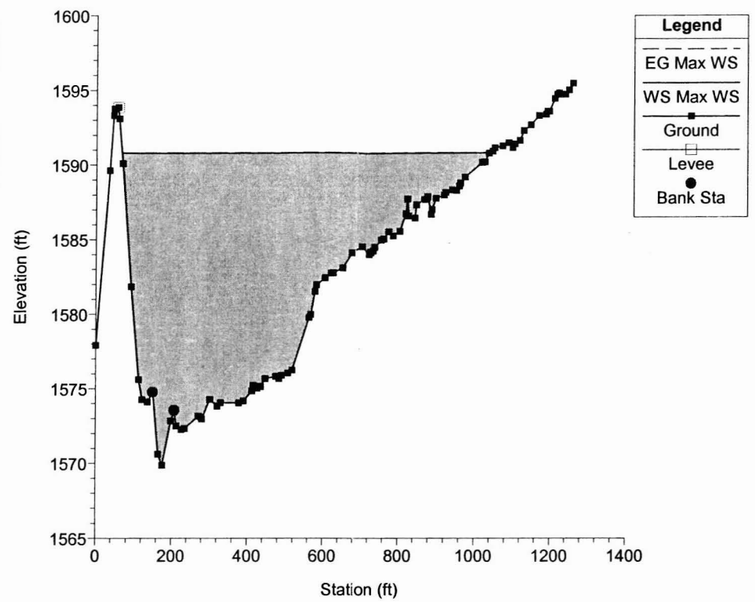
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.328



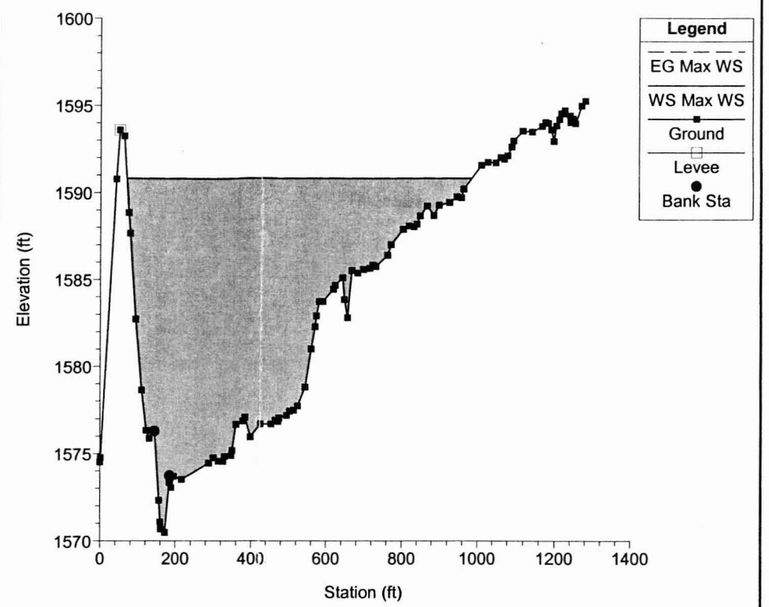
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.281



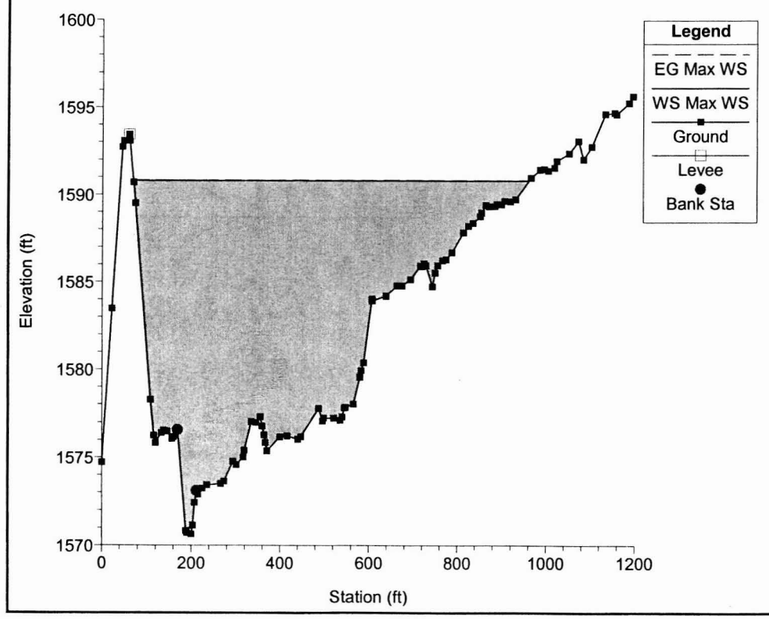
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.205



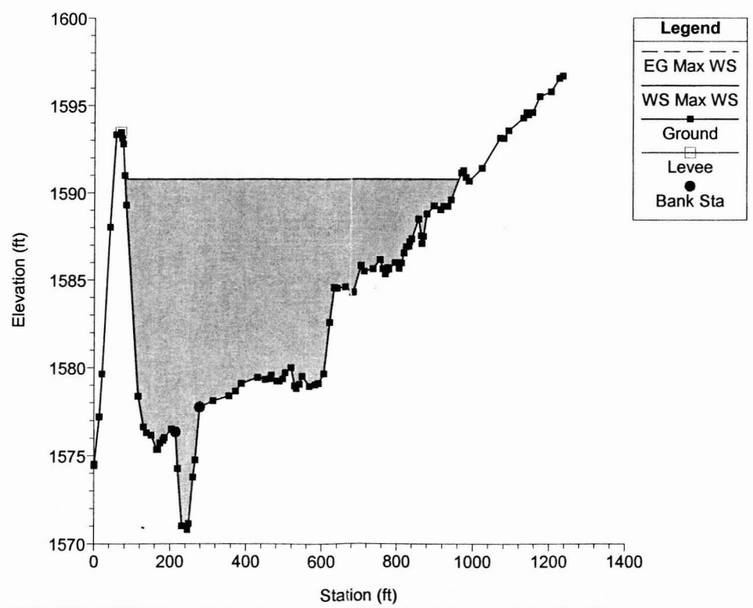
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.129



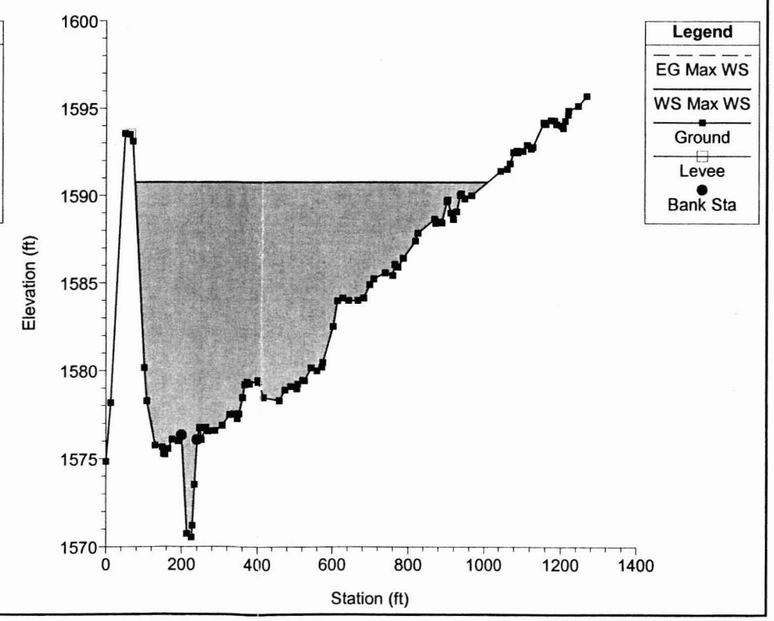
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 2.053



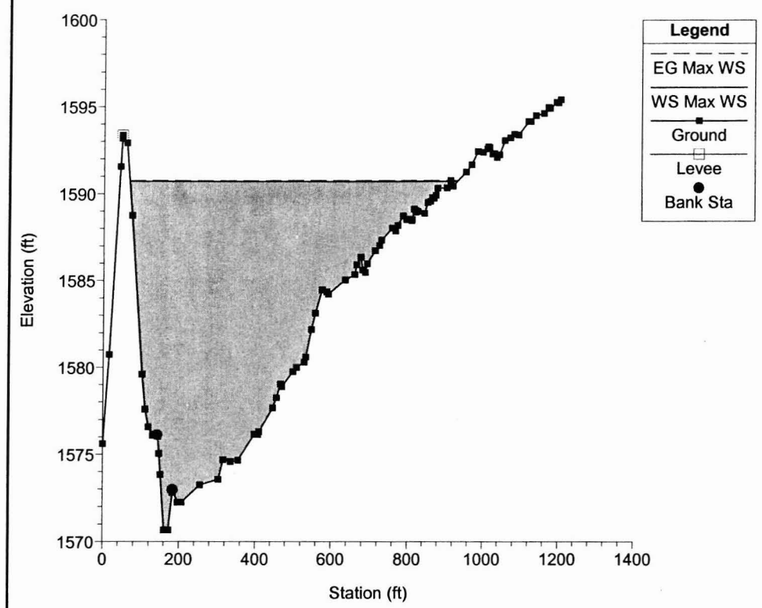
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.977



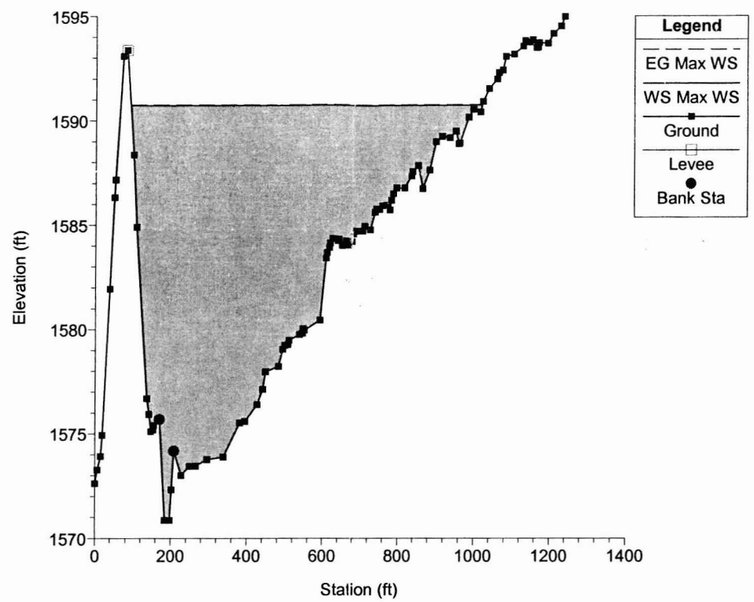
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.901



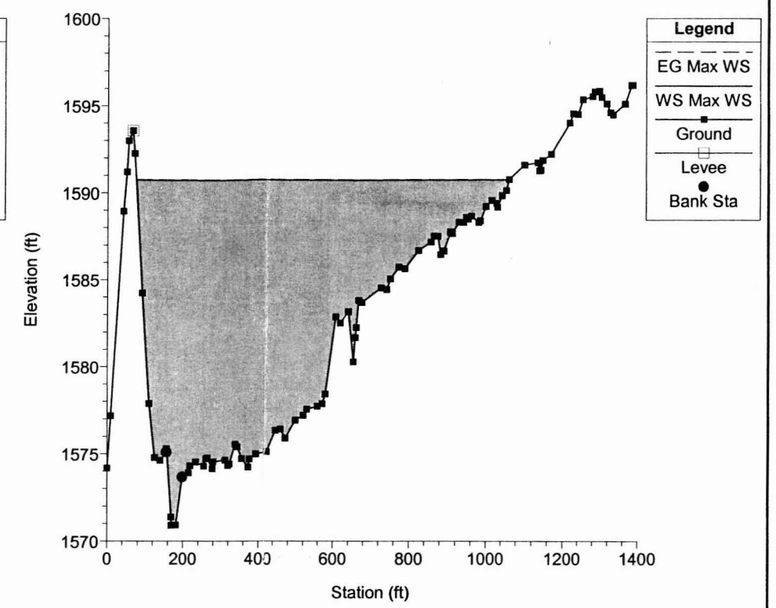
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.874



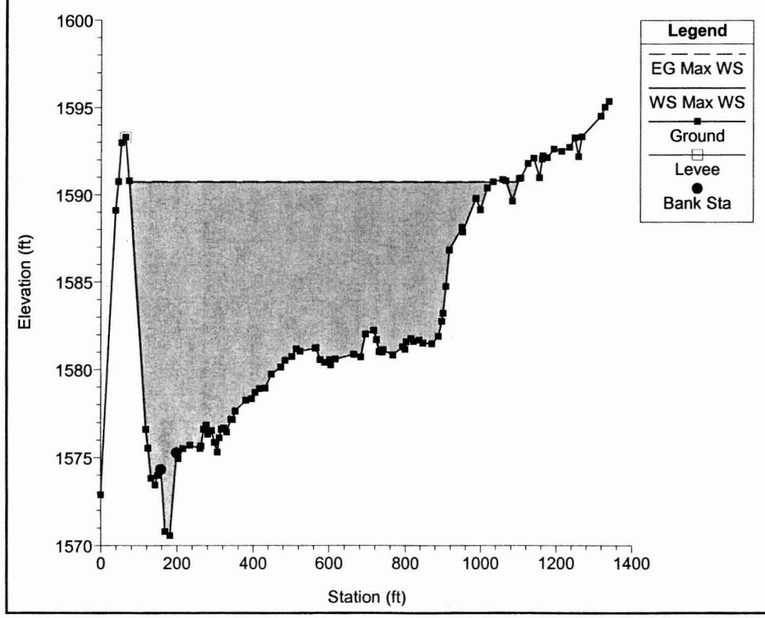
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.826



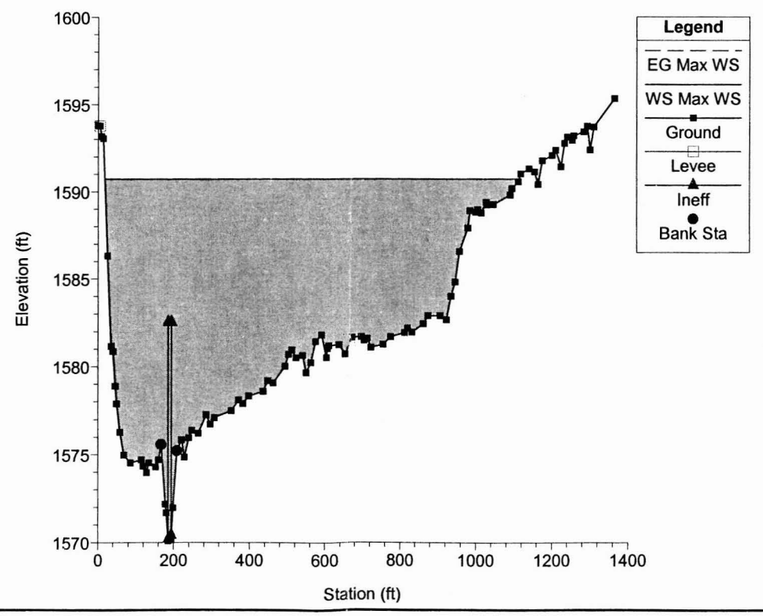
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.756



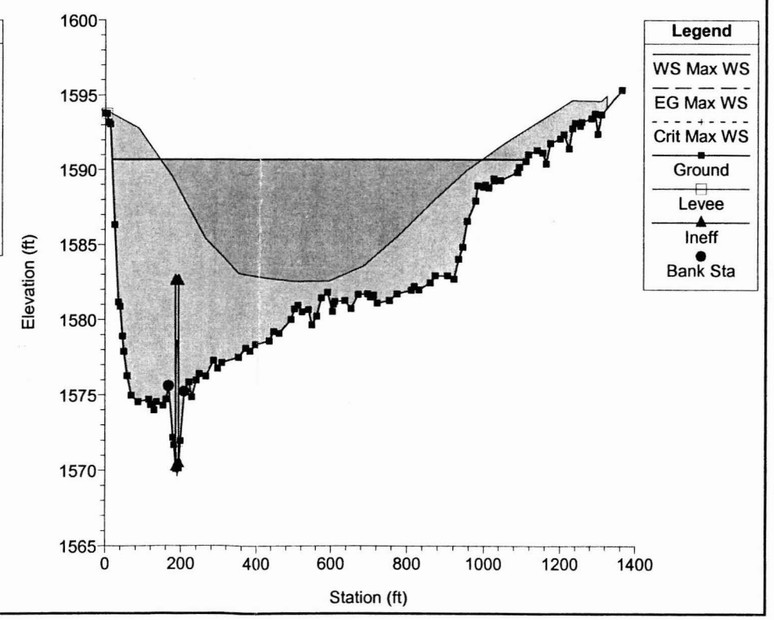
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.656



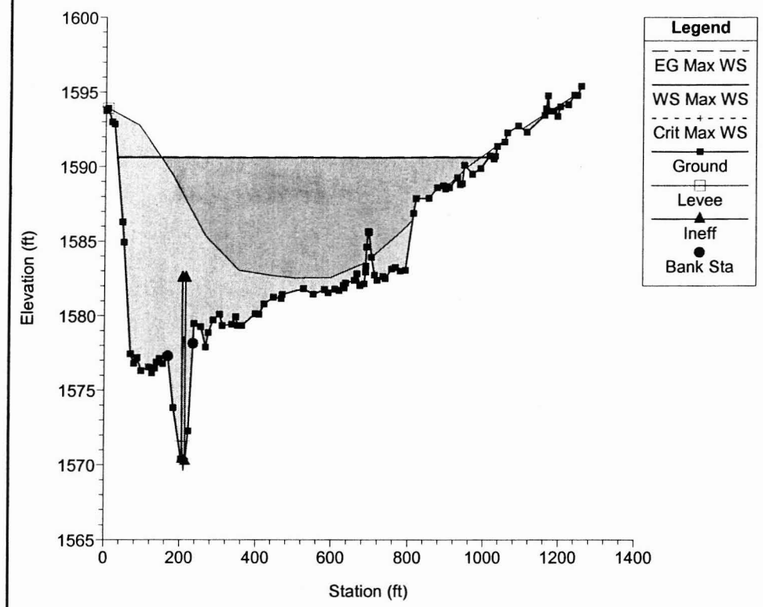
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.632 McKellips Road



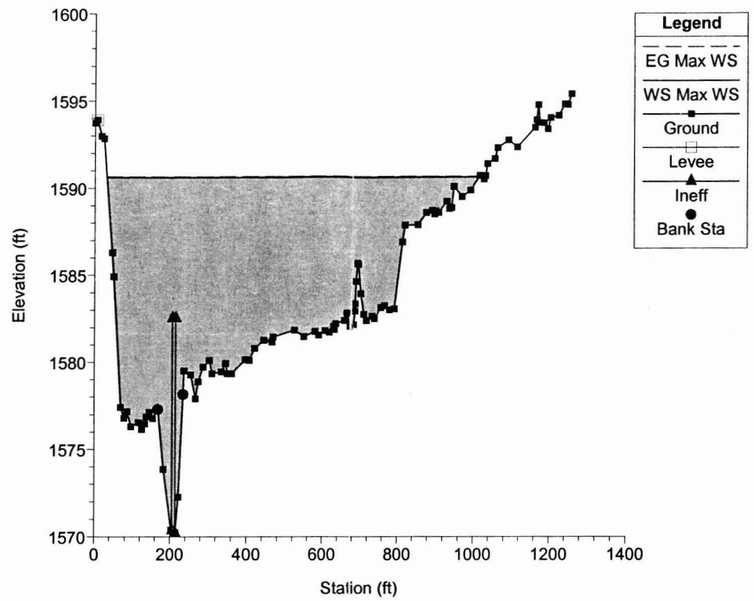
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.632 McKellips Road



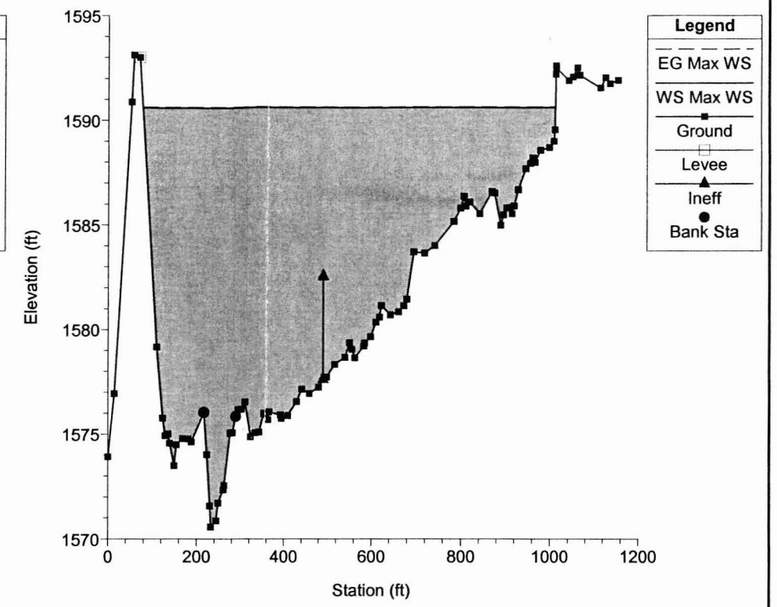
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.607



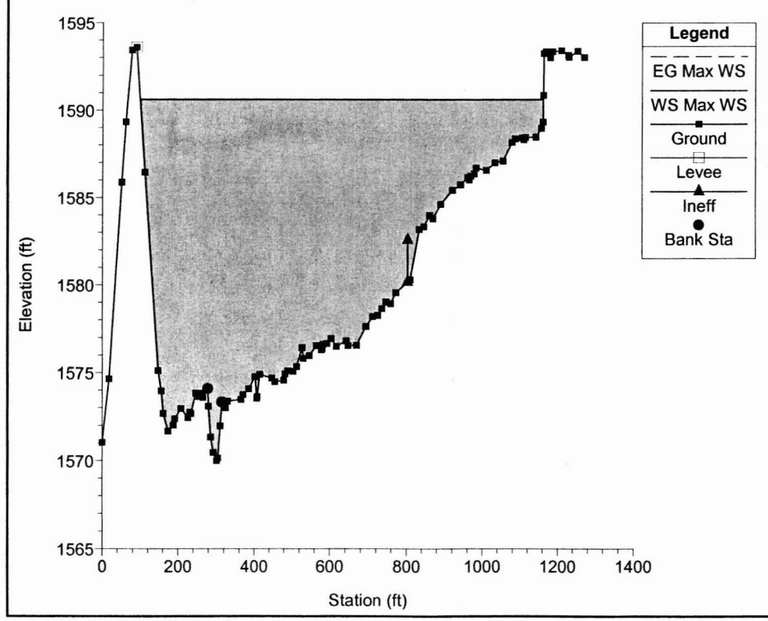
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.509



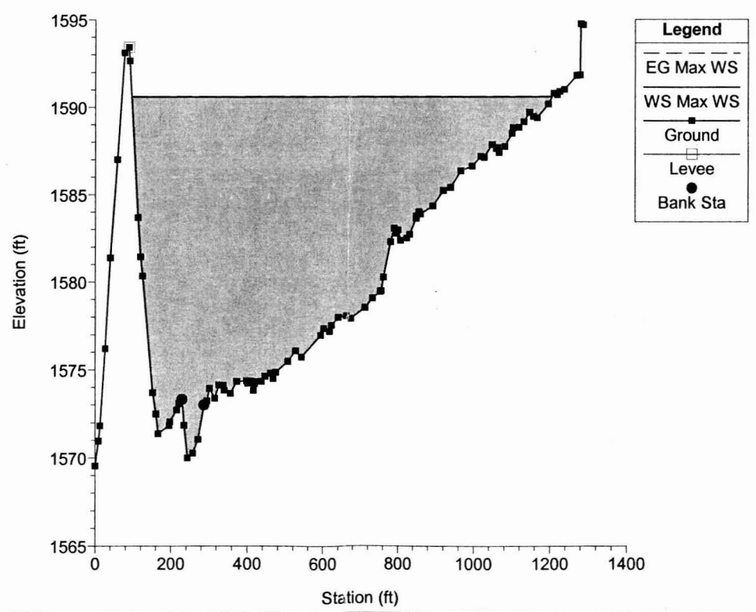
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.433



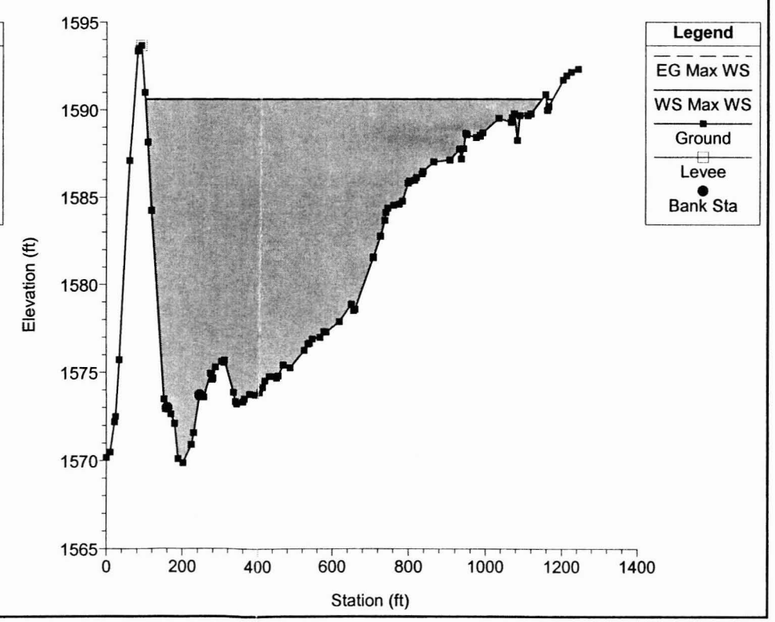
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.358



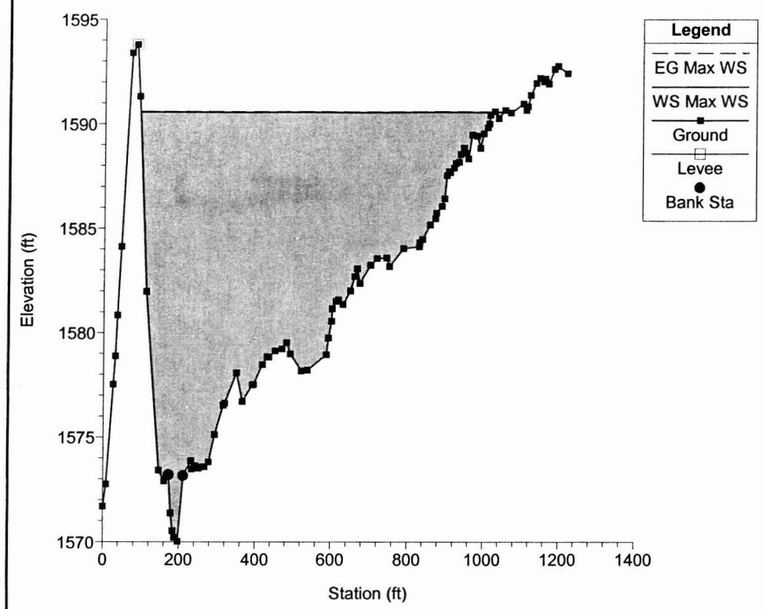
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.283



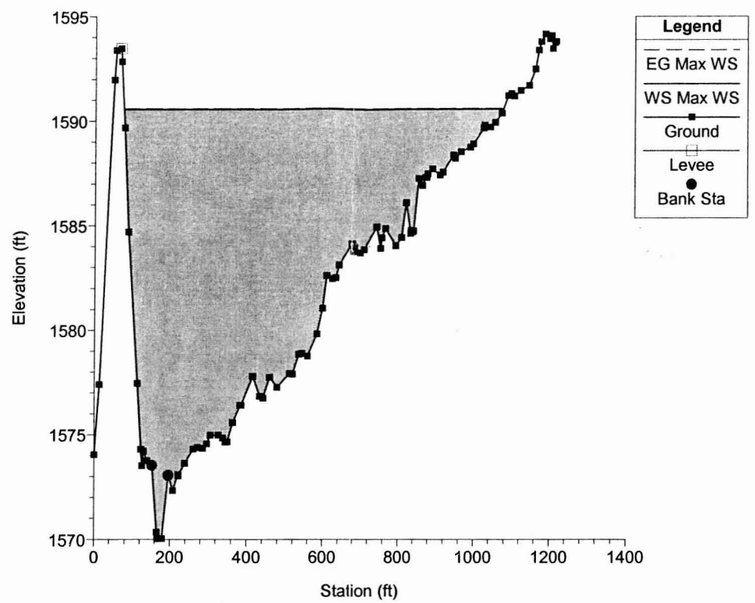
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.210



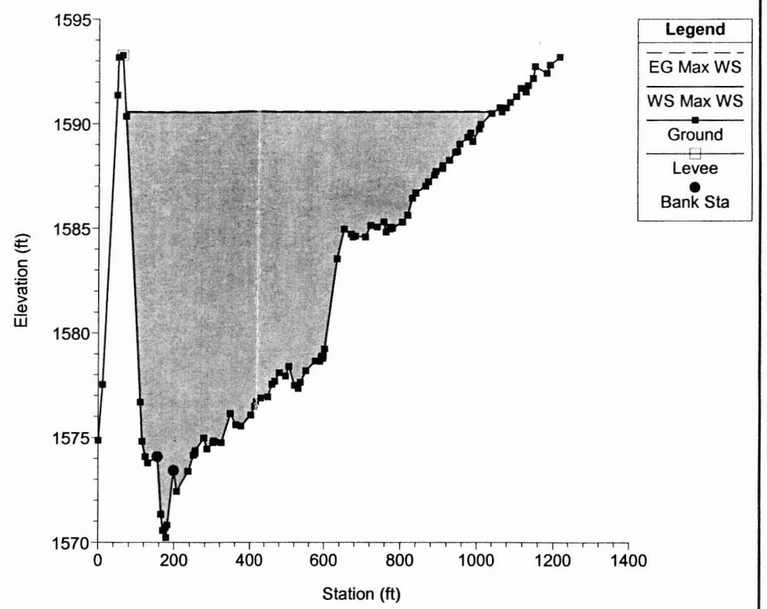
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.164



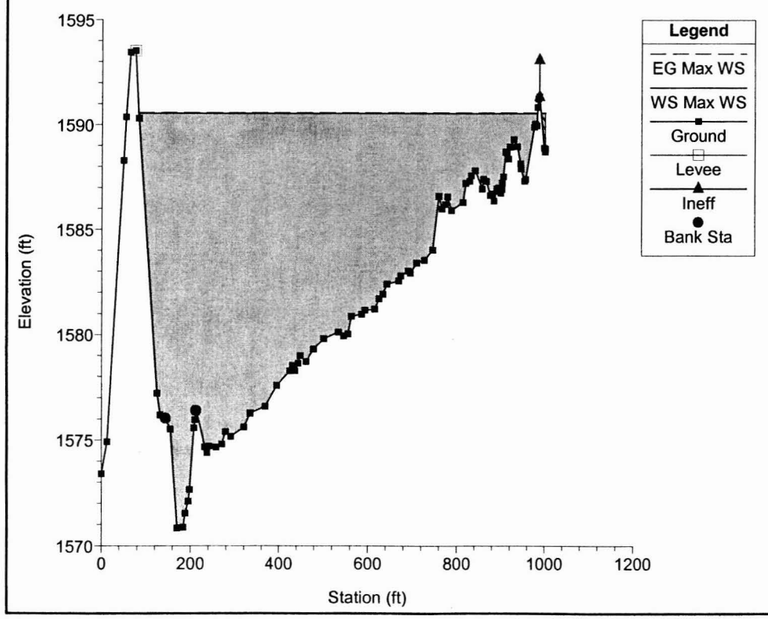
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.135



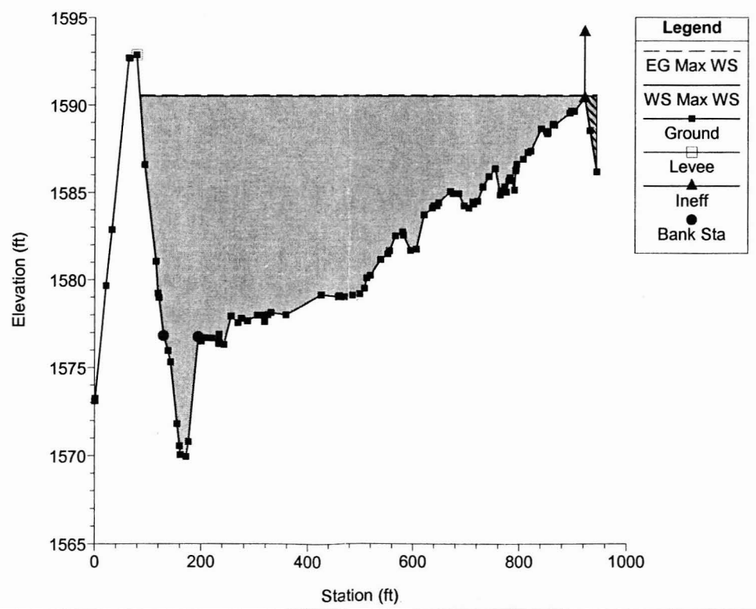
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 1.058



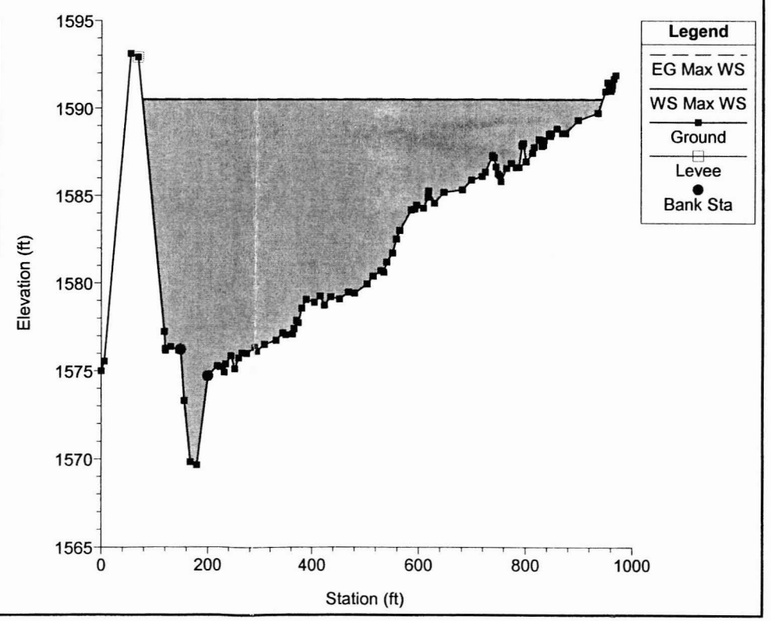
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.983



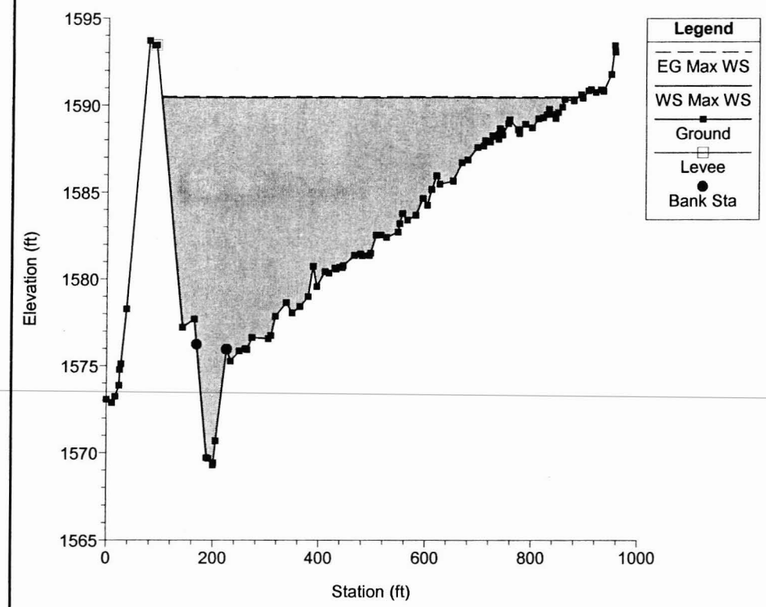
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.906



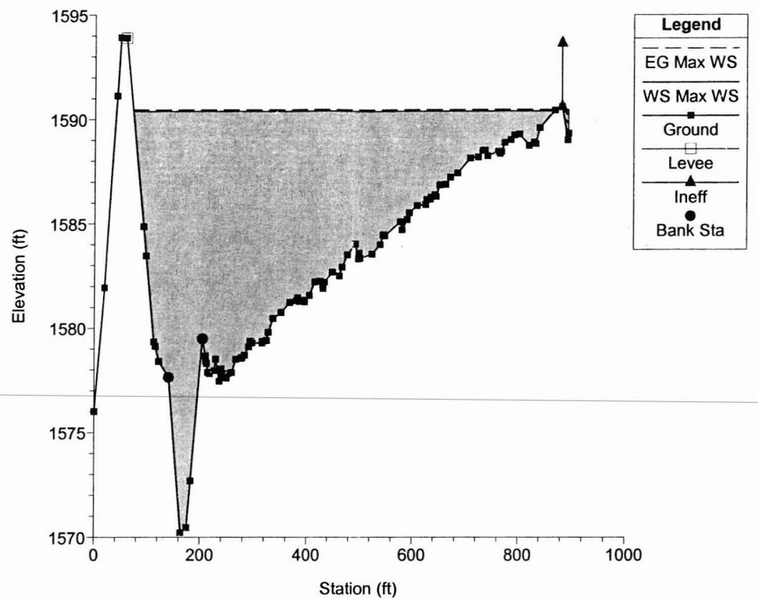
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.831



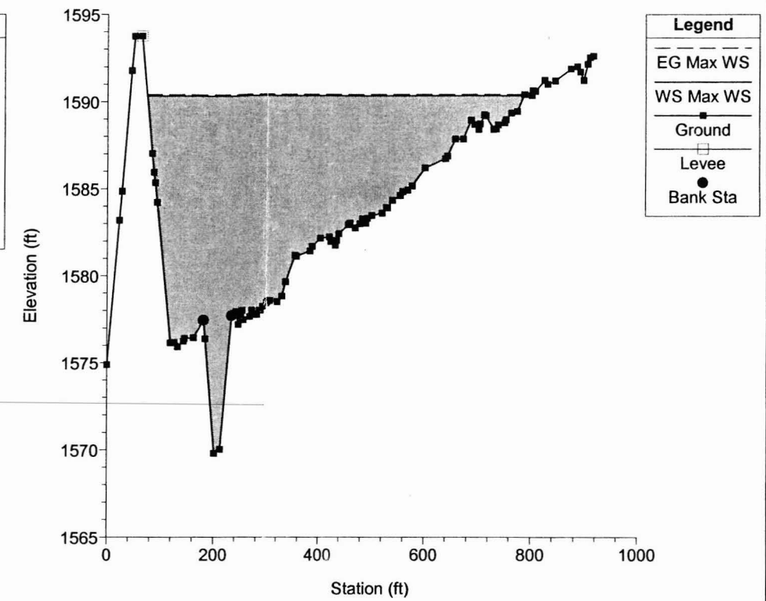
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.756



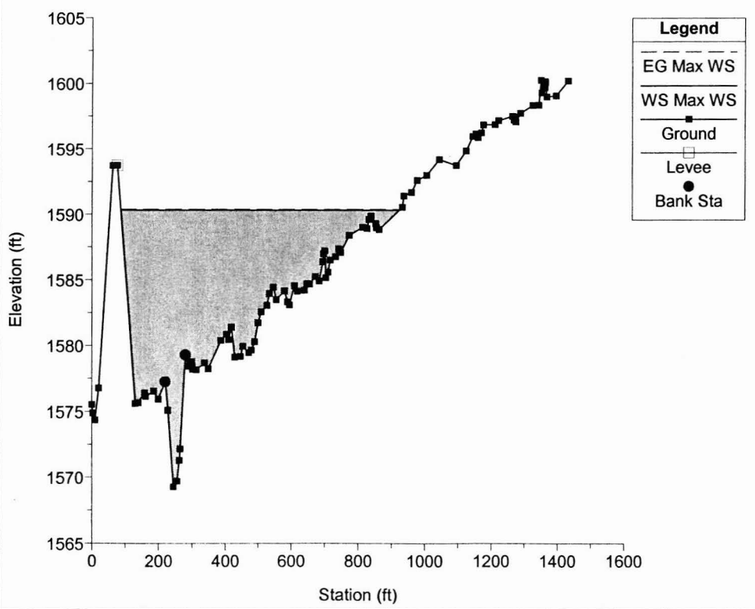
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.680



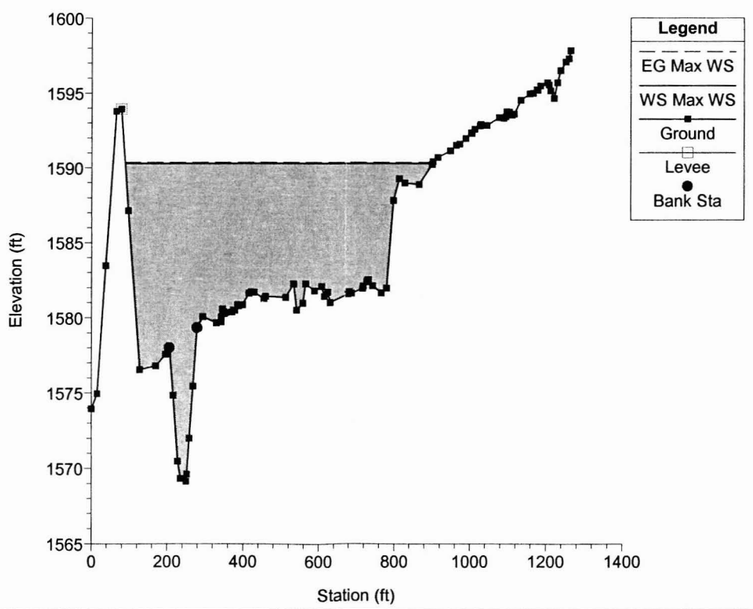
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.604



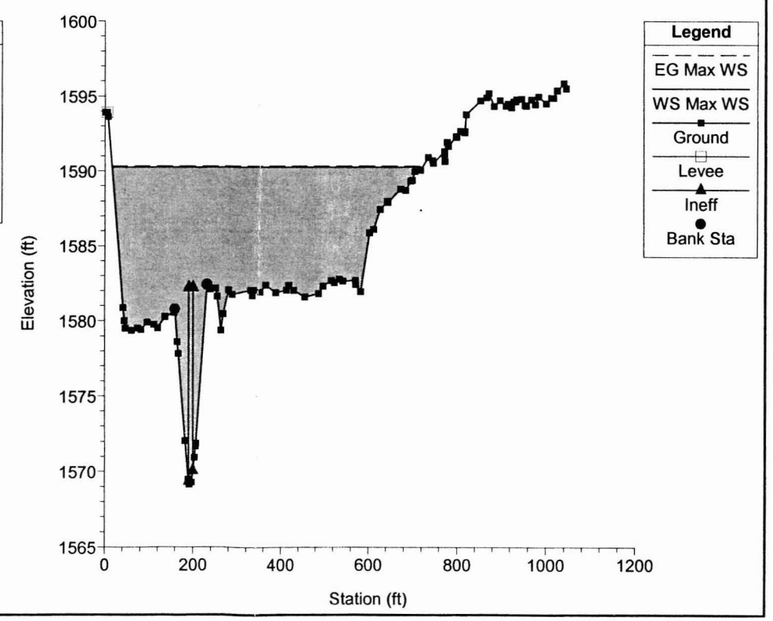
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.533



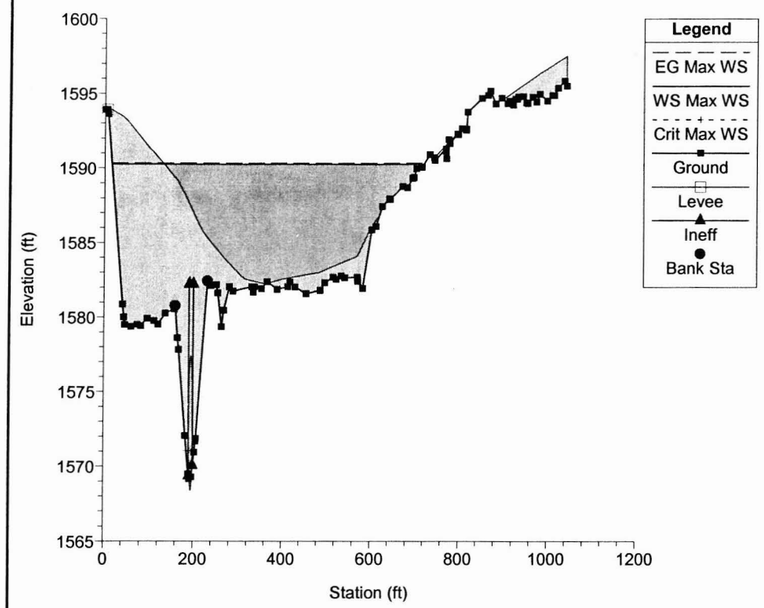
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.465



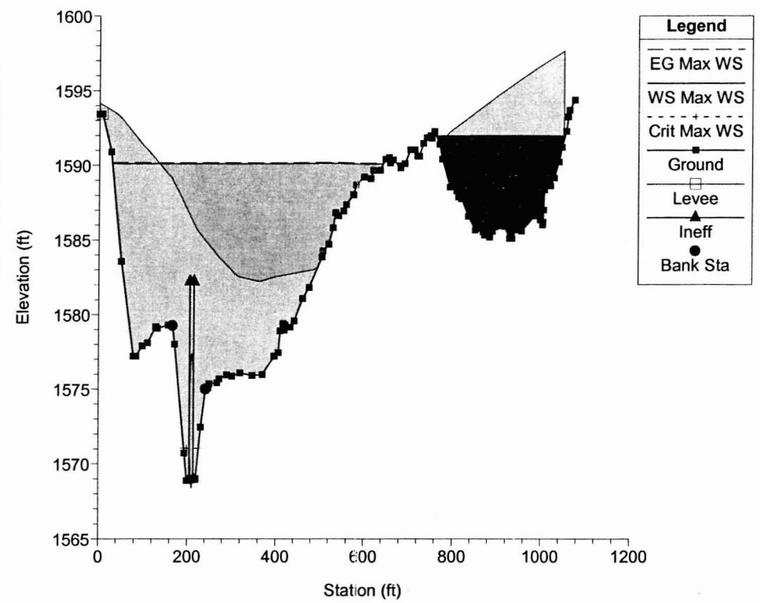
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.445 McDowell Road



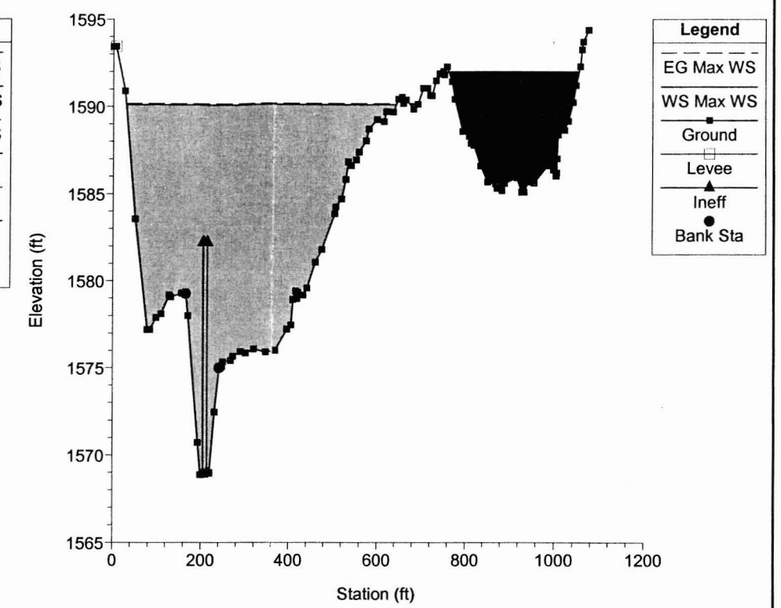
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.445 McDowell Road



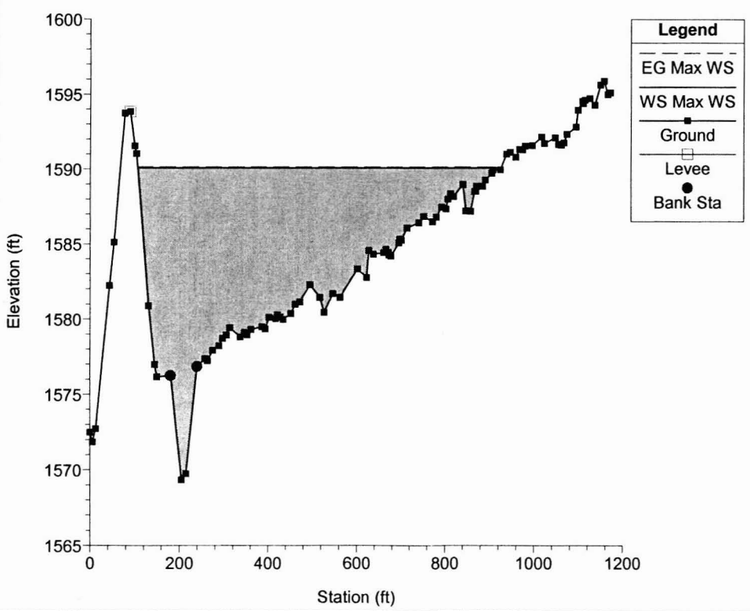
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.425



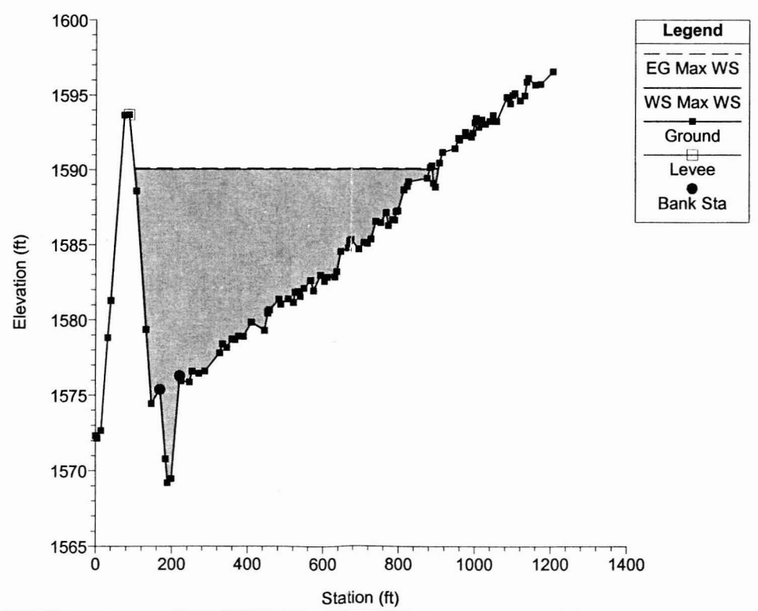
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.336



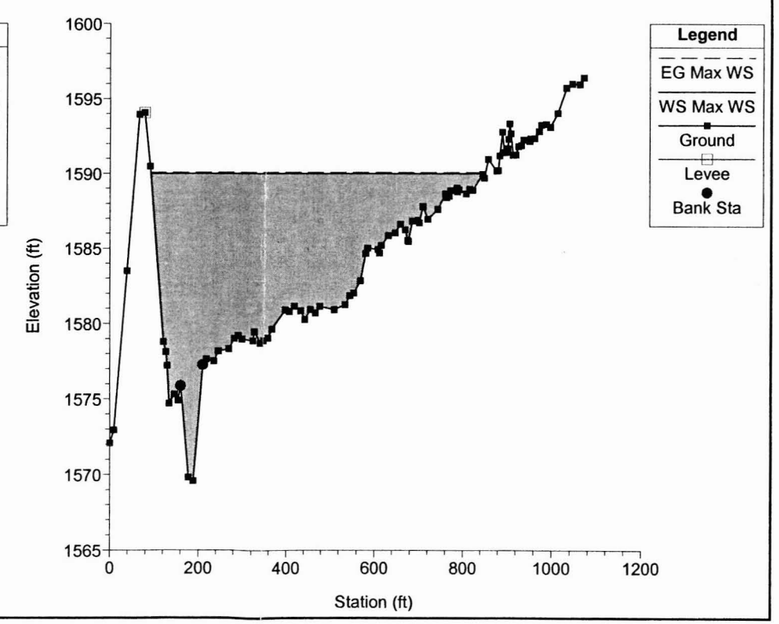
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.261



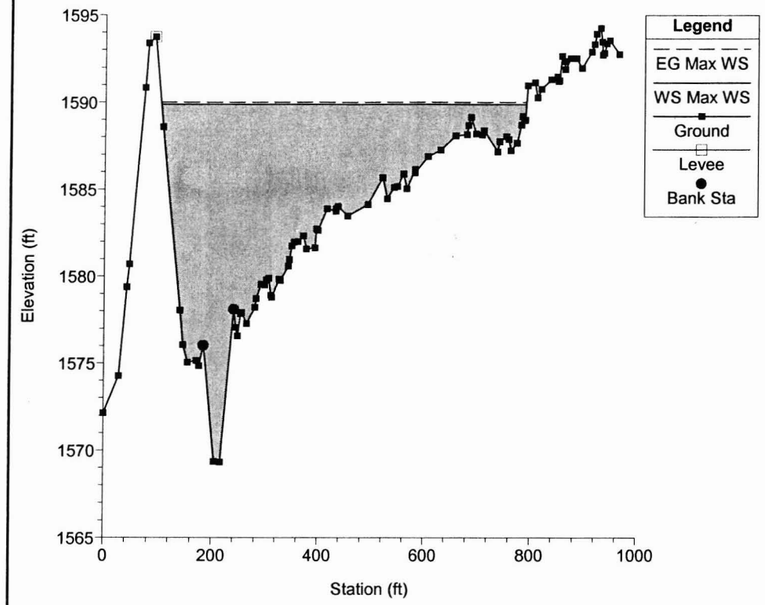
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.185



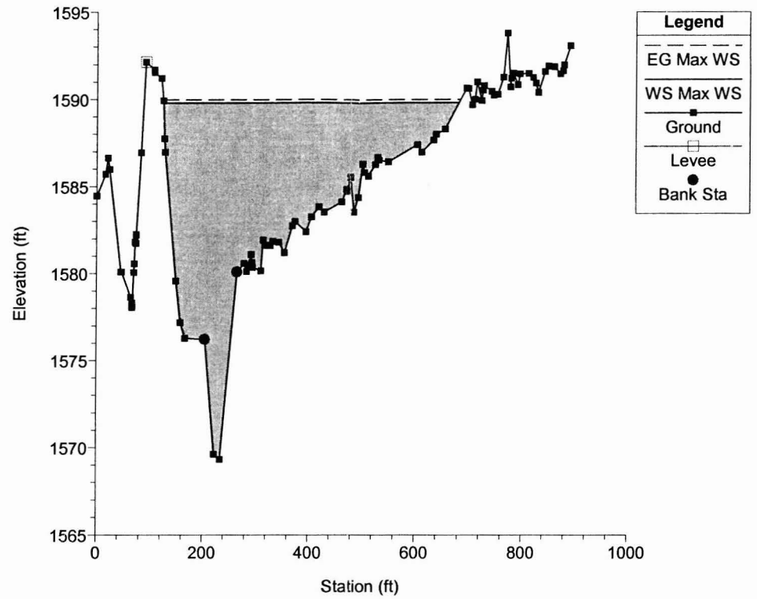
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.109



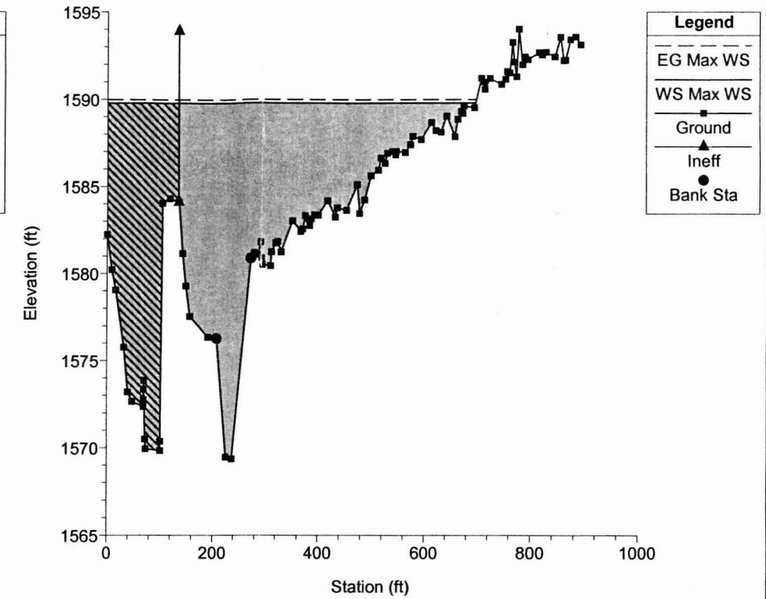
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.068



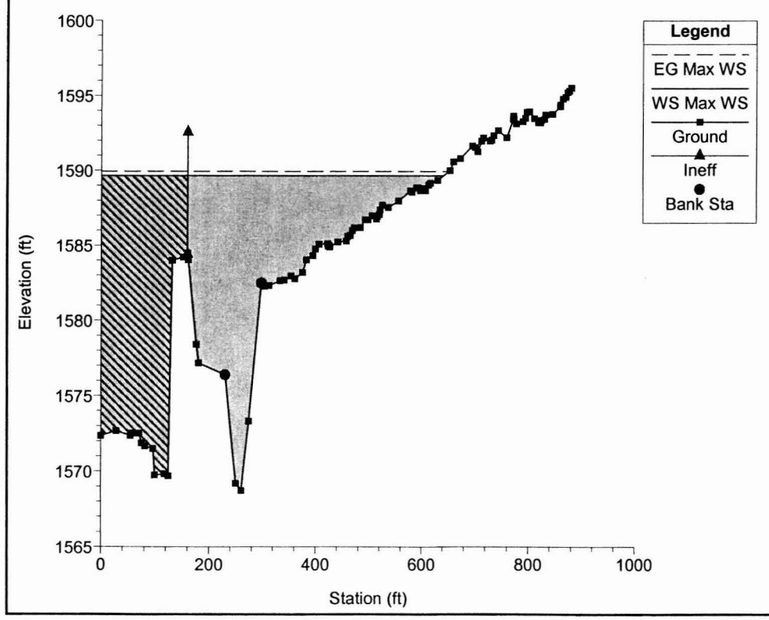
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.063



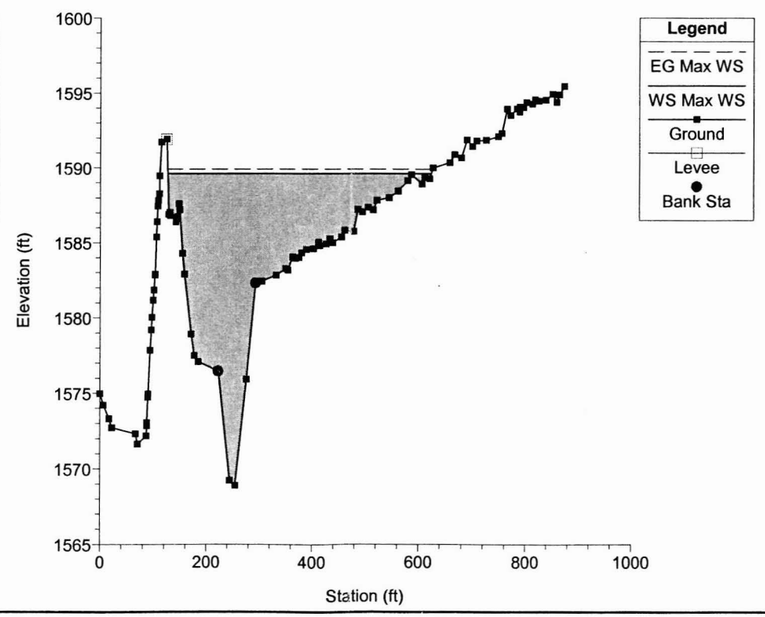
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.019



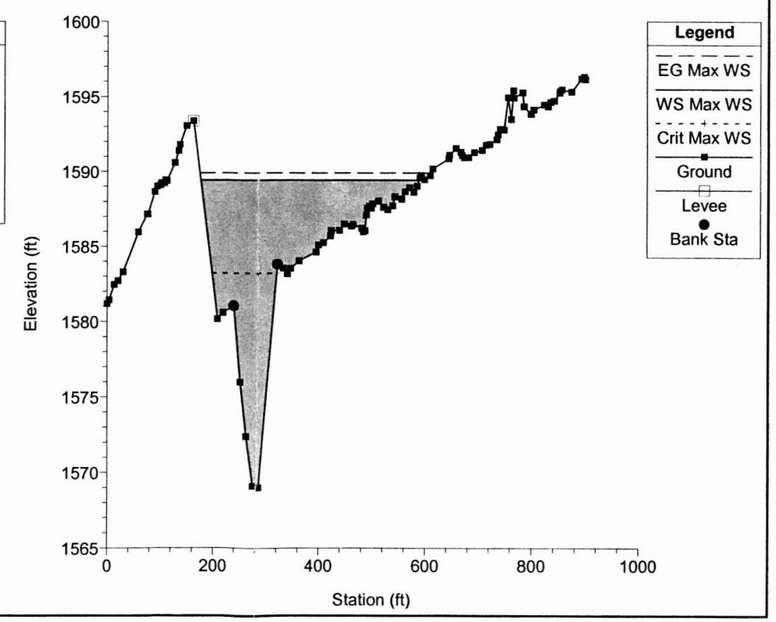
Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.016

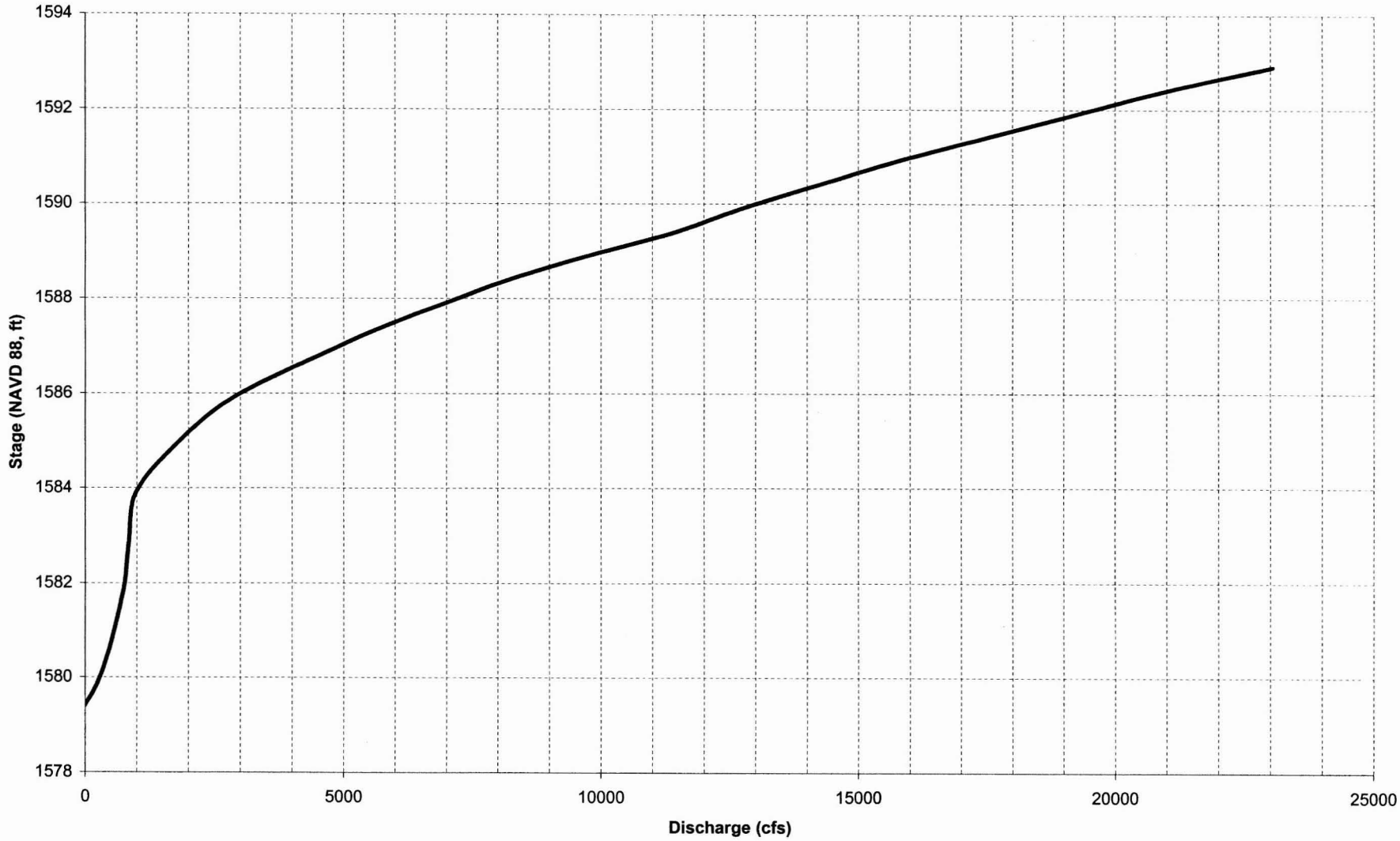


Red Mtn Fwy - Power to University Plan: Spook Hill FRS Hydraulic Analysis

RS = 0.000

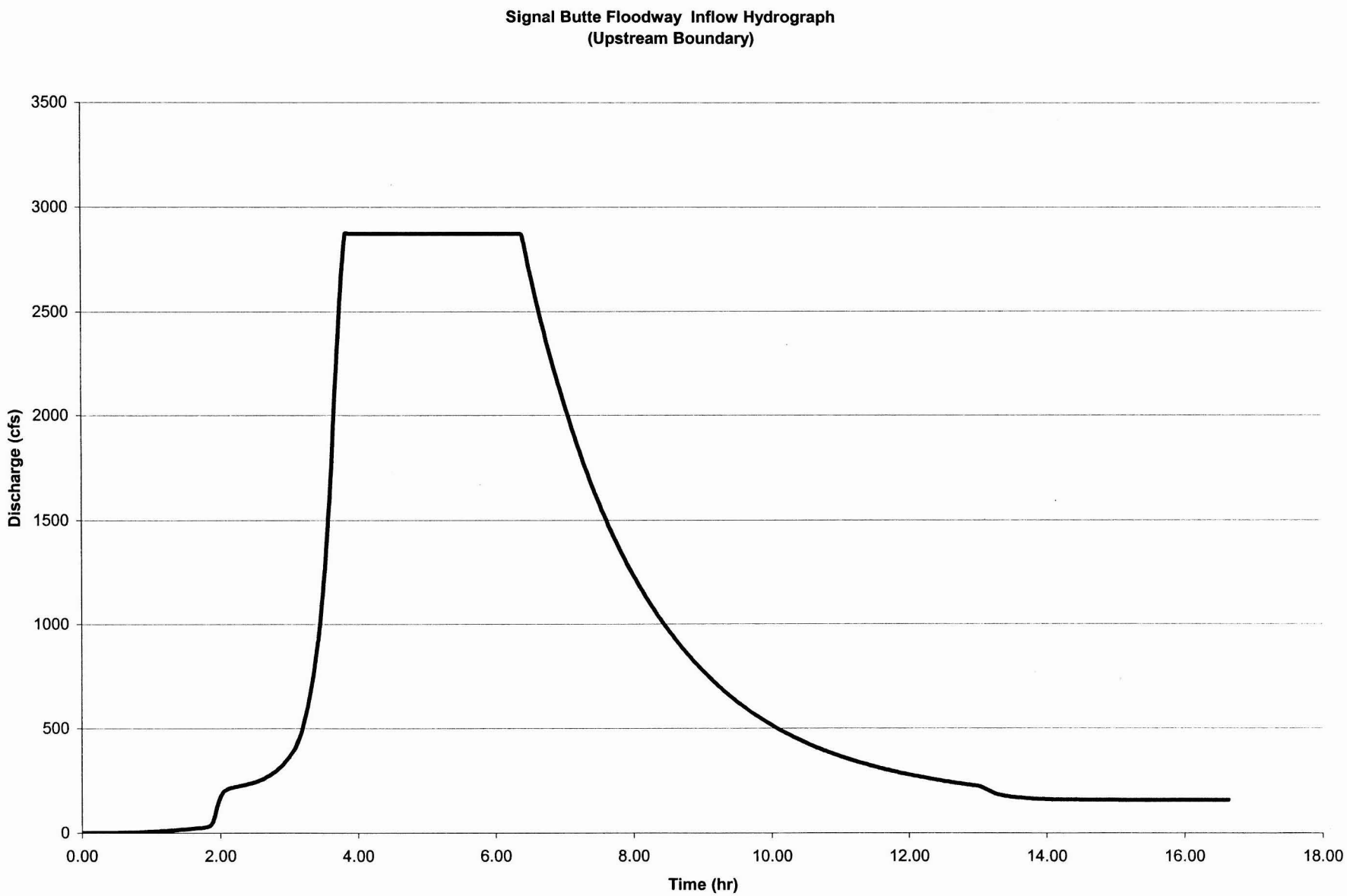


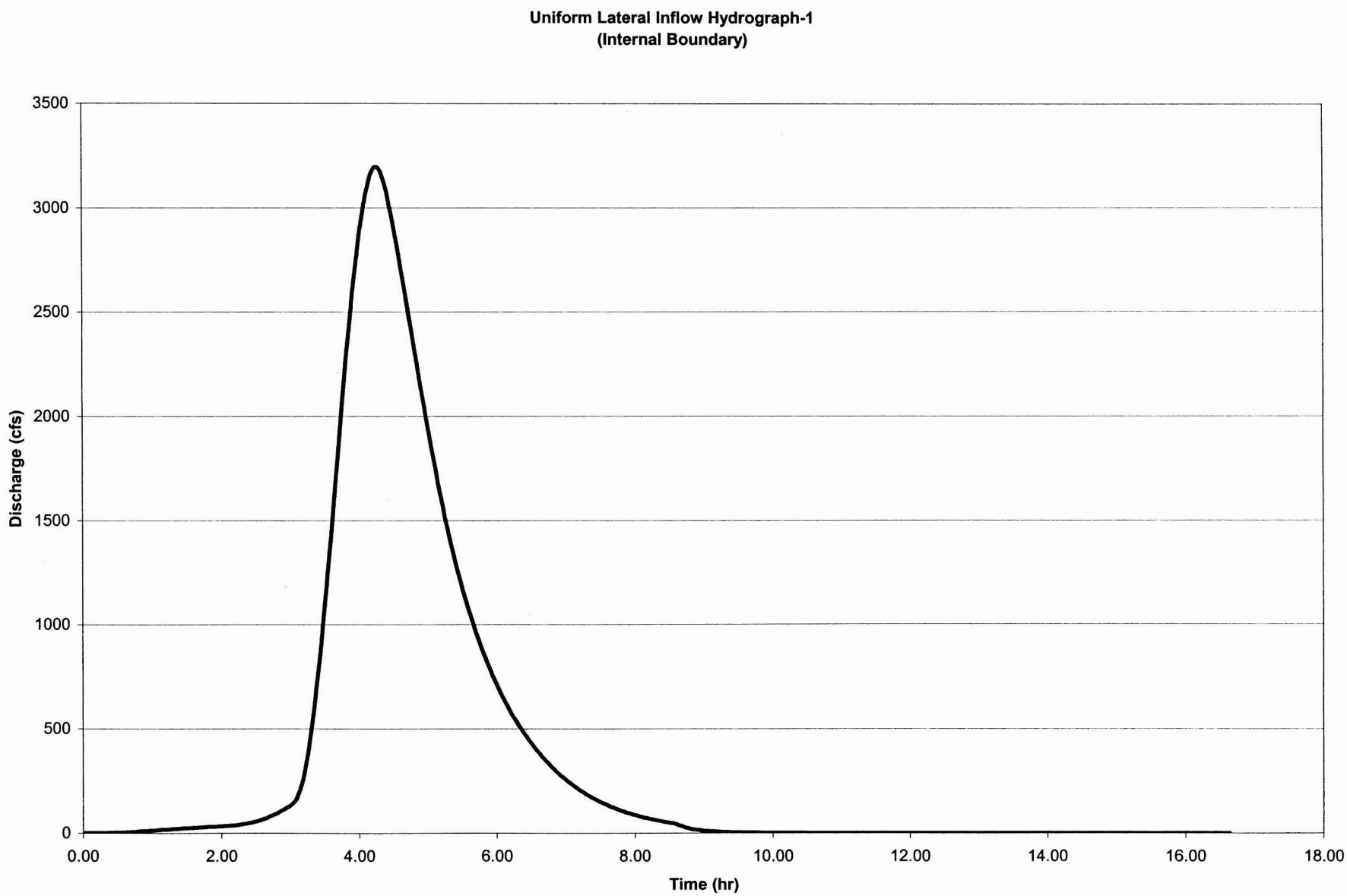
Spook Hill Emergency Spillway Stage-Discharge Function
(Downstream Boundary)

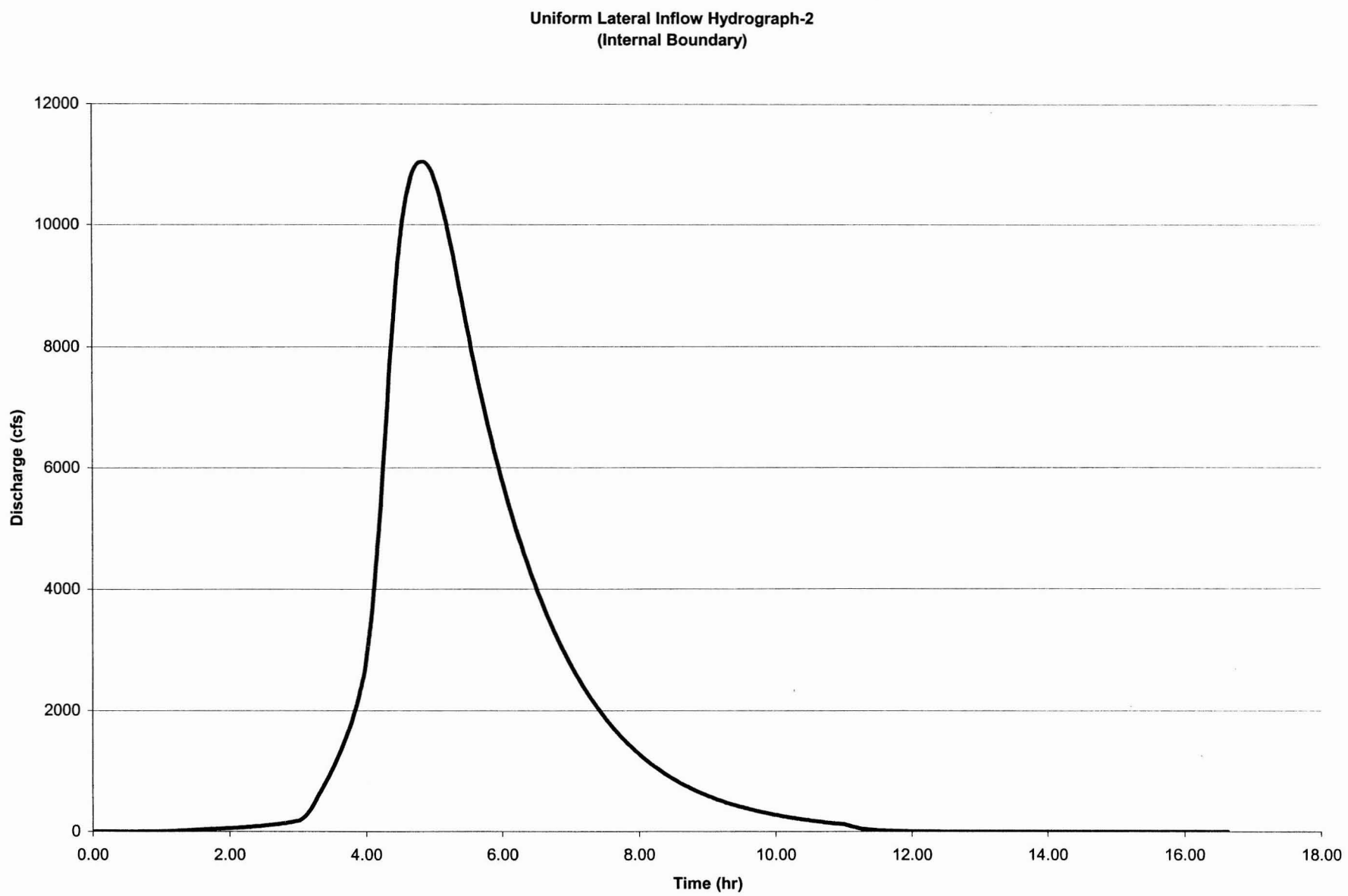


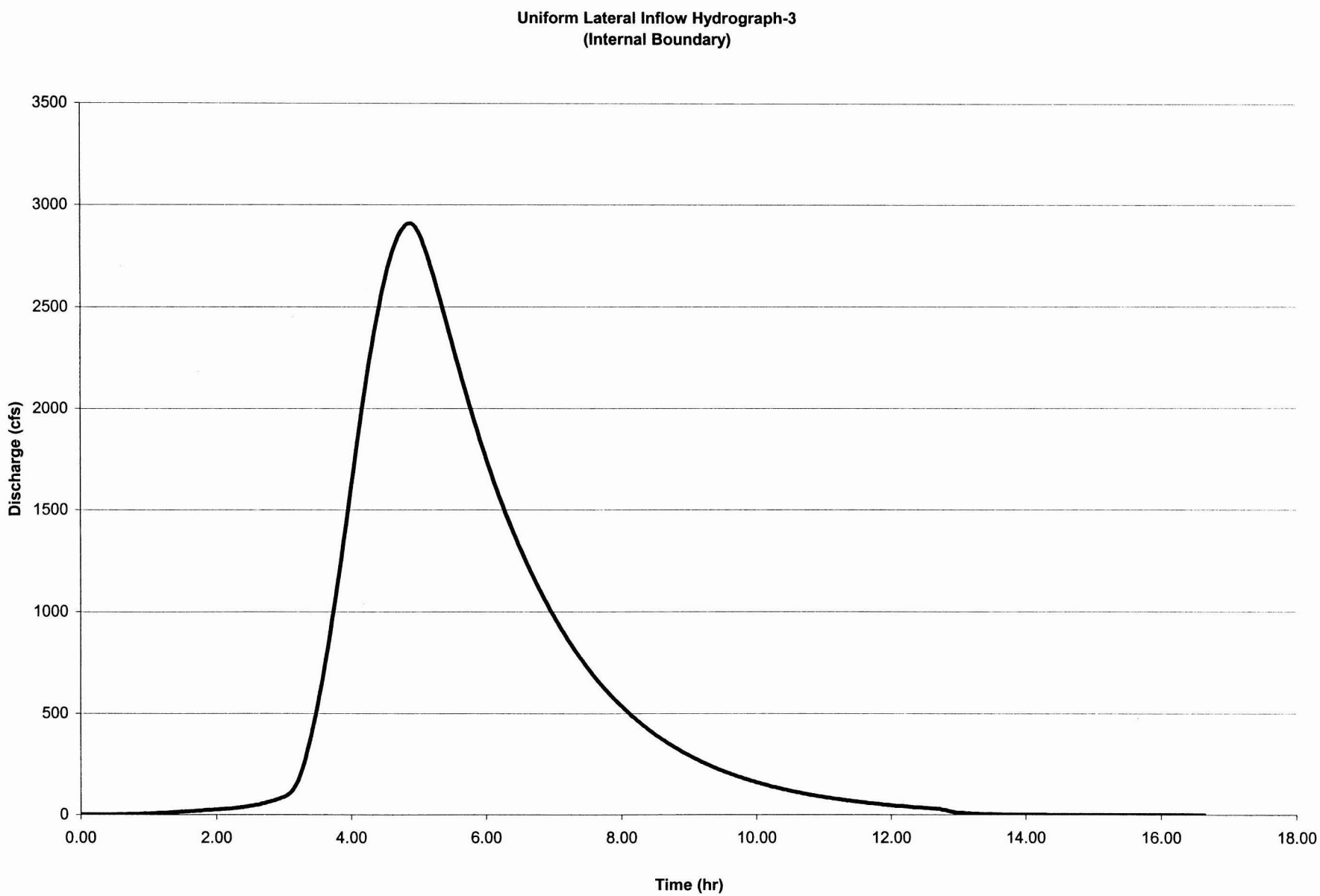
j:\rm06\design\drn\hydraulics\report\Spook Hill FRS-PMFboundary.xls(ds boundary)

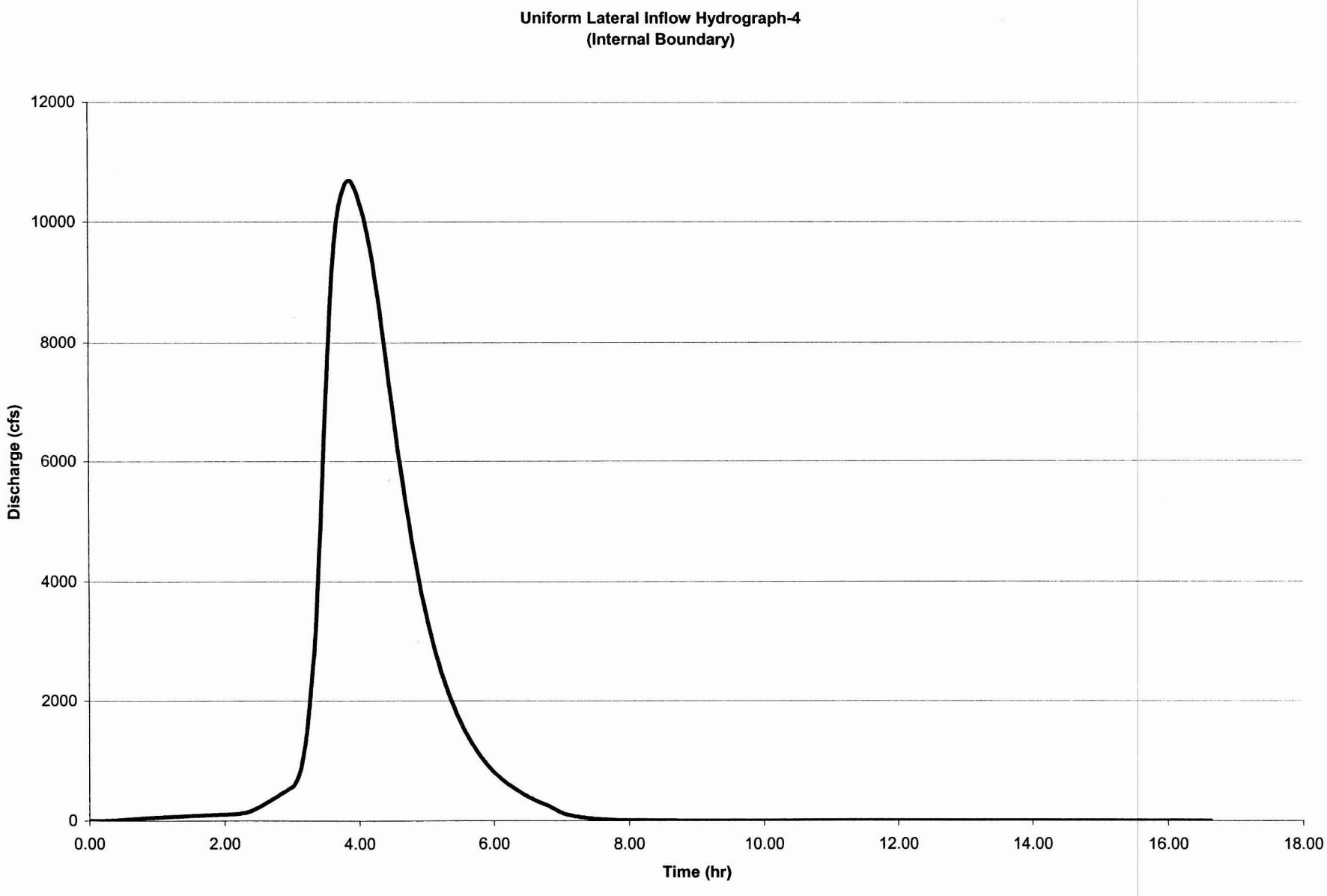
DMJM+HARRIS

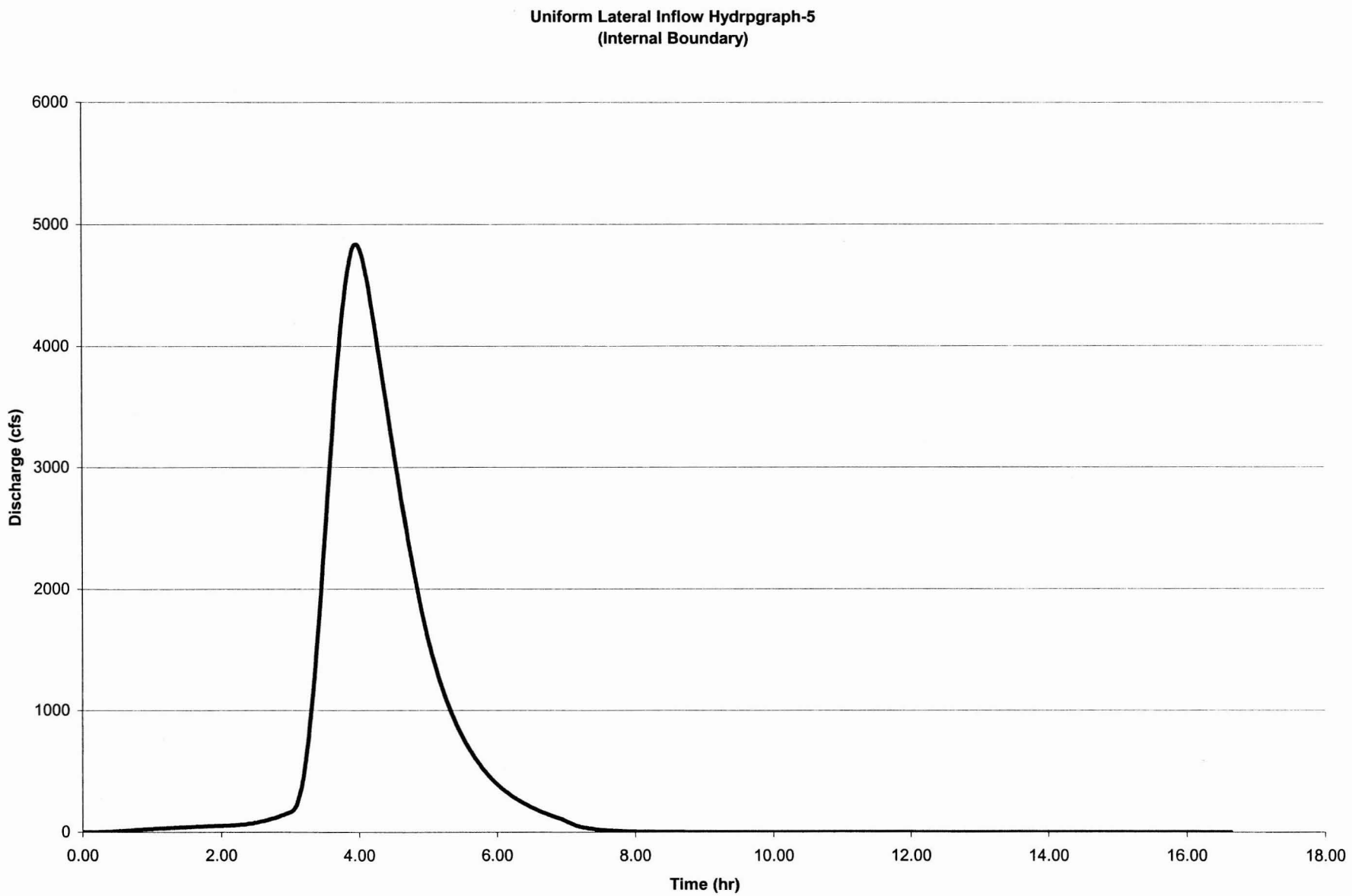

Signal Butte Floodway Inflow Hydrograph
(Upstream Boundary)
Discharge (cfs)
3500
3000
2500
2000
1500
1000
500
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Time (hr)


Uniform Lateral Inflow Hydrograph-1
(Internal Boundary)
Discharge (cfs)
3500
3000
2500
2000
1500
1000
500
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Time (hr)


Uniform Lateral Inflow Hydrograph-2
(Internal Boundary)
Discharge (cfs)
12000
10000
8000
6000
4000
2000
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Time (hr)


Uniform Lateral Inflow Hydrograph-3
(Internal Boundary)
Discharge (cfs)
3500
3000
2500
2000
1500
1000
500
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Time (hr)


Uniform Lateral Inflow Hydrograph-4
(Internal Boundary)
Discharge (cfs)
12000
10000
8000
6000
4000
2000
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Time (hr)


Uniform Lateral Inflow Hydrpgraph-5
(Internal Boundary)
Discharge (cfs)
6000
5000
4000
3000
2000
1000
0
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
16.00
18.00
Time (hr)

```
                    HEC-RAS Version 3.0.1  Mar 2001
                      U.S. Army Corp of Engineers
                     Hydrologic Engineering Center
                       609 Second Street, Suite D
                       Davis, California 95616-4687
                              (916) 756-1104

          X     X  XXXXXX    XXXX        XXXX       XX      XXXX
          X     X  X        X    X       X   X     X  X    X
          X     X  X        X            X   X    X    X   X
          XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
          X     X  X        X            X  X     X    X        X
          X     X  X        X    X       X   X    X    X        X
          X     X  XXXXXX    XXXX        X    X   X    X   XXXXX
```

****

PROJECT DATA
Project Title: Red Mtn Fwy - Power to University
Project File : SHPMF.prj
Run Date and Time: 4/14/02 12:58:16 PM

Project in English units

Project Description:
Red Mountain Freeway (202L)
Power Road to University Drive

Spook Hill
Floodwater Retarding Structure (FRS)
Existing Condition Hydraulics
Probable
Maximum Flood (PMF)

Prepared for:
Arizona Department of
Transportation

Prepared by:
DMJM+HARRIS
2777 East Camelback Road, Suite
200
Phoenix, Arizona 85016
(602) 337-2777

****

PLAN DATA

Plan Title: Spook Hill FRS Hydraulic Analysis
Plan File : C:\HEC\Spook\SHPMF.p01

Geometry Title: Existing Conditions
Geometry File : C:\HEC\Spook\SHPMF.g01

Flow Title :
Flow File :

Plan Summary Information:
Number of: Cross Sections = 60 Mulitple Openings = 0
Culverts = 3 Inline Weirs = 0
Bridges = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculaton tolerance = 0.01
Maximum number of interations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

****

FLOW DATA

Flow Title:
Flow File :

Flow Data (cfs)
****
* River Reach RS * PF 1 *
****

Boundary Conditions
****
* River Reach Profile * Upstream Downstream *
****
****

****

GEOMETRY DATA

Geometry Title: Existing Conditions
Geometry File : C:\HEC\Spook\SHPMF.g01

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 3.852

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1592.65	18.33	1593.17	28.07	1593.9	39.76	1594	54.17	1592.48
95.17	1592.72	128.47	1593.21	137.97	1596.8	152.56	1596.78	156.4	1594.45
173.36	1587.18	183.46	1582.52	187.7	1580.91	195.22	1577.13	196.05	1576.83
211.63	1576.4	227.29	1576.18	230.62	1576.53	247.11	1576.55	259.99	1577.5
265.56	1577.25	266.09	1577.38	281.1	1577.38	281.85	1577.21	307.63	1577.13
336.92	1577.77	337.84	1577.46	343.74	1577.33	364.76	1586.95	386.48	1597.33
389.41	1597.44	389.45	1597.44	393.19	1597.38	403.08	1600.23	414.93	1600.08
424.37	1597.9	430.48	1597.47	450.73	1597.89	458.14	1598.35	473.44	1600.77
477.86	1601	484.1	1600.28	492.2	1599.87	506.78	1600.38	512.61	1601
529.05	1601.8	529.72	1601.19	562.85	1601.3	563.84	1601.56	570.44	1601.44
579.92	1602.18	584.36	1602.73	614.35	1602.2	617.42	1602.41	637.81	1602.54
649.72	1602.2	653.6	1602.38	694.35	1602.59	724.85	1602.23	760.47	1602.3
788.69	1601.95	795.24	1602.77	801.88	1603.06	812.1	1602.83	844	1603.43
855.09	1603.79	883.3	1603.97	895.09	1603.59	901.54	1603.55	914.53	1603.91
966.77	1604.41	1006.88	1605.69	1055.12	1606.26	1061.61	1606.47	1067.42	1606.46
1125.59	1607.45	1160.94	1608.28	1193.42	1608.69	1196.84	1608.48	1211.84	1608.44
1213.53	1608.65	1217.91	1608.83	1265.1	1607.84	1291.18	1607.95	1301.95	1608.28
1309.11	1608.1	1309.62	1609.33	1309.97	1610.35	1316.15	1611.42	1319.07	1611.58
1324.39	1613.39	1340.35	1613.89	1340.94	1613.28	1366.58	1612.72	1382.28	1612.04
1383.54	1612.46	1393.39	1612.29	1399.82	1612.49	1400.69	1611.69	1409.89	1611.54

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	152.56	.035	389.41	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
152.56	389.41	1	1	1	.1	.3

Left Levee Station= 152.56 Elevation= 1596.78

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 3.851

INPUT
Description: Starting section for application of uniform lateral inflow hydrograph
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1592.65	18.33	1593.17	28.07	1593.9	39.76	1594	54.17	1592.48
95.17	1592.72	128.47	1593.21	137.97	1596.8	152.56	1596.78	156.4	1594.45
173.36	1587.18	183.46	1582.52	187.7	1580.91	195.22	1577.13	196.05	1576.83
211.63	1576.4	227.29	1576.18	230.62	1576.53	247.11	1576.55	259.99	1577.5
265.56	1577.25	266.09	1577.38	281.1	1577.38	281.85	1577.21	307.63	1577.13
336.92	1577.77	337.84	1577.46	343.74	1577.33	364.76	1586.95	386.48	1597.33
389.41	1597.44	389.45	1597.44	393.19	1597.38	403.08	1600.23	414.93	1600.08
424.37	1597.9	430.48	1597.47	450.73	1597.89	458.14	1598.35	473.44	1600.77
477.86	1601	484.1	1600.28	492.2	1599.87	506.78	1600.38	512.61	1601
529.05	1601.8	529.72	1601.19	562.85	1601.3	563.84	1601.56	570.44	1601.44

```
  579.92 1602.18  584.36 1602.73  614.35  1602.2  617.42 1602.41  637.81 1602.54
  649.72  1602.2   653.6 1602.38  694.35 1602.59  724.85 1602.23  760.47  1602.3
  788.69 1601.95  795.24 1602.77  801.88 1603.06   812.1 1602.83     844 1603.43
  855.09 1603.79   883.3 1603.97  895.09 1603.59  901.54 1603.55  914.53 1603.91
  966.77 1604.41 1006.88 1605.69 1055.12 1606.26 1061.61 1606.47 1067.42 1606.46
 1125.59 1607.45 1160.94 1608.28 1193.42 1608.69 1196.84 1608.48 1211.84 1608.44
 1213.53 1608.65 1217.91 1608.83  1265.1 1607.84 1291.18 1607.95 1301.95 1608.28
 1309.11  1608.1 1309.62 1609.33 1309.97 1610.35 1316.15 1611.42 1319.07 1611.58
 1324.39 1613.39 1340.35 1613.89 1340.94 1613.28 1366.58 1612.72 1382.28 1612.04
 1383.54 1612.46 1393.39 1612.29 1399.82 1612.49 1400.69 1611.69 1409.89 1611.54

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  152.56    .035  389.41    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        152.56  389.41            146.5   146.5   146.5             .1       .3
Left Levee      Station=  152.56      Elevation= 1596.78

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 3.824

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1589.53   15.02 1593.24    26.4 1593.19   47.51 1590.62   68.84 1590.38
    78.5 1590.55   90.39 1590.36   97.69 1590.39  123.38 1591.16  131.17  1592.7
  140.33 1596.32  141.23 1596.99   160.1  1597.1  164.74 1595.43  166.14 1594.75
  170.97 1592.88  177.12 1589.47  185.36 1585.64  195.76  1582.2  201.24 1579.53
  203.87 1578.68  207.12  1577.4  207.82 1577.29  239.14 1576.78  258.06 1576.89
  265.63 1576.59  277.51 1576.54  282.02 1576.86  304.24 1576.88  310.15 1578.16
  313.39 1579.54  342.06 1592.55  349.55 1596.88  351.52 1597.37  366.73 1597.24
  378.66 1596.47  379.12 1596.56  379.15 1596.57  387.88 1598.51  401.46  1598.2
  424.11 1593.58  427.48 1594.05  442.78 1595.25  450.69 1596.73  456.51 1597.66
  478.58 1599.63  485.87 1599.32  522.82 1599.25  553.15 1600.34  554.19 1599.69
  589.91 1599.34  591.31 1599.57  612.77 1599.71   623.6 1600.15  638.71 1599.66
  662.84  1599.3  706.31 1599.75  712.26 1599.54  720.66 1599.68  726.95 1599.27
  728.29  1599.7  733.12 1599.78  738.82 1601.37  763.91 1600.64  790.45 1601.66
  832.98 1601.47  846.93 1601.27   848.1 1601.47  867.17 1600.99  876.53 1601.04
  877.77  1600.8   914.6 1600.53  915.28 1600.91  921.98 1601.29  940.49 1602.74
  960.77 1602.36 1030.07 1602.21 1045.64 1602.69 1057.09  1604.8  1062.2 1604.82
 1089.31 1604.31 1126.18 1604.25 1160.33 1604.86 1160.97 1604.49 1169.04  1604.6
  1186.5 1603.78 1205.84 1603.23  1221.9 1603.26 1223.04 1603.48 1230.05 1603.61
 1250.09 1605.41 1258.43 1605.54 1308.17 1604.94 1338.34 1604.96 1363.47 1606.03
 1373.19 1605.87 1384.64 1612.38 1402.83 1613.02 1403.77  1612.4  1409.9 1612.26

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035   160.1    .035  351.52    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         160.1  351.52            392.3   392.3   392.3             .1       .3
Left Levee      Station=   160.1      Elevation=  1597.1

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 3.749

INPUT
Description:
Station Elevation Data    num=      99
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0  1584.6   19.48 1590.03    29.1 1592.85   39.24 1592.93   67.83 1586.84
   74.06 1585.68   91.24 1584.42   116.4 1584.93   122.3 1585.22  144.52 1585.58
  165.59 1586.29  175.89 1586.35  179.37 1586.58  197.04 1586.46  199.02  1585.3
  221.74 1576.17   265.5 1575.57   274.1 1575.93  299.27 1576.14   316.4 1576.06
  323.46 1578.02  328.45    1580  344.36 1587.07  351.39 1587.55  355.23 1587.66
  359.75  1587.5  392.07 1594.22  397.59  1595.5   400.1 1595.46  425.92 1595.31
  454.19 1589.22  478.59 1589.21  491.17 1589.83   495.1 1589.48  506.45 1588.95
  521.45 1589.55  533.37 1588.93  536.91 1588.93  576.55 1590.37  581.68 1591.89
  603.62 1591.36  606.51 1591.18  639.17 1591.27  655.74 1591.87  662.54 1591.59
   668.5 1591.65  683.98 1591.37  695.77 1591.68   707.2 1591.51  713.34 1591.56
  718.76 1591.79  730.73 1591.62  734.53 1591.38  748.11 1591.39   760.7 1591.22
  791.04 1591.46  803.06  1591.8  810.89 1591.72  819.75 1591.97  826.31 1591.62
  844.47 1591.73  847.25 1592.12  852.05 1592.45   862.6 1592.72  916.24 1592.44
 1001.28  1592.7 1013.35  1593.4 1018.57 1593.44 1042.46 1592.85 1063.89 1593.43
 1109.27 1592.99 1150.33 1593.17 1203.49 1593.95 1249.76 1593.58 1269.94 1594.17
 1322.94  1594.8 1327.11 1595.02 1352.55 1595.35 1359.48 1596.52 1363.38  1597.5
```

```
 1379.83 1596.45 1408.62 1597.43 1414.88 1597.98 1415.55 1598.39 1417.67    1601
 1418.63 1600.83 1428.16 1601.01 1438.85 1599.08 1491.69 1600.63 1507.29 1600.87
 1509.89 1601.07 1543.03 1602.24 1552.54  1602.3 1591.94 1603.11 1618.47 1604.83
 1626.39 1604.81 1633.52  1606.1 1638.07 1606.45 1643.11 1606.54

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  197.04    .035  344.36    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        197.04  344.36            550.4   550.4   550.4              .1       .3
Left Levee      Station=   39.24      Elevation= 1592.93

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 3.645

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1580.67    3.09 1581.51    6.83  1583.4   28.12 1590.81   35.34 1593.18
   45.32 1593.02   68.62 1585.09   77.79 1582.12   94.81 1578.56   99.04 1577.34
  110.96 1576.77  114.96 1576.68   120.5 1576.84  128.01  1576.7  150.55 1576.79
  154.58 1577.15  168.36 1573.02  177.79 1572.93  187.44 1572.42  223.41 1572.38
  230.76 1572.16  235.96  1572.3  247.77 1572.31  256.22 1572.62     259 1572.84
  276.27 1575.39  291.45 1575.72  303.49 1576.51  331.21 1581.16  348.01 1584.21
  369.99 1589.57  380.26 1591.48  391.04 1593.32   414.8 1593.08   453.7 1593.52
  453.72 1593.52  479.49 1593.51  514.49 1592.78  520.56 1592.97  530.91 1593.07
   539.3 1590.94  553.26  1587.1  569.85 1585.02  591.05 1584.19  611.23 1585.02
  623.35 1585.12  632.85 1585.09  637.33 1585.33  662.72 1586.09  672.14 1585.86
  693.77 1585.79  695.93 1585.61  705.49  1585.7  724.04 1586.14  733.38 1586.13
  740.68 1586.56  757.65 1586.97  772.07 1587.09  776.85  1586.9   806.8 1588.06
  812.88 1587.81  844.26 1587.93  853.82 1588.55  859.91 1588.73  868.51 1587.44
   882.1 1585.96  884.84 1585.79  889.18 1586.09  890.82 1586.05  894.61  1586.3
  905.13 1587.42  906.33 1587.71  918.69 1589.24  937.76 1589.18  940.17 1588.73
  958.91 1589.07  976.54 1588.92   978.6 1589.35  990.09 1589.52   997.3 1589.99
 1001.22 1590.09  1033.4 1589.99 1034.66 1590.11 1080.12  1590.4 1085.78 1589.95
 1128.11    1590 1166.14 1590.52 1173.29 1590.91 1183.81  1591.1 1185.17 1591.27
 1203.46 1592.08 1208.61 1592.19 1224.52 1592.88 1251.89 1593.15 1287.76    1594
 1306.72 1594.09 1313.45 1593.96 1322.28 1594.22 1330.77 1594.99 1337.23 1595.16

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  154.58    .035  276.27    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        154.58  276.27            363.7   363.7   363.7              .1       .3
Left Levee      Station=   45.32      Elevation= 1593.02

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 3.576

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1575.41    2.99 1576.08   17.17 1580.93   39.29 1588.82   49.51 1592.58
   53.64 1593.95   56.41 1594.02   63.58 1594.03   72.47 1591.24    78.4 1589.12
  102.75 1581.59  115.54 1577.32  116.53  1577.2  123.74 1576.99  138.01 1576.26
  146.28 1576.51  154.12 1574.19  161.12  1573.5   179.1  1572.9  181.69 1572.99
  196.76 1573.18   209.5 1573.41  225.84 1573.08  231.45 1573.02  236.21 1573.07
  256.37 1572.96  263.08 1574.35   265.3  1574.7  282.76 1574.12   300.4 1574.65
  308.01 1574.78  309.84 1574.91  312.84 1574.99  323.67    1575  345.23  1575.4
   374.3 1577.17  385.31 1579.36  409.54 1582.73  421.84 1584.63  421.87 1584.64
  431.69 1586.47  453.89 1591.08  457.38 1591.11   499.8 1590.62   501.4 1590.68
  508.84 1590.72  524.08  1587.6  526.89 1586.96  546.66 1581.39  549.35  1581.7
  577.47 1582.72  598.12 1582.16  609.32 1582.01  621.22 1582.29  632.58  1582.7
  638.74 1582.81  658.92 1582.94  679.45 1583.56  692.73  1583.7  711.13 1584.33
   717.3 1584.41  730.16 1584.23  750.69 1584.55  762.57  1584.9  768.53 1584.81
  802.18 1585.88   814.1 1586.15  825.62 1586.15  833.26 1586.55  842.35 1586.53
  858.21 1587.07  882.26  1587.4  894.67 1587.26  901.56 1590.31  924.42  1590.6
  926.14 1590.43  951.49 1590.01  953.81 1590.26  977.34 1591.13 1019.47  1591.6
 1024.85 1591.59 1026.31  1591.9 1031.01 1592.69 1033.96 1592.31 1061.14 1592.18
 1065.43 1592.05  1071.2 1592.06 1081.64 1592.33 1091.36 1592.07 1101.75 1591.97
 1103.64 1591.73 1115.91 1591.66 1129.02 1591.78  1130.8  1592.1  1150.5 1593.99
 1152.39 1593.73 1157.79 1593.96 1190.31 1593.38 1203.96 1594.31 1207.42    1596

Manning's n Values        num=       3
```

```
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  146.28    .035   265.3    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        146.28   265.3             401.9   401.9   401.9             .1       .3
Left Levee      Station=   63.58      Elevation= 1594.03

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 3.500

INPUT
Description:
Station Elevation Data    num=      99
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
**********************************************************************************
       0 1575.82     .81 1575.96   25.44 1582.17   31.55 1584.36   57.32 1593.89
   58.74 1593.75   60.79 1593.77   68.13 1593.63   70.84 1592.62    98.8 1583.62
     105 1581.49  108.86 1580.73  113.71 1579.51  124.94 1576.92   141.4 1576.63
  148.23 1576.91  154.78  1577.3   167.6 1573.84  170.47 1572.99  184.53 1572.48
  196.48 1572.52  207.49 1572.98  223.11 1573.07  243.92 1573.56   247.1  1573.9
  260.69 1573.46  264.52 1573.44  285.03 1575.05  297.75  1575.4  310.59 1575.46
   312.9 1575.11  323.03 1575.16  339.64 1576.05  425.66 1576.31  449.77 1576.75
  472.02 1577.29  499.63  1578.4  535.89 1583.53  569.67 1583.62  581.49 1583.27
  621.63 1585.03  659.03 1586.12  663.37 1586.05  674.25 1585.36  677.95 1585.23
  687.14 1586.16  695.08 1586.49  702.32 1586.68  734.83 1588.36  749.33 1588.66
  752.48 1588.65  755.47 1589.29  757.49 1588.62  760.34 1588.14  774.35 1588.41
  787.67 1588.31  807.68 1588.39  817.04 1588.68  826.62 1589.89   828.3 1590.04
  834.68 1589.51  837.99 1589.64  852.03 1589.05  893.14 1589.34  902.94 1589.95
  904.56 1590.46  913.49 1590.43  930.48 1591.13  940.35 1591.44  944.61 1591.51
  974.94 1591.47  983.37 1591.78  985.04 1591.47  995.72 1594.97  1001.3 1593.48
 1002.56 1593.26 1006.62 1595.05 1009.21 1595.97 1011.67 1595.86 1013.09 1595.93
 1019.97  1595.8 1023.87 1595.98 1032.23  1593.6 1050.99 1593.64 1051.65 1593.77
 1062.25     1595 1091.56 1594.64 1096.43  1594.7 1116.12 1594.53 1139.21 1593.78
 1165.22 1593.94 1176.93  1594.2  1179.6 1594.03 1180.61 1594.15 1182.04 1594.05
 1184.87 1594.25 1190.69 1594.03 1205.08 1593.79 1226.33 1595.27

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  154.78    .035   247.1    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        154.78   247.1              400     400     400             .1       .3
Left Levee      Station=   68.13      Elevation= 1593.63

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 3.424

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
**********************************************************************************
       0 1577.92   24.42 1584.68   25.57 1584.97   31.49 1587.13   50.08 1593.77
   62.07 1593.32   67.47 1591.88  100.47 1581.23  105.59 1579.69  112.87 1578.44
  135.29 1577.52  143.08 1577.96  144.39 1578.02  145.92 1577.58  160.24 1573.21
  162.55 1573.19  176.36  1573.2  181.71 1573.74  186.46 1574.79  188.16 1575.05
  208.97 1576.05  220.76  1576.4   246.3 1577.04  285.91 1577.37   300.5 1578.15
  307.98 1577.41  312.04 1577.22  316.64 1577.17  320.54 1577.29  325.72 1577.34
  329.45 1577.52   334.6 1577.57  345.33 1577.78  361.89 1577.77  385.23 1578.37
  391.97 1578.46  399.57 1578.53  406.09 1578.65  410.24 1578.67  421.03 1579.12
  436.23 1579.16   447.9 1578.91  455.18  1578.9  465.07 1579.67  476.04 1579.76
  476.07 1579.76  490.97 1579.86   508.4 1580.94  526.68  1583.5  532.22 1584.22
  541.91 1584.42  565.14 1585.02  574.53 1585.52  584.17 1586.22  594.17 1586.55
  611.01 1586.88  623.51 1587.17  644.72 1587.87  659.61 1588.07  674.57 1588.36
  683.85 1588.49  701.56 1588.45  711.56 1589.13  716.63 1589.11  725.58    1589
  736.95  1589.2  746.72 1589.29  748.95  1589.8  752.85 1589.87  773.98 1589.49
  793.81  1590.2  794.91 1590.27  803.06 1590.47  817.27 1590.22  825.68 1590.14
  827.17 1590.15  851.84 1590.87  877.62 1591.16  902.62 1592.46  904.11  1592.5
  935.27 1592.73  937.14  1592.8  946.83  1592.6  953.16 1592.62   957.1 1592.67
  978.55 1592.74  980.98 1592.77  986.44 1592.56  987.97 1592.57  992.65 1592.97
  998.08 1593.25 1010.06 1593.67  1014.1 1593.89 1019.93 1594.08 1031.94  1594.6
 1038.62 1594.67 1048.44 1594.73 1057.97 1594.82 1063.47 1594.99 1083.39 1595.69

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
**********************************************
       0    .035  144.39    .035  220.76    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        144.39  220.76             400.3   400.3   400.3             .1       .3
```

Left Levee Station= 50.08 Elevation= 1593.77

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 3.349

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1580.04	4.43	1581.6	24.6	1588.46	34.96	1592.76	36.27	1593.34
39.09	1593.38	47.21	1593.51	50.48	1592.22	66.22	1586.36	96.69	1579.04
97.43	1578.93	102.05	1578.47	110.91	1578.49	113.26	1578.57	115.64	1578.62
131.26	1578.74	133.37	1578.06	141.52	1574.82	147.33	1573.38	161.12	1573.43
161.98	1573.32	163.21	1573.41	173.83	1575.8	179.28	1577	187.09	1577.33
187.44	1577.35	189.73	1577.37	221.35	1577.74	223.05	1577.78	236.09	1577.73
248.08	1577.61	263.36	1577.64	264.09	1577.65	264.49	1577.64	289.38	1577.88
305.38	1578.46	308.23	1578.43	323.05	1578.93	337.47	1579.2	344.81	1579.68
385.13	1581.07	386.81	1581.06	396.94	1581.21	400.98	1581.19	405.78	1581.21
405.79	1581.21	406.39	1581.21	425.08	1581.49	447.5	1581.87	464.96	1582.11
474	1582.43	490.49	1583.43	493.81	1583.67	504.54	1585.54	511.83	1587.5
514.75	1587.45	538.06	1587.94	544.68	1587.96	547.45	1588.07	562.86	1588.46
566.25	1588.37	574.91	1588.26	577.54	1588.19	578.91	1588.22	580.62	1588.22
612.96	1589.1	619.98	1589.61	620.26	1589.63	627.54	1590.07	631.96	1590.19
663.76	1590.74	669.13	1590.87	675.36	1590.82	695.95	1591.16	702.93	1591.19
703.39	1591.18	703.9	1591.17	704.64	1591.23	707.94	1591.25	730.97	1591.54
737.21	1591.59	746.92	1591.6	755.18	1591.64	758.73	1591.59	760.61	1591.63
763.52	1591.88	772.79	1592.19	778.27	1592.31	780.91	1592.22	786.43	1592.36
788.18	1592.38	794.65	1592.55	800.45	1593.06	807.61	1593.31	816.6	1593.42
821.55	1593.63	827.17	1593.57	829.44	1593.69	844.05	1593.78	850.89	1594.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	131.26	.035	187.09	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
131.26	187.09	333.7	333.7	333.7	.1	.3

Left Levee Station= 47.19 Elevation= 1593.51

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 3.285

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1576.49	20.91	1582.9	28.58	1585.21	29.98	1585.67	33.75	1586.66
36.94	1587.84	40.94	1589.01	55.13	1593.54	66.83	1593.43	74.05	1591.52
79.28	1590.25	101.2	1583.45	115.1	1579.94	117.02	1580.01	121.19	1579.72
128.42	1579.32	144.05	1579.21	146.62	1578.32	165.39	1573.48	167.22	1573.04
171.6	1573.2	183.43	1573.31	186.7	1574.18	195.73	1577.4	200.56	1579.04
236.48	1579.18	246.74	1579.28	278.57	1579.79	282.59	1580.08	311.78	1580.59
316.27	1580.64	317.72	1580.76	320.52	1580.85	333.57	1581.53	347.55	1582.55
364.62	1582.97	371.05	1582.82	377.35	1583.41	394.54	1582.56	402.11	1582.87
409.34	1583.28	410.83	1583.44	428.2	1585.73	433.28	1585.11	436.25	1585.01
452.82	1585.37	452.86	1585.37	465.62	1585.66	475.78	1585.99	484.27	1586.36
500.13	1586.96	511.78	1587.15	516.52	1587.07	539.44	1587.32	549.03	1587.34
555.61	1587.41	575.93	1587.82	593.13	1588.59	598.97	1588.55	616.43	1588.77
629.03	1588.63	633.12	1588.65	635.25	1588.73	646.02	1588.63	669.97	1588.73
675.21	1588.84	678.79	1589.03	683.25	1589.07	685.72	1589.26	689.41	1589.41
697.31	1589.48	701.24	1589.45	711.42	1589.72	715.35	1589.75	729.21	1590.6
738.41	1590.49	742.91	1590.54	756.4	1590.52	759.75	1590.71	770.13	1591.11
777.07	1591.43	786.4	1591.6	792.04	1591.76	842.79	1592.54	864.7	1592.71
874.11	1592.64	879.93	1592.53	882.4	1592.8	884.97	1592.99	891.29	1593.23
914.87	1593.38	916.8	1593.28	930.09	1593.04	942.04	1592.75	946.6	1593.48
952.73	1593.16	958.05	1593.5	959.75	1593.52	985.46	1594.97	1005.15	1595.2

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	144.05	.035	200.56	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
144.05	200.56	778.7	778.7	778.7	.1	.3

Left Levee Station= 66.78 Elevation= 1593.43

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 3.138

INPUT

```
Description:
Station Elevation Data    num=      99
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1593.23   8.027 1593.38  18.686 1591.43  31.208 1588.67  43.529 1586.45
  48.335 1584.93  51.446 1584.33  53.328 1583.45  60.643 1582.03  62.059 1582.08
   72.79 1580.06  82.388 1578.83   125.6 1577.15 127.463 1577.46 142.772 1577.09
 156.756 1576.27 158.515 1575.36 163.748 1575.25 175.817 1572.49 181.541 1572.36
 185.435 1573.86 194.735 1578.98 202.393 1579.45 235.677 1578.91 247.164 1578.09
 263.716 1578.99 276.619 1578.94 294.005 1580.68 330.244 1581.08 333.375 1581.43
 348.348 1581.43 356.336  1581.9 371.419 1581.61 381.017 1581.76 387.602 1580.83
 395.221 1581.87 404.082 1582.53 430.555 1582.39 435.898 1582.69 437.967 1582.35
 439.118  1582.6 443.284 1582.06 462.895 1582.28 468.884 1582.78 478.799 1582.19
 484.452 1582.44 488.359 1582.61 495.208 1581.56 501.372 1583.31 505.602 1583.56
 507.555 1583.12  514.34 1583.59 520.873 1583.33 553.878 1584.17 584.801 1585.95
 597.472 1586.26  603.52 1587.16 620.375  1586.8 664.221  1588.1 676.943 1585.89
 685.623  1587.5 692.182 1588.09 710.848 1588.53 755.716 1588.13  762.61 1587.29
 770.197 1588.28 790.849 1587.64 818.804 1589.95  840.84 1588.26 845.859  1589.3
 848.478 1590.34 857.727 1592.03 895.869 1591.05 915.001 1590.95 925.614 1590.22
 942.657 1591.18 963.684 1590.69 969.176 1590.98 983.166 1592.59 991.632 1591.89
 998.533 1592.261009.995 1592.281028.622 1590.711046.972 1592.411080.598 1593.12
1092.616 1593.841096.677 1593.37 1119.71 1593.341124.949  1593.91161.518 1594.91
1171.944 1595.661221.857 1596.451227.659 1595.281230.763 1595.211233.823 1596.07
1262.566 1596.331272.307 1596.77 1281.42 1595.54 1294.66 1596.39

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035 142.772    .035 194.735    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       142.772 194.735            220.7   220.7   220.7              .3       .5
Ineffective Flow     num=        2
   Sta L   Sta R    Elev  Permanent
888        F
888        F
Left Levee      Station=    8.02      Elevation= 1593.38
Skew Angle = 49.7

CULVERT                 RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 3.117

INPUT
Description: Brown Road
Distance from Upstream XS =    80.2
Deck/Roadway Width        =    60.3
Weir Coefficient          =    2.67
Upstream  Deck/Roadway Coordinates
    num=       74
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*******************************************************************************
       0 1594.35    1570   22.12 1594.12    1570  55.482 1593.58    1570
  56.387 1593.57    1570  83.902  1592.9    1570  84.296 1592.87    1570
 108.622 1591.58    1570 108.997 1591.56    1570 138.769  1589.8    1570
 139.099 1589.78    1570 174.582 1587.52    1570 174.724 1587.52    1570
 189.749  1586.8    1570 202.064 1586.21    1570 202.199 1586.21    1570
 229.397 1584.92    1570 229.888  1584.9    1570 264.272 1584.08    1570
 264.608 1584.07    1570 278.191 1583.84    1570  305.02 1583.35    1570
 305.634 1583.34    1570 327.314 1583.51    1570 336.447 1583.57    1570
 336.648 1583.57    1570 357.985 1583.52    1570 375.209 1583.47    1570
 375.442 1583.47    1570  400.99 1583.73    1570 430.943 1584.03    1570
 431.254 1584.03    1570 431.525 1584.03    1570  447.32 1584.16    1570
 491.638 1584.49    1570 491.884  1584.5    1570 493.688 1584.55    1570
 503.927 1584.82    1570 503.953 1584.82    1570 541.266  1585.8    1570
 582.893 1587.45    1570 582.906 1587.45    1570 582.913 1587.45    1570
 584.924 1587.49    1570 632.289 1588.34    1570 632.438 1588.34    1570
 632.541 1588.34    1570 704.367 1589.92    1570   704.6 1589.92    1570
  704.82 1589.92    1570 766.452 1591.31    1570 766.996 1591.32    1570
 813.416 1592.11    1570 813.733 1592.11    1570 845.594 1592.01    1570
 846.518 1592.02    1570 877.086 1591.94    1570 930.103 1591.51    1570
 933.867 1591.49    1570 936.228  1591.5    15701014.988 1592.77    1570
1018.448 1592.88    15701020.744 1592.98    15701090.818 1595.47    1570
 1096.05 1595.64    15701158.116 1597.34    15701166.434 1597.58    1570
1216.683 1598.46    15701229.211  1598.6    15701238.001 1598.74    1570
1295.171 1599.43    15701304.116 1599.53    15701353.026 1600.22    1570
1359.636 1600.24    15701373.167 1600.37    1570

Upstream Bridge Cross Section Data
Station Elevation Data    num=      99
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1593.23   8.027 1593.38  18.686 1591.43  31.208 1588.67  43.529 1586.45
```

```
  48.335 1584.93  51.446 1584.33  53.328 1583.45  60.643 1582.03  62.059 1582.08
   72.79 1580.06  82.388 1578.83   125.6 1577.15 127.463 1577.46 142.772 1577.09
 156.756 1576.27 158.515 1575.36 163.748 1575.25 175.817 1572.49 181.541 1572.36
 185.435 1573.86 194.735 1578.98 202.393 1579.45 235.677 1578.91 247.164 1578.09
 263.716 1578.99 276.619 1578.94 294.005 1580.68 330.244 1581.08 333.375 1581.43
 348.348 1581.43 356.336  1581.9 371.419 1581.61 381.017 1581.76 387.602 1580.83
 395.221 1581.87 404.082 1582.53 430.555 1582.39 435.898 1582.69 437.967 1582.35
 439.118  1582.6 443.284 1582.06 462.895 1582.28 468.884 1582.78 478.799 1582.19
 484.452 1582.44 488.359 1582.61 495.208 1581.56 501.372 1583.31 505.602 1583.56
 507.555 1583.12  514.34 1583.59 520.873 1583.33 553.878 1584.17 584.801 1585.95
 597.472 1586.26  603.52 1587.16 620.375  1586.8 664.221  1588.1 676.943 1585.89
 685.623  1587.5 692.182 1588.09 710.848 1588.53 755.716 1588.13  762.61 1587.29
 770.197 1588.28 790.849 1587.64 818.804 1589.95  840.84 1588.26 845.859  1589.3
 848.478 1590.34 857.727 1592.03 895.869 1591.05 915.001 1590.95 925.614 1590.22
 942.657 1591.18 963.684 1590.69 969.176 1590.98 983.166 1592.59 991.632 1591.89
 998.533 1592.261009.995 1592.281028.622 1590.711046.972 1592.411080.598 1593.12
1092.616 1593.841096.677 1593.37 1119.71 1593.341124.949  1593.91161.518 1594.91
1171.944 1595.661221.857 1596.451227.659 1595.281230.763 1595.211233.823 1596.07
1262.566 1596.331272.307 1596.77 1281.42 1595.54 1294.66 1596.39

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0    .035 142.772    .035 194.735    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
       142.772 194.735             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
888       F
888       F
Left Levee      Station=    8.02      Elevation= 1593.38
Skew Angle = 49.7

Downstream  Deck/Roadway Coordinates
    num=      74
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
       0 1594.35    1570   22.12 1594.12    1570  55.482 1593.58    1570
  56.387 1593.57    1570  83.902  1592.9    1570  84.296 1592.87    1570
 108.622 1591.58    1570 108.997 1591.56    1570 138.769  1589.8    1570
 139.099 1589.78    1570 174.582 1587.52    1570 174.724 1587.52    1570
 189.749  1586.8    1570 202.064 1586.21    1570 202.199 1586.21    1570
 229.397 1584.92    1570 229.888  1584.9    1570 264.272 1584.08    1570
 264.608 1584.07    1570 278.191 1583.84    1570  305.02 1583.35    1570
 305.634 1583.34    1570 327.314 1583.51    1570 336.447 1583.57    1570
 336.648 1583.57    1570 357.985 1583.52    1570 375.209 1583.47    1570
 375.442 1583.47    1570  400.99 1583.73    1570 430.943 1584.03    1570
 431.254 1584.03    1570 431.525 1584.03    1570  447.32 1584.16    1570
 491.638 1584.49    1570 491.884  1584.5    1570 493.688 1584.55    1570
 503.927 1584.82    1570 503.953 1584.82    1570 541.266  1585.8    1570
 582.893 1587.45    1570 582.906 1587.45    1570 582.913 1587.45    1570
 584.924 1587.49    1570 632.289 1588.34    1570 632.438 1588.34    1570
 632.541 1588.34    1570 704.367 1589.92    1570   704.6 1589.92    1570
  704.82 1589.92    1570 766.452 1591.31    1570 766.996 1591.32    1570
 813.416 1592.11    1570 813.733 1592.11    1570 845.594 1592.01    1570
 846.518 1592.02    1570 877.086 1591.94    1570 930.103 1591.51    1570
 933.867 1591.49    1570 936.228  1591.5    15701014.988 1592.77    1570
1018.448 1592.88    15701020.744 1592.98    15701090.818 1595.47    1570
 1096.05 1595.64    15701158.116 1597.34    15701166.434 1597.58    1570
1216.683 1598.46    15701229.211  1598.6    15701238.001 1598.74    1570
1295.171 1599.43    15701304.116 1599.53    15701353.026 1600.22    1570
1359.636 1600.24    15701373.167 1600.37    1570

Downstream Bridge Cross Section Data
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1594.13   8.984 1593.69  32.708 1588.77  44.952 1586.89  58.444 1583.55
   68.21  1581.6  76.101 1580.58  79.911 1580.61  84.729 1580.03  92.497 1579.76
 111.532 1580.46 118.084 1580.18 130.761 1580.31 149.771 1579.49 152.895  1580.2
 164.408 1580.74 172.441  1579.7 192.284 1580.09 195.589  1579.3  227.03 1579.05
 238.918 1578.22  241.55 1577.78 250.528 1577.37 255.747 1578.56 281.172  1579.9
 291.586 1579.11 298.746 1579.85 318.466 1580.39 329.501  1579.3 347.462 1575.03
 357.319 1572.08 365.443 1571.78 369.104 1573.09 374.608 1576.71 380.914 1578.68
 386.379 1581.03  392.66 1582.89  396.98 1583.78 416.423 1583.28 433.388 1582.13
  452.21 1582.94 467.047 1582.87 485.332 1582.02 492.822 1582.12 496.948 1582.59
 506.734     1583 540.639 1582.93 561.672 1583.77 561.718 1583.77 587.363  1584.6
 599.374 1584.39 613.247 1584.94 694.555 1585.88 700.034 1586.42 713.137 1585.99
 740.904 1586.64 744.785 1587.13 761.582 1586.96 781.464  1587.9 810.059 1587.81
 825.064 1588.98 834.204  1588.9 891.697 1590.48 895.073 1590.88 922.898 1591.64
 937.871 1591.22 951.499 1591.72 982.124 1591.59 986.691 1591.29 995.306 1591.85
```

```
1017.614 1592.481030.647 1591.421054.313 1592.611096.186 1593.091099.821 1592.18
1122.096  1594.21140.284 1594.951140.982 1594.751142.367 1595.061146.739 1594.87
1156.699 1595.241176.646 1594.881187.183 1595.151199.355 1594.781238.667 1595.05
1255.244 1595.741258.756 1595.58 1262.43 1595.911282.455 1596.381296.801 1596.36
1299.989 1596.061330.149 1597.111356.396 1598.481362.812 1598.221396.523 1598.95
1405.021 1599.61 1436.43 1599.871471.938    16011478.439 1599.271486.019 1599.81

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035 318.466    .035  396.98    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
       318.466  396.98             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
888       F
888       F
Left Levee      Station=     .05      Elevation= 1594.13
Skew Angle = 49.7

Upstream Embankment side slope              =       3 horiz. to 1.0 vertical
Downstream Embankment side slope            =       3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
Brown           Circular       9
FHWA Chart # 2 - Corrugated Metal Pipe Culvert
FHWA Scale # 2 - Mitered to conform to slope
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    n Value   Entrance Loss Coef   Exit Loss Coef
              39.35     142       .024                   .5                1
Upstream   Elevation =  1571.24
           Centerline Station =  179
Downstream Elevation =  1571.24
           Centerline Station =  360

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 3.096

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1594.13   8.984 1593.69  32.708 1588.77  44.952 1586.89  58.444 1583.55
   68.21  1581.6  76.101 1580.58  79.911 1580.61  84.729 1580.03  92.497 1579.76
 111.532 1580.46 118.084 1580.18 130.761 1580.31 149.771 1579.49 152.895  1580.2
 164.408 1580.74 172.441  1579.7 192.284 1580.09 195.589  1579.3  227.03 1579.05
 238.918 1578.22  241.55 1577.78 250.528 1577.37 255.747 1578.56 281.172  1579.9
 291.586 1579.11 298.746 1579.85 318.466 1580.39 329.501  1579.3 347.462 1575.03
 357.319 1572.08 365.443 1571.78 369.104 1573.09 374.608 1576.71 380.914 1578.68
 386.379 1581.03  392.66 1582.89  396.98 1583.78 416.423 1583.28 433.388 1582.13
  452.21 1582.94 467.047 1582.87 485.332 1582.02 492.822 1582.12 496.948 1582.59
 506.734    1583 540.639 1582.93 561.672 1583.77 561.718 1583.77 587.363  1584.6
 599.374 1584.39 613.247 1584.94 694.555 1585.88 700.034 1586.42 713.137 1585.99
 740.904 1586.64 744.785 1587.13 761.582 1586.96 781.464  1587.9 810.059 1587.81
 825.064 1588.98 834.204  1588.9 891.697 1590.48 895.073 1590.88 922.898 1591.64
 937.871 1591.22 951.499 1591.72 982.124 1591.59 986.691 1591.29 995.306 1591.85
1017.614 1592.481030.647 1591.421054.313 1592.611096.186 1593.091099.821 1592.18
1122.096  1594.21140.284 1594.951140.982 1594.751142.367 1595.061146.739 1594.87
1156.699 1595.241176.646 1594.881187.183 1595.151199.355 1594.781238.667 1595.05
1255.244 1595.741258.756 1595.58 1262.43 1595.911282.455 1596.381296.801 1596.36
1299.989 1596.061330.149 1597.111356.396 1598.481362.812 1598.221396.523 1598.95
1405.021 1599.61 1436.43 1599.871471.938    16011478.439 1599.271486.019 1599.81

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035 318.466    .035  396.98    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       318.466  396.98            684.7   684.7   684.7             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
888       F
```

```
888        F
Left Levee       Station=      .05       Elevation= 1594.13
Skew Angle = 49.7

CROSS SECTION           RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn       RS: 2.966

INPUT
Description:
Station Elevation Data     num=      100
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
*******************************************************************************************
       0 1589.79    15.16 1593.94    21.93 1594.08    26.77 1594.01    52.66     1586
   73.02  1578.6    81.19  1577.3     96.2 1576.25   116.87 1576.11   136.22 1575.34
  143.18 1575.25   155.56 1575.31   162.26 1574.98    196.4 1576.13   203.76 1572.62
  209.39 1571.98   222.61 1571.96   233.26 1573.89   245.77 1576.73   246.68 1576.65
  256.21 1576.87   263.95 1577.22   273.49 1577.47   282.42 1577.87   296.91 1577.79
  300.04 1578.06   303.65 1577.77   326.84 1578.38   340.18 1579.12   355.58 1579.16
  376.36 1580.11   383.27 1580.23   404.67 1580.17    436.3  1581.2   444.76 1581.68
   448.5 1581.72   450.16 1581.16   455.27 1581.19   470.12 1581.73    474.1 1582.02
  495.51 1581.89   510.16 1582.17   515.87 1582.04   540.39 1582.57   561.93 1583.26
  568.62 1583.13   587.19 1583.55   597.05 1584.02   601.66 1584.07   601.67 1584.07
  626.62 1584.54   639.06 1582.89   646.82 1584.01   657.41 1584.95   664.81 1585.36
  687.29 1585.88   704.81 1585.82   726.95 1586.18   745.41 1586.68   755.83 1585.35
   762.6 1585.28   771.26 1585.84   779.34  1586.1   786.75 1586.15   793.89 1585.53
  795.92 1585.54   802.64 1585.97   814.87 1585.47   817.59 1585.51   825.18 1586.42
   830.7 1586.59   836.44 1586.96   839.02 1587.34   842.77 1587.57   847.05 1587.51
  849.17  1587.8   853.04 1588.69   862.93 1588.77    909.4  1589.9   929.58  1590.7
  941.74  1589.8   945.98  1590.8   948.87 1590.83   962.59  1590.4   1027.6 1591.96
 1047.62 1592.75   1055.3 1592.72 1086.57 1593.31 1090.72 1592.79 1096.66 1592.38
 1105.88 1591.28 1112.65 1591.74 1118.55 1592.75 1121.89 1593.14 1134.71 1593.78
 1151.83 1593.86 1166.06 1594.56 1199.74 1594.88 1216.35 1595.58 1229.63 1595.75

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
***********************************************
       0     .035    196.4     .035   245.77     .035

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
         196.4   245.77               400      400      400              .3        .5
Ineffective Flow      num=        1
   Sta L    Sta R     Elev   Permanent
888        F
Left Levee       Station=    26.77       Elevation= 1594.01

CROSS SECTION           RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn       RS: 2.891

INPUT
Description:
Station Elevation Data     num=      100
     Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev      Sta     Elev
*******************************************************************************************
       0 1575.78    22.72 1582.48     34.2 1587.18    43.63 1590.85    50.81 1592.99
   57.52 1593.32    63.68 1593.12    78.24 1588.37    89.66 1584.91    90.89 1584.23
  100.53  1581.3   109.97 1578.65   120.83 1576.77   134.64 1575.94   137.66 1576.02
  160.16 1575.81   169.88 1574.59   179.81 1571.62   190.64 1571.26   210.61 1575.63
  217.33 1576.55   231.15 1575.95   272.46 1576.44   283.66 1576.29    318.2 1576.99
  342.27 1578.01   358.72 1578.31   363.82 1578.68      388 1579.12   395.46 1578.63
  404.75 1578.73   412.39 1578.53   427.14  1579.1   441.78 1579.31   447.44 1579.57
  457.85 1579.34   466.94 1579.65   475.71 1580.46   490.25 1580.65   496.17 1580.46
  512.98 1580.93   525.61 1580.93   540.74 1580.55   551.38 1581.12   557.89 1581.31
  565.75 1581.74   577.55 1581.97   587.41 1581.75   590.62 1581.83   601.87 1581.63
  606.48 1581.86   610.51 1582.34   616.27 1582.13   619.71 1581.58   631.03 1582.18
  635.44 1581.73   639.01  1582.2   659.04 1582.24   665.85  1582.4   675.02 1582.39
  713.28 1583.52   731.17 1583.76   731.21 1583.76   733.84 1583.94   756.82 1582.64
   769.9  1583.9   774.94 1583.49   778.23 1582.88   791.92 1583.99    801.1 1584.51
  808.16 1584.46   818.75 1585.04    856.2  1585.8   873.86 1584.57   889.55 1583.75
   909.9 1585.14   914.11 1585.17   922.44 1585.63   939.77 1585.74   945.92 1585.51
  962.89 1585.36   976.29 1586.12   982.59 1587.16   994.58 1588.06 1027.03 1588.91
 1056.11 1589.88 1057.69 1589.76 1074.56 1589.82 1109.03 1590.39 1110.91 1590.55
 1145.19  1591.3 1159.28 1591.89 1168.28 1591.98 1183.57  1591.7 1222.35  1592.3
 1249.02 1593.24 1258.95 1593.42 1272.24 1593.46  1286.4 1594.07 1290.75 1594.07

Manning's n Values         num=        3
     Sta    n Val      Sta    n Val      Sta    n Val
***********************************************
       0     .035   160.16     .035   210.61     .035

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
         160.16   210.61               102      102      102              .1        .3
Left Levee       Station=    57.52       Elevation= 1593.32
```

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 2.871

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1573.4	24.13	1580.96	33.74	1584.8	50.75	1591.26	56.56	1593.08
63.09	1593.32	69.56	1593.16	95.89	1584.66	117.12	1576.89	124.79	1575.32
143.09	1574.93	165.34	1573.82	168.13	1573.11	176.36	1571.36	186.97	1571.33
197.3	1573.34	208.27	1574.55	219.55	1574.51	233.86	1574.83	269.93	1574.91
295.64	1575.45	314.24	1574.11	320.29	1573.88	369.04	1574.79	377.48	1574.81
398.73	1575.27	404	1575.68	410.28	1576.6	410.8	1576.89	415.08	1577.51
417.81	1577.75	419.51	1577.55	421.12	1577.53	422.34	1577.24	426.09	1576.92
427.48	1576.22	431.27	1576.04	449.61	1576.32	454.23	1576.57	467.32	1576.4
479.36	1576.48	497.71	1576.81	505.18	1577.23	536.66	1577.72	543.83	1577.5
557.84	1578.56	578.92	1581.57	599.43	1581.86	608.91	1582.29	610.93	1582.68
613.7	1582.89	616.94	1582.56	620.83	1582.53	626.33	1582.9	632.16	1582.95
634.98	1582.59	637.75	1582.08	640.34	1582.86	691.54	1583.68	716	1584.3
729.91	1584.45	729.95	1584.45	742.33	1584.49	791.63	1585.49	797.99	1585.42
820.05	1585.86	825.54	1586.2	836.44	1586.5	839.82	1585.78	849.59	1584.64
862.49	1586.24	875.17	1586.86	890.22	1586.85	903.42	1587.05	916.73	1587.46
944.5	1587.88	955.4	1587.82	1007.15	1589.16	1025.42	1589.1	1059.49	1590.62
1062.16	1590.36	1068.27	1590.17	1107.01	1590.51	1114.9	1590.46	1118.31	1590.6
1133.63	1590.81	1141.93	1590.7	1156.43	1591.19	1165.01	1591.16	1180.19	1591.85
1189.75	1591.9	1197.9	1592.17	1206.33	1592.63	1219.44	1592.97	1239.06	1592.57
1249.34	1593.27	1273.12	1593.42	1274.79	1593.34	1282.89	1593.69	1290.74	1593.77

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	143.09	.035	208.27	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
143.09	208.27	294.9	294.9	294.9	.1	.3

Left Levee Station= 63.1 Elevation= 1593.32

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 2.815

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1574.29	3.87	1575.07	16.29	1579.3	25.24	1582.01	31.61	1584.49
40.39	1588.18	51.08	1591.59	59.22	1593.15	65.22	1593.74	71.44	1593.54
77.45	1591.47	94.6	1584.93	96.38	1584.04	108.06	1580.85	119.02	1577.12
126.27	1575.05	129.36	1574.71	131.18	1574.33	138.23	1573.71	159.53	1573.98
171.89	1571.33	182.43	1571.07	192.68	1572.06	198.75	1572.48	205.28	1573.13
214.39	1573.22	217.07	1573.4	222.31	1573.16	225.1	1573.42	233.34	1573.38
253.71	1572.83	263.92	1572.68	272.46	1572.94	319.28	1573.5	328.26	1573.42
350.01	1574.57	368.52	1574.02	412.19	1574.95	415.2	1575.16	425.41	1575.49
492.26	1576.78	496.29	1576.96	511.24	1577.2	545.14	1578.21	562.35	1578.07
584.84	1581.22	592	1581.43	592.84	1581.59	595.15	1581.18	600.19	1581.08
644.55	1581.9	661.07	1582.01	674.2	1582.4	707.3	1582.73	707.34	1582.73
723.38	1582.64	735.67	1582	737.89	1582.19	741.57	1582.18	745.82	1583.16
756.39	1584.25	790.43	1584.29	813.64	1585.05	830.77	1585.39	850.02	1586.24
864.69	1584.84	880.34	1586.29	896.11	1586.63	906.26	1587.15	917.92	1587.3
922.19	1587.59	932.34	1587.54	941.33	1587.71	951.75	1587.73	961.54	1587.94
988.45	1588.99	1006.78	1589.28	1031.07	1590.31	1045.09	1590.27	1047.05	1590.12
1056.1	1590.01	1073.26	1590.5	1078.52	1590.36	1085.96	1590.41	1113.58	1591
1125.4	1591.51	1145.87	1592.08	1162.27	1591.99	1174.9	1592.59	1181.5	1593.23
1189.93	1593.56	1194.01	1593.5	1204.38	1593.65	1207.55	1593.44	1219.9	1593.92
1232.07	1593.86	1251.37	1594.17	1259.54	1593.95	1272	1594.43	1278.4	1594.53

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	159.53	.035	205.28	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
159.53	205.28	417.3	417.3	417.3	.1	.3

Left Levee Station= 71.44 Elevation= 1593.54

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 2.736

INPUT
Description:

```
Station Elevation Data     num=      100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1573.89   11.99 1575.35   15.23 1576.42   41.38 1585.73   61.12 1592.41
   66.36 1593.65   77.24 1593.49    78.7 1592.86   87.36 1590.34  113.68 1581.75
  134.08  1576.8  136.77 1576.48  141.33 1576.26  159.92 1575.97  163.94 1575.99
  170.81 1574.01     179 1571.88  183.44 1571.58  190.03 1570.94  196.46  1571.9
  218.96 1573.59  227.58 1573.05  242.61 1572.97  261.96 1573.22  266.26 1572.97
  285.26 1573.31  293.88 1573.76  321.91 1574.23  333.76 1574.72  338.68 1574.79
  353.41  1574.7  378.92 1575.15   398.1 1575.18  412.67 1575.61  424.06 1575.82
  457.66 1575.92  464.09 1575.84  478.91 1575.99  491.43 1575.93  497.75 1576.42
  518.05 1576.61   520.1 1576.79     524  1576.7  544.46 1576.86  553.42 1577.13
  562.62  1577.9  578.19 1580.16   589.4 1582.61  606.86 1582.79  621.76 1583.93
  623.35 1583.96   623.8 1584.09  629.44 1583.66  636.75  1583.3  648.68 1583.21
  672.12 1584.17  682.24  1584.4   682.3  1584.4  699.67 1584.72  705.04 1584.64
  708.25 1584.45  711.46 1584.44  716.74 1584.91  731.86  1584.6  744.86 1585.06
  765.13 1585.47   770.3 1585.81  771.84 1585.71  776.93 1585.68  792.48 1586.17
  807.88 1586.08  816.26 1586.54  825.64 1586.57   828.7 1586.45  864.36 1588.18
  867.01 1588.38  909.98 1588.11  919.24 1588.23  935.57 1588.25  954.11 1588.87
  964.62 1589.34  965.11 1589.19  975.74 1588.94  1010.3 1590.23  1017.4 1590.16
  1039.3 1590.75 1068.09  1590.9 1077.02 1591.32  1116.6 1591.75 1128.02 1592.31
 1165.94 1592.44 1180.47 1592.82 1194.56 1593.43 1215.83 1593.43 1235.02 1594.22
 1242.75 1594.67 1250.53  1593.7 1252.65 1594.01  1258.3 1594.43 1261.78 1594.56

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  170.81    .035  218.96    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        170.81  218.96            414.3     395   381.7             .1       .3
Left Levee      Station=   77.24      Elevation= 1593.49

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 2.662

INPUT
Description:
Station Elevation Data     num=      99
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1574.63   24.97 1583.64   33.21 1586.95   54.83 1593.06   65.53 1593.41
   67.77 1592.76   83.35 1587.33   99.38 1581.23  114.79 1578.12  123.97 1575.71
  126.76 1575.62  154.63 1576.04  161.41 1573.91  165.45 1572.31  167.51 1571.72
  177.44 1572.02  200.72 1575.68  212.27 1575.08  213.38 1575.15  220.94 1574.14
  269.15 1575.24  295.85 1575.25  306.75 1574.85  311.56 1575.01  322.39 1574.95
  326.15 1574.79  343.55 1575.03  375.31 1576.15  381.27 1575.95  397.07  1576.3
  405.81 1576.02  418.44 1576.24  426.12 1576.59  447.67 1576.73  455.37 1576.08
   468.6 1577.08  482.25 1577.34  502.98 1576.68   520.1 1577.22  550.32  1577.4
  558.32 1577.66  561.91 1578.02  573.74 1580.06  583.29 1581.96  586.92 1582.33
  608.07 1582.41  621.87 1582.91  626.56 1583.22  647.05 1582.79  651.02 1582.83
  656.54 1584.41  660.18  1582.4  661.34  1581.9  685.25 1581.77  694.46 1582.23
   701.1 1581.72  725.08 1581.16  751.92 1582.36  760.08 1584.56  762.64  1584.8
  765.99 1584.49  771.59 1585.06  778.59 1584.71  782.39 1584.97  787.57 1584.94
  791.13 1585.61  792.24 1585.37  794.56 1585.73  803.35 1585.64  811.92 1585.75
  828.71 1585.52   848.1 1586.51  855.29 1586.67  882.57 1586.65  891.09 1587.04
   918.5 1587.34  944.34 1587.92  949.52 1587.91  980.78  1589.2  989.91 1589.11
 1003.14 1589.45 1033.12 1590.59 1041.51 1590.54 1098.72 1591.28 1123.07 1591.99
 1152.32 1592.26 1157.55 1592.56 1171.06 1592.77  1174.2 1592.98 1196.95 1593.54
 1216.16 1594.24 1219.49 1594.07 1226.11  1594.5 1241.43 1594.61 1263.51 1595.16
 1272.18 1595.21 1276.66 1595.01  1279.9 1595.14 1320.59 1595.29

Manning's n Values         num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  154.63    .035  200.72    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        154.63  200.72            402.4   402.4   402.4             .1       .3
Left Levee      Station=   65.51      Elevation= 1593.41

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 2.585

INPUT
Description:
Station Elevation Data     num=      100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1576.21   19.57 1581.99    52.4 1593.44   63.68 1592.97   70.51 1590.75
    80.4 1587.16  100.86 1578.81  113.44  1575.9  116.51 1575.03  145.99 1575.75
   153.3 1573.46  164.23 1571.01  175.47 1570.54     192 1572.03  198.79 1572.42
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  211.99 1571.82  216.85 1572.07  221.08 1572.09  249.82 1572.78  260.97 1573.49
  265.32 1574.09  285.33 1573.01   292.3 1574.15  296.78 1574.66  351.75 1575.75
     370 1576.52  376.22 1577.04  386.95 1575.84  389.35 1575.67  400.14  1575.4
  434.16 1576.53  447.22 1576.84  476.12 1577.22  493.68 1578.13  542.22  1578.9
  555.92 1578.48  585.48 1579.23  590.07 1579.44  595.18 1580.26  628.26 1581.19
  638.18 1581.13  662.26  1581.6  674.36  1582.5  677.62  1582.5  682.23 1583.04
  686.44 1583.12   692.9 1583.08  692.95 1583.08   694.3 1583.07  696.99 1582.86
   701.8 1583.41  708.99  1582.1  711.51 1582.25  732.22 1584.26  736.99 1584.53
  739.62 1584.51  751.39  1584.8  756.76 1586.02  758.26 1586.27  770.08 1586.82
  781.86 1587.17  783.38 1587.08  787.53 1587.14  791.86 1587.06  816.59 1587.24
   821.4  1587.1  823.27 1587.21  831.52 1587.37  838.69 1587.19  843.36 1587.39
  858.39 1587.66  862.15 1588.05  871.57  1588.3  898.01 1588.62  902.77 1588.41
  912.43 1588.56  921.55 1588.58  930.47 1588.73  945.83 1588.75   954.4 1589.52
  958.27 1589.54  969.49 1590.06  987.35 1590.57  990.55 1590.58  992.38 1590.68
 1013.14 1590.36 1023.86  1590.8 1053.92 1591.62 1105.72 1592.16 1158.63 1593.16
 1160.94 1593.14 1183.92 1593.66 1188.73 1593.66 1197.55 1594.07 1222.14 1594.56
 1242.93 1594.79 1252.59  1595.2 1258.89 1594.99 1267.15 1595.56 1273.95 1595.63

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0    .035  145.99    .035  198.79    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        145.99  198.79            402.4   402.4   402.4            .1        .3
Left Levee      Station=    52.4      Elevation= 1593.44

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 2.509

INPUT
Description:
Station Elevation Data    num=      99
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0  1573.8    1.31 1573.97   30.73 1583.78   51.31 1592.07   58.14 1593.02
   59.79 1593.39   70.16  1592.8   82.15  1589.7  123.95 1575.13  125.06 1574.89
  141.67 1574.78  161.89 1575.77  181.73 1575.83  198.31 1576.42   215.2 1571.29
  229.07 1571.35  244.89 1572.71  256.14 1574.11   263.5  1574.1  280.23 1574.45
  290.74 1574.99  310.02 1575.56  325.05 1574.96  332.96 1575.55  342.96 1575.81
  354.18 1575.63  364.24  1575.9  409.73 1576.29  420.14 1576.18   475.8 1577.04
   494.8 1577.61  506.14 1577.77  517.74 1577.54  525.35  1578.1  534.43 1578.55
  544.37 1578.39  555.19 1578.41  615.36 1579.91  625.07 1580.89  635.91 1582.03
  642.78 1582.42  648.08 1583.16  665.48 1583.05  698.61 1583.55  747.68  1585.4
  752.68 1584.76  756.76  1585.6  762.97 1586.06   765.4  1585.5  769.45 1585.03
  790.79 1585.46  796.52 1585.34  798.38 1585.51   804.7 1585.65  809.13 1585.99
  815.19 1586.01  821.68 1586.33  835.79    1586     849 1586.03  854.65 1586.86
  871.35 1586.57  879.27 1587.71  882.27    1588  892.91 1588.02  903.18 1587.76
   917.9 1588.43  926.05 1588.05  951.09 1589.16  954.02  1589.1  979.94 1590.06
  996.11 1590.42 1010.66 1591.11 1013.87  1591.4 1030.53 1591.71 1037.54  1591.5
 1055.23 1591.93 1078.99 1592.27 1094.92 1592.18 1095.81 1592.32 1098.67 1592.28
 1105.16 1591.78 1108.37 1592.22  1113.6 1593.23 1123.96 1593.12 1134.53  1593.3
 1146.37 1593.12 1153.57 1593.37 1160.34 1593.42 1177.07 1593.21 1188.86 1593.56
 1191.81  1593.8 1195.55 1593.74 1219.38 1594.23 1236.95 1594.26  1246.9 1594.03
 1261.73 1594.22 1267.28 1594.93 1268.78 1594.73 1284.04 1595.42

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0    .035  198.31    .035  256.14    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        198.31  256.14            402.4   402.4   402.4            .1        .3
Left Levee      Station=    59.79     Elevation= 1593.39

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 2.433

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1574.97   16.97 1581.16   25.44 1584.39   49.31 1592.66    53.7 1593.62
   63.27 1593.59   74.38 1589.54   78.25 1587.97  116.17 1575.59  125.73 1573.87
   139.6 1575.54   142.7 1575.51  166.66 1575.97  174.86 1576.42  188.34 1575.89
  192.61 1576.12  194.94 1576.11  199.87 1576.48  205.15 1577.17   214.3 1573.62
  221.69 1571.32  232.32 1570.78  236.43 1571.55  242.18 1572.89  257.92 1576.29
  261.69 1576.21  269.51 1575.53  284.68 1574.52  315.11 1574.49  344.73 1576.08
   400.6 1577.49  452.61 1577.91  465.38 1578.33  476.84 1578.52  481.74 1578.81
   498.7 1578.43  514.02 1578.78  527.22 1579.62   548.9 1579.79  574.56 1580.53
  588.14 1580.42  588.16 1580.42  593.35 1580.38  596.28 1580.58  623.95 1580.87
```

627.31	1581.09	634.25	1581.82	642.62	1583	654.3	1583.55	671.69	1584.17
678.01	1584.5	688.22	1584.67	691.06	1584.94	697.35	1585.31	709.65	1585.48
714.2	1585.67	715.69	1585.57	742.66	1585.85	745.7	1585.76	764.12	1586.11
782.59	1586.26	806.66	1586.05	816.18	1586.25	832.12	1586.22	843.91	1586.53
850.66	1587.44	855.28	1587.56	866.27	1588.13	875.55	1588.04	888.44	1588.09
906.3	1588.6	922.1	1588.8	937.53	1589.17	944.06	1589.47	959.45	1589.85
988.17	1590.16	1001.02	1590.84	1006.75	1590.9	1016.24	1590.74	1040.32	1591.34
1050.2	1591.45	1061.57	1591.86	1079.13	1591.95	1082.63	1592.21	1092.5	1592.18
1106.46	1592.71	1116.16	1592.59	1128.4	1592.85	1133.02	1592.68	1147.79	1593.19
1171.5	1593.19	1187.55	1593.47	1197.72	1592.45	1215.41	1594.12	1227.93	1594.43
1238.59	1594.55	1246.9	1594.82	1263.09	1594.87	1266.43	1594.98	1276.07	1594.87

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	205.15	.035	257.92	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
205.15	257.92	402.4	402.4	402.4	.1	.3

Left Levee Station= 63.26 Elevation= 1593.59

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 2.357

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1574.34	5.07	1575.17	20.67	1580.47	41.36	1589.61	48.85	1592.74
51.06	1593.52	63.44	1593.84	74.21	1589.68	99.67	1581.08	110.31	1578.03
126.22	1575.76	136.87	1573.99	151.4	1574.38	159.46	1574.08	167.71	1574.55
181.27	1575.02	197.73	1570.91	209.34	1570.93	217.31	1571.79	231.81	1575.71
236.83	1574.39	254.44	1573.75	257.57	1574.26	303.7	1574.78	308.31	1575.3
350.82	1575.7	353.86	1575.85	355.92	1576.52	371.36	1576.07	407.28	1576.57
446.28	1577.55	464.08	1578.44	494.5	1578.48	522.86	1579.09	561.05	1579.17
582.91	1579.91	586.92	1580.21	594.11	1580.31	594.13	1580.31	607.08	1580.56
622.08	1582.91	624.04	1582.84	668.58	1583.71	678.98	1583.42	682.27	1583.6
694.8	1583.68	699.5	1584.04	710.77	1584.14	718.41	1583.98	733	1584.12
739.87	1584.4	749.96	1584.55	751.87	1584.71	767.55	1584.57	774.73	1584.73
780.45	1585.09	797.8	1586.77	803.08	1586.75	813.02	1587.35	821.06	1587.53
825.38	1587.09	829.31	1587.02	831.54	1586.74	838.34	1586.64	846.4	1586.87
853.48	1587.51	874.93	1588.16	891.12	1588.36	921.92	1587.95	964.76	1589.3
972.97	1588.96	974.76	1589.17	990.01	1589.46	996.95	1589.73	1004.9	1590.38
1009.45	1590.56	1020.08	1590.02	1037.56	1591.15	1052.68	1591.02	1061.39	1591.22
1069.43	1591.2	1084.7	1591.67	1099.3	1592.53	1111.53	1593.07	1127.25	1593.22
1142.49	1593.14	1147.58	1593.39	1157.38	1593.47	1161.16	1593.62	1167.71	1593.62
1173.37	1593.91	1210.44	1594.4	1237.86	1594.61	1255.66	1595.51	1271.77	1594.46
1283.95	1595.09	1286.01	1594.86	1295.02	1594.9	1309.3	1595.36	1313.54	1595.33

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	181.27	.035	231.81	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
181.27	231.81	149.5	149.5	149.5	.1	.3

Left Levee Station= 63.44 Elevation= 1593.84

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 2.328

INPUT
Description:
Station Elevation Data num= 99

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1580.88	11.88	1585.17	34.89	1594.04	45.43	1594.01	50.9	1591.99
61.73	1588.46	92.24	1578.73	104.08	1575.83	117.3	1574.12	138.39	1574.27
142.04	1574.39	143.86	1574.27	156.9	1574.96	165.58	1572.01	169.34	1570.88
177.52	1570.79	180.73	1570.67	193.46	1572.72	201.22	1574.56	203.33	1575.18
208.02	1574.4	213.24	1574.29	249.86	1574.25	258.74	1574.07	288.81	1575.06
294.14	1574.99	302.65	1575.52	315.91	1576.09	339.47	1576.15	342.9	1576.09
346.19	1575.91	397.14	1576.49	415.54	1577.22	444.23	1578.22	447.36	1577.83
454.32	1577.58	486.39	1577.92	496.34	1578.82	497.12	1578.95	537.22	1579.05
577.1	1580.74	584.14	1581.9	590.4	1582.95	594.41	1583.14	646.51	1583.8
658.12	1584.16	671.5	1584.3	690.14	1584.22	699.04	1584.44	712.48	1584.63
727.59	1584.68	732.26	1584.79	743.04	1585.28	749.69	1585.34	759.42	1585.79
775.48	1585.97	787.22	1586.56	799.01	1586.82	802.07	1586.53	803.71	1586.71
805.28	1586.76	813.88	1586.39	830.52	1587.07	854.39	1587.78	865.32	1587.78
869.9	1587.88	874.57	1588.3	887.8	1588.25	920.17	1588.65	928.58	1589.09
936.15	1589.61	967.16	1589.57	972.75	1589.96	977.16	1590.11	999.42	1590.49

```
 1016.65 1591.36  1043.3 1591.34 1045.69  1591.6 1057.57  1591.9  1064.1  1591.9
  1072.8 1592.03 1076.11    1592 1109.61  1593.2  1150.8 1594.22 1160.44 1594.05
 1165.83 1594.17 1171.07 1594.42 1177.03  1594.9 1184.29 1594.86  1220.3 1596.22
 1228.34 1596.21 1247.25 1596.43 1258.47 1596.77 1265.48 1596.84  1272.4 1596.79
  1277.9 1596.96 1301.96  1597.2  1307.6 1597.54 1313.54 1597.65

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035   156.9    .035  203.33    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         156.9  203.33            251.5   251.5   251.5            .1        .3
Left Levee      Station=   45.43      Elevation= 1594.01

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 2.281

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1577.92   34.74 1589.63   44.46 1593.32   46.03 1593.77   56.57 1593.86
   59.31  1593.1   68.23 1590.11   91.64 1581.85  113.09 1575.61  122.12 1574.25
  136.01 1574.11  150.26 1574.76  164.53 1570.61  175.98 1569.87   198.1 1572.84
  206.77 1573.55  212.15  1572.5  226.21 1572.27  234.92 1572.34  271.33 1573.16
  278.83  1573.1  280.64 1572.97   301.7 1574.27  320.93 1573.83  330.43 1574.05
  378.05 1574.04     391 1574.17  412.44 1574.85  415.81 1575.21  426.04 1575.03
  432.23 1575.17  435.58 1575.14  447.36 1575.67  474.49 1575.83  482.99 1575.67
  490.49 1575.89   507.2 1576.05  518.19 1576.25  563.18 1579.77  567.92 1579.97
  579.25 1581.51   583.3 1581.94  605.71 1582.42  605.74 1582.42  621.66 1582.74
   627.6 1582.75  652.96 1583.09  677.12 1584.12  704.85 1584.54  723.29 1584.01
  726.34 1584.19  728.13 1584.14  733.56 1584.25  737.92 1584.51  754.78 1584.99
   761.5 1585.07  774.25 1585.55  786.01 1585.26  804.01 1585.56  820.07 1586.77
  823.98 1587.72  826.95  1586.6  843.98 1586.47  848.19 1587.34  868.33  1587.7
  874.47 1587.71  876.87 1587.87  886.39 1586.69  888.54 1587.02  898.88 1587.77
  919.98 1587.99  924.29 1588.17  941.69 1588.33  952.06  1588.3  960.05 1588.58
  962.98 1588.79  974.65 1589.17 1019.34 1590.15 1026.14 1590.18 1036.94 1590.77
 1047.17 1590.92 1052.65 1591.14  1073.1 1591.25 1089.06 1591.47 1099.33 1591.13
 1105.47 1591.38 1118.73 1591.62 1129.51 1592.28 1147.98 1592.66 1169.84 1593.29
 1188.28 1593.38 1192.39 1593.58 1196.89 1593.58 1211.78 1594.44 1218.39 1594.72
 1222.85  1594.8 1226.86 1594.71 1239.76 1594.73 1249.58 1595.01 1260.12 1595.47

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  150.26    .035  206.77    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         150.26  206.77            400.9   400.9   400.9            .1        .3
Left Levee      Station=   56.57      Elevation= 1593.86

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 2.205

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1574.51    1.51 1574.77   41.64 1590.76   50.46 1593.59   62.38 1593.24
   74.23 1588.85    78.2 1587.66   92.96 1582.72  109.46 1578.64  121.76 1576.33
  130.53 1575.87     144 1576.29  156.15 1572.31  159.19 1571.07  160.65 1570.67
  172.12 1570.47  183.96 1573.34  185.15 1573.72  188.78 1573.05  196.53 1573.68
  217.07 1573.51  287.88 1574.45  299.73 1574.75  313.41 1574.56  325.68 1574.55
  329.53 1574.83  347.24 1574.88     350 1575.17  360.33 1576.67  378.07 1576.86
  383.47 1577.06  398.22 1575.95  425.07 1576.69  453.53 1576.69  465.12  1576.9
  472.16 1576.84  475.19 1577.03  495.13 1577.17  503.03 1577.41  513.84 1577.47
  523.99 1577.71  543.91  1578.8  543.93  1578.8     560 1580.99  570.54 1582.28
  574.22 1582.91  581.25 1583.71   591.4 1583.71  618.82 1584.42  623.91 1584.66
  642.61 1585.09  647.78 1583.83   656.2  1582.8  667.17  1585.5  682.77 1585.36
  697.91 1585.57  714.62 1585.63  722.49 1585.83   730.8 1585.74  761.55 1586.39
   771.2    1587  802.88 1587.87  818.24 1588.08  831.09 1588.03  839.36 1588.18
  848.17 1588.65  866.85 1589.22   883.9 1588.67  898.09 1589.26  925.56 1589.42
  944.99 1589.74  956.92 1589.69  962.66 1590.17 1009.42 1591.54 1026.36 1591.72
 1047.51 1591.69  1060.6    1592 1070.44  1591.9 1078.77 1592.09 1089.76  1592.6
 1093.92 1592.95 1117.37 1593.51 1140.25 1593.47 1166.21 1593.78 1174.74 1594.02
 1181.64 1593.96 1190.29 1593.59 1196.06 1592.92 1203.06 1593.81 1210.86 1594.17
  1215.6 1594.52 1220.82 1594.49 1224.97 1594.69  1238.8  1594.4 1240.34 1594.01
 1245.35 1594.03 1246.27 1594.22  1252.7 1593.95 1269.09 1594.95 1279.19 1595.23
```

```
Manning's n Values          num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
***********************************************
       0    .035      144    .035   185.15    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
           144  185.15             400.9   400.9   400.9              .1       .3
Left Levee      Station=   50.54      Elevation= 1593.59

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 2.129

INPUT
Description:
Station Elevation Data     num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*****************************************************************************
       0 1574.71   21.42 1583.47   44.51 1592.72   47.61 1593.07   59.35 1593.43
   60.34 1593.06   69.03 1590.69   72.95 1589.49  107.36 1578.26  115.59 1576.25
  119.54 1575.82  132.38 1576.39  137.58 1576.53  145.13 1576.48  156.29 1576.05
  160.66 1576.16  168.71 1576.56  187.54 1570.82  190.66 1570.71  200.09 1570.63
  203.51 1571.12  207.76 1572.42  211.31 1573.09  214.96 1572.87  224.64 1573.22
  234.84 1573.41  265.49 1573.48  273.04 1573.63  293.15 1574.75   300.5 1574.57
  316.38    1575  318.71 1575.39  334.26 1577.03  344.88 1576.98  354.31  1577.3
  358.07 1576.78  362.97 1576.27  365.67 1575.84  369.49 1575.36  399.01 1576.15
   415.7 1576.22  440.25 1576.03  446.74 1576.17  486.81 1577.76  495.72 1577.06
  498.11 1577.23  521.22 1577.22   535.9 1577.11  540.53  1577.3  545.42 1577.81
  547.69 1577.83  547.75 1577.83  565.37 1578.02  579.56 1579.55  582.52 1579.93
  588.32 1580.37  606.17    1584  607.08 1583.91  637.72 1584.17  662.12 1584.76
  673.23 1584.76  692.73 1585.12  714.72 1585.89  718.82 1585.87  722.93 1586.03
  726.92 1585.93  742.04 1584.73  748.44 1585.51  753.93 1585.92  764.69 1586.21
  773.07 1586.27  786.78 1586.67  812.74 1587.82  823.87  1588.2  834.32 1588.36
  850.91 1588.75  853.57 1588.96  863.32 1589.39  869.87 1589.32  883.79 1589.34
  888.48 1589.45  898.63 1589.43  905.64 1589.64  918.64 1589.61  930.71 1589.73
  964.98 1590.95  985.76 1591.41  994.95 1591.46 1003.83 1591.36 1018.12 1591.53
 1023.34 1591.92 1050.99 1592.35 1071.88 1593.06 1083.14 1592.01 1102.09 1592.74
 1132.91 1594.62 1153.79  1594.7 1158.47 1594.61 1186.49 1595.26 1195.44 1595.65

Manning's n Values          num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
***********************************************
       0    .035   168.71    .035   211.31    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
        168.71  211.31             400.9   400.9   400.9              .1       .3
Left Levee      Station=   59.34      Elevation= 1593.43

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 2.053

INPUT
Description:
Station Elevation Data     num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*****************************************************************************
       0 1574.43     .91 1574.52   13.24 1577.19   20.88 1579.64   41.61 1588.02
   56.92 1593.33    68.8 1593.46   71.33 1593.11   75.11 1592.79   78.74 1590.98
   82.73 1589.29  115.63 1578.37   129.5 1576.64  137.17  1576.3  149.63 1576.17
  165.06 1575.35  167.92 1575.35  173.72 1575.72  182.02 1575.86  185.37 1576.02
  203.71 1576.52  214.13 1576.35  219.52 1574.27  231.08 1570.99  245.58 1570.79
  249.64 1571.12  260.64 1573.77  266.63 1574.76  278.87 1577.74  313.99  1578.1
  355.56 1578.38  373.07 1578.66  388.19 1579.09  430.93 1579.44  450.26 1579.32
  462.51 1579.37  466.24 1579.57  481.16 1579.24  487.37 1579.23  497.24 1579.37
  503.73 1579.71  518.72    1580  528.09 1578.97  532.52 1578.82  541.69 1579.06
  548.98 1579.51  567.97 1578.95  583.35 1579.03  583.37 1579.03  591.84 1579.11
  606.26 1579.65   621.7 1582.58   633.4 1584.57  641.33 1584.52  663.16  1584.6
  681.82 1584.28  685.52  1584.3  705.31 1585.83  713.95 1585.49  737.41 1585.62
  755.96 1586.15  763.27 1585.63  769.97 1585.33  772.63 1585.55  776.63  1585.7
  778.72 1585.61  795.68 1585.99  805.99 1585.66  812.84 1585.98  819.74 1586.55
   825.4 1586.91  832.35 1586.94  834.47  1587.2  839.92 1587.35  857.85  1588.5
  864.65 1587.55  866.74 1587.09  870.58  1587.5  879.74 1588.79  898.71 1589.25
  915.45 1589.03   923.7 1589.23  934.27 1589.22  942.77  1589.6  969.36 1591.14
   974.8 1591.27  981.38 1590.88  989.26 1590.66    1023  1591.4 1070.85 1593.14
 1080.33  1593.1 1092.67 1593.56 1131.87 1594.28 1140.57  1594.6 1144.99 1594.47
 1156.17  1594.6 1175.48  1595.5 1205.79 1595.78 1227.24 1596.54  1236.7 1596.67

Manning's n Values          num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
***********************************************
       0    .035   214.13    .035   278.87    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right      Coeff Contr.   Expan.
```

```
        214.13  278.87            400.9   400.9   400.9              .1       .3
Left Levee      Station=   68.76      Elevation= 1593.46

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 1.977

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1574.84    12.9 1578.17   49.99 1593.55   62.37  1593.5   70.04  1593.1
  100.91 1580.16  107.73 1578.27  129.15 1575.75  148.68 1575.65  152.19 1575.28
  156.07 1575.25  164.14 1575.55   175.2 1576.08  190.49    1576   199.5 1576.33
  213.35 1570.72  225.83 1570.52   228.2 1571.18  233.55 1573.51  240.66 1576.06
  246.52 1576.74  251.85 1576.06  263.86 1576.73  270.26 1576.55  287.67 1576.57
  307.41 1576.86  327.37 1577.47  336.77 1577.52  347.02 1577.25  351.42 1577.53
  361.77 1578.45  367.29 1579.19  373.61 1579.34  380.15 1579.24  401.98 1579.44
  402.88 1579.33  403.89 1579.36  417.38 1578.45  459.52 1578.26  475.32 1578.87
  489.78 1579.07  506.56 1578.94  508.63 1579.21   521.2 1579.42  526.78 1579.41
  544.86 1580.15  560.03 1579.98  560.06 1579.98  573.37 1580.19  576.11 1580.46
  603.73 1582.52  615.05 1583.97  628.79 1584.12  644.16 1583.99  668.68 1583.99
  684.01 1584.12  699.77 1584.88  710.32 1585.21  740.18 1585.56  760.67 1585.42
  765.91 1586.05  774.37 1585.89  787.93  1586.4  820.05  1587.4   826.9 1587.85
  870.54 1588.64  873.43 1588.41  884.71  1588.5  889.88 1588.44  903.55 1589.67
   905.1 1589.72  912.81    1589   919.6 1588.64  928.03 1589.08  937.99 1590.01
  940.57 1590.09  949.45 1589.81   968.3 1589.99 1044.44 1591.39 1062.65  1591.5
 1070.56 1591.82 1079.21 1592.47 1088.25 1592.56 1090.29 1592.46 1102.58 1592.54
 1113.96 1592.89 1123.86 1592.68 1127.83 1592.77 1156.59 1594.18  1161.5 1594.09
 1175.12  1594.3 1183.47 1594.29 1189.03 1594.08 1201.83    1594 1206.29 1593.86
 1211.67 1594.27 1219.33 1594.62 1221.01 1594.85 1246.28 1595.13 1268.83 1595.69

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035   199.5    .035  240.66    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         199.5  240.66            400.9   400.9   400.9              .1       .3
Left Levee      Station=    62.4      Elevation=  1593.5

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 1.901

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0  1575.6   16.21 1580.74   43.37 1591.56   47.18 1593.18   47.74 1593.36
    59.4 1592.92   73.47 1588.76  101.19 1579.59   109.8 1577.58  117.93 1576.58
  130.09 1576.08  132.97 1576.16  141.85 1576.11  144.07 1576.03  146.57 1575.04
  150.81 1573.83  160.39 1570.66  172.83 1570.66  182.94  1572.8  183.35 1572.96
  196.26 1572.24  207.16 1572.24  255.52 1573.23  303.43 1573.55  315.65 1574.68
  335.31 1574.58  355.05 1574.66     398 1576.16  407.26 1576.14  410.18  1576.3
  446.51 1577.68  456.62 1578.25  467.06 1579.04  470.12 1578.89  499.98 1579.75
  500.03 1579.75  509.39    1580   529.5 1580.31  533.27 1580.61  548.14  1582.2
  558.56 1583.14  575.63 1584.46   587.8 1584.36  592.27 1584.23  636.79 1585.05
  661.82 1585.36     667 1585.93  677.22 1586.36  681.15 1585.62  689.34 1585.48
  694.76 1585.98   715.3 1586.74  726.85 1587.04  731.94 1587.34   759.4 1588.04
  768.23 1587.87  773.99  1588.2  787.97 1588.75  797.03 1588.52  800.23 1588.56
  811.51 1588.47  812.98 1588.54  817.74 1589.13  822.08 1589.04  822.94 1588.96
  827.18 1589.01  845.46 1588.89  854.74 1589.51  861.43 1589.58  866.48 1589.78
  870.27 1589.76  876.12 1589.93  880.16 1590.33  904.94 1590.35   914.8 1590.76
  921.37 1590.45  956.33 1591.26  970.54 1591.67  987.28 1592.44 1001.56  1592.4
  1012.7 1592.58 1015.26 1592.72 1018.34 1592.67 1026.17  1592.3 1031.32 1592.33
 1038.56 1592.09 1045.35 1592.26 1058.99 1593.08 1073.41 1593.23 1083.96 1593.44
 1095.47 1593.39 1121.37 1594.17 1127.03 1594.18 1141.56 1594.51 1162.69 1594.64
 1174.08 1594.99 1178.26 1594.93 1195.42 1595.28 1200.67 1595.24 1206.82 1595.43

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  141.85    .035  183.35    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        141.85  183.35            146.3   146.3   146.3              .1       .3
Left Levee      Station=   47.75      Elevation= 1593.36

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 1.874
```

```
INPUT
Description:
Station Elevation Data    num=      99
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1572.61    5.83 1573.26   14.43 1573.91   18.73 1574.93   38.27 1581.94
   49.47 1586.33   52.53 1587.17   70.86 1593.08   81.81 1593.37   99.74 1588.36
  107.96 1584.91  135.94 1576.67  142.03 1575.93  147.25  1575.1  152.96 1575.18
  155.56  1575.4  170.05 1575.68  184.03 1570.86     197 1570.85  202.69 1572.31
  208.52 1574.17   227.4    1573  249.57 1573.43  265.77 1573.45  295.82 1573.76
  338.79 1573.88  381.92 1575.52   395.3 1575.59  427.17 1576.38  442.03 1577.12
  449.31 1577.96  482.85 1578.21  494.14 1579.04   499.9 1579.23   508.4 1579.26
  510.76 1579.47  538.78 1579.74  546.46  1579.8  548.19 1580.02  551.53 1579.95
  593.67 1580.43   609.8  1583.4  612.72 1583.67  618.51 1583.91  620.49 1584.12
   626.8 1584.34  640.33 1584.24  642.98 1584.32  651.72    1584  662.05 1584.24
  668.63 1584.03  678.72 1584.21  682.52 1584.57   690.1  1584.7  706.74 1584.71
  712.23 1584.95  726.56 1584.78  739.33 1585.62  743.42 1585.77  751.32 1585.75
  758.53 1585.93  769.05 1585.96  778.08 1585.73  782.47 1586.19  787.54 1586.51
   796.4 1586.77   817.7 1586.78  835.95 1587.34     839 1587.55  853.53 1587.83
  865.19 1586.74  883.85 1587.62  900.42 1588.98  916.57 1589.23  936.02 1589.17
  951.78 1589.48  959.19 1588.88  962.25 1588.92  985.36 1590.15  997.26 1590.52
  1015.8  1590.4  1022.6 1590.91 1038.46 1591.52 1059.82 1591.98 1064.18 1592.28
 1074.14  1592.4 1082.39 1593.05 1103.22 1593.16 1128.19 1593.54 1133.24 1593.81
 1144.91 1593.73 1152.95 1593.86 1162.82 1593.47 1167.57  1593.5 1170.28 1593.71
 1193.46 1593.69 1208.49 1594.16 1228.24 1594.52  1238.3 1594.97

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  170.05    .035  208.52    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        170.05  208.52              253     253     253             .1       .3
Left Levee      Station=   81.79      Elevation= 1593.37

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 1.826

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1574.18    9.13 1577.17   41.83 1588.95   50.16  1591.2    54.9 1592.99
      66 1593.57   70.32 1592.26    91.2 1584.24  109.48 1577.87  124.65 1574.79
  139.35 1574.62  155.64  1575.1  156.85 1575.29  168.32 1571.37   169.3  1570.9
  181.27 1570.91  198.35 1573.66  214.72  1573.9  219.26 1574.31  233.57 1574.53
  254.67 1574.29  260.74 1574.71  264.35 1574.76  277.33 1574.15  279.46 1574.54
   311.4 1574.64  318.27 1574.34  323.34 1574.42  338.14 1575.55  343.57 1575.41
  355.55 1574.72  373.03 1574.24  376.44 1574.69  393.73 1574.99  423.14 1575.11
  446.88 1576.34   459.7 1576.41  472.83  1575.9  499.61 1576.92  521.17 1577.19
  530.39 1577.55  558.87 1577.71  558.92 1577.71  571.89 1577.86  580.05 1578.43
  606.79 1582.88  619.05 1582.51  640.53 1583.17  653.36 1580.28  658.82 1581.68
   661.8 1582.25  667.33  1583.8     676 1583.69  726.42 1584.53   741.3 1584.43
  751.01 1585.05  773.44 1585.72  789.19 1585.64     825 1586.68  857.12 1587.17
  865.44 1587.51  874.38  1587.5   882.7 1586.45  890.92 1586.65  907.84 1587.75
  912.12 1587.66  930.28 1588.31  941.68 1588.29  948.67 1588.57  953.29 1588.48
  961.48 1588.65  980.53  1588.3  985.21 1588.38  999.78 1589.21 1015.31 1589.55
 1027.81 1589.39 1030.65 1589.18 1042.82 1589.82 1054.57 1590.12 1061.28 1590.75
 1101.38 1591.59 1135.29 1591.72 1139.98 1591.26 1142.56  1591.3 1147.69 1591.85
 1170.07 1592.21 1218.24 1594.01 1227.46 1594.54 1240.06  1594.5 1253.68 1595.35
 1279.23 1595.52 1285.35 1595.79 1296.88 1595.84 1303.06 1595.47 1316.11  1595.1
 1326.03 1594.59 1333.58 1594.46 1365.59 1595.08 1382.15 1596.16 1386.09 1596.15

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  155.64    .035  198.35    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        155.64  198.35             367.1   367.1   367.1             .1       .3
Left Levee      Station=      66      Elevation= 1593.57

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 1.756

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1572.87   37.72  1589.1   44.79 1590.75   53.12 1592.98   63.77  1593.3
```

```
   72.88  1590.8  116.54 1576.61  122.58 1575.54  130.45 1573.81  141.93 1573.43
  148.65 1573.97  157.12  1574.3  167.88  1570.8  181.27 1570.56  199.02 1575.26
  203.18 1574.93  215.38 1575.49  234.24  1575.7  260.72  1575.5  263.14 1575.65
  269.73 1576.61  276.53 1576.83  280.76 1576.31  290.19 1576.53   297.2 1575.85
  305.04  1575.3  310.55 1576.11  316.02  1576.6  322.46 1576.66  329.66 1576.45
  341.24 1577.17  345.32 1577.15  352.59 1577.63  380.39 1578.24  395.67 1578.32
  404.73 1578.69  415.75  1578.9   431.3 1578.93  447.96 1579.72  473.14 1580.13
  484.26 1580.52  502.54 1580.73  513.76 1581.17  523.65 1581.04  563.28 1581.21
   563.3 1581.21  565.62 1581.24  575.66 1580.56  588.16  1580.4  601.31 1580.57
  604.64 1580.26  616.26 1580.59   664.1 1580.87  682.52 1580.72  695.12 1582.03
  715.77 1582.24  723.53  1581.7  730.49 1581.03  738.86    1581   740.7 1581.13
  766.18 1580.83  792.34 1581.29  798.77 1581.15   801.9 1581.58  814.78 1581.77
  821.58 1581.61  835.92 1581.68  846.91 1581.51  870.19 1581.47  887.76  1581.9
  896.96 1582.76  900.27 1583.22  907.85 1584.74  917.18 1586.82  950.31 1588.13
  952.35 1587.86  986.93 1589.78  998.31 1589.14 1016.92 1590.39 1032.09 1590.73
 1057.65 1590.87 1065.52 1590.79 1083.52 1589.64 1101.62 1590.92 1105.24 1590.95
 1124.34 1591.79 1140.01 1592.09 1155.01 1590.97 1161.62 1592.04 1163.92 1592.23
 1175.55 1592.12 1193.54 1592.61 1213.24 1592.49 1234.97 1592.72  1248.7 1593.26
 1258.75 1592.18 1267.31 1593.33  1317.8 1594.51  1328.5 1595.03 1339.28 1595.36

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
**************************************************
       0    .035  157.12    .035  199.02    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        157.12  199.02             525.9   525.9   525.9              .1       .3
Left Levee      Station=   63.76      Elevation=  1593.3

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 1.656

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1593.78   4.842 1593.77   8.844 1593.16  13.089 1593.05  24.951 1586.32
  35.079 1581.15  39.856 1580.86  45.609 1578.89   49.16 1577.88  57.714 1576.27
  68.656 1574.97  86.046 1574.53 114.951  1574.7 119.253 1574.34 128.686 1573.98
 134.657 1574.53 152.774 1574.29 160.448 1574.69 167.388 1575.58 178.096 1572.17
 180.743 1571.67 185.867 1570.09 193.848 1570.15 198.189 1571.96 208.898 1575.22
 220.639 1575.84 228.241 1574.85 240.127 1575.96 247.882 1576.38 265.676 1576.21
 286.188 1577.26 296.421 1576.73 308.049  1577.1 352.117 1577.48 371.613 1578.09
 382.693 1577.89 397.888 1578.33 436.049 1578.58 448.024 1579.19 462.114 1579.07
 493.642 1580.01 503.132  1580.7 503.164  1580.7 511.605 1580.94 522.757 1580.51
 539.986 1580.64  549.12 1579.65 562.823 1580.23 575.242 1581.43 591.244  1581.8
 604.502 1580.52 607.165 1581.02 610.377 1581.18 637.192 1581.25 653.283 1580.71
 672.609 1581.66 697.674 1581.69 704.872 1581.49 712.732 1581.61 722.246 1581.09
 755.355 1581.26 774.779 1581.69 812.141 1581.94 820.251 1582.19 832.129 1581.96
 861.938 1582.44 874.196  1582.9 906.676  1582.9 922.945 1582.68 934.654 1584.01
  945.58 1584.82 956.522 1586.57 978.972 1587.92 983.854 1588.92 998.533 1588.83
1004.044 1588.981013.494 1588.781026.655 1589.391028.745 1589.251045.054 1589.27
1089.227 1589.811093.964 1590.171110.918 1590.56 1117.18 1591.011139.081  1591.3
 1153.76 1591.131163.112 1590.411174.111 1591.771200.119 1592.071209.529 1592.37
1223.497 1591.421233.052 1592.761239.903 1593.12 1253.25 1592.94 1257.18 1593.19
1283.454 1593.431292.339 1593.751300.021 1592.39 1309.64  1593.71364.231 1595.33

Manning's n Values        num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
**************************************************
       0    .035 167.388    .035 208.898    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       167.388 208.898             261.4   261.4   261.4              .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
888        F
888        F
Left Levee      Station=    4.81      Elevation= 1593.77
Skew Angle = 36.2

CULVERT                RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 1.632

INPUT
Description: McKellips Road
Distance from Upstream XS =     111
Deck/Roadway Width        =    39.4
Weir Coefficient          =    2.67
Upstream  Deck/Roadway Coordinates
    num=      17
```

```
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
       0 1594.01    1569   88.44 1592.78    1569  177.21  1589.5    1569
  264.84 1585.39    1569  353.85 1583.06    1569  440.92 1582.71    1569
  503.46 1582.54    1569   596.1 1582.56    1569  686.97 1583.57    1569
  777.51 1585.59    1569  866.76 1587.84    1569  956.65 1589.98    1569
    1048 1591.64    1569 1139.15 1593.16    1569 1232.03 1594.65    1569
 1308.69 1594.61    1569 1324.67 1594.96    1569

Upstream Bridge Cross Section Data
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1593.78   4.842 1593.77   8.844 1593.16  13.089 1593.05  24.951 1586.32
  35.079 1581.15  39.856 1580.86  45.609 1578.89   49.16 1577.88  57.714 1576.27
  68.656 1574.97  86.046 1574.53 114.951  1574.7 119.253 1574.34 128.686 1573.98
 134.657 1574.53 152.774 1574.29 160.448 1574.69 167.388 1575.58 178.096 1572.17
 180.743 1571.67 185.867 1570.09 193.848 1570.15 198.189 1571.96 208.898 1575.22
 220.639 1575.84 228.241 1574.85 240.127 1575.96 247.882 1576.38 265.676 1576.21
 286.188 1577.26 296.421 1576.73 308.049  1577.1 352.117 1577.48 371.613 1578.09
 382.693 1577.89 397.888 1578.33 436.049 1578.58 448.024 1579.19 462.114 1579.07
 493.642 1580.01 503.132  1580.7 503.164  1580.7 511.605 1580.94 522.757 1580.51
 539.986 1580.64  549.12 1579.65 562.823 1580.23 575.242 1581.43 591.244  1581.8
 604.502 1580.52 607.165 1581.02 610.377 1581.18 637.192 1581.25 653.283 1580.71
 672.609 1581.66 697.674 1581.69 704.872 1581.49 712.732 1581.61 722.246 1581.09
 755.355 1581.26 774.779 1581.69 812.141 1581.94 820.251 1582.19 832.129 1581.96
 861.938 1582.44 874.196  1582.9 906.676  1582.9 922.945 1582.68 934.654 1584.01
  945.58 1584.82 956.522 1586.57 978.972 1587.92 983.854 1588.92 998.533 1588.83
1004.044 1588.981013.494 1588.781026.655 1589.391028.745 1589.251045.054 1589.27
1089.227 1589.811093.964 1590.171110.918 1590.56 1117.18 1591.011139.081  1591.3
 1153.76 1591.131163.112 1590.411174.111 1591.771200.119 1592.071209.529 1592.37
1223.497 1591.421233.052 1592.761239.903 1593.12 1253.25 1592.94 1257.18 1593.19
1283.454 1593.431292.339 1593.751300.021 1592.39 1309.64  1593.71364.231 1595.33

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*************************************************
       0    .035 167.388    .035 208.898    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
       167.388 208.898             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
888        F
888        F
Left Levee      Station=    4.81      Elevation= 1593.77
Skew Angle = 36.2

Downstream  Deck/Roadway Coordinates
    num=      17
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
       0 1594.01    1569   88.44 1592.78    1569  177.21  1589.5    1569
  264.84 1585.39    1569  353.85 1583.06    1569  440.92 1582.71    1569
  503.46 1582.54    1569   596.1 1582.56    1569  686.97 1583.57    1569
  777.51 1585.59    1569  866.76 1587.84    1569  956.65 1589.98    1569
    1048 1591.64    1569 1139.15 1593.16    1569 1232.03 1594.65    1569
 1308.69 1594.61    1569 1324.67 1594.96    1569

Downstream Bridge Cross Section Data
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1593.75   5.665 1593.91  16.833 1592.98  23.031 1592.85  45.513  1586.3
  49.612 1584.92  68.575 1577.42  77.557 1576.79   85.78 1577.17  96.416  1576.3
 116.364 1576.53 124.926 1576.14 132.608 1576.46 136.844 1576.87 144.373 1577.12
 154.194 1576.77 167.525 1577.29 181.631 1573.84 202.846 1570.39 214.466 1570.24
 222.422 1572.26 234.131 1578.14 236.133 1579.49 253.466 1579.27 266.692 1577.89
 273.987 1578.87 286.422 1579.71 302.433  1580.1 309.816 1579.34 335.114 1579.44
 345.573 1579.93 350.568 1579.34 361.672 1579.34 397.186 1580.14 397.242 1580.14
 407.023  1580.1 420.822  1580.8 445.418 1581.26 465.761 1581.16 468.699 1581.44
 524.637 1581.83 550.896 1581.46 580.503 1581.75 590.751 1581.55 608.053 1581.79
 618.882 1581.71 630.317 1582.04 632.423 1581.87  636.32 1582.19 658.625 1582.39
 665.226 1582.82 673.521 1582.05 683.778 1582.15 687.813 1582.93 689.023 1583.35
 690.984 1584.63 694.631 1585.67 696.762 1585.61 702.709 1583.93 710.424 1582.74
 717.638 1582.39 733.414 1582.64 739.281  1582.5 756.299 1583.14 765.499 1583.24
 778.822 1583.01 792.169 1583.06 813.392 1586.89  820.17 1587.86 854.095 1587.87
 876.585 1588.59 891.764 1588.72  897.84  1588.5 900.342 1588.67 908.661 1588.59
 929.772 1589.24 937.163 1588.81 942.352 1588.87 947.904 1590.08 969.216  1589.5
  991.73 1589.871016.205 1590.711027.285  1590.51030.964  1590.71036.323 1591.37
1055.795 1591.661062.985 1592.281091.204 1592.731114.388 1592.32 1161.66 1593.45
1165.864 1593.891170.512 1594.761174.361 1593.731184.803 1593.721195.544 1593.37
```

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1203.089 1594.021224.498 1594.151240.032 1594.81 1247.73 1594.771257.704 1595.39

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035 167.525    .035 234.131    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
       167.525 234.131             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
888       F
888       F
Left Levee      Station=    5.67      Elevation= 1593.91
Skew Angle = 36.2

Upstream Embankment side slope              =       3 horiz. to 1.0 vertical
Downstream Embankment side slope            =       3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
McKellips       Circular       9
FHWA Chart # 2 - Corrugated Metal Pipe Culvert
FHWA Scale # 2 - Mitered to conform to slope
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    n Value   Entrance Loss Coef   Exit Loss Coef
               28.5     204       .024                   .5                1
Upstream   Elevation =  1569.6
           Centerline Station =  190
Downstream Elevation =  1569.6
           Centerline Station =  210

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 1.607

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1593.75   5.665 1593.91  16.833 1592.98  23.031 1592.85  45.513  1586.3
  49.612 1584.92  68.575 1577.42  77.557 1576.79   85.78 1577.17  96.416  1576.3
 116.364 1576.53 124.926 1576.14 132.608 1576.46 136.844 1576.87 144.373 1577.12
 154.194 1576.77 167.525 1577.29 181.631 1573.84 202.846 1570.39 214.466 1570.24
 222.422 1572.26 234.131 1578.14 236.133 1579.49 253.466 1579.27 266.692 1577.89
 273.987 1578.87 286.422 1579.71 302.433  1580.1 309.816 1579.34 335.114 1579.44
 345.573 1579.93 350.568 1579.34 361.672 1579.34 397.186 1580.14 397.242 1580.14
 407.023  1580.1 420.822  1580.8 445.418 1581.26 465.761 1581.16 468.699 1581.44
 524.637 1581.83 550.896 1581.46 580.503 1581.75 590.751 1581.55 608.053 1581.79
 618.882 1581.71 630.317 1582.04 632.423 1581.87  636.32 1582.19 658.625 1582.39
 665.226 1582.82 673.521 1582.05 683.778 1582.15 687.813 1582.93 689.023 1583.35
 690.984 1584.63 694.631 1585.67 696.762 1585.61 702.709 1583.93 710.424 1582.74
 717.638 1582.39 733.414 1582.64 739.281  1582.5 756.299 1583.14 765.499 1583.24
 778.822 1583.01 792.169 1583.06 813.392 1586.89  820.17 1587.86 854.095 1587.87
 876.585 1588.59 891.764 1588.72  897.84  1588.5 900.342 1588.67 908.661 1588.59
 929.772 1589.24 937.163 1588.81 942.352 1588.87 947.904 1590.08 969.216  1589.5
  991.73 1589.871016.205 1590.711027.285  1590.51030.964  1590.71036.323 1591.37
1055.795 1591.661062.985 1592.281091.204 1592.731114.388 1592.32 1161.66 1593.45
1165.864 1593.891170.512 1594.761174.361 1593.731184.803 1593.721195.544 1593.37
1203.089 1594.021224.498 1594.151240.032 1594.81 1247.73 1594.771257.704 1595.39

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035 167.525    .035 234.131    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       167.525 234.131            516.4   516.4   516.4             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
888       F
888       F
Left Levee      Station=    5.67      Elevation= 1593.91
Skew Angle = 36.2

CROSS SECTION          RIVER: Spook Hill FRS
```

REACH: Mesa-Buckhorn RS: 1.509

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1573.91	14.4	1576.92	52.34	1590.88	57.46	1593.11	70.44	1593
109.66	1579.17	123.34	1575.77	129.06	1574.92	136.1	1575.01	139.3	1574.57
149.38	1573.49	154.84	1574.49	168.7	1574.78	181.23	1574.77	188.96	1574.62
216.52	1576.03	222.9	1574.02	229.74	1571.56	231.88	1570.57	244.22	1570.85
248.79	1571.7	260.26	1572.34	261.92	1572.54	276.2	1575.04	281.48	1575.07
289.24	1575.84	294.38	1576.17	302.47	1576.18	310.34	1576.53	323.24	1574.86
333.09	1575.06	342.46	1575.09	353.44	1575.97	358.5	1575.93	363.86	1575.68
366.25	1576.05	392.22	1575.9	394.6	1575.74	409.7	1575.88	429.16	1576.54
441.21	1577.13	458.79	1576.93	480.84	1577.23	492.95	1577.68	498.56	1577.71
516.89	1578.32	540.41	1578.66	550.59	1579.36	555.48	1579.04	555.5	1579.04
562.36	1578.64	582.98	1579.2	584.61	1579.35	598.14	1579.65	610.06	1580.35
618.41	1580.58	622.19	1581.14	642.43	1580.69	661.08	1580.84	672.94	1581.13
679.72	1581.44	694.91	1583.71	719.08	1583.65	741.68	1584.01	784.13	1585.16
799.26	1585.8	806.2	1586.36	810.2	1585.9	819.01	1586.09	841.97	1585.53
869.09	1586.59	874.59	1586.52	888.84	1584.98	895.22	1585.47	902.48	1585.8
907.85	1585.84	914.46	1585.54	917.75	1585.9	919.63	1585.91	928.48	1586.68
945.47	1587.68	955.69	1587.93	960.36	1588.2	962.45	1588.19	965.04	1587.98
977.74	1588.56	997.46	1588.69	1007.73	1588.99	1010.03	1589.55	1011.99	1592.19
1012.17	1592.59	1013.06	1592.48	1041.01	1591.89	1050.45	1592.06	1060.91	1592.5
1065.69	1592.14	1113.29	1591.54	1125.01	1592.04	1135.17	1591.75	1153.45	1591.91

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	216.52	.035	289.24	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
216.52	289.24	400	400	400	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
888		F	

Left Levee Station= 70.44 Elevation= 1593

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 1.433

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1571.02	17.74	1574.64	50.52	1585.86	60.94	1589.32	76	1593.43
88.26	1593.59	109.85	1586.43	146.6	1575.1	155.55	1573.95	160.74	1572.67
174.15	1571.68	187.58	1572.01	191.61	1572.37	207.82	1572.94	226.01	1572.43
231.25	1572.73	234.04	1572.66	247.13	1573.82	255.04	1573.61	261.85	1573.8
265.7	1573.57	277.72	1574.07	279.65	1573.08	285.3	1571.33	291.81	1570.45
301.36	1569.98	303.73	1570.15	310.61	1571.96	314.44	1573.31	324.35	1572.98
329.63	1573.35	364.6	1573.46	370.4	1573.73	385.37	1574.06	401.88	1574.76
406.86	1573.53	407.95	1573.63	414.63	1574.88	446.44	1574.67	454.46	1574.47
478.11	1574.55	482.45	1574.91	489.04	1575.09	503.44	1575.06	513.18	1575.33
527.08	1576.42	530.25	1575.8	546.28	1575.95	564.87	1576.52	577.99	1576.29
579.88	1576.35	582.27	1576.61	592.8	1576.65	602.88	1576.92	617.24	1576.49
642.1	1576.79	647.28	1576.53	669.34	1576.55	693.53	1577.61	710.89	1578.18
723.8	1578.25	734.46	1578.64	734.49	1578.64	745.12	1579	757.66	1578.92
771.75	1579.54	808.65	1580.29	832.61	1583.17	844.45	1583.33	860.14	1583.98
868.28	1583.79	888.84	1584.61	920.19	1585.42	941.54	1585.72	959.83	1586.14
964.22	1586	968.99	1586.22	978.27	1586.35	982.8	1586.67	1009.65	1586.54
1033.12	1586.98	1054.12	1587.08	1078.06	1588.15	1087.11	1588.35	1105.51	1588.41
1109.43	1588.31	1114.03	1588.44	1141.89	1588.45	1156.55	1588.96	1161.27	1589.32
1162.1	1590.85	1163.17	1593.23	1168.25	1593.34	1180.02	1592.99	1185.67	1593.34
1209.13	1593.39	1227.4	1593.13	1228.78	1593.02	1252.34	1593.37	1269.15	1593.01

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	277.72	.035	314.44	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
277.72	314.44	400	400	400	.3	.5

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
888		F	

Left Levee Station= 88.25 Elevation= 1593.59

CROSS SECTION RIVER: Spook Hill FRS

```
REACH: Mesa-Buckhorn       RS: 1.358

INPUT
Description:
Station Elevation Data     num=      100
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
*********************************************************************************
       0 1569.54     8.57 1570.96    12.29 1571.82    26.49  1576.2    39.72 1581.38
   57.69 1586.99    76.47 1593.11    88.08 1593.42    90.42 1592.65   112.35 1583.69
  118.54 1581.43   123.75 1580.33   151.14 1573.69   159.94 1572.49   166.15 1571.37
  195.63 1571.84   197.99 1572.05    215.8  1572.7   221.47 1573.07   229.66 1573.31
  234.49 1571.85    243.3     1570    257.8 1570.27   271.93 1571.06   287.71 1573.01
  288.85 1572.92   295.13 1573.24   301.86 1573.95   316.09 1573.38   327.37 1574.13
  338.05 1574.12   340.14 1573.85   356.93 1573.65   373.72 1574.34   399.09 1574.37
  401.42 1574.24   409.47 1574.35    415.8 1573.83   419.35 1574.21   419.45 1574.32
  436.56 1574.33   446.28 1574.63    461.2  1574.8   467.05 1574.49   474.55 1574.86
  506.01 1575.47   526.69 1576.09   543.03 1575.72    594.5 1576.96   602.69 1577.36
  617.78 1577.18   622.92 1577.53   641.27 1577.98   662.16 1578.07   675.59 1577.92
  712.63 1578.54   732.57 1579.08   753.14 1579.45   755.93  1579.5   762.01 1580.28
  781.04  1582.3   790.55 1583.08   794.64 1582.98   795.96 1582.77   800.23 1582.97
  807.11 1582.39   823.14 1582.52   831.68 1582.73   848.41 1583.64   849.04 1583.77
  856.18 1584.02      860 1583.89    892.1 1584.35   920.36 1585.23   938.62  1585.4
  965.67 1586.35   995.01 1586.62 1018.74 1587.18 1027.09 1587.12 1047.39 1587.86
 1058.04 1587.63 1061.39 1587.69 1065.85  1587.4 1080.86 1587.75 1099.81  1588.5
 1103.11 1588.82 1117.87 1588.85 1131.56 1589.16 1146.11  1589.7 1155.52 1589.46
 1166.49 1589.39 1195.53 1590.17 1210.07  1590.8 1219.19 1590.71 1225.28  1590.9
 1237.38 1591.01 1269.97  1591.8 1278.36 1591.83 1280.24 1594.76 1286.32 1594.69

Manning's n Values         num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
***********************************************
       0    .035   229.66    .035   287.71    .035

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
        229.66   287.71              391.6   391.6    391.6          .1          .3
Left Levee       Station=    88.08       Elevation= 1593.42

CROSS SECTION           RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn       RS: 1.283

INPUT
Description:
Station Elevation Data     num=      100
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
*********************************************************************************
       0 1570.17    10.21 1570.47    20.92  1572.2    23.93 1572.49    33.53 1575.71
   60.29 1587.08     81.4 1593.34    83.67 1593.48     91.7 1593.65   100.09 1590.98
  108.02 1588.14   118.07 1584.23   151.19 1573.47      155 1572.91   160.01 1572.97
  169.04 1572.62   179.24 1572.08   188.52 1570.09   202.03 1569.85   223.58  1570.9
  229.76 1571.56   245.74 1573.69   256.27 1573.57   274.11 1574.92   278.06 1574.57
  280.27 1574.66   286.95 1575.28   302.76 1575.59   308.71 1575.54   310.48 1575.66
  334.31 1573.85   339.91 1573.32   343.23 1573.19   359.96 1573.31   364.45 1573.48
   378.5 1573.74   393.41 1573.72   405.46 1573.85   406.87 1574.08   414.19 1574.13
  420.19 1574.49   431.73 1574.75   444.91 1574.76   450.87 1574.67   455.91 1574.79
  468.77 1575.41   486.93 1575.25   525.22 1576.25    535.3 1576.61   539.25 1576.65
  547.07  1576.9   567.67 1576.98    578.3 1577.31   583.78 1577.29   618.85 1577.87
  651.22 1578.86   656.74 1578.51    660.8 1578.58   708.51 1581.52   709.12 1581.56
  727.74 1582.75   738.84 1583.66      742 1584.11   746.21 1584.35    761.4 1584.52
  776.14 1584.58    784.9 1584.75   799.29 1585.78   803.83 1585.89   816.43 1585.94
  820.79  1586.1   835.36 1586.31   838.28 1586.45   865.97 1586.99   907.36 1587.09
  933.15 1587.73   936.56 1587.17   942.96 1587.76   948.71 1588.63    951.4 1588.55
  976.04  1588.4   986.02 1588.53   986.83 1588.47   993.09 1588.67 1035.68  1589.5
 1068.37 1589.26 1071.89 1589.53 1077.05 1589.75 1084.69 1588.23 1091.45 1589.66
 1112.12 1589.65 1119.94 1589.76 1158.37 1590.86 1162.73 1589.96 1163.56 1589.97
 1166.13 1590.18 1204.08 1591.67 1213.26 1591.92 1226.27 1592.13 1244.75  1592.3

Manning's n Values         num=       3
     Sta   n Val      Sta   n Val      Sta   n Val
***********************************************
       0    .035   160.01    .035   245.74    .035

Bank Sta: Left    Right     Lengths: Left Channel    Right      Coeff Contr.    Expan.
        160.01   245.74              416.3   386.1    361.6          .1          .3
Left Levee       Station=     91.7       Elevation= 1593.65

CROSS SECTION           RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn       RS: 1.210

INPUT
Description:
Station Elevation Data     num=      100
     Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev      Sta    Elev
```

```
*******************************************************************************
       0 1571.69    8.06 1572.75    25.6 1577.52   30.93 1578.88   36.07 1580.84
   45.27 1584.13    70.3 1593.39    83.3 1593.78   90.61 1591.31  110.96 1581.97
  145.87 1573.41  160.71 1572.89   172.3 1573.19  178.05 1571.36  183.13 1570.53
  187.74 1570.21  196.74 1570.03  211.89 1573.15  231.31 1573.87  233.48 1573.47
   242.2 1573.63  251.48  1573.5  251.77 1573.57  266.44 1573.58   278.2  1573.8
  293.75 1575.12  315.76 1576.53  319.87 1576.61  350.13 1578.07  365.87  1576.7
  391.87 1577.49  395.44 1577.52  418.83 1578.46   431.2 1578.85  435.91 1578.83
  452.51 1579.13  471.15 1579.22  483.17 1579.52  492.93 1578.98  522.07 1578.16
  538.84  1578.2  588.42 1578.95   593.8 1579.75  601.52 1580.56  603.23 1581.16
  612.85 1581.51  619.21  1581.6  631.06 1581.37  651.11 1582.01   662.3 1582.71
  662.34 1582.71   668.3 1583.08  675.55 1582.37  703.45 1583.25   719.8 1583.57
  744.62 1583.59  752.48 1583.19  789.74 1584.04  830.42 1584.13  831.85 1584.32
  839.62 1584.48  859.43 1585.17  873.27 1585.48  876.05 1585.74  890.27 1586.07
  897.32 1586.43     903 1587.53  908.64 1587.72  911.69 1587.68  921.45  1587.9
  926.13 1588.11  935.04 1588.17  939.76 1588.55  947.78 1588.85   951.2 1588.62
   959.3 1588.34  969.47 1589.48  981.99 1589.43  991.04 1588.85  999.83 1589.54
 1010.52 1589.83 1014.29 1590.02 1017.06 1590.44 1028.51 1590.61 1039.18 1590.28
 1056.24 1590.66 1071.28 1590.55 1105.03 1590.98 1112.53 1590.67 1116.56 1590.85
 1123.91 1591.39 1138.82 1591.97 1148.73 1592.21 1158.45 1592.04 1162.26 1592.17
 1163.59 1592.05 1171.45 1591.93 1187.15 1592.63 1196.21 1592.77 1221.51 1592.42

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035   172.3    .035  211.89    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          172.3  211.89            256.4   242.6   226.5            .1        .3
Left Levee      Station=    83.3      Elevation= 1593.78

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 1.164

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1574.05   12.52  1577.4   49.63 1591.98    54.5 1593.39   66.96 1593.47
   68.33 1592.85   76.75 1589.69   88.11  1584.7  112.97 1577.45  122.68  1574.3
  126.28 1573.52  130.13 1574.22  139.17 1573.76  152.82 1573.53  165.15 1570.35
  166.93 1570.04  178.86 1570.05  195.99 1573.05   207.6 1572.33   221.3 1573.08
  222.54 1573.02  239.02 1573.62  261.44 1574.31  272.88 1574.38  285.87 1574.35
  296.46 1574.56  306.02 1574.97  326.31 1574.97  338.71 1574.84  345.16 1574.65
  350.22 1574.66  364.24 1575.57  383.71 1576.39  386.21  1576.4  415.18 1577.78
  433.08 1576.83  441.78 1576.74  459.34 1577.74  478.34 1577.26  511.37 1577.91
  519.57 1577.89  535.86 1578.84  543.97 1578.88  559.04 1578.76  585.29 1579.82
  599.75 1581.04  610.59  1582.6  624.82 1582.45  624.87 1582.45  634.47  1582.5
  643.13  1583.1  675.82 1584.13  678.63 1584.14  680.63 1583.77   684.4 1583.97
  699.65  1583.7  709.65 1583.86  742.22 1584.95  753.03 1583.92  756.64 1584.43
  765.96 1584.87  792.88 1584.04  808.49 1584.44  820.69  1586.1  832.39 1584.63
  833.52 1584.77   837.7  1584.7  840.58 1584.75  853.73 1587.25  863.67 1586.92
   872.7 1587.29  875.83  1587.3  877.54 1587.47  890.73  1587.7  910.15 1587.41
  918.46 1587.55  945.25 1588.36  950.39 1588.21   965.5 1588.52  989.98 1588.74
  997.61 1588.89 1025.09 1589.65 1027.21  1589.8 1042.17  1589.7 1054.73 1589.92
  1072.1 1590.36 1088.85 1591.21 1097.41  1591.3 1105.22 1591.18 1121.99 1591.45
 1144.28 1591.69 1160.89 1592.47 1169.88 1593.38 1176.24 1593.78 1186.69 1594.14
 1199.24 1593.92 1203.64 1594.07 1206.93 1593.45 1212.64 1593.73  1215.6  1593.8

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  152.82    .035  195.99    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          152.82 195.99            157.6   157.6   157.6            .1        .3
Left Levee      Station=   66.96      Elevation= 1593.47

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 1.135

INPUT
Description:
Station Elevation Data    num=      99
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1574.87    11.6 1577.53    47.5 1591.36   51.15 1593.16   61.72 1593.27
   70.47 1590.35  109.82 1576.68  114.94 1574.82  123.61 1574.08  129.77 1573.78
  155.29 1574.08  164.86 1571.34  169.88 1570.56  176.92  1570.7  178.59 1570.23
  181.53 1570.82  198.33 1573.42   206.5 1572.42  236.15 1573.38  250.47 1574.15
  254.16 1574.24  254.47 1574.37  276.62 1574.97  284.99 1574.45  300.88 1574.76
```

```
  302.89 1574.84  305.67 1574.79   323.7 1574.76  347.86 1576.13  362.45  1575.6
  375.55 1575.54   401.9 1576.05   412.2 1576.47  416.41  1576.7  430.22 1576.87
  449.22 1576.93  460.28 1577.53  468.01 1577.67  479.69 1578.08  496.29 1577.92
  505.07 1578.38   520.3 1577.48  530.69 1577.33  536.51 1577.62  551.67 1578.18
  576.58 1578.65  588.52 1578.63  591.83 1578.77  592.87 1578.88  596.74 1578.78
  597.83 1578.89  600.85 1579.22  633.86 1583.53  652.46 1584.96  669.83 1584.73
  675.62 1584.58  681.55 1584.63  708.22 1584.58  722.08 1585.14  739.04 1585.07
  756.42 1585.31  762.04 1584.82  773.01 1584.97  774.81 1585.05  778.73 1585.01
  804.65 1585.29  818.49 1585.62  830.52 1586.44  839.46 1586.68  864.93    1587
   872.3 1587.21  888.56 1587.53   892.1 1587.71  908.71 1587.85  909.79 1587.98
  927.02 1588.24  943.05 1588.62   948.3 1588.67  954.26 1589.02  974.65 1589.34
  982.71 1589.55  988.13 1589.13 1005.49 1589.74 1009.27 1589.95 1038.19 1590.48
 1059.42 1590.76 1065.49 1590.56 1076.93 1590.75 1087.45 1591.01 1103.54 1591.29
 1115.01 1591.69 1124.58 1591.66 1127.04 1591.51 1133.37 1591.82 1146.09 1592.16
 1151.37 1592.72 1181.84  1592.4 1190.34  1592.8  1215.6 1593.17

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  155.29    .035  198.33    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        155.29  198.33            402.1   402.1   402.1            .1        .3
Left Levee      Station=   61.72      Elevation= 1593.27

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 1.058

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1573.39   12.58 1574.91   48.65 1588.28   53.94 1590.36   63.77 1593.45
   75.16 1593.52    82.3  1590.3  124.41  1577.2  132.05 1576.18  143.85 1576.02
  154.59 1575.51  169.98 1570.83  184.28 1570.87   188.7 1571.53  195.65 1572.09
   198.3 1572.65  208.29 1575.58  210.64 1575.96  212.07  1576.4  213.85 1576.35
  232.32 1574.67  236.98  1574.4  241.54 1574.71  257.39 1574.66  270.95  1574.8
   278.6  1575.4  290.37 1575.17  320.32 1575.61  334.63 1576.26  368.45 1576.59
  395.24 1577.58  425.49 1578.27  431.37 1578.52  436.82 1578.29  444.11 1578.63
  448.62    1579  462.02 1578.72  478.58 1579.31  501.54  1579.8   534.3 1580.12
  534.34 1580.12  546.15 1579.94  555.68 1580.03  563.82 1580.88  586.53 1580.97
  593.61 1581.16   615.6 1581.21     625  1581.7   633.3 1581.91  642.75 1582.39
  669.33 1582.55   673.7 1582.79  690.67 1583.02  695.29 1582.92  709.96  1583.4
  727.02 1583.53  746.09 1584.03  759.94 1586.61  766.68 1585.99  774.57 1586.21
  779.13 1586.57  788.22 1585.92  814.21 1586.31  820.74 1587.21  829.41 1587.31
  833.04 1587.57  841.85 1587.81  857.57 1586.94  860.25  1587.4  866.87  1587.3
  875.59 1586.64  881.45 1586.71  884.14 1586.38  890.43 1586.94  894.47 1586.99
  895.33 1586.83  899.75 1586.75  902.29 1586.93  903.24 1587.22  906.12 1587.52
  910.81 1588.71  913.66 1588.66  917.51 1588.38  920.94 1588.95  923.01 1588.94
  929.29  1589.3  937.42 1588.97  944.87 1588.15  946.05 1587.91  954.04 1587.32
  956.45  1587.4  976.58 1589.91  978.84 1590.04   982.2 1589.97  983.98 1590.84
  985.56 1591.26  988.02 1591.35  998.67 1588.89 1001.05 1588.71 1001.38 1588.86

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  143.85    .035  212.07    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        143.85  212.07            400.1   400.1   400.1            .1        .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
888        F
Left Levee      Station=   75.16      Elevation= 1593.52

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.983

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1573.09     .87  1573.1    1.06 1573.23   21.48 1579.66    32.1 1582.86
   63.03 1592.69   65.57 1592.66   78.42 1592.86   93.37 1586.57     115 1581.04
  119.18 1579.22  120.96 1578.97  129.23 1576.81  138.12 1575.95  142.46 1575.31
  154.84 1571.81  159.59 1570.55  161.22 1570.04  172.05 1569.94  176.59  1570.8
  195.04 1576.75  200.55 1576.51  207.55 1576.69  220.54 1576.67  233.06 1576.36
   233.2 1576.44  233.75 1576.51  234.36 1576.89  242.99 1576.31  256.45 1577.93
  269.36 1577.56  275.35 1577.81  286.32 1577.66  304.75 1577.98  312.68 1577.98
  318.07 1577.61  323.51 1578.01   329.7 1578.14  358.51    1578  425.71 1579.14
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   457.7 1579.02  459.81 1579.08   469.7 1579.01  485.27 1579.11  485.31 1579.11
  499.01 1579.17  508.09  1579.5  512.12 1580.08  519.18 1580.23  538.21 1581.14
  551.76 1581.48  555.19 1581.65  566.33  1582.5  579.76 1582.73  581.03 1582.54
  594.63 1581.67  606.31 1581.75  620.95 1583.71  636.65 1584.11  639.54 1584.24
   645.2 1584.24  648.26 1584.41  670.22 1585.04  674.85 1584.93  685.37 1584.93
  695.64 1584.24  704.93  1584.1   712.3 1584.45  713.69 1584.34  721.48  1584.5
  731.33  1585.3  742.72 1585.89     754 1586.34  763.73 1584.86  764.94 1585.09
  772.11  1585.3  775.17 1585.02  779.39 1585.65  782.11 1585.83  785.54 1585.67
  790.32 1585.13  793.01 1586.23  794.02 1586.34  794.73 1586.61  807.21 1586.89
  816.22 1587.27   821.3 1587.35   840.7 1588.63   850.1 1588.48  852.33 1588.35
  852.77 1588.45  853.54 1588.41  863.02 1588.89  866.03 1588.84  894.15 1589.52
  896.95 1589.64  902.31 1589.63  922.02 1590.39  931.06 1588.52     944 1586.17

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  129.23    .035  195.04    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        129.23  195.04              402     402     402             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
888        F
Left Levee      Station=   78.42      Elevation= 1592.86

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.906

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0    1575    5.63 1575.55   54.35 1593.11   68.15 1592.91  117.91 1577.22
  119.97 1576.26  120.52 1576.16  130.33 1576.37  145.36 1576.17  148.89 1576.22
  155.53 1573.29  166.72 1569.83  179.05 1569.66  199.84 1574.69  217.68 1575.28
  222.82 1575.22  230.84 1574.92  233.47 1575.37  243.41 1575.85  250.87 1575.12
  258.13 1575.74  264.24 1576.02  273.27    1576  289.09 1576.34  293.35 1576.12
  308.55  1576.5  331.01 1576.74  343.53 1577.15  349.52 1577.05  362.03  1577.1
  364.81 1577.41  365.63 1577.39  369.47 1577.88  373.49 1577.74  380.03 1578.55
  388.62 1579.05  404.46 1578.89  415.25 1579.25  423.09 1578.73  435.15 1579.21
  451.86 1579.07  468.91 1579.47  480.19 1579.41     504 1579.93  514.89 1580.37
  514.93 1580.37  529.54  1580.7  535.02 1580.61  540.87 1581.19  551.88 1581.71
  558.99  1582.5  565.08 1582.99  586.35 1584.17  592.37 1584.22  595.97 1584.45
  608.45 1584.28  617.65  1584.9  618.22 1585.24  628.82 1584.56  646.27 1585.18
   680.8 1585.32  697.57 1585.88  717.55 1586.08  723.88 1586.33  736.93 1587.28
  740.14 1587.17  743.52 1586.63  747.82 1586.23  750.66 1586.14  753.68 1585.79
  764.58 1586.54  772.96 1586.84  782.04 1586.59  787.42 1586.61  792.83 1587.84
  794.55 1587.98  800.17 1586.93  811.72 1587.43  815.17 1587.76  824.16 1588.21
  827.31 1588.18  829.44 1587.82  832.03 1587.87  833.84 1588.17  843.31 1588.51
  844.97 1588.39  846.83 1588.56  857.41 1588.82  867.07 1588.56  874.08 1588.55
  897.43  1589.3  934.94 1589.71  948.65 1590.95  952.75 1591.46  955.34 1591.18
  959.31 1590.98  960.98 1591.11  961.89 1591.31     965 1591.66   968.2 1591.86

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  148.89    .035  199.84    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        148.89  199.84            397.4   397.4   397.4             .1       .3
Left Levee      Station=   68.15      Elevation= 1592.91

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.831

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1573.07    9.81 1572.87   16.08 1573.24   23.02 1573.88   24.16 1574.78
   26.64 1575.11   36.27 1578.28    76.8 1593.71   86.51 1593.44   89.83 1593.45
   141.8 1577.23  163.77  1577.7  168.35 1576.25  187.64 1569.73  191.01 1569.68
  199.51 1569.31  200.29 1569.44  204.65  1570.7  224.41 1575.97  231.72 1575.27
  248.29 1575.87  259.01 1575.99  262.63 1575.94  271.98 1576.65  302.81 1576.58
   308.1 1576.77   316.8 1577.87  337.12 1578.65  348.22 1578.07  363.59 1578.43
  379.14    1579     388 1580.73  395.05 1579.56   411.1 1580.44  417.84 1580.34
  429.28 1580.64  431.63 1580.58  438.73  1580.7  443.25 1580.66  444.86 1580.78
  466.39 1581.38  477.09 1581.46  480.42 1581.36  493.65 1581.37  496.24 1581.51
  506.53 1582.55  514.72 1582.56  514.76 1582.56  525.78 1582.41  547.55 1582.71
  550.53 1583.21  555.28 1583.78  564.75 1583.41  581.16 1583.69  594.19 1584.65
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  602.67 1584.26  610.81 1585.18  619.81 1585.95  626.03 1585.47  651.89 1585.65
  668.27  1586.7  679.26 1586.87  697.61 1587.59  708.55 1587.68  711.97 1587.99
  721.21  1587.9  725.45 1588.28  733.36 1588.22   736.6 1588.35  736.98 1588.07
  739.27 1588.68  742.38 1588.56  744.59 1588.31  755.47 1588.98  757.13 1589.19
  773.52 1588.61  776.45 1588.39  776.53 1588.63  787.23 1588.93  799.98 1588.73
  811.86 1589.25  821.08 1589.31  827.28  1589.5  831.55  1589.8  836.02 1589.51
  844.15 1589.27  848.91 1589.61  856.95 1589.92  861.11 1590.36  878.87 1590.28
  892.39 1590.64  895.35 1590.43  905.96 1590.85  910.96 1590.93  920.06 1590.77
     930 1590.91  934.54 1590.82  949.34 1591.79  956.15 1593.44   956.8 1593.07

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  168.35    .035  224.41    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        168.35  224.41            396.4   396.4   396.4             .1       .3
Left Levee      Station=   89.78      Elevation= 1593.45

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.756

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1576.01   18.91 1581.93   41.75 1591.13    48.3 1593.92   59.34  1593.9
    92.4 1584.87   97.11 1583.47  112.09 1579.35  115.04 1579.13  121.72  1578.4
  140.24 1577.64  163.62 1570.22  174.93 1570.46  182.48 1572.69  204.14 1579.49
  209.52 1578.67  210.55 1578.41  211.79  1578.3  214.09 1577.87  217.69 1577.82
  226.58 1577.96  229.04 1578.51   235.9 1577.46  239.28 1578.05  241.42 1577.72
   249.5  1577.6  252.45 1577.82   259.1 1577.86  267.29  1578.5  276.92 1578.55
  278.82 1578.59  283.52  1578.7  291.13 1579.11     294 1579.37  297.16 1579.29
  316.34 1579.28   317.4 1579.37  323.94  1579.4  327.65  1579.8  335.98 1580.47
  351.08 1580.75  367.84 1581.24  380.28 1581.32  382.31 1581.45  385.93 1581.28
  393.49 1581.33   395.7 1581.26  404.57 1581.56  415.79  1582.2  425.19 1582.24
  430.03 1582.05  431.03 1581.89  433.56 1582.19  448.39 1582.67  461.58 1582.49
  466.68 1582.91  476.82  1583.5  491.86 1584.03  498.19 1583.32  499.23 1583.58
  500.93 1583.34  523.91 1583.55  538.97    1584  544.04 1584.48  547.29 1584.43
  576.82  1585.1  580.22 1584.72   589.4  1585.2   593.7 1585.52  608.43 1585.87
  624.55 1585.92  627.17 1586.16   633.1 1586.17  634.58 1586.28  642.41 1586.39
  643.96 1586.32  651.35 1586.86  662.06 1586.88  671.27 1587.22  684.23 1587.43
  708.76 1588.14  723.24 1588.19  731.91  1588.5  735.45 1588.51   740.6 1588.25
  761.21 1588.45  764.43 1588.35  767.28 1588.45   773.6 1588.88  784.63 1589.02
  791.89 1589.23  800.99 1589.28   819.5 1588.74  828.71 1588.89  832.32 1588.84
  840.04 1589.59  868.34 1590.44  881.64 1590.61  892.48 1589.01  893.94 1589.34

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  140.24    .035  204.14    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        140.24  204.14            401.3   401.3   401.3             .1       .3
Ineffective Flow     num=       1
   Sta L   Sta R    Elev  Permanent
888       F
Left Levee      Station=   59.36      Elevation=  1593.9

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.680

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1574.88   22.81 1583.19   27.64 1584.86   45.51 1591.78   51.04 1593.75
   64.42 1593.76   83.93 1587.03   87.44 1585.94   89.82 1585.35   93.69 1584.24
  119.29 1576.15  126.44 1576.17  133.27 1575.92  144.61 1576.25  146.32  1576.4
  162.97 1576.44  181.48 1577.45  184.46 1576.39  201.63  1569.8  212.73 1570.03
  234.46 1577.71  242.74 1577.95  246.89 1577.21  251.79 1577.71  253.91 1578.01
  256.18 1577.47  268.74 1577.66  272.74 1578.01  275.76 1577.79  281.85 1577.76
  286.65    1578  289.33    1578  293.48 1578.22  300.34 1578.43  302.78  1578.5
  307.79 1578.56  321.82 1578.49  330.57 1578.81   337.8 1579.64  355.69 1581.17
  358.12 1581.11  385.07 1581.41   389.1 1581.68   404.7 1582.16  421.75 1582.22
  424.86 1581.96  433.12 1581.75  434.73 1582.02  435.76 1582.03  439.83 1582.41
  457.94 1582.94  460.54 1583.02  470.82 1582.75  479.72 1582.99  484.54 1583.26
  486.33 1583.26  490.47 1583.02  493.41  1583.3  501.67 1583.46  521.48  1583.6
  529.54 1583.91  531.38  1583.9  540.76 1584.33  555.49 1584.61  560.26 1584.83
  569.14 1584.91  577.63 1585.14  602.12 1586.19  640.49 1586.72   644.1 1586.87
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  658.89 1587.84  673.47 1587.85  688.03 1588.93  694.51 1588.68  697.12 1588.69
  702.53 1588.39  705.31 1588.72  712.61 1589.23  715.81 1589.17   730.2  1588.4
  735.75 1588.42  739.56 1588.66  751.74 1588.79  754.05 1588.96  764.24 1589.33
  775.15 1589.43  788.84  1590.4  801.79 1590.34  803.96 1590.63  808.04 1590.59
  824.95 1591.22  830.91    1591   844.9 1591.19   873.8 1591.87  886.06 1591.99
  891.88 1591.69  898.45 1591.22  906.29 1592.14  910.43 1592.52  916.51  1592.6

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0    .035  181.48    .035  234.46    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        181.48  234.46            400.1   400.1   400.1             .1       .3
Left Levee      Station=   64.42      Elevation= 1593.76

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.604

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1575.51    3.25 1574.86   10.09 1574.35   20.21 1576.75   61.41  1593.7
   75.28 1593.72  129.69 1575.57  139.14 1575.63  157.83 1576.38  160.63 1576.11
     185  1576.5  199.72 1575.91  220.03 1577.24  227.81 1575.07  244.66 1569.28
  256.28 1569.71  262.78 1571.28  265.12 1572.14  280.46 1579.27  288.09 1578.41
  298.47 1578.77  300.64 1578.41  300.88 1578.17  312.56 1578.14  336.62 1578.66
  348.19 1578.22  385.96 1580.38   402.6 1580.85  408.43 1580.44  417.11  1581.4
  427.25 1579.11   445.3 1579.16   452.2 1579.94  469.97 1579.46   478.4 1579.64
  488.05 1580.28  488.11 1580.28     499 1581.73  508.21 1582.55  525.46 1583.05
  533.33 1583.94  544.42 1584.42  553.63 1583.47  578.79 1584.14  587.82 1583.33
  593.65  1583.1  609.26 1584.53  618.06 1584.11  639.43 1584.19  646.79  1584.7
  654.25 1584.66  672.16 1585.24  682.99 1584.91  694.32 1586.37  696.23 1586.99
  699.88  1587.2  702.66 1585.15  709.67 1585.57  716.85  1586.5  732.46 1586.75
  741.49 1587.36  747.54 1587.08  773.54 1588.39  813.59    1589  825.66 1588.92
  832.02  1589.6  838.11 1589.88  851.29 1589.29  853.64 1588.96  862.41 1588.83
  932.13 1590.54  936.44 1591.41  959.35 1591.68  976.64 1592.59 1005.29 1592.98
 1043.29 1594.19 1094.54 1593.72 1123.46 1594.84 1143.96 1595.96 1153.29 1596.15
 1159.67 1595.87 1170.27 1596.24 1176.49 1596.85 1211.24 1596.86 1221.55 1597.18
 1263.69  1597.5 1267.85 1597.22 1270.89 1597.46 1273.41 1597.09 1287.64 1597.73
 1324.76 1598.34 1342.18 1598.36  1349.1 1600.26 1351.31  1599.3 1360.92 1599.68
 1361.31 1600.17 1362.39 1600.09 1366.18 1598.99 1394.47 1599.06 1431.25  1600.2

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
************************************************
       0    .035  220.03    .035  280.46    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        220.03  280.46            376.2   376.2   376.2             .1       .3
Left Levee      Station=   75.27      Elevation= 1593.72

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.533

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1573.94   14.95 1574.94   37.84 1583.46   65.06 1593.78   78.59 1593.93
   97.04 1587.14  127.61 1576.54  169.99 1576.79  195.84 1577.54  201.49  1577.6
  205.89    1578  215.73 1574.83  227.86 1570.47  234.78 1569.32  250.43 1569.13
  252.12 1569.61  258.56 1571.99  268.62 1575.44   279.2 1579.33  293.76 1580.06
  329.69 1579.65  342.46 1579.71   343.3 1580.06  345.46 1580.58  347.83 1580.33
  349.13 1580.39  351.13 1580.26  354.39 1580.34  370.77 1580.38   374.6 1580.51
  378.32  1580.5  385.37 1580.84  388.48 1580.78  398.97 1580.84  415.36  1581.6
  421.18  1581.7   428.7 1581.67  428.76 1581.67  454.32 1581.26  458.56 1581.41
  512.44 1581.34  532.79 1582.24   540.8 1580.51  557.92 1580.97  565.59 1582.24
  589.17 1581.77  607.56 1582.06   615.1  1581.4  623.78 1581.69  630.44    1581
  678.17 1581.56  681.39  1581.7  687.15 1581.61  716.82 1581.92  718.68 1582.08
  727.18 1582.34  729.01 1582.47  731.36  1582.5  742.77 1582.09  765.62 1581.62
  779.76 1581.94  797.47 1587.81  812.69 1589.26  827.72 1588.97  865.22 1588.88
  899.56 1590.23  902.01  1590.4  914.06 1590.69  947.47 1591.13  962.64  1591.5
  971.93 1591.59  988.09 1591.95 1002.77 1592.35 1004.42  1592.3  1011.6 1592.58
 1025.58  1592.8  1027.6 1592.91  1043.6 1592.84 1076.61 1593.36 1088.56  1593.3
 1094.08  1593.4 1096.72 1593.75  1103.4 1593.73    1111 1593.52 1116.08 1593.59
 1134.02 1594.52 1157.77 1594.95 1166.62 1594.97 1176.18 1595.21 1178.58 1595.18
 1185.79 1595.46 1203.77 1595.68 1207.28 1595.54 1212.08 1595.14 1221.43 1594.64
 1230.07 1595.69 1238.95 1596.48 1252.18 1597.05 1260.09 1597.27 1264.77  1597.8
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  205.89    .035   279.2    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        205.89   279.2            361.9   361.9   361.9            .1        .3
Left Levee      Station=   78.59      Elevation= 1593.93

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.465

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1593.92    5.21 1593.92    6.94 1593.63   41.23 1580.87      44 1580.01
   46.24  1579.5   60.14 1579.37   74.15  1579.5   81.96 1579.42   95.95  1579.9
  110.82 1579.75  119.91 1579.51  136.24 1580.25  156.68 1580.55   158.9 1580.76
  164.03 1578.61  166.44 1577.82  181.96 1572.04  189.56 1569.49  191.78 1569.15
  196.51 1569.29  202.87 1570.93  202.91 1570.94  205.25 1571.67  206.43 1571.86
  230.96 1582.41  238.07 1582.09  250.19 1582.17  253.44 1581.63  261.92 1579.36
  267.23 1580.46  279.57 1582.04  288.01 1581.74  330.25 1582.03  334.03 1581.67
  336.86 1582.02  352.88 1581.91  365.78 1582.36   388.4 1581.86  412.84 1582.02
  417.74 1582.34  429.35 1582.01  454.78 1581.58  487.32  1581.8  497.79  1582.3
  516.61 1582.67  523.01 1582.53  534.77 1582.75  542.42 1582.63  570.79 1582.67
   571.7  1582.4   582.8 1581.93  602.93 1585.86  612.13 1586.09  626.89 1587.43
  642.43 1587.95  644.41  1587.9  672.74 1588.78  683.66 1588.68   695.4 1589.31
     699 1589.36  704.79 1589.95  717.15 1590.04  734.77 1590.89  744.23  1590.7
  746.36 1590.51  771.06 1591.29  771.16 1591.09  772.09 1590.63   776.7  1591.9
  779.86 1591.64  796.97 1592.29  798.33 1592.24  807.17 1592.65  816.09 1592.55
  816.96 1592.64   819.4 1593.76  851.88 1594.69   865.8 1594.89  870.45 1595.18
  882.87 1594.31  896.55 1594.71  910.17 1594.33  914.22 1594.49   922.3 1594.24
  927.79 1594.63  931.78 1594.62  933.57 1594.77  944.62 1594.81  952.09 1594.38
  955.06 1594.34     966 1594.76  974.88 1594.43   982.4 1594.96  999.32 1594.51
 1011.03 1594.88 1015.19 1594.88 1023.49 1595.37  1038.3 1595.84 1043.77  1595.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035   158.9    .035  230.96    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
         158.9  230.96            211.2   211.2   211.2            .3        .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
888        F
888        F
Left Levee      Station=    5.07      Elevation= 1593.92
Skew Angle = 20

CULVERT                RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.445

INPUT
Description: McDowell Road
Distance from Upstream XS =   73.45
Deck/Roadway Width        =    64.3
Weir Coefficient          =    2.67
Upstream  Deck/Roadway Coordinates
    num=      62
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
***********************************************************************
       0 1594.17    1569  38.631  1593.5    1569  48.563 1593.24    1569
   92.87  1591.6    1569 101.196 1591.29    1569 111.147 1590.99    1569
 163.225 1589.14    1569 172.264 1588.62    1569 175.563 1588.45    1569
 175.591 1588.45    1569 179.105 1588.27    1569 214.645 1586.04    1569
 218.807 1585.81    1569 225.827  1585.5    1569 262.033 1584.16    1569
 268.395 1583.94    1569 307.477 1582.72    1569 314.947 1582.55    1569
 354.734 1582.27    1569 358.934 1582.24    1569 362.909 1582.22    1569
 397.847 1582.54    1569 397.932 1582.54    1569 480.521 1582.97    1569
 480.531 1582.97    1569 480.549 1582.97    1569 480.568 1582.97    1569
 480.578 1582.97    1569  482.26 1582.96    1569 483.171 1582.97    1569
  507.19 1583.29    1569 569.266 1584.06    1569 571.681 1584.14    1569
 594.421 1585.61    1569  595.37 1585.64    1569 596.667 1585.72    1569
 600.529 1585.69    1569 604.927 1585.81    1569 605.068 1586.07    1569
 605.181 1586.27    1569 605.839 1586.28    1569 606.168 1586.28    1569
  607.85 1586.31    1569 613.535  1586.6    1569 614.888 1586.64    1569
 624.463 1586.77    1569 627.264 1586.91    1569 654.252 1587.83    1569
  658.01 1587.89    1569 692.441 1589.02    1569 701.123 1589.33    1569
```

```
 792.828 1592.22    1569   800.9 1592.42    1569 892.041 1594.46    1569
  896.26 1594.55    1569 982.637 1596.36    1569 982.881 1596.36    1569
 982.937 1596.36    1569 983.022 1596.37    1569 996.149 1596.61    1569
1040.165 1597.44    15691050.792 1597.64    1569

Upstream Bridge Cross Section Data
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1593.92    5.21 1593.92    6.94 1593.63   41.23 1580.87      44 1580.01
   46.24  1579.5   60.14 1579.37   74.15  1579.5   81.96 1579.42   95.95  1579.9
  110.82 1579.75  119.91 1579.51  136.24 1580.25  156.68 1580.55   158.9 1580.76
  164.03 1578.61  166.44 1577.82  181.96 1572.04  189.56 1569.49  191.78 1569.15
  196.51 1569.29  202.87 1570.93  202.91 1570.94  205.25 1571.67  206.43 1571.86
  230.96 1582.41  238.07 1582.09  250.19 1582.17  253.44 1581.63  261.92 1579.36
  267.23 1580.46  279.57 1582.04  288.01 1581.74  330.25 1582.03  334.03 1581.67
  336.86 1582.02  352.88 1581.91  365.78 1582.36   388.4 1581.86  412.84 1582.02
  417.74 1582.34  429.35 1582.01  454.78 1581.58  487.32  1581.8  497.79  1582.3
  516.61 1582.67  523.01 1582.53  534.77 1582.75  542.42 1582.63  570.79 1582.67
   571.7  1582.4   582.8 1581.93  602.93 1585.86  612.13 1586.09  626.89 1587.43
  642.43 1587.95  644.41  1587.9  672.74 1588.78  683.66 1588.68   695.4 1589.31
     699 1589.36  704.79 1589.95  717.15 1590.04  734.77 1590.89  744.23  1590.7
  746.36 1590.51  771.06 1591.29  771.16 1591.09  772.09 1590.63   776.7  1591.9
  779.86 1591.64  796.97 1592.29  798.33 1592.24  807.17 1592.65  816.09 1592.55
  816.96 1592.64   819.4 1593.76  851.88 1594.69   865.8 1594.89  870.45 1595.18
  882.87 1594.31  896.55 1594.71  910.17 1594.33  914.22 1594.49   922.3 1594.24
  927.79 1594.63  931.78 1594.62  933.57 1594.77  944.62 1594.81  952.09 1594.38
  955.06 1594.34     966 1594.76  974.88 1594.43   982.4 1594.96  999.32 1594.51
 1011.03 1594.88 1015.19 1594.88 1023.49 1595.37  1038.3 1595.84 1043.77  1595.5

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
*********************************************
       0    .035   158.9    .035  230.96    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
         158.9  230.96             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
888       F
888       F
Left Levee      Station=    5.07      Elevation= 1593.92
Skew Angle = 20

Downstream  Deck/Roadway Coordinates
    num=      62
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
*************************************************************************
       0 1594.17    1569  38.631  1593.5    1569  48.563 1593.24    1569
   92.87  1591.6    1569 101.196 1591.29    1569 111.147 1590.99    1569
 163.225 1589.14    1569 172.264 1588.62    1569 175.563 1588.45    1569
 175.591 1588.45    1569 179.105 1588.27    1569 214.645 1586.04    1569
 218.807 1585.81    1569 225.827  1585.5    1569 262.033 1584.16    1569
 268.395 1583.94    1569 307.477 1582.72    1569 314.947 1582.55    1569
 354.734 1582.27    1569 358.934 1582.24    1569 362.909 1582.22    1569
 397.847 1582.54    1569 397.932 1582.54    1569 480.521 1582.97    1569
 480.531 1582.97    1569 480.549 1582.97    1569 480.568 1582.97    1569
 480.578 1582.97    1569  482.26 1582.96    1569 483.171 1582.97    1569
  507.19 1583.29    1569 569.266 1584.06    1569 571.681 1584.14    1569
 594.421 1585.61    1569  595.37 1585.64    1569 596.667 1585.72    1569
 600.529 1585.69    1569 604.927 1585.81    1569 605.068 1586.07    1569
 605.181 1586.27    1569 605.839 1586.28    1569 606.168 1586.28    1569
  607.85 1586.31    1569 613.535  1586.6    1569 614.888 1586.64    1569
 624.463 1586.77    1569 627.264 1586.91    1569 654.252 1587.83    1569
  658.01 1587.89    1569 692.441 1589.02    1569 701.123 1589.33    1569
 792.828 1592.22    1569   800.9 1592.42    1569 892.041 1594.46    1569
  896.26 1594.55    1569 982.637 1596.36    1569 982.881 1596.36    1569
 982.937 1596.36    1569 983.022 1596.37    1569 996.149 1596.61    1569
1040.165 1597.44    15691050.792 1597.64    1569

Downstream Bridge Cross Section Data
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1593.43   6.305 1593.44  26.499  1590.9  50.311 1583.56  77.703  1577.2
  83.952  1577.2  98.207 1577.89 109.944  1578.1 128.024 1579.18  131.66 1579.07
 156.431 1579.29 156.468 1579.29 165.696 1579.27 170.629 1578.01 193.567 1570.72
 198.783 1568.88 219.362 1569.01 230.976 1572.46 241.426    1575 247.524 1575.08
 249.554 1575.35 267.549 1575.42 272.163 1575.67 289.529 1575.94 301.566 1575.85
 319.458 1576.07 346.784  1575.9  369.44 1575.98 396.362 1577.21 405.327 1577.45
  409.65 1578.91 415.908  1579.4  418.52 1578.96 420.212 1579.32  432.08 1579.16
 441.524 1579.57 460.628 1581.06 475.644 1581.79 504.258 1583.84 506.983 1584.23
```

```
 519.612 1584.69 529.235 1585.81  534.46 1586.82 541.376 1586.61 552.661 1586.93
 558.863 1587.38 574.772 1588.04 581.097 1588.72  599.58 1589.25 614.841 1589.14
 620.705 1589.69 635.796 1589.68 648.021 1590.42 655.595 1590.54 658.339 1590.17
 665.002 1590.37 681.879 1589.84 691.285 1590.12  704.13 1591.04 713.565 1591.04
 719.842 1590.63 724.146 1590.61 733.346 1591.47 741.023 1591.86 749.536 1591.99
 752.506  1591.8 758.022 1592.26 769.702 1591.41 775.998  1590.4 793.599 1588.55
 808.342 1588.28 811.904 1587.88 818.801 1587.76 834.456 1586.58 850.309 1585.65
 867.853 1585.53 871.471 1585.31 882.381 1585.18 889.165 1585.56 916.069 1585.89
 927.862 1585.09 933.058 1585.09 942.211 1585.65 949.324 1585.72 954.906 1585.59
 984.629 1586.59 996.939 1586.34  998.64 1586.431002.812    15861003.968 1586.19
1004.945    15871007.238 1588.351020.976 1588.621028.757 1589.15 1039.77 1590.22
1046.348  1591.21056.224 1592.271060.218 1593.241062.933 1593.691074.623 1594.37

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035 165.696    .035 241.426    .035

Bank Sta: Left   Right    Coeff Contr.   Expan.
       165.696 241.426             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
888       F
888       F
Left Levee      Station=    6.11      Elevation= 1593.44
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
     7561074.623    1592
Skew Angle = 20

Upstream Embankment side slope              =       3 horiz. to 1.0 vertical
Downstream Embankment side slope            =       3 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .95
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
McDowell        Circular       9
FHWA Chart # 2 - Corrugated Metal Pipe Culvert
FHWA Scale # 2 - Mitered to conform to slope
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    n Value   Entrance Loss Coef   Exit Loss Coef
              12.65     186       .024                   .5                1
Upstream   Elevation =  1568.38
           Centerline Station =  195
Downstream Elevation =  1568.38
           Centerline Station =  210

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.425

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1593.43   6.305 1593.44  26.499  1590.9  50.311 1583.56  77.703  1577.2
  83.952  1577.2  98.207 1577.89 109.944  1578.1 128.024 1579.18  131.66 1579.07
 156.431 1579.29 156.468 1579.29 165.696 1579.27 170.629 1578.01 193.567 1570.72
 198.783 1568.88 219.362 1569.01 230.976 1572.46 241.426    1575 247.524 1575.08
 249.554 1575.35 267.549 1575.42 272.163 1575.67 289.529 1575.94 301.566 1575.85
 319.458 1576.07 346.784  1575.9  369.44 1575.98 396.362 1577.21 405.327 1577.45
  409.65 1578.91 415.908  1579.4  418.52 1578.96 420.212 1579.32  432.08 1579.16
 441.524 1579.57 460.628 1581.06 475.644 1581.79 504.258 1583.84 506.983 1584.23
 519.612 1584.69 529.235 1585.81  534.46 1586.82 541.376 1586.61 552.661 1586.93
 558.863 1587.38 574.772 1588.04 581.097 1588.72  599.58 1589.25 614.841 1589.14
 620.705 1589.69 635.796 1589.68 648.021 1590.42 655.595 1590.54 658.339 1590.17
 665.002 1590.37 681.879 1589.84 691.285 1590.12  704.13 1591.04 713.565 1591.04
 719.842 1590.63 724.146 1590.61 733.346 1591.47 741.023 1591.86 749.536 1591.99
 752.506  1591.8 758.022 1592.26 769.702 1591.41 775.998  1590.4 793.599 1588.55
 808.342 1588.28 811.904 1587.88 818.801 1587.76 834.456 1586.58 850.309 1585.65
 867.853 1585.53 871.471 1585.31 882.381 1585.18 889.165 1585.56 916.069 1585.89
 927.862 1585.09 933.058 1585.09 942.211 1585.65 949.324 1585.72 954.906 1585.59
 984.629 1586.59 996.939 1586.34  998.64 1586.431002.812    15861003.968 1586.19
1004.945    15871007.238 1588.351020.976 1588.621028.757 1589.15 1039.77 1590.22
1046.348  1591.21056.224 1592.271060.218 1593.241062.933 1593.691074.623 1594.37
```

```
Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035 165.696    .035 241.426    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       165.696 241.426            465.5   465.5   465.5             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
888        F
888        F
Left Levee      Station=    6.11      Elevation= 1593.44
Blocked Obstructions     num=       1
   Sta L   Sta R    Elev
************************
     7561074.623    1592
Skew Angle = 20

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.336

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0 1572.48    5.91 1571.85   12.91 1572.73   43.13 1582.22   53.64 1585.11
   76.83 1593.72   88.98 1593.83   98.89 1591.53  103.06 1591.02  130.23 1580.88
   144.6 1576.97  149.55 1576.14  180.16 1576.23  204.63 1569.34  214.74 1569.74
  239.31 1576.83  256.78 1577.35  262.46 1577.22  274.37 1577.92   288.5 1578.22
  296.55 1578.71  304.77 1578.93  312.21 1579.42  335.94  1578.8  345.66 1579.09
  352.31 1578.95  360.83 1579.29  385.76 1579.48  393.25 1579.34   402.3  1580.1
  416.83 1580.02  421.03 1580.28  427.23 1580.13  433.65 1579.97  451.63 1580.36
  461.57 1580.99  471.79 1581.13  494.59 1582.27  516.96 1581.43   526.8 1580.44
  546.67 1581.67  562.63 1581.43  601.12 1583.32  621.52 1582.75  626.72 1584.55
  636.95  1584.3  660.53 1584.43  665.65 1584.64  671.11 1584.44  672.48 1584.25
  676.74 1584.18  695.18 1585.07  696.87 1585.32  700.57 1585.25  713.89 1586.06
  740.52 1586.41  751.06 1586.83  771.31 1586.48  779.99 1586.78  791.59 1587.46
  801.41 1587.34  805.94 1587.99  811.62 1588.35  818.41 1588.16  839.18 1588.95
  846.46 1587.21  857.04 1587.19  866.15 1588.52  868.59 1588.52  869.99 1588.84
   883.7 1588.86  889.89 1589.26   904.6 1589.71  907.06 1589.93  923.45 1589.96
  937.71 1590.99  946.04 1591.11  958.28 1590.79  966.64 1591.31  973.56 1591.29
  979.21 1591.54     995 1591.57 1016.36 1592.14 1022.75 1591.72 1047.28 1592.09
 1054.46 1591.66 1060.71  1591.6 1066.14 1591.76 1073.42 1592.33 1093.45 1592.81
 1098.29 1593.94 1108.22 1594.54 1109.96 1594.38 1114.07 1594.63 1124.99 1594.73
 1136.13 1594.29 1149.47 1595.63 1157.39 1595.88 1166.03 1594.99 1171.45 1595.11

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  180.16    .035  239.31    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        180.16  239.31            398.7   398.7   398.7             .1       .3
Left Levee      Station=   88.99      Elevation= 1593.83

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.261

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*********************************************************************************
       0 1572.31     3.8 1572.14   13.91 1572.66   31.59 1578.81    39.7 1581.27
   74.08 1593.65   86.88 1593.68  106.39 1588.59  131.42 1579.35  145.85 1574.42
  168.64 1575.36  182.95 1570.79  188.52  1569.2  199.01 1569.46  220.64 1576.27
  223.94 1575.93  246.13 1575.86  253.36 1576.56  271.09 1576.43  287.01 1576.59
  326.89 1577.79  334.58 1578.39  345.77 1578.15  359.34 1578.72  367.87 1578.68
  376.66 1578.91  389.26 1578.89  409.86 1579.83  444.46  1579.3  452.87 1580.45
  453.84 1580.58  458.11 1580.67  482.36 1581.37   487.2 1581.05  507.08 1581.39
  520.98 1581.17  525.72 1581.82  533.34 1581.87  538.87 1581.56  549.61  1582.1
  566.43 1582.61  574.34 1581.92  593.42 1582.97   603.7 1582.56  611.86 1582.83
  630.85 1582.86   636.1 1583.21  647.15 1584.55  666.87 1584.78  669.97 1585.25
  674.09 1585.35  694.63 1584.71  708.76 1585.15  717.54 1585.08  726.53 1585.37
  739.42 1586.54  752.26 1586.47  766.23 1587.13   772.3 1586.28  783.41 1586.67
  788.64 1586.65  793.04 1587.21  797.65 1587.26   813.3 1588.66  821.85 1588.89
   825.4  1589.2  874.25 1589.43  882.24 1590.16  886.75 1590.28  890.16 1589.09
  895.63 1588.86  906.15 1590.46  914.44 1591.16  946.65 1591.42  956.24 1592.11
  959.05    1592  974.04 1592.52   975.5 1592.27  989.63  1592.2  993.98 1592.46
  998.95 1593.16 1002.33 1593.44 1009.02 1592.86 1017.13 1593.34  1026.7 1593.05
 1038.16 1593.24 1047.03 1593.64 1056.41 1593.24 1083.35 1594.86 1087.92 1594.79
```

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 1092.91 1594.42 1098.62 1594.97 1104.81 1595.11 1118.94 1594.62  1130.7 1594.95
 1135.73 1595.87 1140.27 1596.11 1159.37 1595.67 1173.11 1595.71  1205.4 1596.55

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  168.64    .035  220.64    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        168.64  220.64              400     400     400             .1       .3
Left Levee      Station=   86.85      Elevation= 1593.68

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.185

INPUT
Description:
Station Elevation Data    num=      99
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1572.08    9.04 1572.95   38.57 1583.49   66.02 1593.95   77.97 1594.06
   90.19 1590.48  121.05 1578.79  126.96 1578.11  129.48 1577.21  134.17 1574.69
  146.25  1575.3  154.37 1574.89  160.24 1575.85  177.95 1569.82   188.8 1569.58
  210.15 1577.25  218.16 1577.63  234.73 1577.49  244.93 1578.15  269.15 1578.31
  281.35    1579  290.73 1579.19  298.81 1578.96  323.63 1578.86  327.24 1579.47
  340.09  1578.7  348.18 1578.88  358.74 1579.05  367.94 1579.63  398.21 1580.89
  407.39 1580.79  418.73 1581.14  432.95 1580.85  442.58 1580.27  455.43 1580.93
  466.73 1580.71  477.28 1581.14  510.02 1580.92  534.41 1581.24  545.51 1581.84
  554.02 1582.01  569.38 1582.83  581.41 1584.65  585.43 1585.02  608.42 1584.93
  612.03  1584.7  615.74 1585.19  632.04 1585.86  646.96 1586.04   659.2 1586.61
  669.92 1586.25  675.67 1585.53  677.55 1585.47  686.47 1586.84  698.55 1586.88
  701.63 1586.72  710.33 1587.79  721.34 1586.95  743.64 1587.61  761.14 1588.64
  763.59  1588.4  769.15 1588.51   772.5 1588.85   786.6 1589.03  787.63 1588.78
  791.37 1588.91  807.82 1588.63  815.47 1588.94  822.58 1588.88  845.27 1589.96
  848.31  1589.7  857.76 1590.95  877.11 1590.17  880.37 1590.21  883.61 1591.19
  890.18 1592.76  894.28  1591.4  898.86 1591.42  901.87 1591.67  904.03  1592.3
  906.51 1593.32  909.36 1592.66  914.01 1591.24  920.03 1591.25  926.51 1591.81
  932.65 1591.88   938.2 1592.24  951.25 1592.16  953.68 1592.33  961.99 1592.34
  971.84 1592.81  976.82 1593.24  987.02 1593.29  996.13  1593.1 1012.62 1594.03
 1031.62 1595.72 1044.81 1595.98 1062.08 1595.96 1070.67  1596.4

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
       0    .035  160.24    .035  210.15    .035

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        160.24  210.15             401.3   401.3   401.3             .1       .3
Left Levee      Station=   77.76      Elevation= 1594.06

CROSS SECTION          RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn      RS: 0.109

INPUT
Description:
Station Elevation Data    num=     100
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
*******************************************************************************
       0 1572.14   27.79 1574.26   42.27 1579.38   46.84  1580.7   73.92 1590.84
   79.78 1593.38   92.41 1593.75  106.93 1588.58  140.45 1578.05  146.08 1576.06
  155.09 1575.04  171.05 1575.15  176.43 1574.85  184.24 1576.02  204.71 1569.35
  216.24 1569.32  240.86  1578.1   244.1 1577.07   248.1 1576.58  253.46 1577.86
  254.79 1577.92  264.75 1577.29  280.38 1578.22  282.75 1578.73  292.41 1579.54
  299.19 1579.49  302.37 1579.78  306.59 1579.89   310.2 1578.91  312.38  1578.8
  326.59 1579.83  328.82 1579.76  343.89 1580.58  345.79 1580.96  345.83 1580.97
  350.53 1581.75  355.02 1581.96  362.17 1581.99  372.07 1582.33  377.86 1581.57
  394.31 1581.64  397.16 1582.73  400.19 1582.65  416.86 1583.89  433.33 1583.74
  433.68 1583.89  437.37 1584.02  455.66 1583.47  493.98 1584.14  521.31 1585.68
  530.15 1584.47   543.5 1585.12  549.65 1585.17  561.21 1585.88  567.41 1585.04
  583.48 1586.14  583.63 1585.95  608.12 1586.88  631.84 1587.26  659.66 1588.08
  680.88 1588.15  684.09 1588.69   688.7 1589.15  698.25 1588.19  709.52 1588.13
  712.99 1588.36  738.87 1587.15  742.56 1587.74     755 1588.04  759.43 1587.87
  763.68 1587.23  774.67 1587.66   783.1  1588.7  785.34 1589.21     788 1588.96
  789.87 1588.99  794.25 1590.97  807.42 1591.14     813 1590.27  819.82 1590.77
  838.28 1591.32  849.91 1591.47  851.73 1591.22  853.15 1591.26  857.85 1592.64
  862.06 1592.35  864.08 1591.89  873.75 1592.51  884.95 1592.51  895.46 1591.96
  913.94 1592.89  919.03 1593.33  922.64 1593.91  930.57 1594.25  933.31 1593.47
  934.69 1592.72  937.42 1592.82  942.07 1593.37  947.72 1593.54  966.56 1592.74

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
***********************************************
```

```
       0    .035  184.24    .035  240.86    .035

 Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        184.24  240.86             219.6   219.6   219.6             .1       .3
 Left Levee      Station=   92.17      Elevation= 1593.75

 CROSS SECTION          RIVER: Spook Hill FRS
 REACH: Mesa-Buckhorn      RS: 0.068

 INPUT
 Description:
 Station Elevation Data    num=     100
      Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 ********************************************************************************
        0 1584.46   16.38 1585.71   21.54 1586.64   24.68 1585.98   45.56 1580.09
    47.01 1580.09   64.62 1578.64   66.22 1578.17   66.87 1578.33      67 1578.05
     67.4 1578.17   70.18 1580.06    71.3 1580.57   72.67 1581.81   73.88 1581.74
    74.26 1582.25   74.52 1582.21   83.17 1586.93   91.22 1592.14  107.06  1591.7
   107.45 1591.54  120.16 1591.22   124.2 1589.93  125.86 1587.75  127.45 1586.96
   149.04 1579.57  157.29 1577.18  166.12 1576.27  204.46 1576.22  222.32 1569.61
   233.66 1569.32  265.22 1580.08  278.18 1580.58   282.9 1580.11  287.34 1580.47
   291.66 1581.09  292.68 1580.63  293.82 1580.34  309.87 1580.15     314 1581.92
   317.68 1581.63  321.57 1581.61   321.6 1581.61  327.58  1581.6  332.39 1581.83
   343.56 1581.79  354.44 1581.19  369.83 1582.73  374.19 1582.97  395.15 1582.39
   405.75 1583.24  419.28 1583.82  429.28 1583.51  462.13 1584.12  471.05 1584.82
   472.65 1584.71   478.9 1585.52  485.19 1583.53  493.99 1584.36  501.66 1586.27
    504.6 1585.79  512.35 1585.59  525.69 1586.24  529.99 1586.66  532.39  1586.5
   549.86  1586.4  604.09 1587.37   612.4 1586.95  634.49 1587.64  639.46 1587.98
   656.13 1588.28  695.07 1590.64  698.93 1590.61  706.28 1589.67   711.5 1589.98
      715 1590.98  723.75 1589.91  725.85 1590.51  727.95 1590.77   742.4 1590.44
   746.34 1590.21  753.33 1590.26  764.58 1591.25  771.91 1593.76  777.51 1590.68
   779.01 1591.19     783 1591.48  791.57 1590.81   795.9 1591.43  812.18 1591.46
   820.74 1591.23   825.9 1590.91  830.62 1590.37  843.19 1591.58  849.77 1591.88
   861.37 1591.85  872.69 1591.45  877.74 1591.62  879.53 1591.95  891.27 1593.05

 Manning's n Values        num=       3
      Sta   n Val     Sta   n Val     Sta   n Val
 ************************************************
        0    .035  204.46    .035  265.22    .035

 Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        204.46  265.22             22.1    22.1    22.1             .1       .3
 Left Levee      Station=   91.24      Elevation= 1592.15

 CROSS SECTION          RIVER: Spook Hill FRS
 REACH: Mesa-Buckhorn      RS: 0.063

 INPUT
 Description:
 Station Elevation Data    num=     100
      Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 ********************************************************************************
        0 1582.24    8.77 1580.22   15.92 1579.05   31.61 1575.76   39.39  1573.2
    47.25 1572.64   69.28 1572.36   69.73 1572.74   69.89 1573.35   70.16 1573.86
     72.2  1570.5   72.69  1570.5   73.46 1569.94  101.53 1569.84  101.61 1570.37
   105.26 1584.05  119.04  1584.3  136.12 1584.11  143.21 1581.15  149.37 1579.28
   156.96 1577.55  191.11 1576.34  207.03 1576.27   225.3 1569.47  236.81 1569.37
   272.97 1580.86  278.89 1581.18  285.79 1581.08  291.26 1581.81  292.99  1580.9
   294.61  1580.5   310.4 1580.43  312.09 1581.23  320.15 1581.75  320.16 1581.75
   323.67 1581.82  330.26 1581.23  351.05 1583.02  366.71 1582.41  370.74 1582.56
   375.17 1583.32  382.12 1583.12  383.81 1582.74  387.15 1583.13  392.69 1583.36
   399.82 1583.34  417.66 1584.18  431.74 1583.23  435.59 1583.77  452.62 1583.63
   472.67  1585.1  477.37 1583.45  486.86 1584.24  498.57  1585.6  512.14 1585.92
   516.99 1586.62  524.76 1586.31  529.56 1586.89  538.24    1587  544.59  1586.8
      546 1586.99  562.94 1586.94  573.13 1587.39  577.17 1587.86  592.74 1587.68
   612.65 1588.66  620.89 1588.19  630.86  1588.1  641.18 1589.03  656.95 1587.85
   662.73 1588.85  669.25  1589.3  671.83 1589.18  674.14 1589.59  694.06 1589.51
   706.68  1591.2     711 1590.98   713.3 1590.57  723.31 1591.19  744.88 1590.85
   752.55 1591.14  756.13 1591.57  760.83 1591.51  765.98 1593.24   769.4 1592.11
   773.24 1591.29  777.82 1594.01  784.34 1591.96  788.54 1592.42  793.84 1592.26
   814.38 1592.66  819.76 1592.53  826.78 1592.68   843.1 1592.41  853.78 1593.54
   859.88 1592.19  862.82 1592.22  872.68 1593.39  882.13 1593.56  891.27  1593.1

 Manning's n Values        num=       3
      Sta   n Val     Sta   n Val     Sta   n Val
 ************************************************
        0    .035  207.03    .035  272.97    .035

 Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
        207.03  272.97             232.4   232.4   232.4             .1       .3
 Ineffective Flow     num=       1
    Sta L   Sta R    Elev  Permanent
```

888 F

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 0.019

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1572.35	28.21	1572.67	54.43	1572.35	57.97	1572.5	69.92	1572.51
75.04	1571.86	80.89	1571.66	95.5	1571.49	99	1569.74	117.36	1569.81
124.83	1569.69	131.36	1583.99	151.59	1584.21	159.07	1584.46	160.46	1584.02
175.89	1578.41	179.94	1577.16	229.18	1576.37	249.87	1569.18	260.3	1568.71
274.64	1573.31	297.48	1582.46	303.34	1582.25	303.49	1582.24	311.63	1582.3
332.53	1582.62	340.89	1582.67	353.37	1582.93	360.89	1582.76	375.3	1583.18
382.36	1584.01	394.88	1584.31	399.7	1584.74	406.33	1585.06	421.74	1585.1
423.15	1584.95	424.09	1584.98	425.87	1584.87	441.19	1585.22	456.94	1585.29
459.56	1585.58	464.5	1585.66	468.2	1585.97	472.25	1586.16	483.12	1586.18
492.29	1586.69	497.8	1586.69	505.54	1586.97	513.35	1586.75	515.54	1586.94
518.75	1587.06	520.25	1587.35	524.71	1587.68	536.15	1587.52	555.62	1587.96
578.03	1588.63	580.88	1588.56	589.8	1588.84	592.01	1588.84	596.72	1588.65
600.3	1588.79	606.8	1588.65	612.62	1589.02	616.3	1589.15	629.88	1589.33
653.2	1589.99	659.84	1590.57	672.62	1590.8	695.36	1591.63	700.63	1591.53
705.45	1591.25	712.23	1591.96	715.44	1592.18	728.43	1591.98	731.18	1592.04
735.11	1592.33	743.42	1592.66	759.07	1592.2	770.88	1593.43	771.5	1593.64
772.52	1593.44	776.69	1593.12	789.14	1593.27	793.82	1593.49	796.71	1593.9
801.28	1593.93	810.35	1593.47	817.98	1593.21	821.96	1593.19	823.92	1593.36
829.37	1593.42	831.98	1593.71	844.67	1593.77	858.8	1594.27	859.39	1594.39
864.16	1594.77	869.31	1594.9	872.85	1595.22	876.03	1595.31	879.49	1595.51

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	229.18	.035	297.48	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
229.18	297.48	15.5	15.5	15.5	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent

888 F

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 0.016

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1574.96	6.46	1574.21	17.34	1573.32	22.88	1572.73	66.73	1572.31
70.8	1571.65	86.7	1572.19	87.46	1572.86	87.52	1573.06	89.54	1574.72
90.16	1574.95	93.96	1577.84	96.31	1579.19	97.13	1580.04	99.45	1581.16
101.18	1581.84	102.62	1582.83	103.2	1582.91	105.72	1585.39	106.5	1586.41
108.27	1587.46	109.15	1587.83	110.96	1588.28	111.34	1589.47	114.6	1591.73
124.44	1591.92	127.77	1586.9	130.38	1587.03	131.32	1586.82	142.03	1586.4
143.51	1586.65	145.28	1586.75	147.88	1587.61	149.12	1587.21	154.44	1584.29
158.22	1582.91	171.1	1578.93	177.32	1577.5	185.06	1577.08	222.66	1576.46
244.69	1569.24	254.9	1568.89	276.52	1575.93	293.29	1582.32	295.06	1582.34
305.03	1582.44	332.41	1582.84	350.56	1583.28	354.53	1583.17	363.65	1584.07
368.07	1583.96	375.29	1584.01	380.78	1584.34	389.54	1584.56	402.64	1584.61
412.31	1585.04	414.83	1584.81	426.4	1584.93	433.56	1585.29	439.06	1585.01
455.39	1585.39	461.6	1585.84	478.65	1585.77	486.94	1587.23	494.74	1587.07
505.66	1587.38	514.97	1587.21	522.04	1587.85	545.11	1588.02	562.1	1588.45
580.25	1589.15	586.56	1589.54	606.52	1588.92	611.68	1589.33	620.66	1589.27
627.11	1590.01	658.33	1590.36	667.3	1590.89	679.75	1590.67	690.24	1591.87
700.24	1591.44	708.59	1591.81	725.88	1591.85	749.05	1592.1	755.28	1592.32
765.6	1593.93	771.82	1593.51	783.84	1593.94	789.1	1593.73	789.8	1594.06
796.7	1594.03	802.44	1594.37	813.17	1594.27	818.37	1594.55	825.77	1594.47
839.07	1594.53	851.51	1594.92	859.06	1594.39	864.34	1594.9	874	1595.45

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	222.66	.035	293.29	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
222.66	293.29	86.6	86.6	86.6	.1	.3

Left Levee Station= 124 Elevation= 1591.92

CROSS SECTION RIVER: Spook Hill FRS
REACH: Mesa-Buckhorn RS: 0.000

INPUT
Description:
Station Elevation Data num= 100

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1581.17	3.98	1581.42	13.5	1582.45	20.18	1582.7	30	1583.29
58.09	1585.95	75.32	1587.16	76.77	1587.16	90.22	1588.64	94.65	1589.01
100.9	1589.08	102.51	1589.23	108.19	1589.21	110.14	1589.41	112.61	1589.37
127.63	1590.58	134.82	1591.39	136.74	1591.79	149.95	1593.06	162.34	1593.38
208.58	1580.16	219.23	1580.58	239.71	1581.01	251.61	1575.98	262.55	1572.39
274.9	1569.1	286.63	1568.99	323.28	1583.79	324.69	1583.76	325.71	1583.73
333.47	1583.55	341.42	1583.18	347.31	1583.53	363	1584.04	395.81	1584.62
400.21	1585.09	409.51	1585.24	422.75	1585.71	424.36	1586.04	439.12	1586.08
448.54	1586.49	461.51	1586.36	465.06	1586.46	481.03	1586.21	484.47	1585.98
487.11	1586.05	490.09	1587.1	491.99	1587.55	495.76	1587.67	498.84	1587.54
502.01	1587.84	512.4	1588.01	521.92	1587.6	529.64	1587.45	539.37	1587.71
543.51	1588.3	556.29	1588.14	562.92	1588.63	571.04	1588.9	578.97	1588.6
585.12	1589	590.51	1589.58	593.53	1589.74	599.02	1589.45	609.86	1589.71
614.92	1590.17	644.36	1590.85	645.88	1591.08	658.34	1591.54	667.29	1591.28
669.62	1591.07	674.03	1590.91	681.83	1590.93	692.94	1591.27	707.4	1591.4
715.09	1591.76	722.24	1591.8	735.74	1592.13	737.84	1592.44	742.31	1592.81
749.32	1592.76	756.98	1594.93	763.11	1593.47	767.32	1595.39	768.32	1594.91
784.58	1595.26	786.52	1594.33	799.56	1593.83	804.44	1594.12	823.71	1594.45
830.78	1594.33	835.53	1594.63	841.76	1594.7	852.19	1595.25	852.43	1595.35
856.61	1595.46	874.56	1595.31	893.01	1596.18	897.95	1596.29	900.66	1596.12

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.035	239.71	.035	323.28	.035

Bank Sta: Left	Right	Lengths: Left	Channel	Right	Coeff Contr.	Expan.
239.71	323.28		0	0	.1	.3

Left Levee Station= 162.33 Elevation= 1593.38

SUMMARY OF MANNING'S N VALUES

River:Spook Hill FRS

Reach	River Sta.	n1	n2	n3
Mesa-Buckhorn	3.852	.035	.035	.035
Mesa-Buckhorn	3.851	.035	.035	.035
Mesa-Buckhorn	3.824	.035	.035	.035
Mesa-Buckhorn	3.749	.035	.035	.035
Mesa-Buckhorn	3.645	.035	.035	.035
Mesa-Buckhorn	3.576	.035	.035	.035
Mesa-Buckhorn	3.500	.035	.035	.035
Mesa-Buckhorn	3.424	.035	.035	.035
Mesa-Buckhorn	3.349	.035	.035	.035
Mesa-Buckhorn	3.285	.035	.035	.035
Mesa-Buckhorn	3.138	.035	.035	.035
Mesa-Buckhorn	3.117	Culvert		
Mesa-Buckhorn	3.096	.035	.035	.035
Mesa-Buckhorn	2.966	.035	.035	.035
Mesa-Buckhorn	2.891	.035	.035	.035
Mesa-Buckhorn	2.871	.035	.035	.035
Mesa-Buckhorn	2.815	.035	.035	.035
Mesa-Buckhorn	2.736	.035	.035	.035
Mesa-Buckhorn	2.662	.035	.035	.035
Mesa-Buckhorn	2.585	.035	.035	.035
Mesa-Buckhorn	2.509	.035	.035	.035
Mesa-Buckhorn	2.433	.035	.035	.035
Mesa-Buckhorn	2.357	.035	.035	.035
Mesa-Buckhorn	2.328	.035	.035	.035
Mesa-Buckhorn	2.281	.035	.035	.035
Mesa-Buckhorn	2.205	.035	.035	.035
Mesa-Buckhorn	2.129	.035	.035	.035
Mesa-Buckhorn	2.053	.035	.035	.035
Mesa-Buckhorn	1.977	.035	.035	.035
Mesa-Buckhorn	1.901	.035	.035	.035
Mesa-Buckhorn	1.874	.035	.035	.035
Mesa-Buckhorn	1.826	.035	.035	.035
Mesa-Buckhorn	1.756	.035	.035	.035
Mesa-Buckhorn	1.656	.035	.035	.035
Mesa-Buckhorn	1.632	Culvert		
Mesa-Buckhorn	1.607	.035	.035	.035
Mesa-Buckhorn	1.509	.035	.035	.035
Mesa-Buckhorn	1.433	.035	.035	.035

*Mesa-Buckhorn	* 1.358	* .035*	.035*	.035*
*Mesa-Buckhorn	* 1.283	* .035*	.035*	.035*
*Mesa-Buckhorn	* 1.210	* .035*	.035*	.035*
*Mesa-Buckhorn	* 1.164	* .035*	.035*	.035*
*Mesa-Buckhorn	* 1.135	* .035*	.035*	.035*
*Mesa-Buckhorn	* 1.058	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.983	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.906	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.831	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.756	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.680	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.604	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.533	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.465	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.445	*Culvert *	*	*
*Mesa-Buckhorn	* 0.425	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.336	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.261	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.185	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.109	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.068	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.063	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.019	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.016	* .035*	.035*	.035*
*Mesa-Buckhorn	* 0.000	* .035*	.035*	.035*

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SUMMARY OF REACH LENGTHS

River: Spook Hill FRS

Reach	River Sta.	Left	Channel	Right
*Mesa-Buckhorn	* 3.852	* 1*	1*	1*
*Mesa-Buckhorn	* 3.851	* 146.5*	146.5*	146.5*
*Mesa-Buckhorn	* 3.824	* 392.3*	392.3*	392.3*
*Mesa-Buckhorn	* 3.749	* 550.4*	550.4*	550.4*
*Mesa-Buckhorn	* 3.645	* 363.7*	363.7*	363.7*
*Mesa-Buckhorn	* 3.576	* 401.9*	401.9*	401.9*
*Mesa-Buckhorn	* 3.500	* 400*	400*	400*
*Mesa-Buckhorn	* 3.424	* 400.3*	400.3*	400.3*
*Mesa-Buckhorn	* 3.349	* 333.7*	333.7*	333.7*
*Mesa-Buckhorn	* 3.285	* 778.7*	778.7*	778.7*
*Mesa-Buckhorn	* 3.138	* 220.7*	220.7*	220.7*
*Mesa-Buckhorn	* 3.117	*Culvert *	*	*
*Mesa-Buckhorn	* 3.096	* 684.7*	684.7*	684.7*
*Mesa-Buckhorn	* 2.966	* 400*	400*	400*
*Mesa-Buckhorn	* 2.891	* 102*	102*	102*
*Mesa-Buckhorn	* 2.871	* 294.9*	294.9*	294.9*
*Mesa-Buckhorn	* 2.815	* 417.3*	417.3*	417.3*
*Mesa-Buckhorn	* 2.736	* 414.3*	395*	381.7*
*Mesa-Buckhorn	* 2.662	* 402.4*	402.4*	402.4*
*Mesa-Buckhorn	* 2.585	* 402.4*	402.4*	402.4*
*Mesa-Buckhorn	* 2.509	* 402.4*	402.4*	402.4*
*Mesa-Buckhorn	* 2.433	* 402.4*	402.4*	402.4*
*Mesa-Buckhorn	* 2.357	* 149.5*	149.5*	149.5*
*Mesa-Buckhorn	* 2.328	* 251.5*	251.5*	251.5*
*Mesa-Buckhorn	* 2.281	* 400.9*	400.9*	400.9*
*Mesa-Buckhorn	* 2.205	* 400.9*	400.9*	400.9*
*Mesa-Buckhorn	* 2.129	* 400.9*	400.9*	400.9*
*Mesa-Buckhorn	* 2.053	* 400.9*	400.9*	400.9*
*Mesa-Buckhorn	* 1.977	* 400.9*	400.9*	400.9*
*Mesa-Buckhorn	* 1.901	* 146.3*	146.3*	146.3*
*Mesa-Buckhorn	* 1.874	* 253*	253*	253*
*Mesa-Buckhorn	* 1.826	* 367.1*	367.1*	367.1*
*Mesa-Buckhorn	* 1.756	* 525.9*	525.9*	525.9*
*Mesa-Buckhorn	* 1.656	* 261.4*	261.4*	261.4*
*Mesa-Buckhorn	* 1.632	*Culvert *	*	*
*Mesa-Buckhorn	* 1.607	* 516.4*	516.4*	516.4*
*Mesa-Buckhorn	* 1.509	* 400*	400*	400*
*Mesa-Buckhorn	* 1.433	* 400*	400*	400*
*Mesa-Buckhorn	* 1.358	* 391.6*	391.6*	391.6*
*Mesa-Buckhorn	* 1.283	* 416.3*	386.1*	361.6*
*Mesa-Buckhorn	* 1.210	* 256.4*	242.6*	226.5*
*Mesa-Buckhorn	* 1.164	* 157.6*	157.6*	157.6*
*Mesa-Buckhorn	* 1.135	* 402.1*	402.1*	402.1*
*Mesa-Buckhorn	* 1.058	* 400.1*	400.1*	400.1*
*Mesa-Buckhorn	* 0.983	* 402*	402*	402*
*Mesa-Buckhorn	* 0.906	* 397.4*	397.4*	397.4*
*Mesa-Buckhorn	* 0.831	* 396.4*	396.4*	396.4*

*Mesa-Buckhorn	*	0.756	* 401.3*	401.3*	401.3*
*Mesa-Buckhorn	*	0.680	* 400.1*	400.1*	400.1*
*Mesa-Buckhorn	*	0.604	* 376.2*	376.2*	376.2*
*Mesa-Buckhorn	*	0.533	* 361.9*	361.9*	361.9*
*Mesa-Buckhorn	*	0.465	* 211.2*	211.2*	211.2*
*Mesa-Buckhorn	*	0.445	*Culvert *	*	*
*Mesa-Buckhorn	*	0.425	* 465.5*	465.5*	465.5*
*Mesa-Buckhorn	*	0.336	* 398.7*	398.7*	398.7*
*Mesa-Buckhorn	*	0.261	* 400*	400*	400*
*Mesa-Buckhorn	*	0.185	* 401.3*	401.3*	401.3*
*Mesa-Buckhorn	*	0.109	* 219.6*	219.6*	219.6*
*Mesa-Buckhorn	*	0.068	* 22.1*	22.1*	22.1*
*Mesa-Buckhorn	*	0.063	* 232.4*	232.4*	232.4*
*Mesa-Buckhorn	*	0.019	* 15.5*	15.5*	15.5*
*Mesa-Buckhorn	*	0.016	* 86.6*	86.6*	86.6*
*Mesa-Buckhorn	*	0.000	* 0*	0*	0*

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Spook Hill FRS

Reach	River Sta.	Contr.	Expan.
*Mesa-Buckhorn	* 3.852	* .1*	.3*
*Mesa-Buckhorn	* 3.851	* .1*	.3*
*Mesa-Buckhorn	* 3.824	* .1*	.3*
*Mesa-Buckhorn	* 3.749	* .1*	.3*
*Mesa-Buckhorn	* 3.645	* .1*	.3*
*Mesa-Buckhorn	* 3.576	* .1*	.3*
*Mesa-Buckhorn	* 3.500	* .1*	.3*
*Mesa-Buckhorn	* 3.424	* .1*	.3*
*Mesa-Buckhorn	* 3.349	* .1*	.3*
*Mesa-Buckhorn	* 3.285	* .1*	.3*
*Mesa-Buckhorn	* 3.138	* .3*	.5*
*Mesa-Buckhorn	* 3.117	*Culvert *	*
*Mesa-Buckhorn	* 3.096	* .3*	.5*
*Mesa-Buckhorn	* 2.966	* .3*	.5*
*Mesa-Buckhorn	* 2.891	* .1*	.3*
*Mesa-Buckhorn	* 2.871	* .1*	.3*
*Mesa-Buckhorn	* 2.815	* .1*	.3*
*Mesa-Buckhorn	* 2.736	* .1*	.3*
*Mesa-Buckhorn	* 2.662	* .1*	.3*
*Mesa-Buckhorn	* 2.585	* .1*	.3*
*Mesa-Buckhorn	* 2.509	* .1*	.3*
*Mesa-Buckhorn	* 2.433	* .1*	.3*
*Mesa-Buckhorn	* 2.357	* .1*	.3*
*Mesa-Buckhorn	* 2.328	* .1*	.3*
*Mesa-Buckhorn	* 2.281	* .1*	.3*
*Mesa-Buckhorn	* 2.205	* .1*	.3*
*Mesa-Buckhorn	* 2.129	* .1*	.3*
*Mesa-Buckhorn	* 2.053	* .1*	.3*
*Mesa-Buckhorn	* 1.977	* .1*	.3*
*Mesa-Buckhorn	* 1.901	* .1*	.3*
*Mesa-Buckhorn	* 1.874	* .1*	.3*
*Mesa-Buckhorn	* 1.826	* .1*	.3*
*Mesa-Buckhorn	* 1.756	* .1*	.3*
*Mesa-Buckhorn	* 1.656	* .3*	.5*
*Mesa-Buckhorn	* 1.632	*Culvert *	*
*Mesa-Buckhorn	* 1.607	* .3*	.5*
*Mesa-Buckhorn	* 1.509	* .3*	.5*
*Mesa-Buckhorn	* 1.433	* .3*	.5*
*Mesa-Buckhorn	* 1.358	* .1*	.3*
*Mesa-Buckhorn	* 1.283	* .1*	.3*
*Mesa-Buckhorn	* 1.210	* .1*	.3*
*Mesa-Buckhorn	* 1.164	* .1*	.3*
*Mesa-Buckhorn	* 1.135	* .1*	.3*
*Mesa-Buckhorn	* 1.058	* .1*	.3*
*Mesa-Buckhorn	* 0.983	* .1*	.3*
*Mesa-Buckhorn	* 0.906	* .1*	.3*
*Mesa-Buckhorn	* 0.831	* .1*	.3*
*Mesa-Buckhorn	* 0.756	* .1*	.3*
*Mesa-Buckhorn	* 0.680	* .1*	.3*
*Mesa-Buckhorn	* 0.604	* .1*	.3*
*Mesa-Buckhorn	* 0.533	* .1*	.3*
*Mesa-Buckhorn	* 0.465	* .3*	.5*
*Mesa-Buckhorn	* 0.445	*Culvert *	*
*Mesa-Buckhorn	* 0.425	* .3*	.5*
*Mesa-Buckhorn	* 0.336	* .1*	.3*
*Mesa-Buckhorn	* 0.261	* .1*	.3*

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*Mesa-Buckhorn    *    0.185    *        .1*        .3*
*Mesa-Buckhorn    *    0.109    *        .1*        .3*
*Mesa-Buckhorn    *    0.068    *        .1*        .3*
*Mesa-Buckhorn    *    0.063    *        .1*        .3*
*Mesa-Buckhorn    *    0.019    *        .1*        .3*
*Mesa-Buckhorn    *    0.016    *        .1*        .3*
*Mesa-Buckhorn    *    0.000    *        .1*        .3*
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